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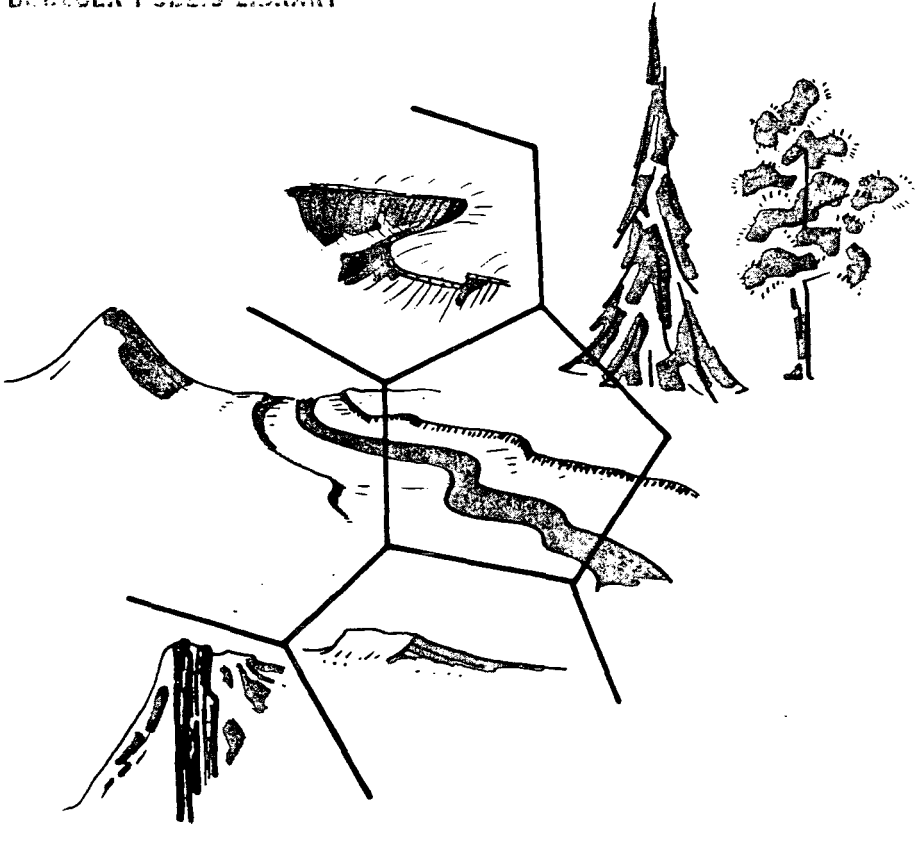

Department of Geography / University of Colorado

— Boulder - Natural hist. —

VALMONT DIKE

NATURAL AREA STUDY

Michael R. Tripp, William G. Callahan
and Manik Hwang

Editors

DEPARTMENT OF GEOGRAPHY
UNIVERSITY OF COLORADO

Boulder, Colorado

1970

TABLE OF CONTENTS

Chapter		Page
	FOREWORD	v
	Donald D. MacPhail	
	ACKNOWLEDGMENTS	vii
1.	INTRODUCTION	1
	Michael R. Tripp, William G. Callahan and Manik Hwang	
2.	AN ENVIRONMENTAL SURVEY.	4
	Scott Mernitz, George R. Greenbank, and Helen Louise Young	
3.	HISTORY AND LAND USE	9
	Manik Hwang and Gary A. Heaslet	
4.	CADASTRAL AND LAND TENURE SURVEY	22
	John L. Harper, James Biggins and Wil. Ulman	
5.	LAND ECONOMICS	27
	Max H. Dodson, Robert E. Key and Dean G. Wilder	
6.	CONCLUSIONS AND RECOMMENDATIONS.	32
	Michael R. Tripp, William G. Callahan, and Manik Hwang	
APPENDIX		
A.	PHOTOGRAPHS	35

FIGURES

		Page
1-A	Location of Valmont Dike	2
1-B	Cross Section of Valmont Dike Showing Bedrock Structure	5
2.	Plat of Valmont, 1865	10
3.	Past Land Use	14
4.	Present Land Use	16
5.	Future Land Use	19
6.	Cadastral and Land Tenure Map, 1950	23
7.	Cadastral and Land Tenure Map, 1970	24
8.	Land Economics Map	29
9.	Valmont School, One of the Last Remaining Buildings of Valmont	37
10.	The Town of Valmont, 1914 View	37
11.	The Same Scene as Above, 52 Years Later	37
12.	View of West End of Valmont Dike in the 1870s	39
13.	A Current View of the Dike at the Western Terminus	39
14.	The Valmont Plant of the Public Service Company of Colorado	39
15.	Aerial View of Valmont Dike, September 10, 1957	41
16.	Aerial View of Valmont Dike, September 6, 1969	41

TABLES

Page

1. Index to Land Use Classification Categories 15

2. Filing Dates of the Major Land Owners 22

3. Land Economics - Assessed and Appraised Values 28

4. 1960 - 1970 Land Values - Selected Properties 30

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Boulder Valley School District No. RE-2 J.

FOREWORD

This report is one of six undertaken this year in the Department of Geography at the University of Colorado. It has become almost a tradition for the graduate seminar in land use to initiate a project in the local area in cooperation with an agency of the Boulder community on either the municipal or county level, sometimes both.

These studies achieve a number of objectives. The participating students undertake a realistic project which they are able to plan, execute, and publish within the brief span of one semester. Also, these studies provide new information for municipal and county officials and citizen groups concerned with planning and guiding the growth and development of the City of Boulder and Boulder County. In short, these are professional training exercises for graduate geographers and are a serious effort in providing new planning perspectives in the interest of public service.

In response to a suggestion by the Natural Areas Committee of the University of Colorado, the land use seminar elected to study and analyze a number of natural sites in the Boulder Valley. The group was also joined in the endeavor by the graduate field seminar of the Department of Geography.

The cooperative base within the Boulder community was wider than usual this year. The sites chosen for study seemed to have potential for a variety of uses beyond their present development. These includes instruction of public school and university students, scientific research, recreation, greenbelt, and open space. The graduate students involved worked in cooperation with the resident property owners, the Parks and Recreation Department and the Planning Office of the City of Boulder, the Department of Development and the Parks and Open Space Advisory Committee of Boulder County, the Boulder and Longmont Offices of the Soil Conservation Service, the Science Director of the Boulder Valley RE-2 School District, the Planning Office and the Natural Areas Committee of the University of Colorado, and the Denver Regional Council of Governments.

Sometimes the graduate researchers felt that they would have liked to pursue certain themes in greater depth if there had been more time available. Nonetheless, they join me in expressing the hope that this report provides informative insights on a fascinating part of Boulder County.

The various chapters which appear in this study were originally submitted as special reports by the individuals indicated. They represent the endeavors and views of the authors and in no way should be interpreted as the official views of the Department of Geography or any other cooperating agency or organization previously mentioned. Because of this independence from official views, the participants in this project are especially grateful to the Graduate School of the University of Colorado, the City of

Boulder, the Boulder County Commissioners, the Boulder Valley RE-2 School District and the University of Colorado Foundation for sharing the costs of printing this report.

This is the collective and individual effort of a group of dedicated geographers concerned about the quality of the local environment and its attendant stresses. Boulder County residents, students, and local officials may gain understanding from this report that will assist them in their efforts to perpetuate the Boulder area as a pleasant and attractive place to live.

Donald D. MacPhail, Ph.D.
Professor of Geography

Boulder, Colorado
June, 1970

ACKNOWLEDGMENTS

The editors wish to express their appreciating to the many individuals involved in producing this report. Dr. Donald D. MacPhail initially brought the need for this study to our attention, and has encouraged us and assisted us throughout the period of its development. The students, whose names appear in the Table of Contents under the appropriate chapter headings, worked with interest and concern to make this report as complete and informative as it is.

Our thanks also go to the following individuals and groups for their time, assistance, and helpful information: Ralph E. Bachus, Boulder Public School Science Director; Carol Hamon and D. C. Moreland, Soil Conservationists, Agricultural Stabilization and Conservation Service, Longmont, Colorado; the Boulder City Planning Department; the Boulder County Assessor's and Treasurer's Offices; the Boulder County Planning Department; the Transamerican Title Company, Boulder Office; the Flatiron Companies, the Colorado Brick Company and the Public Service Company of Colorado; Eldin Baird, Baird Realty, Boulder; Jack K. Basart, M.A.I., Real Estate Appraiser; Robert E. Key, Director of Parks and Recreation for the City of Boulder; Lloyd Harrell, Assistant to the City Manager of Boulder and Don Look of Look Photos. Special thanks go to Dr. W. A. Weber of the University of Colorado Museum for his help.

Mrs. Nancy Stonington, Graduate Geography Student, created the cover design and Mrs. Sue Middleton, Secretary, Department of Geography, typed the manuscript. We also wish to thank Mr. Wilbert J. Ulman for his work with the copy camera and contact printer in the final preparation of the maps for publication.

The Editors

William G. Callahan
Manik Hwang
Michael R. Tripp

CHAPTER 1. INTRODUCTION

Michael R. Tripp, William G. Callahan, and Manik Hwang

This report represents a comprehensive evaluation of Valmont Dike and its immediate environs as a potential natural area study site.

Valmont Dike, rising approximately 200 feet above the surrounding terrain 4 miles east-northeast of Boulder, Colorado, has long been a prominent landmark in the Boulder area. Originally, the series of elongated hillocks were referred to as Valmont Buttes, but the term "dike" is more geologically correct since the core of Valmont Dike -- the reason for its topographic prominence -- is porphyritic basalt which thrusts its way upward through the overlying beds of sedimentary materials to solidity as an igneous intrusive.

To refer to Valmont Dike as a "natural area study site" implies that the area offers unusual or unique attributes and amenities. Certainly the Dike's geologic structure is of special interest, as are the varied vegetation zones it harbors, and the vantage point it offers for observing the surrounding landscape. In being offered such opportunities for study and experience, students find the immediacy and reality of direct contact with the Dike both stimulating and informative. Such considerations strongly suggest that Valmont Dike's "highest and best use" is to remain in a relatively undeveloped state, being always available to interested parties and study groups from various University departments as well as to others similarly oriented.

Five teams of students have shared responsibility for compiling and presenting the material in this report. Included are chapters dealing with historical and current aspects of the area's physical environment, land use, land ownership and tenure, and land economics. Considerations of how this area might be secured and maintained as a natural area study site are treated in the Conclusion.

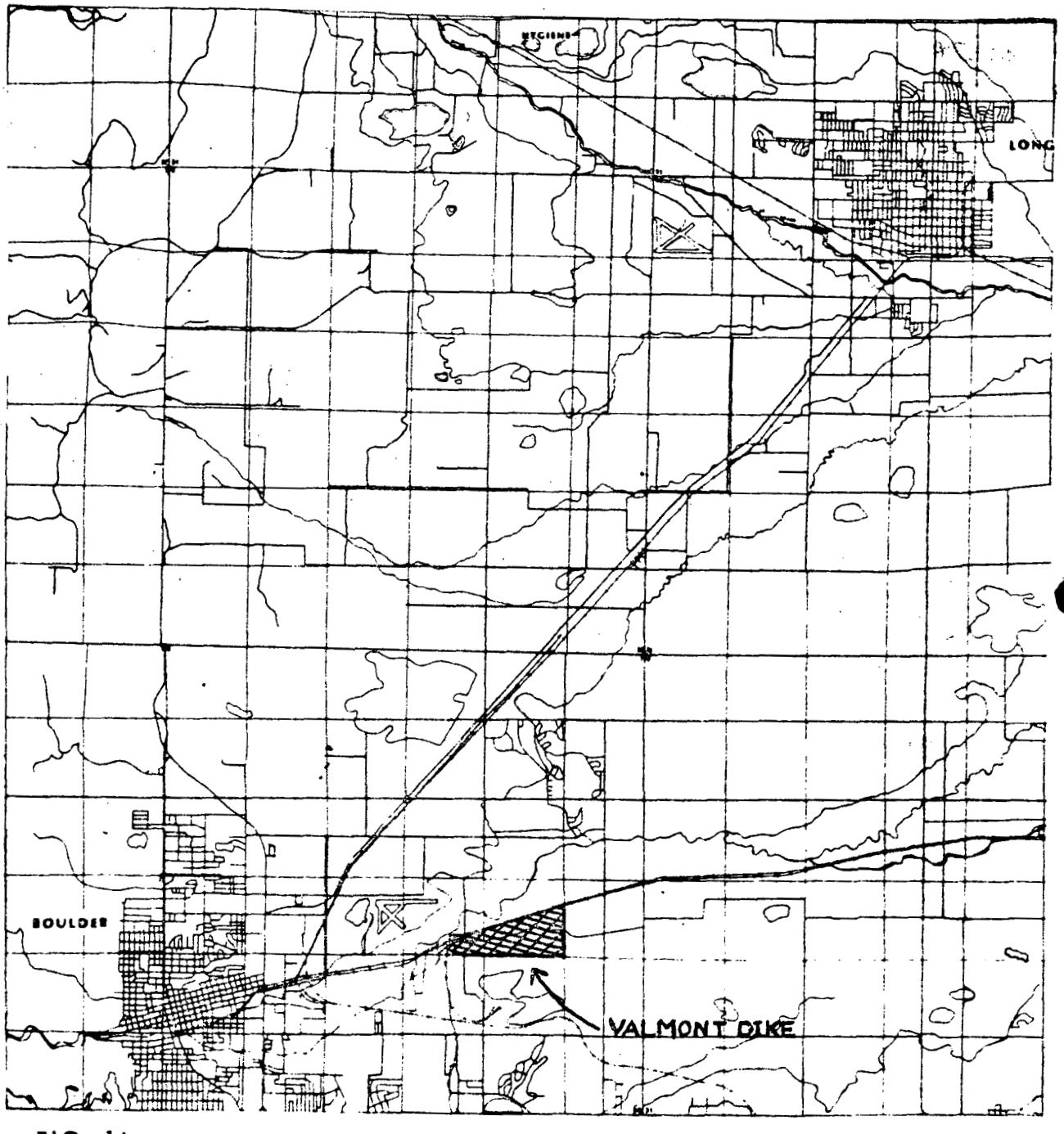

FIG. 1A Location of Valmont Dike Area

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CHAPTER 2. AN ENVIRONMENTAL SURVEY

Scott Mernitz, George R. Greenbank and Helen L. Young

Location

Valmont Dike is located approximately 4 miles northeast of Boulder, Colorado. A buffer area surrounding the dike will also be considered in this survey because of the interesting contrasts to be made with the dike itself in terms of vegetation, relief, and land use. All of Sections 22 and 23, T 1 N, R 70 W were surveyed. Portions of Sections 26 and 27, directly south of Sections 22 and 23, will be included in the cadastral and land use chapters of this report.

Topography

The general physiographic province in which Valmont Dike is located is the Denver Basin, a large synclinal trough within the Northern Colorado Piedmont. The overall topography consists of a series of broad, shallow valleys with gently sloping sides, plateaus and mesas capped by resistant materials, and stream terraces and floodplains.

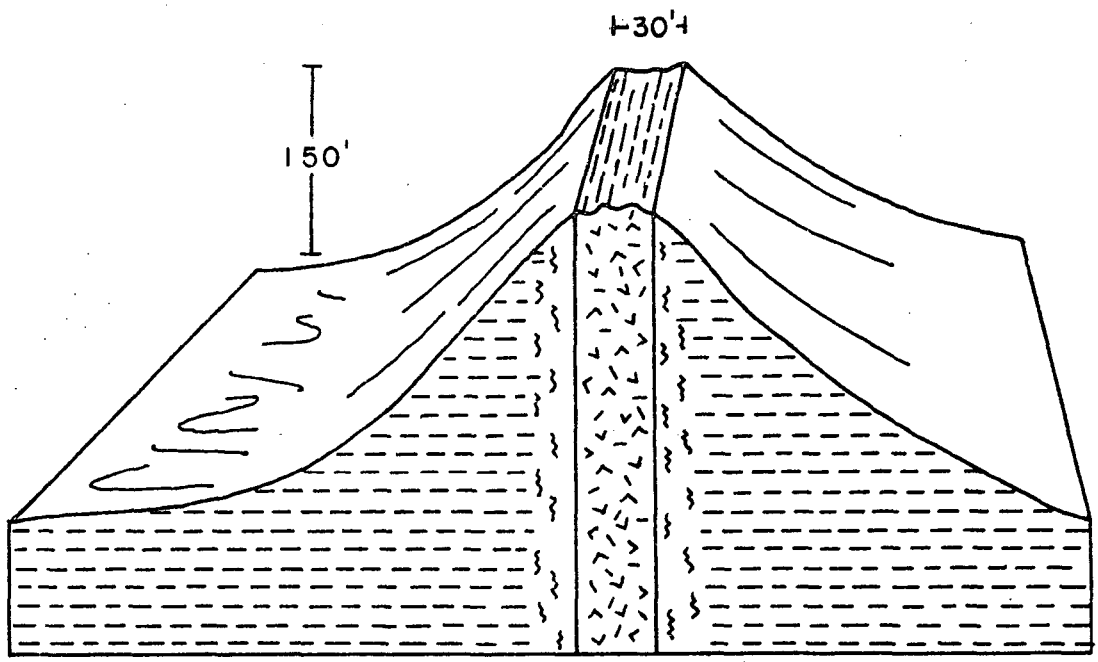
In order to adequately understand and evaluate the topography of Valmont Dike, its genesis **must** be considered. Horizontal beds of sediments deposited during Cretaceous time (135 million to 65 million years ago) are thick successions of predominantly marine-origin silts and sediments laid down adjacent to or in an advancing sea (Knight, 1964). The only visible sedimentary outcrop of this type in the vicinity of the dike is the Pierre formation which is composed of dark gray shales and shaly sandstones. In the northern foothills of the Front Range, the Pierre reaches a thickness of approximately 8,000 feet (Griffitts, 1949).

A vertical igneous intrustion of Tertiary time, Valmont Dike cuts through the Pierre bedding planes at a right angle (Figure 1). The dike, now exposed at the surface, forms a prominent east-west ridge extending for a mile immediately south of the town of Valmont. Further to the east, there are small rock outcrops extending for another mile. The dike outcrop along the top of the ridge is about 20 feet wide while at its western end a 40 to 50 feet width is exposed. These exposures provide excellent cross-sections of the rock comprising the dike. The highest part of the dike rises over 200 feet above the floodplain.

Dark gray, macrocrystalline basalt comprises the dike. Crystals of plagioclase feldspar and olivine give the basalt its porphyritic texture. The Pierre shale bedrock has been partially metamorphosed at its contact with the igneous intrusive. This resultant rock is not a true slate, but is called hornfels, a fine-grained non-schistose metamorphic.

CROSS SECTION OF VALMONT DIKE

SHOWING BEDROCK STRUCTURE



PIERRE SHALE

BASALT PORPHYRY

HORNFELS — Partially metamorphosed shale

FIG. 1B

Valmont Dike provides interesting examples of weathering. First, the basalt dike, being much more resistant than the friable shales, stands high above the floodplain. Originally the dike was completely covered by shale bedrock, but through time it has withstood the erosive power of the elements (especially Boulder Creek). Consequently, its cover has been removed without the dike being removed itself. The dike is marked by jointing -- a series of rock fractures vertical and transverse to the bedding plane.

The north slope of the dike, dropping abruptly to the floodplain, is much steeper than the south slope which is gently inclined. Both slopes are covered with fragments of the dike, providing a good field example of mass wasting. A remnant of a gravel-capped stream may be easily viewed in a road cut southeast of the fluorspar mill on the southern slope.

The Pierre is not a good aquifer, and there is no trace of groundwater in the intrusive itself. The surrounding terraces in Sections 22 and 23 do contain ground water tables. The Pierre formation is conducive to surface water retention, therefore, the reservoirs south of the dike do not suffer from water seepage.

Vegetation

The topography also acts as a control on the type of vegetation found on the dike. Four zones of vegetation are recognized due to the effect of topography: the south slope, the ridgetop, the north-facing slope along the ridge, and the north slope of talus blocks, shrub thickets and grassland.

The steeper, shaded north slope supports more rock-clinging plants, such as mosses, ferns and lichens. Examples of ferns include: golden aster (*Cystopteris montana* de Lamarck), and club moss (*Lycopodiacea* spp.). Representing the mosses, these genera are present: *Tortula*, *Bryum*, *Grimmia*, and *Hedwigia*. Covering the rocks are a number of crustose lichens: *Rinodina*, *Rhizocarpon*, *Acarospora*, *Parmelia*, *Dermatocarpon*, and *Umbilicaria*. All of the above genera are good representatives of a rock-crevice flora. The lower part of the north slope is dominated by shrub thickets of wild plum (*Prunus americana* Marshall) and other woody plants.

Due to more exposure to direct sunlight, the ridgetop and the south-facing slope have a different vegetational character than does the north slope. The ridgetop supports a scattered cover of woody plants including the wild plum and the sand cherry (*Prunus pumila* Linnaesu), wild currant (*Ribes triste* Pallas), skunkbush (*Rhus trilobata* Nuttall), and several herbaceous species. The south slope contains little interesting vegetation. It has been altered by the presence of man (the fluorspar mill and the brick yard are located here). In places where the disturbance has been minimal the native grass cover of the dominant blue gramma (*Bouteloua gracilis* H.B.K) is well developed. Among the native species are the following: prairie sage (*Artemisia* spp.), Spanish bayonet (*Yucca glauca* Nuttall), and the prickly pear cactus (*Opuntia polyacantha* Haworth). A few weedy species of mosses (*Bryum* spp.) occur in the dense grass.

A very rugged terrain on the dike itself permits only a hardy vegetation cover. The soil is thin and rocky, and not suitable for agriculture. Valmont Dike and its vegetation are quite durable. They would not suffer from field trips into the area.

Summary

The effect of man's presence in the study area is especially noticeable due to the presence of the fluorspar mill adjacent to the dike on the west, south and east sides. Some definite effects on the biota, namely the lack of native vegetation on the slope, may be noted. On the basis of this environmental survey, it is recommended that the area be established as a natural site by interested parties. Valmont Dike is unique geologically as a Tertiary intrusive into sedimentary rock. There is also biological interest in the form of vegetation and exposure. Distance from Boulder (approximately 4 miles) provides easy access for public school and university students. A responsible party should acquire control of the dike and the immediate adjacent area before man destroys or alters a unique and valuable natural feature.

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Maps

U.S. Geological Survey 7.5 minute topographic quadrangle: Niwot, Colorado (1967).

CHAPTER 3. HISTORY AND LAND USE

Manik Hwang and Gary A. Heaslet

Introduction

The Valmont Dike area has been the scene of a colorful part of Boulder Valley's historical evolution. Although the topography is relatively unimpressive when compared to the spectacular Front Range to the west, the early white settlers in this area found the landscape aesthetically pleasing nonetheless. The transition of land use patterns in this area reflects the heavy impact of these white settlers on the land in the 110 years that have occupied and used the area.

Historical Land Use

The region was originally used by the Arapahoes and the Utes as a campground, hunting area and burial site. Early historical accounts tell of the antelope roundup held in the vicinity of Valmont Dike in 1860, the last of its kind before the Arapahoes were moved to Oklahoma. Another account describes a burial ground with 15 to 20 mounds which was located south of the dike (Larkin, 1968). The Boulder Creek floodplain adjacent to the dike was a natural area for hunting, camping and replenishing supplies. In these early days, the only other visitors to the area were occasional trappers who did little to modify the natural surroundings.

In 1859 a party of miners arrived in the area, and after convincing the Indians of their peaceful intentions, made a base camp for exploration into the mountains to the west for gold and silver. One of the party, Thomas Aiken, later took up farming on some land close to the dike. Thus, the first white settlement began about 1860. The farmers who later arrived sold their produce to the miners who were in the mountain mining camps. Service centers were established which competed with each other for the business of the miners.

The farmers, using irrigation practices, and planting the fertile terraces and floodplain, had excellent crops for the first few years. Wheat was the main crop grown although the farmers also grew fruits and vegetables, adjusting their crops to the demands of their customers. Within a few short years, the Valmont area had become a thriving agricultural community. More people began to move into the vicinity.

Thomas Jones, one of the first residents of the area, built a large home which served as a stage coach stop and inn. Judge A. D. Allen and his son made a plat of Valmont in 1865, laying out streets, lots and alleys (Figure 2). "The plat included three blacksmith shops, two general stores, one hardware store, two hotels, a school, two churches and the offices of three doctors." In addition the town had three saloons on the west end, the area being referred to as "Devils Row" (James).

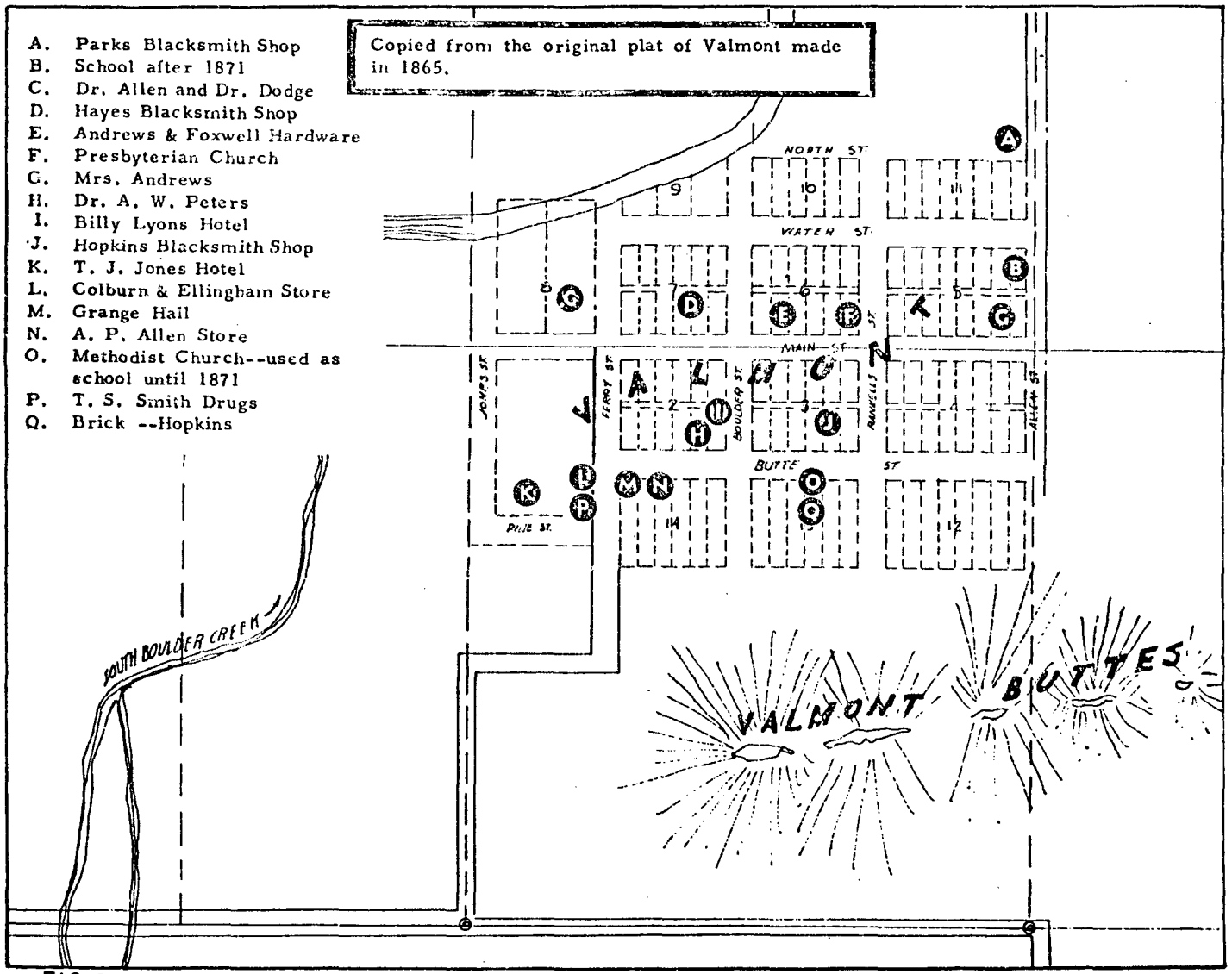
A. Parks Blacksmith Shop
B. School after 1871
C. Dr. Allen and Dr. Dodge
D. Hayes Blacksmith Shop
E. Andrews & Foxwell Hardware
F. Presbyterian Church
G. Mrs. Andrews
H. Dr. A. W. Peters
I. Billy Lyons Hotel
J. Hopkins Blacksmith Shop
K. T. J. Jones Hotel
L. Colburn & Ellingham Store
M. Grange Hall
N. A. P. Allen Store
O. Methodist Church--used as school until 1871
P. T. S. Smith Drugs
Q. Brick --Hopkins
Copied from the original plat of Valmont made in 1865.
NORTH ST.
WATER ST.
MAIN ST.
BUTTE ST.
JONES ST.
FERRY ST.
BOULDER ST.
RANELLS ST.
ALLEN ST.
PINE ST.
SOUTH BOULDER CREEK
VALMONT BUTTES

FIG. 2

During this period of time the area was experiencing Indian trouble. The Indians, angered by the broken promises of the whites and the continual infringement of their lands, began to raid white settlements. As a result, Fort Chambers, built on the farm of George W. Chambers in 1864 and located a short distance from Valmont, was used by Company D of the Third Colorado Regiment of Volunteers as a training site. Fort Chambers was a sod-brick fortification, measuring 100 by 200 feet, with walls 2 feet thick.

The company, composed of local men from Valmont, Boulder and the surrounding area, later took part in the battles which eliminated the Indian threat once and for all. The most famous, or infamous, battle was fought at Sand Creek, about 30 miles north of Lamar in Kiowa County, and is referred to as the "Sand Creek Massacre." By 1868 the Indian threat was gone in the Valmont area.

By the late 1860s, Valmont had become a rival to nearby Boulder, actually outnumbering Boulder in population for a period of time. The City of Valmont had organized the Valmont Presbyterian Church in the home of Mrs. A. A. Brookfield in 1863 and had built the first church building in 1866. Another church began in Valmont, the Congregational Church, but it later built its facilities in Boulder, In addition, a newspaper known as the Valmont Bulletin had originated. Edited and published by D. G. Scouten and Dr. H. W. Allen, the first issue was dated January 1, 1866.

A colorful story of the demise of this paper is included in some of the historical accounts of the Boulder area (Bixby, 1880). Apparently some of the residents of nearby Boulder resented Valmont having its own newspaper, and so hatched a plan which would alleviate the problem.

On the evening of April 1, 1967 Mr. Scouten was entertained by friends at a local saloon. In the meantime, the hand-operated printing press was hijacked and brought to Boulder to be used by the proposed Boulder Valley News. When Scouten sobered up and realized what had happened, he apparently gave in and took a job with the News. In the meantime, Dr. Allen had been paid a handsome fee ($32) to move his paper to Boulder. Thus, Boulder gained a newspaper overnight.

This incident, and the failure of Valmont to obtain the transfer of the county seat from Boulder, seemed to mark the beginning of a gradual shift of activity away from Valmont toward Boulder. At this time, there were about 300 residents in the immediate vicinity of Valmont.

Although more and more acreage was put into wheat in the 1870s, the yields gradually diminished as soils were depleted. Still the Boulder Valley was known as an important wheat growing area. An early settler by the name of John De Baker built a flour mill at the eastern end of the dike, using water from Boulder Creek as the source of power. According to a newspaper clipping, the mill did a thriving business and sold the flour for a high price (Valmont Material).

Another crop grown because of local demand was barley. The barley was used by the Boulder Brewing Company in the brewing of beer. Cheese

also afforded an industrial base. The first cheese factory in the county was established in Valmont in the spring of 1877. The factory was run by C. W. Hayden, a cheese-maker from Jefferson County, Wisconsin (Bixby, 1880).

The 1870s also brought the railroads into the area. Valmont was chosen for a right-of-way in 1873. The line began operating on April 22, 1873. The Union Pacific Railroad, running through Valmont and on to Boulder, served the functions of shipping beef, flour and wheat in both directions; serving the mining interests to the west; and providing transportation as the demand increased. With the railroad came a post office and a railroad station, both of which remained for a number of years.

Valmont's civic spirit declined as a number of activities shifted toward Boulder. However, newspaper clippings record instances of large Fourth of July celebrations with band concerts, public speakers, dances and all-day picnics (Valmont Material).

In the late 1870s basalt was quarried from the west end of the dike. The basalt was brought down from the top of the dike by means of a conveyor belt attached to a tall wooden tower; it was then cut and shipped by train to Denver. The mill closed in 1901 and was dismantled in 1910 (Schooland, 1967). Later basalt was collected by local people and loaded onto freight cars. The railroads used the rock for their railroad beds that led to the mountain mining communities (see Fig. 12, pp. 38-39).

Another feature which was located in the vicinity of the dike was a gold and silver stamp mill. It was constructed on the south slope of the dike in 1898, and it had a capacity of processing 250 tons of ore per day (Crossen, 1962). The stamp mill was located adjacent to the dike so that the gravity flow of water could be utilized in the processing of the ore. Disposing of the tailings was relatively easy from this location. Finally, a railroad spur was nearby, facilitating shipment of the ores.

In the early 1900s, the area around the dike was used for two other purposes. First, farmers used much of the land for grazing horses, cattle and sheep, while farming much of the remainder. The second use of the area involved the lakes to the south of the dike; Leggett Reservoir, then called Owens Lake, was used for boating and picnicking by the local populace. Cottages were located around one end of the lake. Colorado and Southern trains from Denver and Boulder stopped here regularly, making it a popular resort and recreation area.

Around 1915, gravel was mined from an old stream bed lying on high ground to the south of the dike and soutwest of the Valmont cemetary. The gravel was crushed at the site and carried by wagon to be used for road surfacing. Later, gravel was also mined in the floodplain area north of the dike, where the Sawhill Lakes are presently located. As the use of ready-mix concrete increased, the excavation of gravel also increased. The Flatiron Paving Company estimates that it has taken out approximately two million tons of gravel from this area since 1930.

Another use of the area immediately adjacent to the dike began in 1915 when the Colorado Brick Company purchased the land where the old

basalt quarry had once stood. The bricks were made from the shales lying adjacent to the basalt, and marketed in Boulder, Denver and the surrounding vicinity. Up to 1950, the company used clays taken solely from the dike area. However, now only 20 per cent of their clay is derived from the dike. The brick factory expanded its facilities in 1952. It currently makes about one and one-fourth million bricks per year.

In 1924, the Public Service Company purchased the property around the lakes to the south of the dike and built a power plant. The area was attractive to the company because large amounts of water were needed to cool the generators. In addition, the growth of the area had created a need for a local source of electric power. Coal from nearby coal mines provided the heat from which the electricity is generated.

In 1961, the power plant was increased in size. To provide more water for cooling, Valmont No. 3 Reservoir was created by means of earth-fill dams. Gravel and earth for the dams were taken from the south edge of the dike. The total area of the three lakes is about 518 acres. At present, some of the water is being used for irrigation purposes further east.

Currently the southern lakes area is being leased by the Colorado Department of Game, Fish and Parks as a geese nesting preserve. No other uses are allowed in the area. In the past, there has been pressure brought to bear on the Public Service Company to allow fishing in their lakes, but the company has thus far refused permission.

Another industrial activity began operation on the southern edge of the dike in 1935. A small gold mill began operating, but lasted only two years before going bankrupt. In 1937, the site was then used as a fluorspar processing mill by two partners from the Boulder area. They, in turn, were bought out by the Allied Chemical Company in 1941, which used the mill to process fluorspar from the Burlington Mine near Jamestown. The mill makes fluorspar into calcium fluoride, and then ships it by rail to the west coast. The mill was located on the edge of the dike because of the advantages of using gravity flow in the processing of the fluorspar, due to the ease is disposing of the tailings, and because of the railroad spur which gave access to shipment of the product. Currently the company produces about 45 to 50 tons of calcium fluoride per day.

A recent use of the area adjacent to the gravel pits on the north has been the removal of topsoil. This has been in response to the rapid expansion of residential areas where poor soils exist. It is estimated that about 200 thousand cubic yards of topsoil have been removed from the area and sold for use in these newly-built residential areas (Larkin, 1968).

The floodplain area to the north and east of the dike, called the Sawhill Lakes, is now being made into a recreation area. The Department of Game, Fish and Parks purchased much of the area in 1966 for hunting and fishing. Some boating, swimming, and camping are also found in the area.

Today, about all that is left of the once thriving community of Valmont is the Valmont Presbyterian Church and 11 residences. Only one road winds through the town and a dirt road connects the north part of the town with a county road. For a number of years the dike has been of interest to geology and geography students, but the town itself has nearly disappeared.

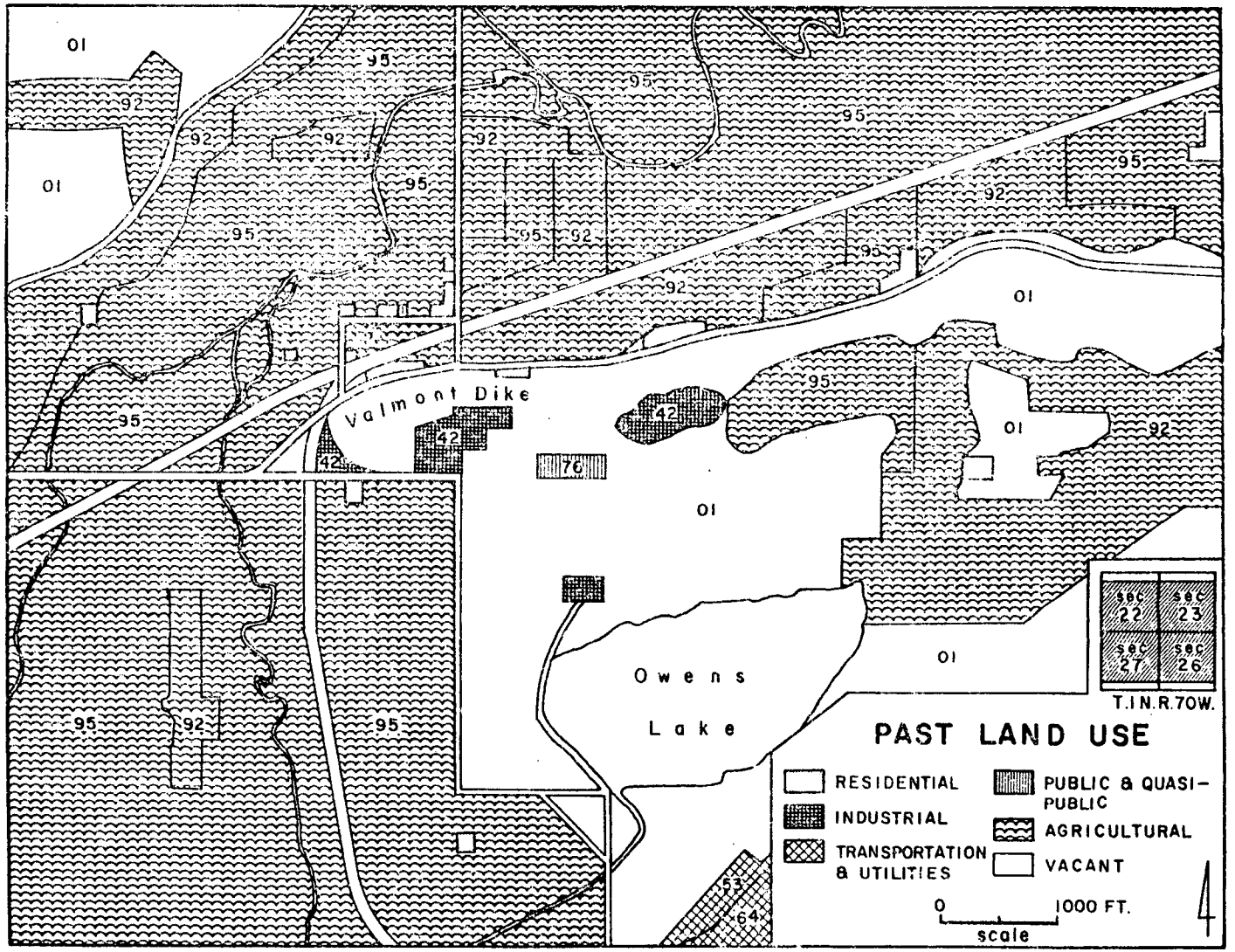
Valmont Dike
Owens Lake
PAST LAND USE
RESIDENTIAL
INDUSTRIAL
TRANSPORTATION & UTILITIES
PUBLIC & QUASI-PUBLIC
AGRICULTURAL
VACANT
0
1000 FT.
scale
T.1N.R.70W.
sec 22
sec 23
sec 27
sec 26

FIG. 3

Present Land Use

Today, the Valmont Dike area is one the edge of the rapidly growing city of Boulder, Because of Boulder's rapid population growth, the historical site of Valmont is slowly disappearing as residential and industrial encroachment occurs.

Present land use revolves mainly around nine categories (See Table 1.). The only areas of Residential land use are found along the north side of Valmont Road. A trailer court is located in the San Largo area, covering about 32 acres; there are approximately 209 trailers housing about 1,300 people.

TABLE 1. INDEX TO LAND USE CLASSIFICATION CATEGORIES

Category	Numerical Code*
Residential	1
Single Family Dwelling	11
Mobile Home Dwelling	14
Commercial	2
Retail Business	22
Professional Services	34
Industrial	4
Primary Manufacturing	42
Utilities	6
Electricity and Gas	64
Public and Quasi-Public	7
Cemetary	76
Church	73
Parks and Recreation	8
Open space park and recreation areas	83
Agricultural	9
Crop production	92
Pasture, grazing land	95
Vacant	0
River bottom land	01
Water area	03

* Numerical code of Denver Regional Council of Governments

Source: Inter-County Regional Planning Commission, 1966.

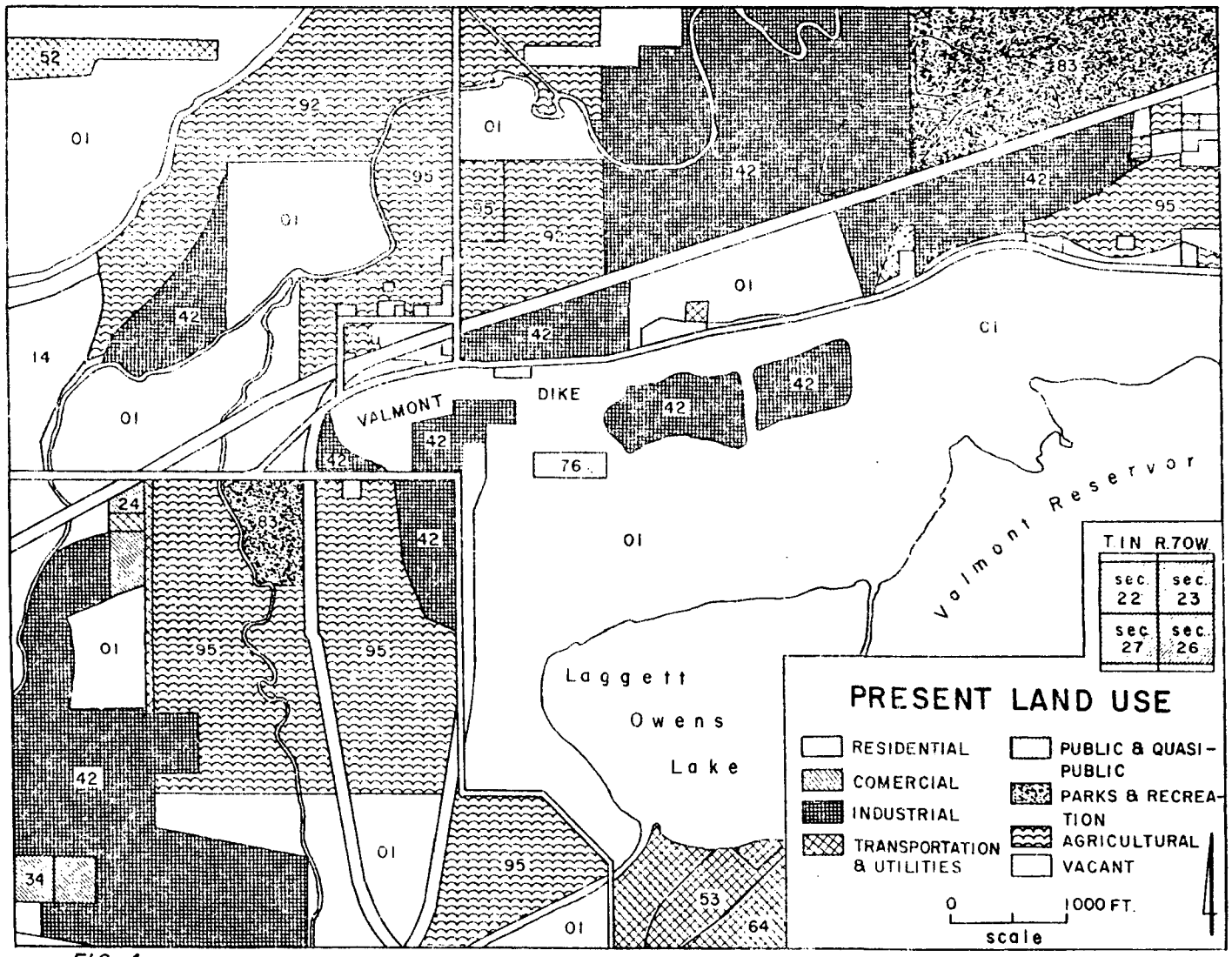
VALMONT DIKE
Laggett Owens Lake
Valmont Reservoir
T1N R.70W.
sec. 22
sec. 23
sec. 27
sec. 26
PRESENT LAND USE
RESIDENTIAL
COMERCIAL
INDUSTRIAL
TRANSPORTATION & UTILITIES
PUBLIC & QUASI-PUBLIC
PARKS & RECREATION
AGRICULTURAL
VACANT
0
1000 FT.
scale

FIG. 4

Further east is the area which originally served as the center of the town of Valmont. This area occupies about 20 acres and now has 11 residences. The remaining homes in the area are individual dwellings located along the road further east.

A second category of land use is classified Commercial. This land category is confined to two small locations on the south side of Valmont Road where the railroad track crosses from the south to the north side. This area, along 55th Avenue, includes a nonprofit business that hires handicapped people and a company which makes camping and outdoor equipment.

A third category is Professional Services. This category includes the Laboratory of Astrophysics and Space which is part of the University of Colorado. This facility is located on 55th Avenue next to the Flatiron Sand and Gravel Company.

Industrial land use is found in a number of locations surrounding the dike. On the west side, the Flatiron Sand and Gravel Company occupies over 150 acres which are used for mining gravel. In conjunction with the gravel mining operation, the company also manufactures pre-stressed concrete materials. Actually the Flatiron Company is four companies in one. Included are the Flatiron Sand and Gravel Company, the Flatiron Pre-Mix Concrete Company, the Flatiron Paving Company, and the Flatiron Service Company. This company owns over 40 acres of river bottom on the north side of Valmont Road next to the trailer court, which is also used for gravel mining. A third area, used by the Flatiron Paving Company, is found further east in the Sawhill Lakes area. The gravel in this 80-acre site is used for making asphalt.

A second sand and gravel company, the McStain Corporation, has over 30 acres between Valmont and Jay Roads near 63rd Avenue.

The Colorado Brick Company is located at 60th and Valmont Road at the base of the western face of the dike. This company also occupies 15 acres along the Sioss railroad spur.

The Industrial Chemicals Division of the Allied Chemical Corporation, previously referred to as the fluorspar mill, is located along the south face of the dike. Although the mill itself only occupies about 13 acres of land, the company also owns 79 acres to the east, along the south of the dike, which is used for tailings disposal.

The most extensive land use category in the area is Utilities. Only one other company is included in this category besides the Public Service Company of Colorado. A small propane gas facility is located near the corner of Valmont Road and 55th Avenue, occupying one acre.

The Public Service Company is the single largest land holder in the area, owning over 1,000 acres. Their property includes Leggett Reservoir, Hillcrest Reservoir, Valmont No. 3 Reservoir, as well as the 40 acres which include the generating plant, related buildings and railroad spurs.

The category of Public and Quasi-Public land use is represented by only two small areas. These are the Valmont Cemetery on the south side of the dike near the fluorspar mill, and the church in the Town of Valmont.

The remaining three categories of land use include Parks and Recreation, Agriculture, and Vacant Land. The parks and recreation land is primarily in the Sawhill Lakes area which was recently purchased by the Colorado Department of Game, Fish and Parks.

Agriculture land is divided into three groups: land used for dry farming (usually wheat), irrigated pasture (predominantly alfalfa), and unimproved pasture. The low lying areas are often left to pasture, whereas the terraces at the edge of the floodplain are more suitable for irrigation or dry farming.

Vacant land is found along the floodplain in the river bottom lands. This land is used in summer for grazing, but the carrying capacity is quite low. Vacant land is also found along the periphery of the Public Service Company's holdings. This land has been grazed in the past. In fact, much yucca and cactus are found here, indicating over-grazing was the general rule.

Future Land Use

The estimates of future land use in the Valmont Dike natural area are based primarily on information included in "A Plan for the Boulder Valley" (Porreca, 1969). This report, created by the coordinated efforts of the City and County of Boulder, is the basis for planning for future development in Boulder Valley. It anticipates rates of population growth, community needs, residential densities, commercial and industrial growth, and open space requirements.

Four major categories of land use are anticipated in the Valmont area. By far the largest use will be that of parks, recreation and open space. The County hopes to include all of the area north of Valmont Road in this category except for the small residential section in the Town of Valmont. In addition, all of the area surrounding the three Public Service Company lakes is included as potential parks and recreation lands. Finally, the river bottom area of South Boulder Creek is to be zoned in this category of land use.

Only two other land use categories are projected for the area. The land now occupied by the Colorado Brick Company, fluorspar mill and the land adjacent to 60th Avenue is indicated to continue to have heavy industrial usages. This classification also extends to the land west of 55th Avenue and south of Valmont Road, except for the land directly within the South Boulder Creek floodplain. Apparently the County hopes that the Public Service Company will make some arrangements whereby land in the vicinity of the lakes will be open to recreational use.

County officials admit candidly that plans to acquire some of the area which is projected to be parks and open space is more wishful than realistic. However, the County intends to establish zoning restrictions which will hopefully eliminate development of any kind along the floodplain of Boulder Creek.

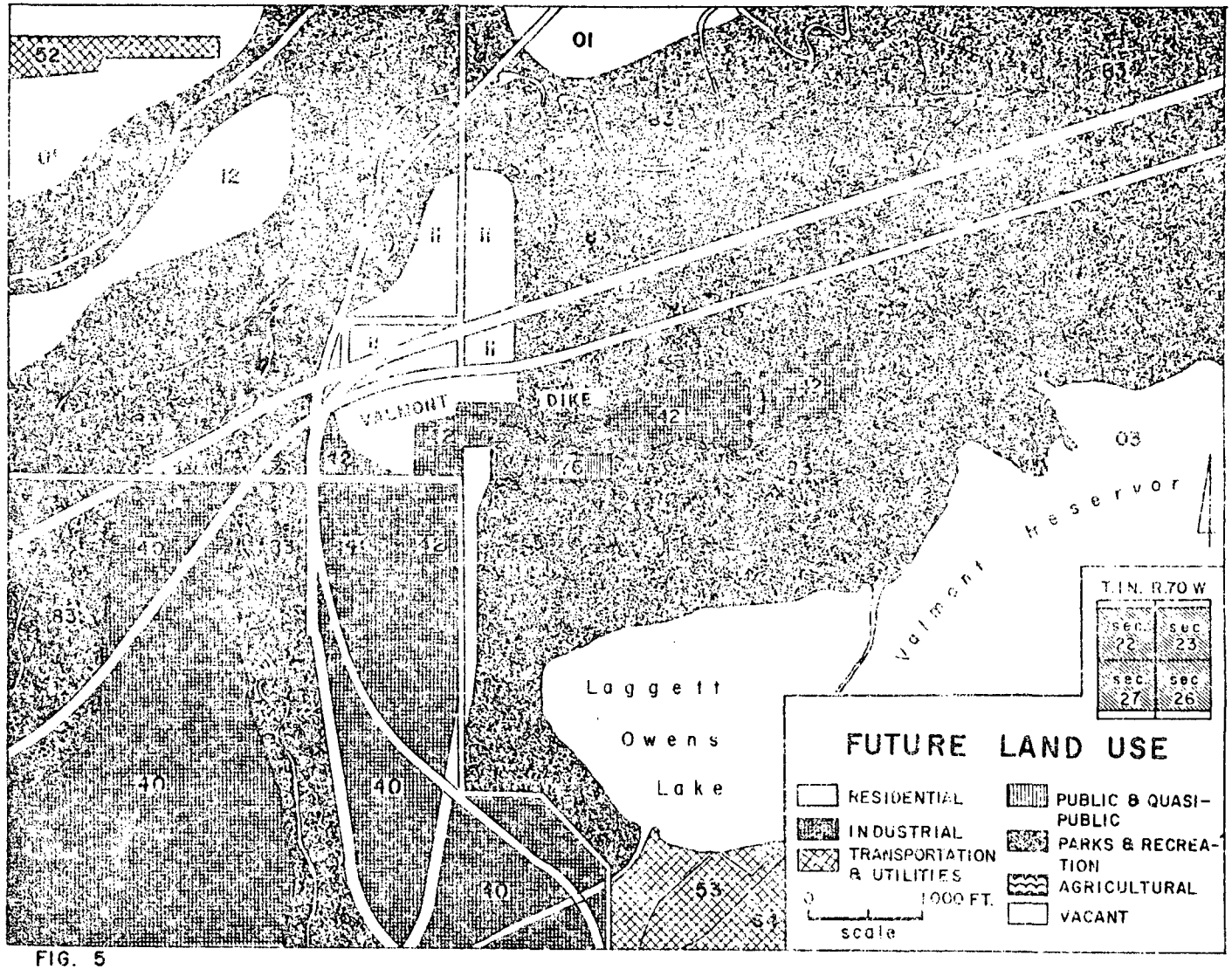
VALMONT
DIKE
Laggett
Owens
Lake
Valmont Reservoir
T.1N. R.70W
sec. 22
sec. 23
sec. 27
sec. 26
FUTURE LAND USE
RESIDENTIAL
INDUSTRIAL
TRANSPORTATION & UTILITIES
PUBLIC & QUASI-PUBLIC
PARKS & RECREATION
AGRICULTURAL
VACANT
0
1000 FT.
scale

FIG. 5

Current industrial usages are expected to remain, but not expand, except between 61st Avenue and South Boulder Creek, and west of the creek along Valmont Road. In general, future changes are expected to reflect a gradual decline in gravel mining north of Valmont Road, and a slow disappearance of agricultural land use in the vicinity of South Boulder Creek. Hopefully, such changes will be accompanied by a shift in the Public Service Company's land use policy which will allow easier access to the lakes and vacant land on their property.

Summary

The historical evolution of land use in the vicinity of Valmont Dike has resulted in the area undergoing a continual transition. The area has experienced a number of changes in the past 110 years. Starting in 1860, the land was first farmed and homesteaded. Later, residential and community growth occurred bringing with it the railroad and some commercial development. Mining and quarrying followed accompanied by a rapid decline in the community's growth as the city of Boulder steadily consolidated and expanded its position as the main service center for the surrounding area.

In the 1900s some suburban growth occurred at the periphery of the City of Boulder, with accompanying development of heavy and light industry. Extensive modification of the terrain was brought about by the Public Service Company's construction of a lake, and the mining of gravel along the floodplain of the nearby creeks.

Recently the County has begun to project much of the area as future parks, recreation and open space land. This has been partially accompanied by the land purchases of the Colorado Department of Game, Fish and Parks.

Valmont Dike and its environs have a rich historical background. When this background is combined with the natural attractiveness of the area, and its proximity to the rapidly growing city of Boulder, the idea of transforming this site into a natural area becomes justified.

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CHAPTER 4. CADASTRAL AND LAND TENURE SURVEY

John L. Harper, James Biggins, and Wil. Ulman

The cadastral and land tenure patterns for the Valmont Dike area have not changed to any discernible degree in the past 20 years (Compare Figures 6 and 7). This is due primarily to the continued occupance of the area by the two major land owners, The Public Service Company of Colorado and the Allied Chemical Company. In fact, the present title pattern was essentially established prior to World War II (See Table 2.)

For the most part, holdings are owner-operated. Only two leases contradict this overall pattern. A one-half acre plot (Parcel 68876) is leased from Mrs. Joy E. Keeter by Mr. C. R. Morrison, and Mr. George Gapter leases 20 acres in the NW¼ of the NE¼ of Section 27 from the Public Service Company of Colorado.

TABLE 2. FILING DATES OF THE MAJOR LAND OWNERS

Description	Grantee	Filing Date
Tract 10009-A	Allied Chemical Company	11-17-41
Parcel 391520	Allied Chemical Company	11-17-41
NW¼SW¼, 5.14 ac.	George L. Sawhill	4-4-36
Tract 3760 and Parcel 688876	J. E. Keeter	2-16-61
Parcel 65412	Harold H. Short and James G. Milne	11-1-61
Parcel 213455	Public Service Company	10-9-23
Parcel 217009	Public Service Company	4-23-25
73.5 ac N of C&S Railroad in Sec. 26	Public Service Company	10-9-23
Tract 2175	Colorado Brick Company	3-4-55

The community of Valmont has remained virtually unchanged in areal extent since the late nineteenth century. In view of this, it was decided that the community be treated as a single entity although it is actually comprised of numerous individual residences.

In summary, the overwhelming impression created by this analysis of Valmont Dike and environs is one of ownership stability throughout the

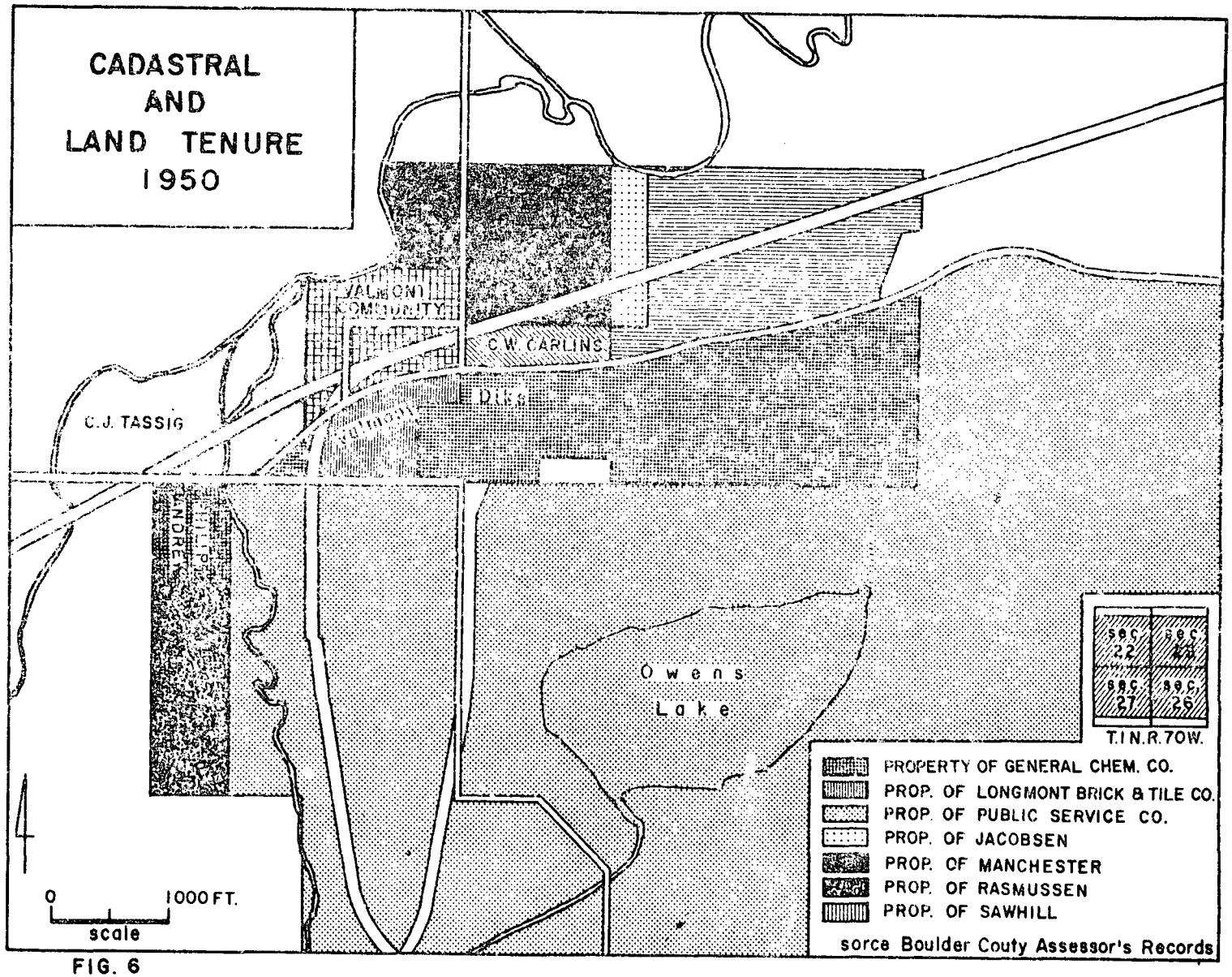
CADASTRAL
AND
LAND TENURE
1950
VALMONT
COMMUNITY
C.W. CARLINS
C.J. TASSIG
L.N. DREW
Owens
Lake
0
1000 FT.
scale
T.1 N.R.70W.
PROPERTY OF GENERAL CHEM. CO.
PROP. OF LONGMONT BRICK & TILE CO.
PROP. OF PUBLIC SERVICE CO.
PROP. OF JACOBSEN
PROP. OF MANCHESTER
PROP. OF RASMUSSEN
PROP. OF SAWHILL
sorce Boulder Couty Assessor's Records

FIG. 6

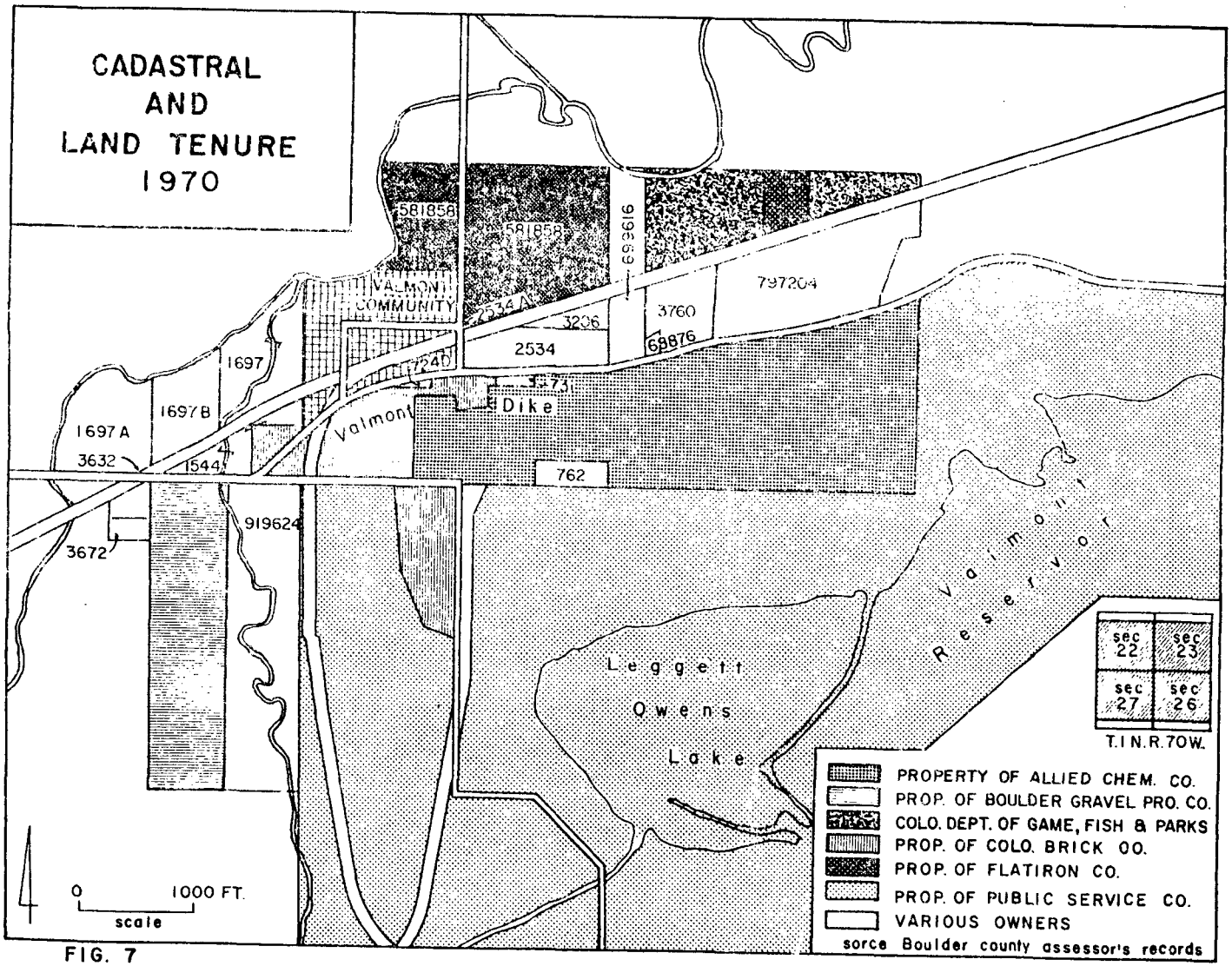
CADASTRAL
AND
LAND TENURE
1970
581858
581858
919619
797204
VALMONT
COMMUNITY
2534 A
3296
3760
2534
68876
1697
2240
3673
Dike
1697 B
1697 A
3632
1544
Valmont
762
919624
3672
Leggett
Owens
Lake
Valmont
Reservoir
sec 22
sec 23
sec 27
sec 26
T.1 N.R.70W.
PROPERTY OF ALLIED CHEM. CO.
PROP. OF BOULDER GRAVEL PRO. CO.
COLO. DEPT. OF GAME, FISH & PARKS
PROP. OF COLO. BRICK CO.
PROP. OF FLATIRON CO.
PROP. OF PUBLIC SERVICE CO.
VARIOUS OWNERS
sorce Boulder county assessor's records
0
1000 FT.
scale

FIG. 7

great preponderance of acreage involved, most of it industrial property. A glance at the "Boulder Valley Comprehensive Plan" reveals that this pattern is projected to continue for at least another 20 years. It appears from this, therefore, that attempts to purchase land in the vicinity of the dike itself for other than industrial purposes (e.g., creating a natural area site) would probably be unsuccessful. This does not, however, preclude the possibility that the University of Colorado and/or other interested institutions may be able to arrange permanent access to the area for academic purposes. Arrangements should at least be made for the preservation of the biological and geological features in and around the dike.

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CHAPTER 5. LAND ECONOMICS

Max H. Dodson, Robert E. Key and Dean G. Wilder

Methodology

The methodology involved in conducting this land economic study of the Valmont area was twofold. First, a study was conducted on the past and present assessed land values utilizing records available at the County Assessor's Office, Boulder, Colorado. In the appropriate land books were located the legal descriptions, assessed land values, and taxes on those particular properties encompassing the Valmont area.

The assessed value as entered in the land books is 30 per cent of the appraised values. By multiplying the assessed value by the proper mill levy, a tax was derived. Table 3 was compiled showing property description, acreage, assessed land value per acre, and appraised value per acre. The appraisal value per acre is cartographically portrayed in Figure 8 of this study.

Past land values were more difficult to compile, and so for simplicity, only selected tracts or parcels of land were chosen to show the annual per cent increase in assessed land values from 1960 to 1970 as shown in Table 4.

The second part of the study pertained to present fair market values in the area. Fair market value according to Mr. Jack K. Basart, Boulder Real Estate Appraiser, is defined as "the highest price estimated in terms of money which a property will bring if exposed in the open market for a reasonable length of time, allowing a knowledgeable buyer and seller to agree." To obtain a complete fair market value for the entire study area was not possible, but by utilizing Mr. Basart's appraisal report of January 10, 1969 on two tracts of land located in Section 28, T 1 N, R 70 W, and a telephone interview with Mr. Eldin Baird of Baird Realty in Boulder, comparable or correlative estimates could be made on property within the Valmont study area.

Review of Information

In reviewing the statistical information in Table 3, Figure 8 and the Cadastral and Land Tenure Survey some prominant characteristics were observed. It can be seen that the higher land values were associated with the smaller parcels of land. Also, location and desirability seemed to significantly affect land values. The majority of the high priced land was observed to be adjacent to transportation facilities. Functional use also seemed to determine land values. For example, the highest single land value in the area was occupied by a residence (Parcel 688876).

TABLE 3. LAND ECONOMICS

Description	Acreage	Assessed Value/Acre	Appraised Value/Acre
SECTION 22			
Tract 723	3.00	$ 73.33	$ 241.99
724-D	1.00	660.00	2,178.00
731	2.00	330.00	1,089.00
1009	19.00	91.58	302.21
1009-A	9.00	120.00	396.00
1544	8.00	375.00	1,237.50
1544-A 3990	1.60	643.75	2,124.38
1697	22.00	181.82	600.00
1697-A	22.00	181.82	600.00
1697-B	8.00	120.00	396.00
2534	9.75	83.08	274.16
2534-A	0.10	200.00	660.00
3208	4.00	137.50	453.75
Parcel 391520	19.00	175.79	580.11
581858	49.00	22.45	74.09
SECTION 23			
Tract 3760	8.00	135.00	445.50
Parcel 213455	15.00	*	
240716	100.00	*	
217099	19.00	*	
391520	79.00	20.89	68.94
655412	3.60	138.89	458.34
688876	0.50	1,320.00	4,356.00
699616	11.00	163.64	540.01
797204	31.00	111.81	368.97
799153-5 799193-5	36.85	No Tax	
SECTION 26	313.00	*	
SECTION 27			
Tract 2175	12.00	600.00	1,980.00
3632	1.00	1,200.00	3,960.00
3672	1.00	1,200.00	3,960.00
Parcel 703457	20.00	300.00	990.00
794740	7.55	298.01	983.43
919624	10.00	750.00	2,475.00

* Colorado State Tax Commission; taxed as a statewide unit (Public Service Company of Colorado).

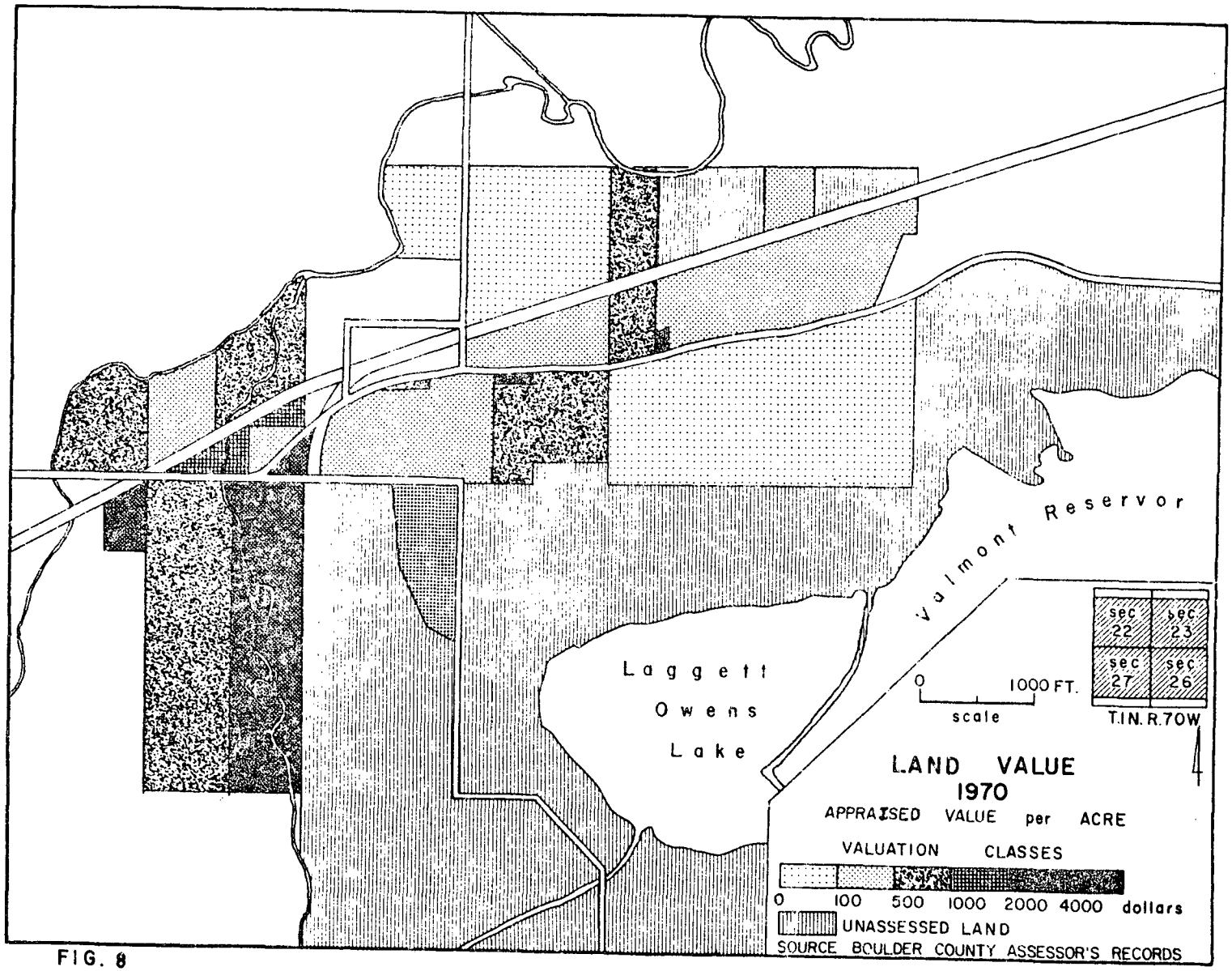
Laggett
Owens
Lake
Valmont Reservor
0
1000 FT.
scale
sec 22
sec 23
sec 27
sec 26
T.1N. R.70W
LAND VALUE
1970
APPRAISED VALUE per ACRE
VALUATION CLASSES
0 100 500 1000 2000 4000 dollars
UNASSESSED LAND
SOURCE BOULDER COUNTY ASSESSOR'S RECORDS

FIG. 8

TABLE 4. 1960-70 LAND VALUES OF SELECTED PROPERTIES

Description	Acreage	1960 Assessed Value	1970 Assessed Value	Percent Annual Increase
Parcel 655412	3.60	$ 400.00	$ 500.00	2.5%
Tract 2175	12.08	1,600.00	7,200.00	45.0
Tract 1544	8.00	1,100.00	3,000.00	27.3
Parcel 703457	20.00	1,570.00	6,000.00	38.1

The lowest land values were occupied by tailing ponds (Parcel 391520) and an unoccupied property (Parcel 581858).

Fair Market Value

Comparison with other properties of known or recognized value is an effective way of arriving at fair market values. When allowing for suitability, size, location, access, utilities, and other factors, a general estimate of land values could be made for properties within the study area.

An appraisal made by Mr. Basart (Basart, 1970) for the City of Boulder showed what land is worth in East Boulder. A sales chart on properties located within or closer than 2 miles of the Valmont Butte area inciated that acre costs ranged from $2,700 to $11,000. These properties portrayed the same characteristics as did the properties in the study area. Smaller parcels of land were the most expensive, and location and functional use apparently influenced or determined the wide range of property values.

Mr. Eldin Baird stated that land in and around Valmont sells from $2,000 to $6,000 per acre depending upon land characteristics. The City recognized industry as being the best use of the area. This is evidenced by the industrial zoning of a great part of eastern Boulder.

Future Land Values

Future land values, if they follow the trends shown in Table 4, would spiral unbelievably in the coming years. Further improvements in utilities and transportation is projected for the area. This undoubtedly would affect future land values. On the other hand, if an economic leveling off period or stabilization of growth in the near future occurs, land values could conceivably stabilize to some degree.

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CHAPTER 6. CONCLUSION

Michael R. Tripp, William G. Callahan, and Manik Hwang

The preceding chapters present a picture of the Valmont Dike natural area through both geologic and historical time. They emphasize the educational value of the area's unique environmental characteristics, and suggest, through ownership patterns and economic trends, what directions man's use of the area may take in the future.

That Valmont Dike and its immediate environs represent a natural area study site of great value is readily agreed upon. Individual researchers, as well as groups of students from several University departments, have regularly used it for educational purposes. Geologists rightly emphasize the Dike's uniqueness as a Tertiary igneous intrusive thrust into sedimentary rock. This uniqueness is enhanced by a conveniently exposed cross section revealing the structure and components located on the west face of the Dike at the site of the old cobblestone quarry. Biologists are interested in the several closely-spaced vegetation zones differentiated by exposure and elevation. Geographers, in addition to the study of the Dike's geomorphic attributes, are able to employ its crest as an elevated observation post from which to view the panoramic transition zone of plains, foothills, and mountains with their varied and changing land use patterns.

Any consideration of how such attributes might be protected and maintained must be concerned with the possible alternate uses to which this site and its environs might be put. Instrumental in determining such alternatives are the attitudes and plans of landowners, business operators, local governments, and other interested organizations such as the University of Colorado and the Boulder Valley RE-2 School District.

From an educational standpoint, out-right purchase of the site by the University or the Boulder School District would seem to best insure its control and use as an educational resource, and educators such as Ralph E. Bachus, Boulder Public School Science Director, would strongly endorse such a move (Bachus, 1970). However, the several industrial concerns who own much of the land in the area, including the site of the Dike itself, have no intention of selling their land and indeed, expect to continue their operations indefinitely (Public Service Company, et al, 1970).

The possibility of private land dedications must not be overlooked, but acquisition by the City of Boulder of certain land parcels through easements granted by owners in return for other considerations seems more realistic. In fact, Boulder's Greenbelt plan includes all of the land in the study area. However, according to Robert E. Key, Director of Parks and Recreation for the City of Boulder, acquisition of this land presently

has low priority, but until such time as the land may be acquired under the Greenbelt plan, concerned city and county agencies will watch closely any land use changes or developments through zoning and building regulations (Key, 1970).

On August 4, 1970, Boulder voters will be presented with Ordinance No. 3525 which provides for public recreational and open-space use of the Public Service Company of Colorado's land and water facilities lying within the presently designated Greenbelt areas "to the extent that such use does not interfere with the company's use of such lands and water facilities" (City..., 1970). Lloyd Harrell, Assistant to the City Manager of Boulder, adds that this franchise proposal, involving a year of negotiations between city government officials and representatives from the Public Service Company, provides for an exclusive 20-year franchise whereby the Company will furnish natural gas and electricity to the City of Boulder (Harrell, 1970). Obviously, such an agreement would go far in shifting the use of the land and lakes immediately south of Valmont Dike toward recreational use, thereby enhancing the possibility that the Dike itself would eventually be reserved as an integral part of Boulder's Greenbelt program.

References

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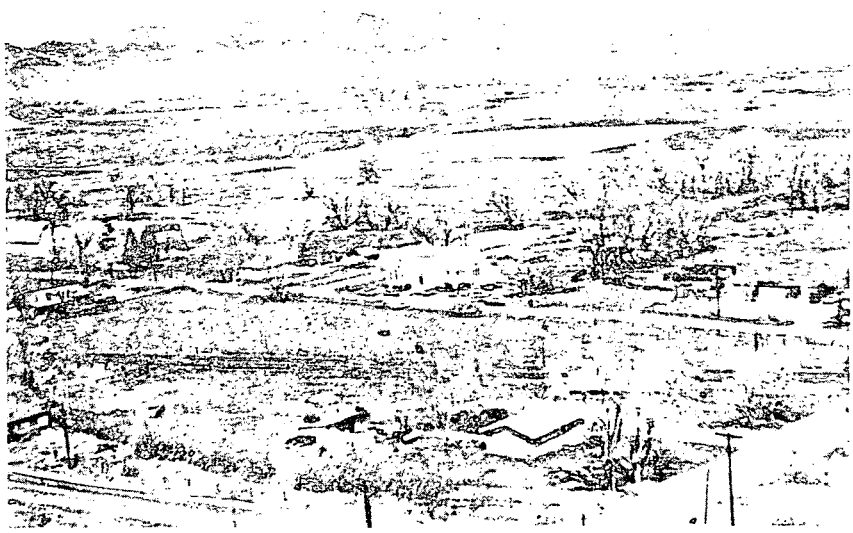
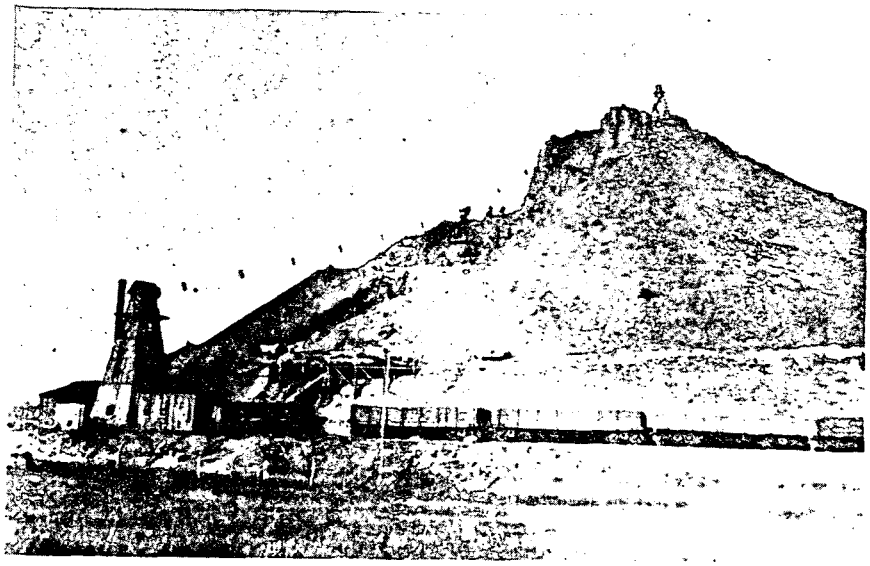
Key, Robert E. 1970. Director of Parks and Recreation, City of Boulder, Colorado. Personal interview, (May).

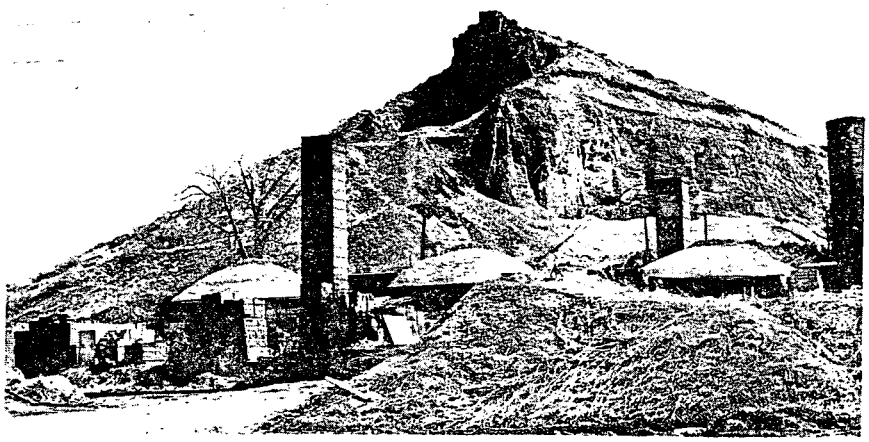
Representatives of Public Service Company of Colorado, Flatiron Companies, and the Colorado Brick Company, all of Boulder, Colorado. 1970. Personal interviews, (March).

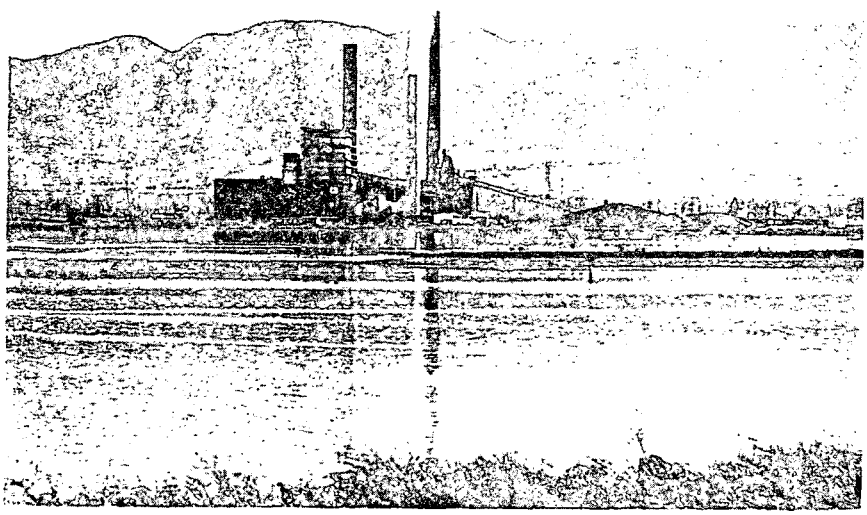
APPENDIX A - PHOTOGRAPHS

VALMONT SCHOOL
DIST. No. 4
1911









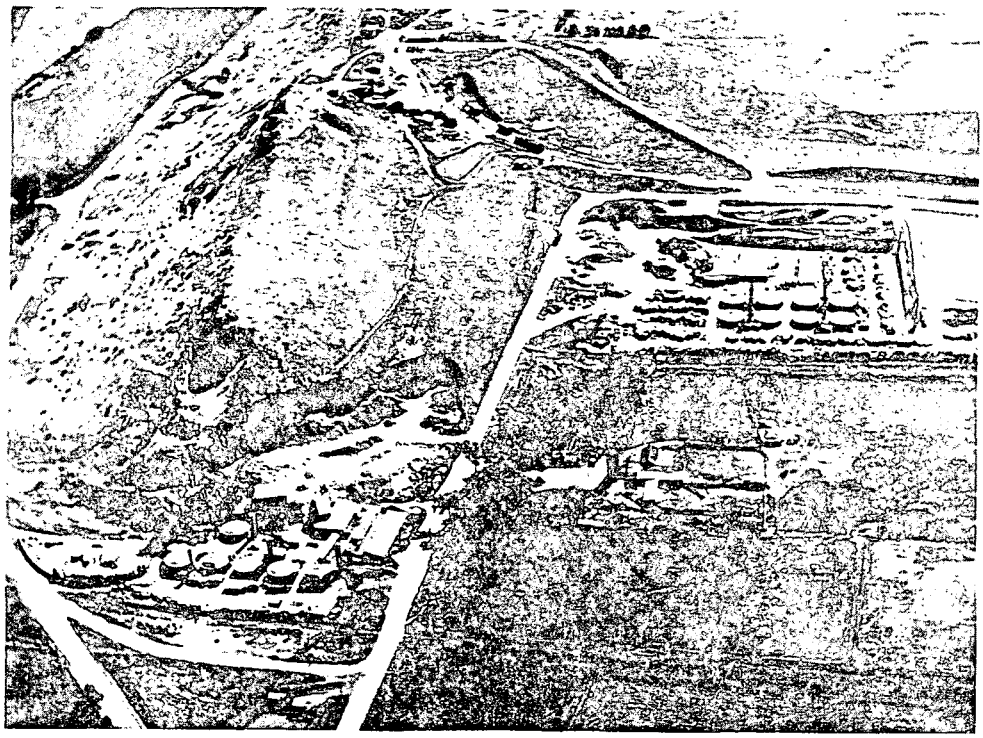


Figure 15

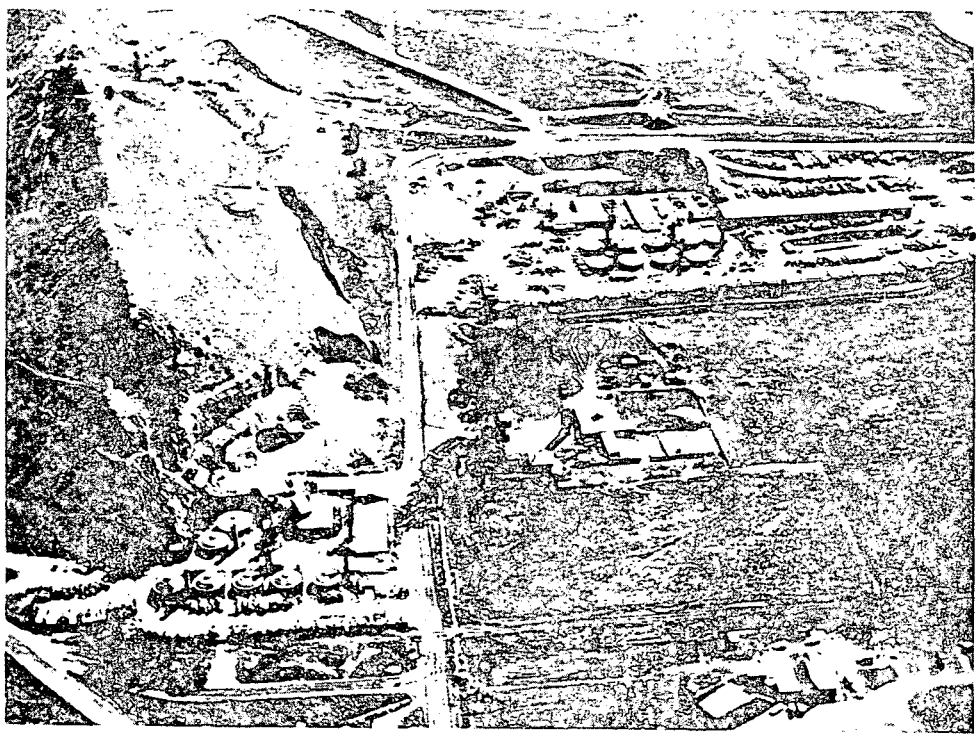
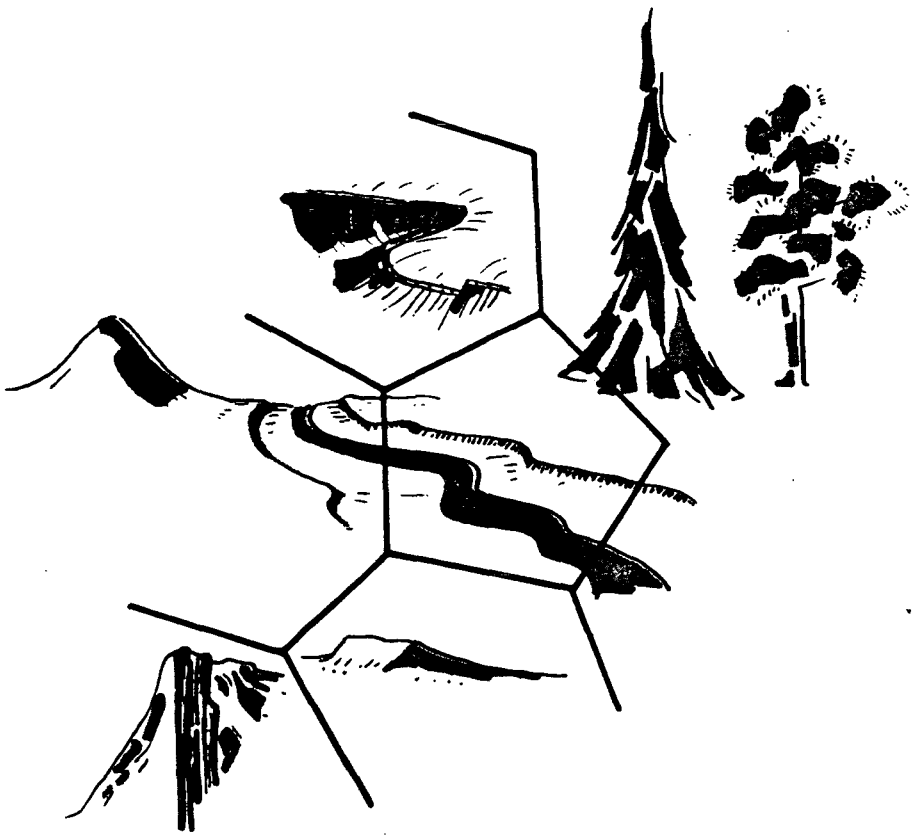


Figure 16

SIX-MILE FOLD
Natural Area Study



Department of Geography / University of Colorado

SIX-MILE FOLD

NATURAL AREA STUDY

Gary Heaslet and Dean G. Wilder

Editors

DEPARTMENT OF GEOGRAPHY

UNIVERSITY OF COLORADO

Boulder, Colorado

1970

TABLE OF CONTENTS

Chapter		Page
	FOREWORD . . . . . Donald D. MacPhail	iv
	ACKNOWLEDGEMENTS	vi
I.	INTRODUCTION . . . . . Gary Heaslet and Dean G. Wilder	1
II.	ENVIRONMENTAL STUDY OF SIX-MILE FOLD . . . . . Wil. Ulman and Robert Key	6
	Geology Soils Vegetation Summary	
III.	PAST, PRESENT AND FUTURE LAND USE . . . . . Dean G. Wilder, Jim Biggins and Helen Young	20
	Land Use Survey Historical Land Use Summary and Predictions	
IV.	LAND ECONOMICS . . . . . William Callahan and John Harper	29
	Introduction Land Valuation Mineral Rights Improvements Summary	
V.	CADASTRAL AND LAND TENURE . . . . . Scott Mernitz, Max Dodson, and Michael Tripp	34
	Introduction Past Cadastral Patterns Present Cadastral Patterns Land Tenure	
VI.	SUMMARY . . . . . Dean G. Wilder and Gary Heaslet	41

FIGURES

		Page
1.	Six-Mile Fold Natural Area Site	2
2.	Topographic Relief - Six-Mile Fold	3
2-A.	Aerial View of Six-Mile Fold	8
2-B.	Undergraduate Class Studies a Fault	8
3.	Geology - Six-Mile Fold	9
4.	Niobrara Fossil	12
5.	Watergap at Six-Mile Fold	12
6.	Selected Fossils Found in the Six-Mile Fold Area	13
7.	Soils - Six-Mile Fold	15
8.	Vegetation - Six-Mile Fold	17
9.	Key to Land Use Classification Code	21
10.	Land Use: Six-Mile Fold and Area - 1956	22
11.	Land Use: Six-Mile Fold and Area - 1963	25
12.	Land Use: Six-Mile Fold and Area - 1969	26
13.	Six-Mile Fold - Fair Market Value by Acre - 1970	30
14.	Six-Mile Fold - Fair Market Value by Acre - 1950	31
15.	Land Ownership - 1880	35
16.	Land Ownership - 1910	36
17.	Land Ownership - 1930	37
18.	Land Ownership - 1950	38
19.	Land Ownership - 1970	39

FOREWORD

This report is one of six undertaken this year in the Department of Geography at the University of Colorado. It has become almost a tradition for the graduate seminar in land use to initiate a project in the local area in cooperation with an agency of the Boulder community on either the municipal or county level, sometimes both.

These studies achieve a number of objectives. The participating students undertake a realistic project which they are able to plan, execute, and publish within the brief span of one semester. Also, these studies provide new information for municipal and county officials and citizen groups concerned with planning and guiding the growth and development of the City of Boulder and Boulder County. In short, these are professional training exercises for graduate geographers and are a serious effort in providing new planning perspectives in the interest of public service.

In response to a suggestion by the Natural Areas Committee of the University of Colorado, the land use seminar elected to study and analyze a number of natural sites in the Boulder Valley. The group was also joined in the endeavor by the graduate field seminar of the Department of Geography.

The cooperative base within the Boulder community was wider than usual this year. The sites chosen for study seemed to have potential for a variety of uses beyond their present development. These included instruction of public school and university students, scientific research, recreation, greenbelt, and open space. The graduate students involved worked in cooperation with the resident property owners, the Parks and Recreation Department and the Planning Office of the City of Boulder, the Department of Development and the Parks and Open Space Advisory Committee of Boulder County, the Boulder and Longmont Offices of the Soil Conservation Service, the Science Director of the Boulder Valley RE-2 School District, the Planning Office and the Natural Areas Committee of the University of Colorado, and the Denver Regional Council of Governments.

Sometimes the graduate researchers felt that they would have liked to pursue certain themes in greater depth if they had had more time available. Nonetheless, they join me in expressing the hope that this report provides informative insights on a fascinating part of Boulder County.

The various chapters which appear in this study were originally submitted as special reports by the individuals indicated. They represent the endeavors and views of the authors and in no way should be interpreted as the official views of the Department of Geography or any other cooperating agency or organization previously mentioned. Because of this independence from official views, the participants in this project are especially grateful to the Graduate School of the University of Colorado, the City of

Boulder, the Boulder County Commissioners, the Boulder Valley RE-2 School District, and the University of Colorado Foundation for sharing the costs of printing this report.

This is the collective and individual effort of a group of dedicated geographers concerned about the quality of the local environment and its attendant stresses. Boulder County residents, students, and local officials may gain understanding from this report that will assist them in their efforts to perpetuate the Boulder area as a pleasant and attractive place to live.

Donald D. MacPhail, Ph.D.
Professor of Geography

Boulder, Colorado
June, 1970

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University of Colorado Foundation
The City of Boulder
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Boulder Valley School District RE-2 (J).

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The authors of this study wish to thank all of the people who assisted us in bringing together this information. In particular we wish to thank the librarians from the Western Historical Research Collection of Norlin Library of the University of Colorado, the people at the Boulder County Assessors' Office and the County Treasurer's Office, Harold Nesbitt of the Agricultural Stabilization and Conservation Service, Gary Hansen of Beech Aircraft Corporation, Bob Trenka and Vince Porreca of the Boulder County Planning Office, and Mrs. Anna B. Joder and Don Look of Look Photos for their personal assistance. We also wish to thank Mrs. Nancy Stonington for the cover design of this report, Mrs. Sue Middleton for the typing of the report, and Dr. Donald D. MacPhail for his guidance, assistance, and cooperation in this endeavor. Our thanks also go to Mr. Wilbert J. Ulman for his work with the copy camera and contact printer in the final preparation of the maps for publication.

The Authors

CHAPTER I. INTRODUCTION

Gary Heaslet and Dean G. Wilder

Boulder's rapid growth since the end of World War II has brought a significant change in the natural landscape of the area. Construction of highways, commercial and residential expansion, and building due to rezoning of agricultural areas has blanketed the Boulder area with cultural features. One result of this growth and development is a reduction in the natural attractiveness of the area.

The citizens of Boulder, recognizing the inevitable expansion of their city and its effects on the landscape, have enacted various types of ordinances and legislation that attempt to guarantee the preservation of the natural beauty of their community. The two best examples of this type of policy are the Blue Line and City Greenbelt Programs (City Manager, 1968).

In the process of adopting these programs, which aim to provide natural areas around and within the community, Boulder residents have become more sensitive to their environment. The orientation of most seems to be toward preserving areas for their visual appeal and aesthetic value.

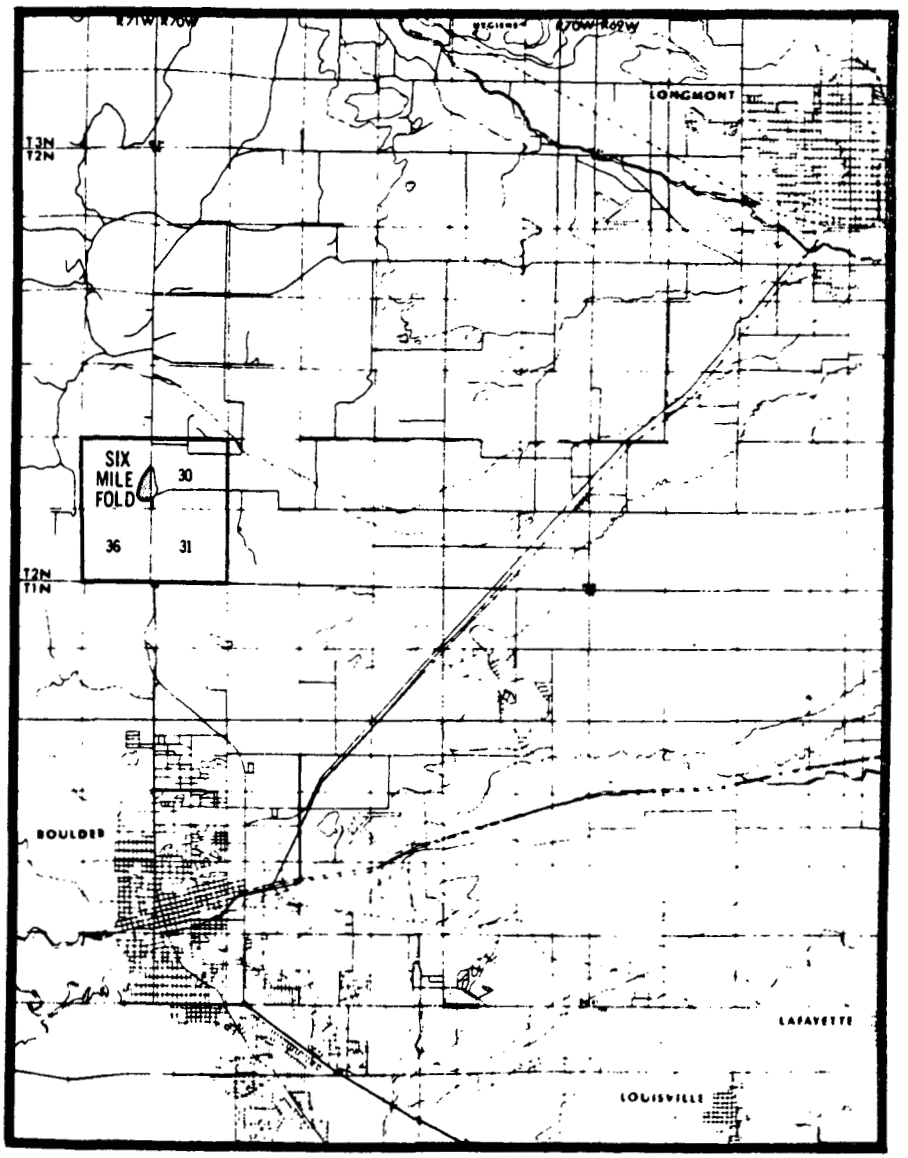
In addition to natural beauty, there are other criteria that should be considered in evaluating natural areas. These include the historical significance of the location, its potential for academic study or research, the possibility of the area serving as a neighborhood or community recreation area, or possibly restricted uses, as in the case of a floodplain.

The members of the Department of Geography seminar on land use decided in January of 1970 to undertake a study of six natural areas within a few miles of the University in an attempt to evaluate their merits for a number of alternate uses. A preliminary survey by the class identified the sites which had the greatest interest to a number of groups within the Boulder community. The main focus of study has been oriented toward identifying and analyzing specific natural areas in the Boulder community having one or more unique characteristics. The purpose of the seminar's activities was to provide a set of reports which would contain the pertinent information regarding each of these locations.

This report deals with the site known as Six-Mile Fold and is broken down into six sections: introduction; environmental survey; past, present, and future land use; land economics; cadastral and land tenure; and conclusions. Each section was prepared by a different team of graduate students, thereby providing a maximum amount of exposure to the various aspects of regional description and analysis.

Six-Mile Fold is located about 4 and 1/2 miles north of Boulder immediately west of Highway 7 (Figure 1). In the past, this area has been

Figure 1



SIX-MILE FOLD
NATURAL AREA SITE

the scene of many field trips conducted by various departments of the University of Colorado (Figure 2B). A wide array of natural phenomena, of interest especially to students of geography, geology, and biology, are present within this relatively confined area. Although most intensively used for freshman sequence courses, upper-class as well as graduate courses have undertaken studies in this natural area with the permission of the landowners.

To illustrate the uniqueness of Six-Mile Fold as an area of interest, the following section will provide a description of the geology, soils, and vegetation found within the area of study. The study area, as shown in Figure 2, occupies approximately 70 acres.

References

City Manager, City of Boulder. 1968. Memorandum to City Council entitled "Plan for Implementing the Greenbelt Program," March 12, 1968. Boulder, Colorado

CHAPTER II. ENVIRONMENTAL STUDY OF SIX-MILE FOLD

Wil. Ulman and Robert Key

Six-Mile Fold owes its name to a long asymmetrical anticline and syncline on the lower slope of the foothills. To the untrained observer in the field, these features might easily go unnoticed. However, observed from the air, the anticline and syncline are visible as a light-toned "S" shaped curve on a dark background.

The foothills, paralleling Highway 7 northbound, are an expression of the upturned western edges of the sedimentary beds which dip eastward to the Great Plains. As the Front Range of the Rocky Mountains uplifted during the Cretaceous period, the overburden of thousands of feet of sedimentary rocks were forced to yield from their former horizontal position. Accompanying this uplift, frequent folding and warping occurred within the sedimentary strata. In this manner, Six-Mile Fold was formed. Where the stress of the slow continuous uplift exceeded the elasticity of the rocks faults and fractures resulted.

The anticline and syncline of the Six-Mile Fold maintain their topographic expression through the relative resistance of the Niobrara formation to erosion (Figures 2A and 3). The entire thickness of the Niobrara formation is approximately 400 feet. Throughout this sedimentary stratum, the uniformity of the formation varies. At the base of the formation lies the Fort Hayes member consisting of 20 feet of medium-bedded to massive, light gray, very fine-grained limestone. The remainder of the formation consists of a less resistant, highly calcareous shale which weathers a dark brown to black and is poorly laminated. Near the top of the Niobrara lies the Oysterbed member. Although considerably less resistant to differential weathering and erosion than the Fort Hayes member, the Oysterbed is more resistant than the middle portion of the formation.

The position of the Niobrara formation within the stratigraphic sequence of sedimentary beds gives rise to the topographic expression of Six-Mile Fold. Directly beneath the Niobrara and surfacing immediately west of Six-Mile Fold is the Benton shale formation, relatively soft and easily weathered and eroded. Thus, it is associated with valleys. Surfacing some distance east of the Fold, is the Pierre formation, also comparatively softer than the Niobrara with relatively little relief. Located between two beds of a less durable nature, the Niobrara naturally stands out in relief. Outcrops of the Fort Hayes limestone are especially visible because of the strikingly white coloration of this member. Easily observed on an air photography or traced in the field, outcrops of the twisted, folded and warped Fort Hayes limestone form the backbone of Six-Mile Fold (Figure 2A).

At the base of the southward plunging anticline and syncline, the Fort Hayes limestone dips beneath the less resistant upper members of the Niobara.

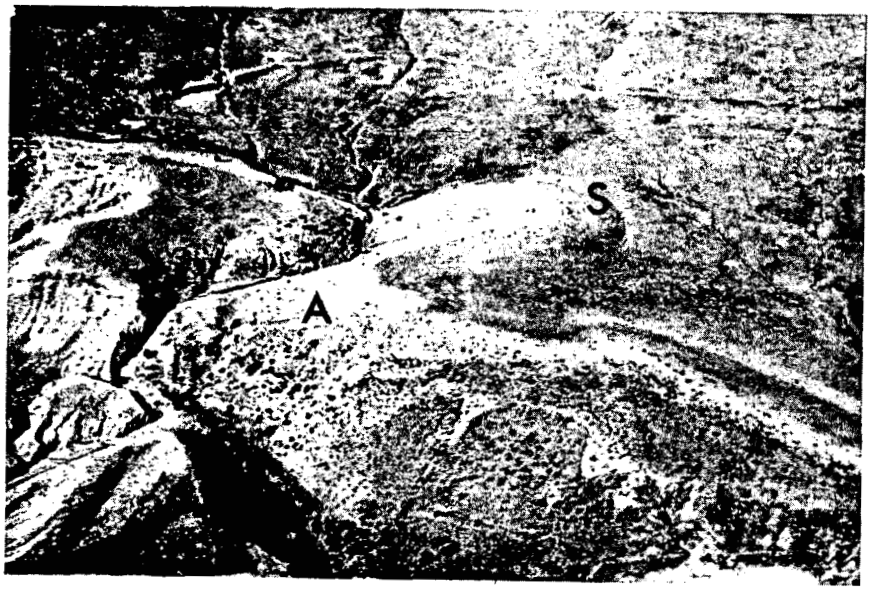


Figure 2A

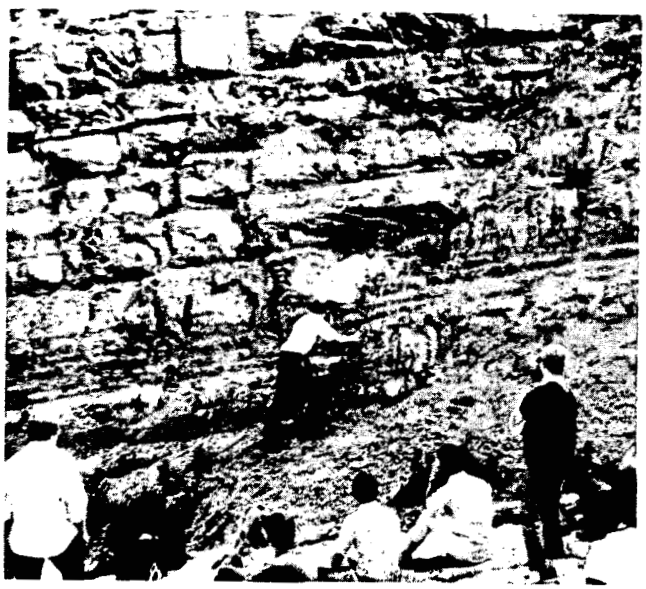
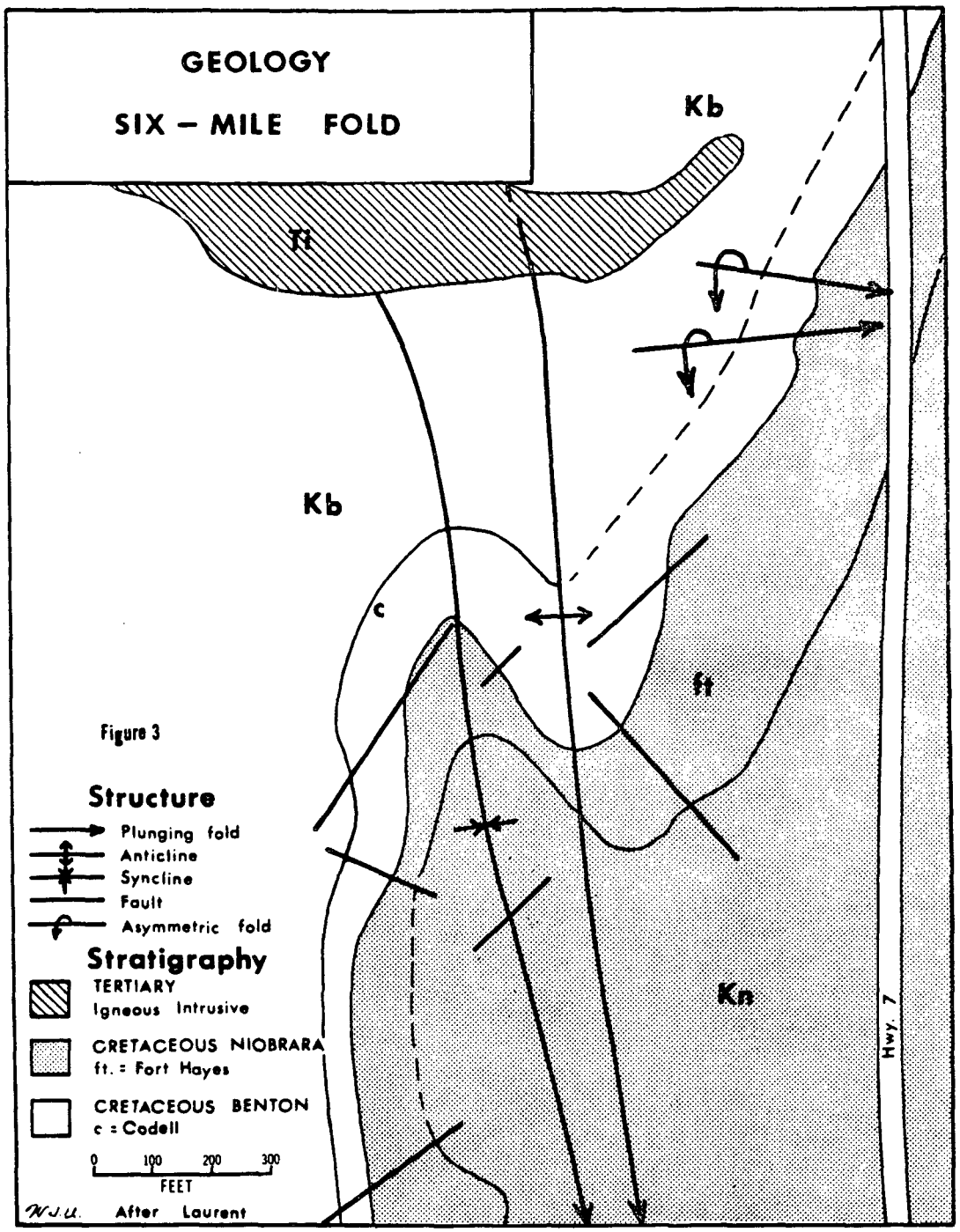


Figure 2B


GEOLOGY
SIX – MILE FOLD
Kb
Tt
Kb
c
ft
Kn
Hwy. 7
Figure 3
Structure
Plunging fold
Anticline
Syncline
Fault
Asymmetric fold
Stratigraphy
TERTIARY
Igneous Intrusive
CRETACEOUS NIOBRARA
ft. = Fort Hayes
CRETACEOUS BENTON
c = Codell
0 100 200 300
FEET
WJU. After Laurent

A structurally controlled stream, which now flows westward at the base of the fold, formerly flowed to the northeast joining the well-marked arroyo channel directly north of the Fold. Stream piracy has since captured the former stream flow diverting the runoff to its present course. Where this stream now crosses the Fort Hayes limestone, its erosive action has cut a small water gap (Figures 2A and 5).

The less resistant portion of the Niobrara formation determines the area immediately south of the anticline and syncline. Only in the extreme southwest corner of the study area does the Fort Hayes member appear again. Here, the limestone beds are seen dipping sharply to the east at an angle of about 55 degrees. This outcrop forms an almost solid eastward dipping wall extending about 400 feet north from the stream entering the southwestern corner of the study area. Where this stream has cut through the Fort Hayes, another water gap has formed. Within this branch, the massive beds of the Fort Hayes limestone are most clearly visible.

Contrasting sharply with the northern two-thirds of the study area, the terrain in the southern portion is very rugged. Here, where the less durable members of the Niobrara formation lie exposed on top of the Fort Hayes, rapid erosion of the softer calcareous shales is manifested in the formation of numerous gullies depicting a badland-like topography devoid of vegetation.

Because all of the sedimentary beds in this area are of marine origin, the Niobrara and Benton are well endowed with preserved fossils (Figure 6). Inoceramus labiatus and Metoicoceral whitei, both fossils of the late Cretaceous age are found in the upper portions of the Benton shales. Exposed in the outcrops of the Fort Hayes member of the Niobrara are numerous Inoceramus deformus, a shell ranging up to 10 inches in diameter (Figure 4). The Oysterbed of the Niobrara derives its name from the abundance of Ostrea congesta pelecypods concentrated within this zone. Fossils found in the Niobrara have also been dated to the upper Cretaceous period.

Several well-defined faults are in evidence in the study area (Figure 2B). Two drag faults offset the smooth linearity of the Fort Hayes limestone outcropping in the "S" shaped curve of the anticline and syncline (Figure 2A). A nearly vertical reverse thrust fault has offset the normal bedding planes of the calcareous shale member of the Niobrara. This fault is located on an escarpment immediately south of the anticlinal nose (Figure 2B).

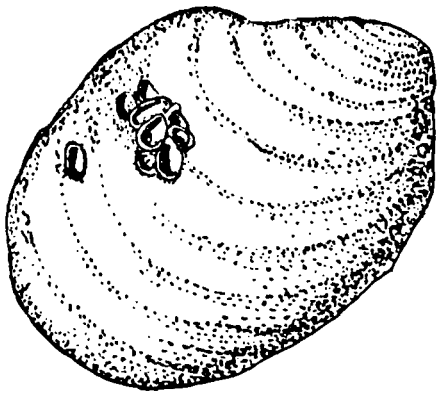
Facilitated by the semi-arid to steppe climate of the region, the geology of Six-Mile Fold has created a unique area of natural interest to earth scientists. These characteristics are also reflected in the soil development and consequent vegetation diversity found here.

Soils

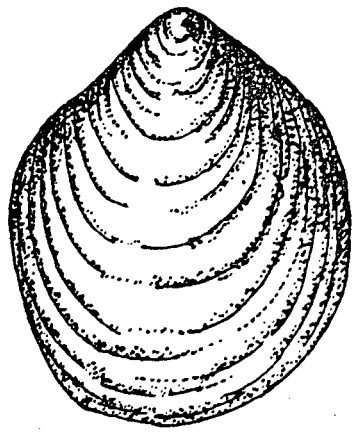
A study of the soils in the Six-Mile Fold area reveals a diversity of soil types common to this area of Colorado. These soils are of low to moderate fertility, generally unsuitable for agricultural crops, but supportive

Figure 4

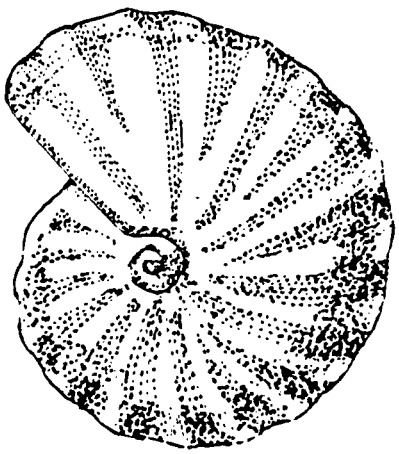
Figure 5



a. *Inoceramus deformis,* with a small colony of *Ostrea congesta* attached, from the Niobrara Formation (x 1/3).



b. *Inoceramus labiatus* from the Benton Formation (about natural size).



c. *Metoicoceral whitei* from the Benton Formation (about natural size).

Figure 6. Selected fossils found in the Six-Mile Fold area.

Source: John and Halka Chronic, "The Geologic Story of the NCAR Site" (Part I), Natural Features of the NCAR Site, p. 6. (Reproduced by permission of the National Center for Atmospheric Research)

of various grasses which make the area suitable for livestock grazing. The most fertile soil is found in the stream basins. This is evidenced by shallow profiles seen on embankments and by the dense growth of grass and shrub vegetation found in these areas.

Existing soil maps show only major soil types and do not indicate detailed sub-groups (Moreland, 1968). The major types and their descriptions are as follows (See Figure 7):

70-DE LaPorte very fine sandy loam (5 to 20%)

These are very shallow, well drained soils with very fine sandy loam or loam surface soils underlain by limestone at less than 20 inches. These soils are on upland slopes. Water intake rate is medium. Water-holding capacity is low. These soils are used primarily for rangeland. Erosion control is important on these soils. They have severe limitations for septic tank filter fields because of shallow depth.

24-C (3 to 5%) 24-D (5 to 9%) Nunn clay loam

These are deep, well-drained soils with clay loam surface soils and clay subsoils. These soils are on terraces and uplands. Water intake rate is low. Water holding capacity is high. These are good irrigated soils and are capable of producing good yields with good management. Slopes of more than five per cent should not be dry-farmed, because of the hazard of erosion. These soils have moderate to severe limitations for septic tank filter fields because of slow permeability. They have fair to good stability for embankments.

51-CD Samsil clay

This is a shallow, well-drained soil with clay or clay loam surface soil and underlain by shale at less than 20 inches. These soils are on uplands. Water intake rate is slow and water holding capacity is low. These soils are best suited for pasture. If irrigated, frequent light irrigations will probably be necessary to maintain sufficient available moisiure and avoid erosion. If not irrigated, proper range use is necessary to maintain desirable grasses and avoid erosion. These soils have severe limitations for septic tank filter fields and for foundations.

79-EF Lefthand stony sandy loam

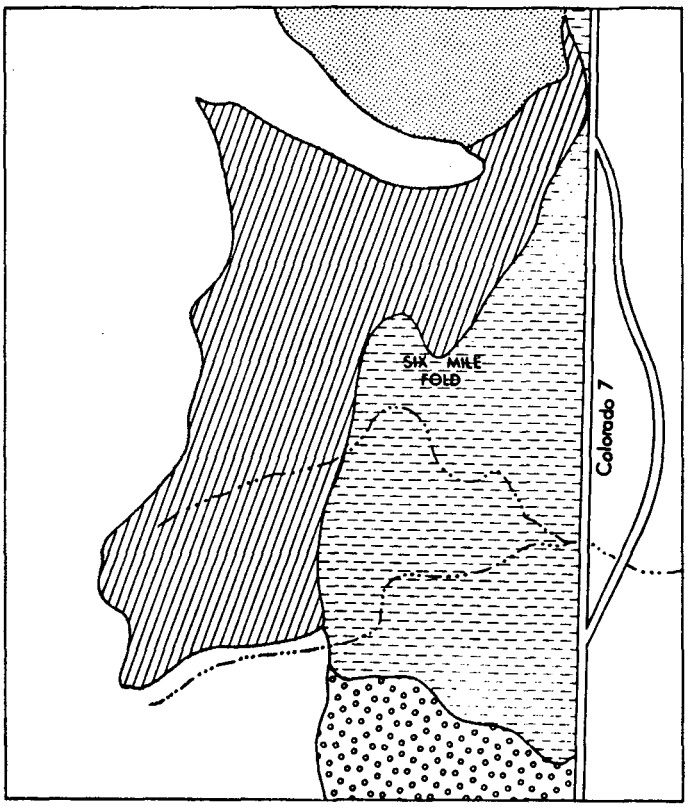
These are shallow, well-drained soils with sandy loam surface soils and underlain by sandstone by less than 20 inches. These soils have many sandstone rocks throughout. Water intake rate is rapid. Water holding capacity is low. These soils are suited only for pasture or range. Erosion control is necessary. These soils have severe limitations for septic tank filter fields. Excavation is difficult without blasting.

Limestone (LS) rock outcrop

These are areas of nearly bare rock outcrop. They include some areas of shallow soils and moderately deep soils that are on such steep slopes as to be unsuitable for anything but very limited grazing for wildlife and recreation.

Figure 7

SOILS
SIX – MILE FOLD



SOIL TYPE

- La Porte very fine sandy loam
- Nunn clay loam
- Samsil clay
- Lefthand stony sandy loam
- Rock outcrop

N

0 600 1200
Feet

Source: Soil Conservation Service

Vegetation

Six classifications of vegetation can be identified from field examination and analysis of aerial photos (Quick, 1970). These stands of vegetation reflect local variations in soils, the underlying geology, and in micro-climate (Figure 8).

Dense Grasses

Two areas are found at Six-Mile Fold with predominant grass vegetation. Along the northeast boundary on the western side of the anticlinal ridge, the grass is abundant but appears to have been heavily grazed in the past. Few other forms of vegetation are found in this area. The grasses are predominantly the short grass plains types such as Buffalo Grass (*Buchloe dactyloides*), Blue Grama (*Bouteloua gracilis*), and Brom (*Bromus* spp.). Here the soil appears well developed, with good moisture-retention qualities.

Sparse Grasses and Sparse Grasses with Yucca, Skunkbrush and Prickly Pear

These two categories of vegetation are found on the eastern side of the anticlinal area to the edge of the northern creek system. Sparse grass stands also predominate along the southeast portion of the study area. The vegetation is comprised of short grasses and xerophytic vegetation such as Yucca (*Yucca glauca*), Prickly Pear (*Opuntia rafinesquei*), and Skunkbrush (*Rhus trilobata*). In this area the soils are poorly formed, with the limestone occurring very close to the surface. Slopes are steep and moisture is not as available as in adjacent areas.

Skunkbrush, Hackberry and Occasional Wild Plum

This vegetation stand is found along the drainage systems of the two intermittent streams. These areas have the best soil profiles, composed primarily of colluvium, and adequate moisture. A third area is near the southwest corner of the study area. Here the limestone is highly fractured. The vegetation roots penetrate through the fractures where the moisture is available. The fractured limestone causes rapid infiltration of available moisture which then drains down the steep sides of the Niobrara to the stream bottom and watergap below. Vegetation is primarily composed of shrubs such as Skunkbrush, Hackberry (*Celtis reticulata*) and Wild Plum (*Prunus americana*).

This vegetation shows evidence of heavy browsing by deer. Raccoon, rabbit and coyote tracks were also found in the vicinity. A Prairie Rattlesnake was also seen nearby.

Willow and Cottonwood

Only two small standsof willow and cottonwood were noted, both near the confluence of the two streams. Willow (*Salix* spp.) and Cottonwoods (*Populus* spp.) are normally found in floodplains where the water table is close to the surface. Those found in the study area were small and shrub-like, indicating a relatively poor source of moisture.

Bare Erosion Surface

The last category reflects a lack of vegetation. These erosional surfaces are steep, with less than five per cent occupied by vegetation. Most of the material in this category is limestone outcrop or heavily eroded slopes where little moisutre is available for plants.

Summary

The uniqueness of Six-Mile Fold as a natural area is presented to the viewer as a striking change from the landscape existing immediately north or south. Certain characteristics of interest to both the natural and physical sciences are found within a relatively confined area. Six-Mile Fold is perhaps the most representative of folded strata along the foothills of the Front Range in the Boulder, Colorado area. The site also demonstrates a close inter-relationship between vegetation patterns and soil parent material. This combination of geologic and vegetative features, besides presenting a characteristic gross landscape, also develops a number of micro-environmental sites.

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CHAPTER III. PAST, PRESENT AND FUTURE LAND USE

Dean G. Wilder, Jim Biggins and Helen Young

Land Use Survey

The Six-Mile Fold site is not isolated. Increasing settlement and use of adjacent land, as well as increasing traffic through the area, may affect the site indirectly. This may occur through potential air and water pollution and, more significantly, through trespassing. Accordingly, the changing land use patterns of the adjacent area were studied in an effort to learn what is happening to the whole area. The area chosen for study was believed to be definitive in terms of the kind of land use that has existed and does exist near Six-Mile Fold and the apparent trends that have occurred.

This area includes all of Sections 30 and 31, Township 2 North, Range 70 West, and the eastern halves of Sections 25 (which includes Six-Mile Fold) and 36, Township 2 North, Range 71 West. The area covers 3 square miles (2,240 acres), with Six-Mile Fold west of the center. The western portions of Sections 25 and 36 include parts of the first hogback at the edge of the foothills. This land has been used only for grazing, and because of its rugged nature, it is doubtful that it will be used for anything else in the near future.

The land use code used by the Denver Regional Council of Governments was followed in designating the types of land use (Figure 9). Land use patterns were determined by field inspection and by use of aerial photographs. The aerial photographs used were taken in 1938, 1956, 1963, and 1969 for the U.S. Department of Agriculture. All of the photos were taken in late summer, to best record agricultural land use. Determinations made from the photographs were plotted on maps at a scale of 1 inch to 1,000 feet.

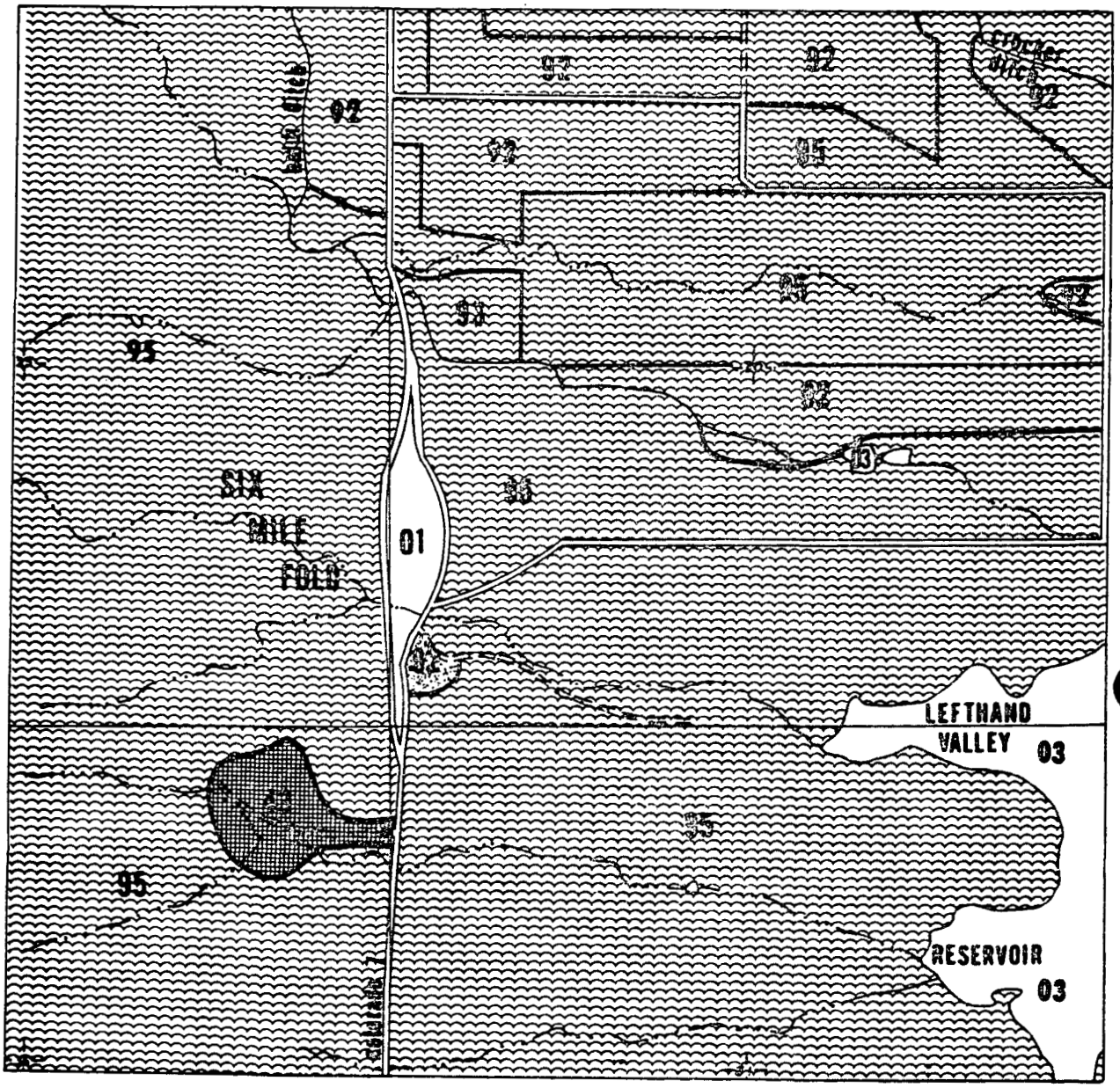
It must be emphasized that more meaningful impressions regarding specific uses of land can be obtained from the maps than from descriptions. The following paragraphs are intended only to point out apparent trends in land use.

Historical Land Use

1938 - 1956 (See Figure 10)

Colorado Highway 7 (Boulder-Lyons Road or Foothills Highway) runs generally along the range line (R 70-71 W) that separates the eastern from the western sections of the study area. It serves a useful boundary line, because trends in land uses on either side of the highway are somewhat different. The highway itself was altered in this 18 year period: road cuts were made through the sloping ridges near the Six-Mile Fold site, so that

Figure 10



LAND USE: SIX-MILE FOLD & AREA 1956

N

0 1000 2000
FEET

Location: Town 2 North, Ranges 70 & 71 West

the highway could take its present course between Sections 25 and 30. Minor changes were also made in the road that branches off to Niwot. Prior to 1956, there was an east-west road across the middle of Section 31; it was abandoned before 1956. It joined a road that was along the eastern boundary of the area, across land now flooded by Lefthand Valley Reservoir.

In 1938, about 14 per cent of the area was used for growing crops, probably hay, and the rest was grazing land. (See Table I) Between 1938 and 1956, agricultural land use "degenerated" in the sense that cropland acreage was reduced by one-half. Acreage used for grazing increased only slightly, however, because the parts of the area came under some new uses: a poultry farm was established northeast of Six-Mile Fold, Lefthand Valley Reservoir was constructed, and Beech Aircraft, Inc. began to occupy its present location south of Six-Mile Fold.

In summary, during the 1938 to 1956 period, about four per cent of the land in the area was converted to uses other than for crop growing and grazing. In addition, during this period there was a notable increase in the variety of uses of the land which contributed to the overall degredation of the original rural patterns of use. Thus, this period saw the beginning of change in land utilization from a predominantly agricultural area to one of varied land uses.

1956 - 1963 (See Figure 11)

Crop land declined slightly in acreage, and some of the land was put to other uses. Livestock raising (poultry and horses) was undertaken or expanded, about 30 acres were flooded by reservoirs, and Beech Aircraft, Inc. expanded its facilities. Some land was left idle.

Although 80 per cent of the area was still used for grazing, increasing diversification of land use meant that by 1963 grazing was reduced by about 150 acres. By the end of 1963 about 8 per cent of the area was being used for purposes other than grazing and crop growing. (Note: Six-Mile Fold and vacant land was not counted in estimating percentage.)

1963 - 1969 (See Figure 12)

Two important events occurred: Beech Aircraft, Inc. continued to expand, and single-family residences were built northeast of Six-Mile Fold. During this brief period, grazing land continued to decline in acreage, but crop land increased slightly. More important, however, is that resident population in the area increased from about 21 in 1963 to over 100 in 1969. (Note: Estimation based on assuming three persons per house). In addition, 14 per cent of the land was used other than to grow crops or to graze animals. Thus, there were more changes in the area between 1963 and 1969 than in the entire previous 25 years.

Summary and Predictions

East of Colorado Highway 7 the land is naturally terraced, and only moderately suitable for agricultural use. In general, and typical of this region, the upper parts of the terraces are difficult to irrigate and are best suited for grazing, whereas lower ground can be irrigated and used for crop growing.

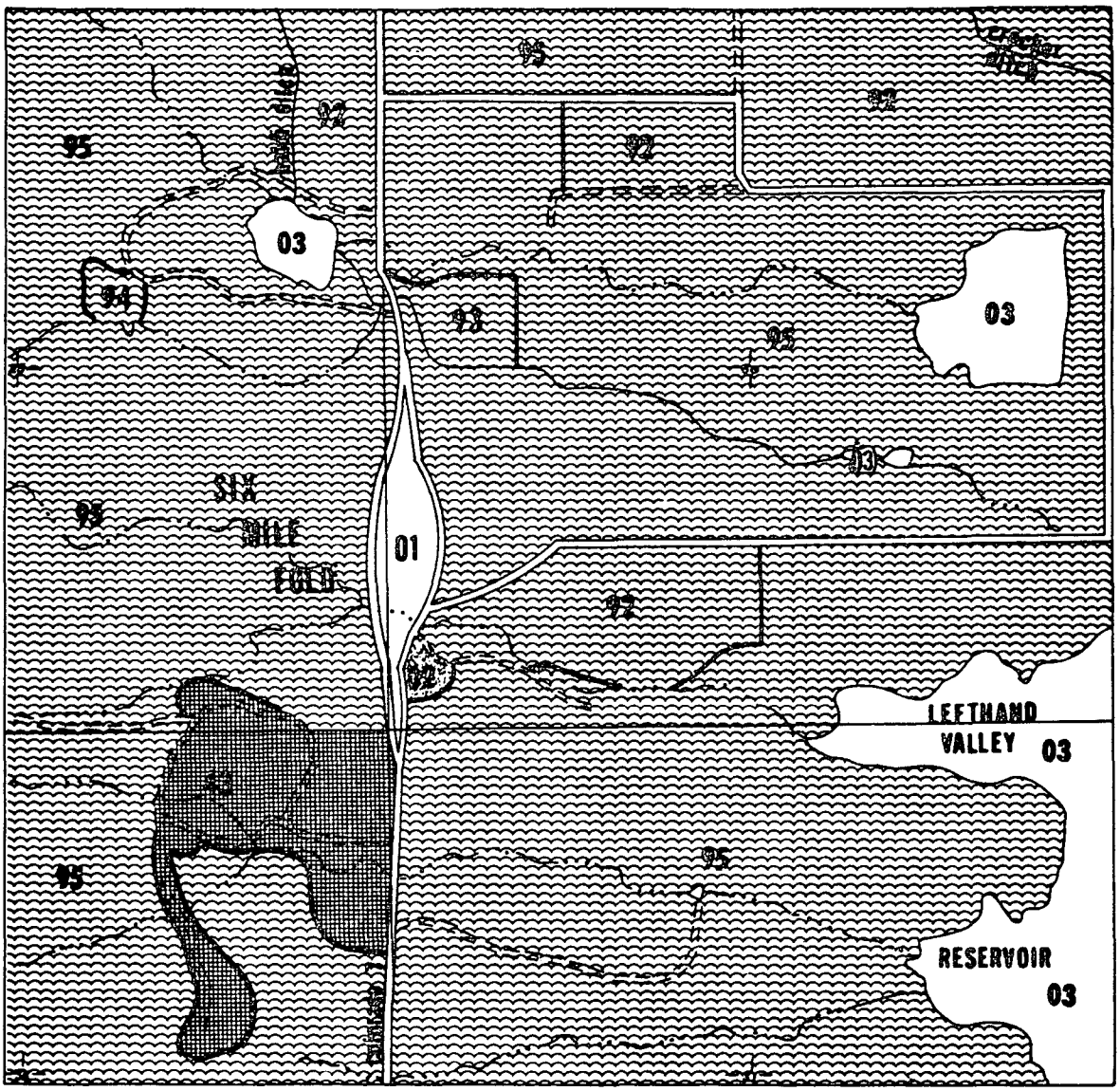
TABLE 1. ESTIMATED ACREAGE OF LAND USE[1]

Category[2]	1938	1956	1963	1969
Crop Production	330	164	140	160
Pasture, Grazing	1,910	1,973	1,821	1,767
Reservoirs	-	60	90	90
Secondary Metal Products Manufacturing (Including parking lots)	-	20	52+	60
Vacant Land	-	11	56	46
Animal Production	?	12	12	12
Six-Mile Fold (Scientifically used)	-	-	65	65
Animal Husbandry	-	-	4	4
Single-Family Residence	-	-	-	35
Recreation (Outdoor facilities)	-	-	-	1

[1]Estimated acreage was based on a total 2,240 acres within the study area.

[2]Categories are based on those used by the Denver Regional Council of Government.

Figure 11



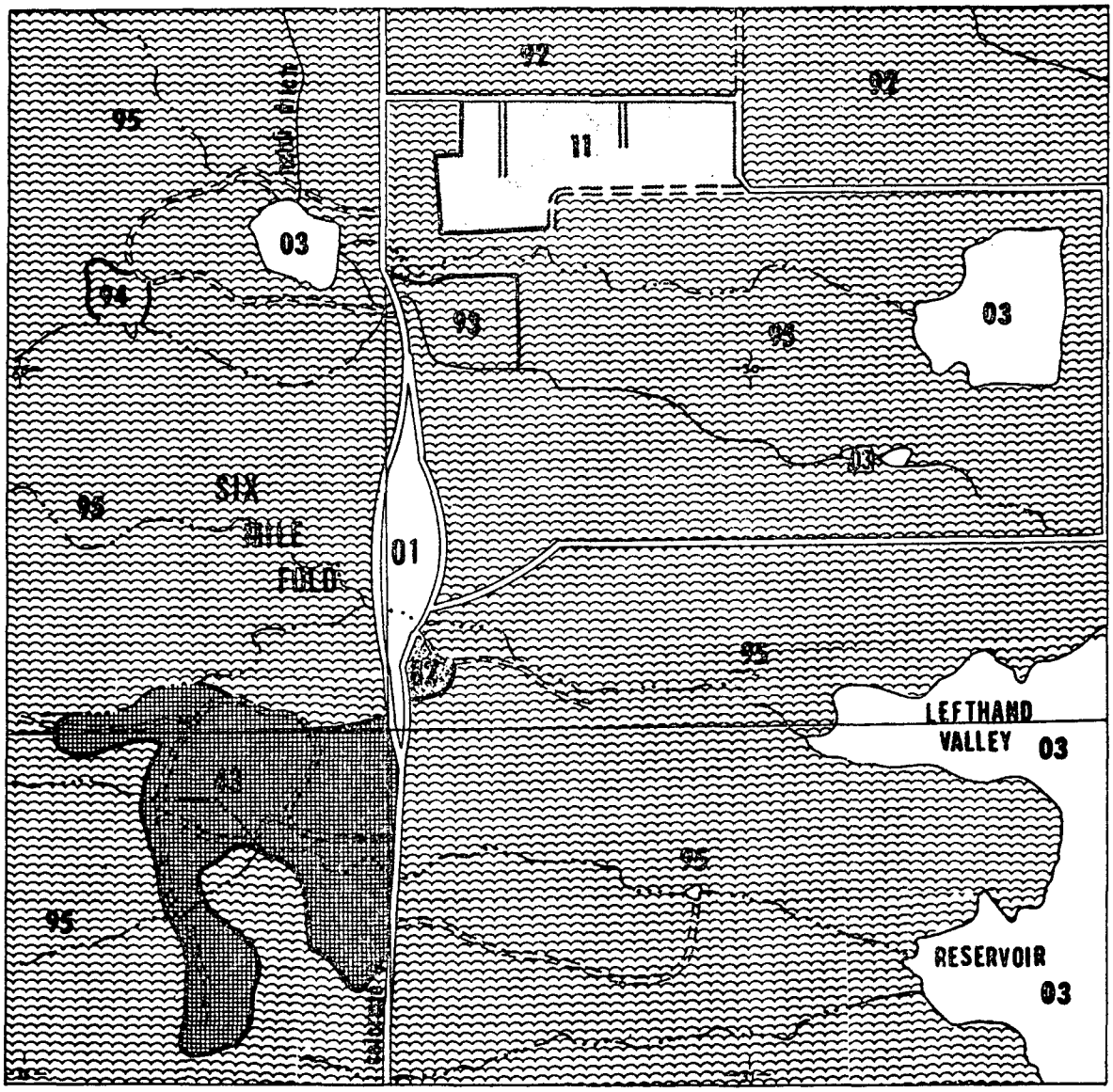
LAND USE: SIX-MILE FOLD & AREA 1963

N

0 1000 2000
FEET

Location: Town 2 North, Ranges 70 & 71 West

Figure 12



LAND USE: SIX-MILE FOLD & AREA 1969

N

0 1000 2000
FEET

Location: Town 2 North, Ranges 70 & 71 West

West of the highway the land varies from gently rolling to moderately rough, and would probably be judged as Class IV to Class VI land in the land capability scheme used by the Soil Conservation Service (Soil, 1957). Class IV to Class VI land ranges from land with severe limitations in choices of crop to severe limitations on use as pasture land. Some of the land in the Six-Mile Fold site is deeply gullied so that use even for industrial sites might be impractical.

Agricultural land use declined from 100 per cent of the area in 1938 to 86 per cent in 1969. It seems unlikely that more irrigation water can be obtained, and without irrigation, agriculture in the area will probably continue to decline. The tendency towards other land use points to a further decline in agriculture, and an increase in residential use. From the estimates of population in 1963 and 1969, it is possible to predict 144 residents by 1972 and 240 by 1980. These estimates are conservative. With decreasing distance to Boulder and Longmont as the cities expand, the Six-Mile Fold area should become even more populated than previously indicated.

It should be pointed out that the land east of Colorado Highway 7 is, in many respects, on the verge of development for residential subdivisions, assuming adequate sewage and water facilities can be provided. It is essentially level, geologically stable, and close to shopping facilities and employment centers via an all-weather highway.

References

Soil, Yearbook of Agriculture, 1963. 1963. U.S. Government Printing Office, Washington, D. C.

CHAPTER IV. LAND ECONOMICS

William Callahan and John Harper

Introduction

The figures indicated on the 1970 land economics map (Figure 13) are the fair market values of the land (in terms of dollars per acre) as classified by the county tax assessor. These figures were derived by multiplying the assessed value (defined as 30 per cent of the fair market value) of each parcel of land by 3.3, and then dividing the resultant figure by the number of acres included within that parcel. The figures on the 1950 map (Figure 14) are also fair market values, but, in 1950 the assessed value was defined as 18 to 20 per cent of the fair market value. Therefore, these figures were derived by multiplying the assessed value by 5.0, and again dividing by the number of acres involved. The values should be used primarily for comparison between the two maps and within each individually. In this way, changes in land value through time and space can be visualized.

Land Valuation

Most of the area under study is classified as agricultural (especially grazing) land, but purchases in the area, especially along the major arteries, reflect a transition from agricultural usages to industrial and residential developments. Actual land values, therefore, must be derived by other means. An excellent representative sample is the "Saddle Club Acres" subdivision (T 2 N R 70 W, Section 30). Table II shows the fair market values and sale prices of 12 lots in this subdivision. The average dollar-per-acre figures are an indication of the wide differentiation between assessed and actual land values in the area.

Mineral Rights

Mineral rights are also assessed by the county tax office. In Section 25 (T 2 N R 71 W) minerals are assessed at $2.00 per acre. This value is not included in the figures included on the land economics maps. Coal rights under the Beech Aircraft Corporation's holdings belong to the State of Colorado. They are, therefore, not taxed (or assessed). When mineral rights are severed from the surface rights as they are in portions of Section 30 (T 2 N R 70 W) they are assessed at a maximum of $1.00 per acre to a minimun of $10.00 for an entire holding.

Mill Levy

The tax rate for any parcel of land can be determined by using the mill levy (1 mill = .1 cent). For example, in Section 36 (T 2 N R 71 W) the mill levy is 78,334 mills or $78.334 per $1,000 of assessed value. In

Figure 13

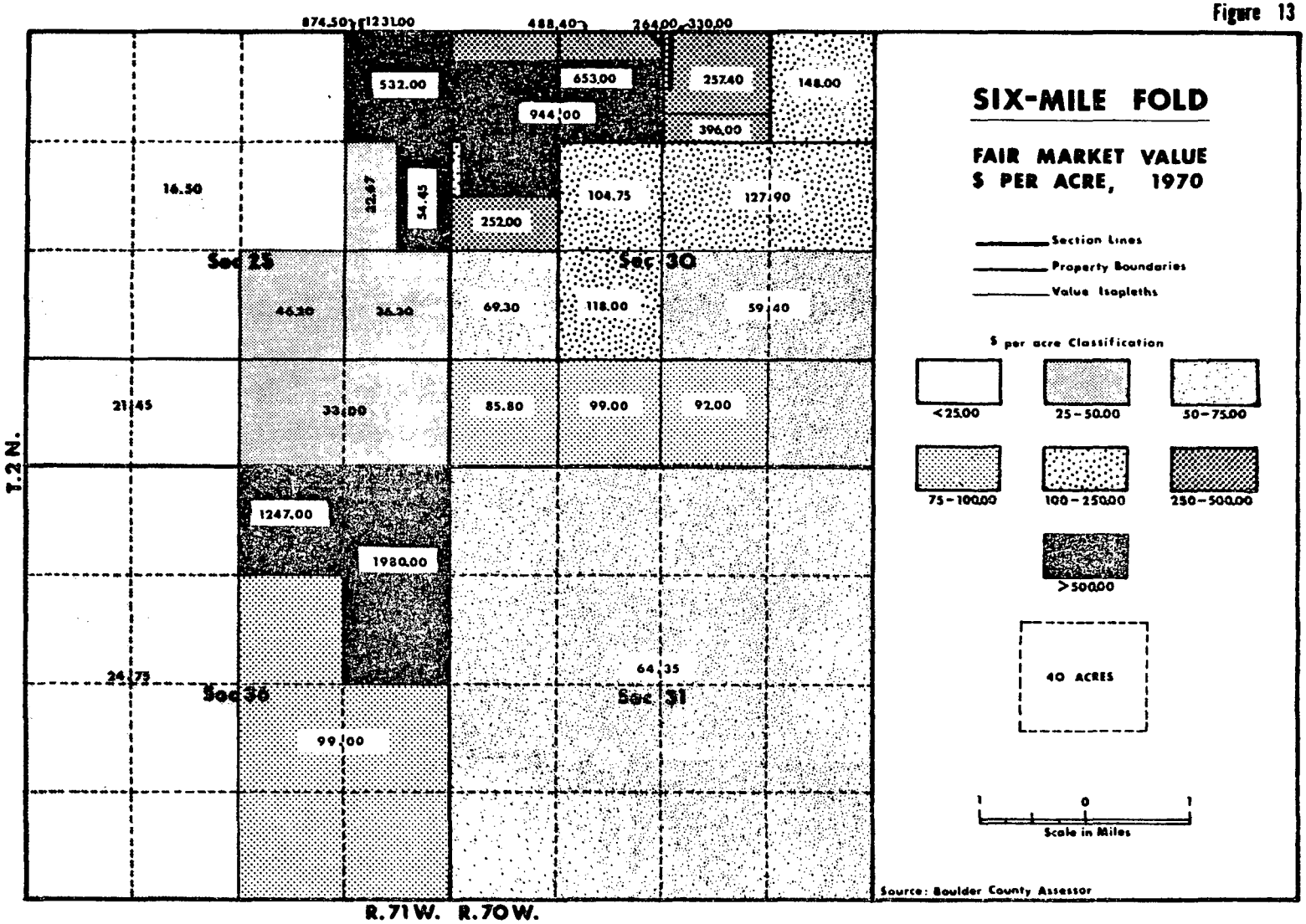

874.50
1231.00
488.40
264.00
330.00
532.00
653.00
257.40
148.00
944.00
396.00
16.50
22.87
34.45
104.75
127.90
252.00
Sec 25
Sec 30
46.30
36.30
69.30
118.00
59.40
21.45
33.00
85.80
99.00
92.00
1247.00
1980.00
24.75
64.35
Sec 36
Sec 31
99.00
T.2 N.
R.71 W.
R.70 W.
SIX-MILE FOLD
FAIR MARKET VALUE
$ PER ACRE, 1970
Section Lines
Property Boundaries
Value Isopleths
$ per acre Classification
<25.00
25-50.00
50-75.00
75-100.00
100-250.00
250-500.00
>500.00
40 ACRES
1
0
1
Scale in Miles
Source: Boulder County Assessor

Figure 14

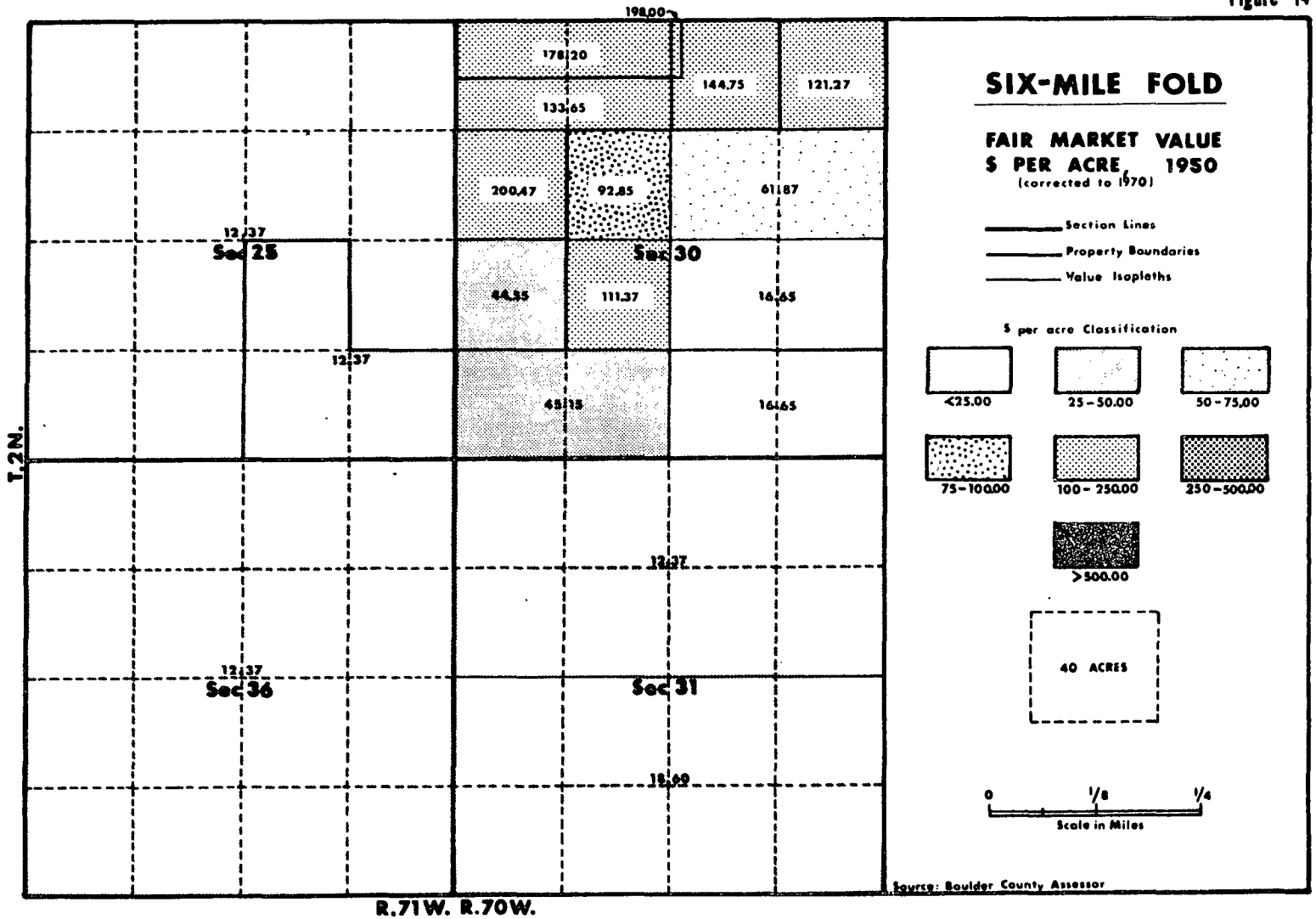

SIX-MILE FOLD
FAIR MARKET VALUE
$ PER ACRE, 1950
(corrected to 1970)
Section Lines
Property Boundaries
Value Isopleths
$ per acre Classification
<25.00
25-50.00
50-75.00
75-100.00
100-250.00
250-500.00
>500.00
40 ACRES
0
1/8
1/4
Scale in Miles
Source: Boulder County Assessor
198.00
178.20
133.65
144.75
121.27
200.47
92.85
61.87
12.37
Sec 25
Sec 30
44.35
111.37
16.65
12.37
45.15
16.65
12.37
12.37
Sec 36
Sec 31
12.69
T.2N.
R.71W. R.70W.

TABLE II. SADDLE CLUB ACRES - FAIR MARKET VALUE BY LOT

Lot Number	Acreage	Fair Market Value (3.3 times the assessed value)	Sale Price
1	4.5	$ 3,630	$ 3,000
2	4.5	3,630	3,700
3	3.3	3,630	6,640
4	3.3	3,630	3.000
5	3.3	3,630	6,500
6	3.3	3,630	3,000
7	3.4	3,630	6,000
8	3.4	3,630	7,750
9	3.0	3,630	6,500
10	3.0	3,630	10,300
11	7.0	3,630	7,810
12	7.0	3,993	9,530
	Total:	$43,923	$73,730
		($896.4/acre)	($1,504.7/acre)

Extremes

Lot 10 = $3,433 per acre

Lot 4 = $ 909 per acre

Section 25 (T 2 N R 71 W) and Sections 30 and 31 (T 2 N R 70 W) the levy is 67,360 mills per thousand.

Improvements

The value of improvements placed on the land (buildings, etc.) has not been included in the value of the land itself. The value of improvements, however, can be an indication of land use and land values. A grouping of $10,000 homes does not carry the same implications as does a grouping of $50,000 homes. For this reason a listing of the major improvements in the area is offered in Table III.

Summary

The two maps (Figure 13 and 14) and Table II indicate the major economic trend of the area, namely rising land values. In 1950, (Figure 14) the Beech Aircraft Corporation was not located in the area, and the entire

TABLE III. ASSESSED VALUE OF IMPROVEMENTS OF SELECTED LOCATIONS

Name of Owner	Assessed Value of Improvements*	Section Location
R. J. Wright	6,580	25 NE¼ of NE¼
Anna B. Joder	9,020	25 NE¼ of NE¼
Frank Campbell	5,050	30 NE¼ of NE¼
Edythe M. Snyder	2,400	30 NE¼ of NW¼
Robert G. Schooley	14,510	30 SW¼ of NW¼
Beech Aircraft Corporation	233,890	36 NW¼ of NE¼
Left Hand Water Supply Company	5,620	30 NE¼ of SW¼
Left Hand Water Supply Company	1,260	30 NW¼ of SE¼
Saddle Club Acres		
Lot No. 1	7,160	30 NW¼
2	7,740	
3	6,730	
4	6,380	
5	9,370	
6	6,470	
7	6,960	
8	6,870	
9	5,900	
10	7,040	
11	6,300	
12	6,340	

* To obtain the fair market value, multiply by 3.3

area of Sections 25, 31, and 36 were valued at less than $15.00 per acre (fair market value). Only portions of Section 30 displayed some degree of correspondance to contemporary prices. Most land was agricultural, and was, therefore, assessed under that classification. The lowest value per acre was $12.37 while the highest value was a modest $200.47.

The past 20 years have seen value increases of at least 100 per cent in all but the northwest portion of Section 25. The Beech Aircraft holdings have displayed the most drastic rise. (The NE¼ and the SE¼ of Section 36 have increased a phenomenal 15,000 per cent). This inflation has affected surrounding land values as well. Furthermore, increased amounts of marginal farmland have been residentially developed, explaining the sharp increase in land values in the north central portion of Figure 13. This is the Saddle Club Acres Subdivision mentioned earlier.

An analysis of the above shows clearly that increased land values in the area have been accompanied by an intensification of land uses which will in turn command higher land prices in the future.

CHAPTER V. CADASTRAL AND LAND TENURE

Scott Mernitz, Max Dodson, and Michael Tripp

Introduction

The study area for the cadastral and land tenure segments of the survey on the Six-Mile Fold Site was enlarged to include all of Sections 25 and 36, T 2 N R 71 W, and Sections 30 and 31, T 2 N R 70 W. This chapter briefly traces changing ownership patterns and present land tenure in the designated area during the period 1880 to 1970.

Past Cadastral Patterns

Fully one-half of the study area (Sections 25 and 36) remained vacant in 1880. According to the Boulder County Assessor, this portion was most probably owned by the U.S. Government rather than the State of Colorado. Seven individuals owned the land comprising Sections 30 and 31 with one owner holding 800 acres. Each of the other six holdings were much smaller, the next largest being 160 acres (Figure 15).

By 1910 both Sections 25 and 36 were in private ownership. Six new owners are indicated in Sections 30 and 31, but only two boundary changes occurred (Figure 16).

The changes between 1910 and 1930 echo those of the earlier period. Ownership changed on all parcels, but only two small boundary line changes took place. Parcel size remained essentially as before (Figure 17).

Basically the same pattern is revealed on the 1950 map. With one exception, a complete change of ownership occurred. Boundary lines remained static except for consolidation of all acreage in Section 31 into a single holding (Figure 19).

Present Cadastral Pattern

The 1970 map reveals an interesting combination of consolidation and fragmentation of property holdings. The light industrial concern of Beech Aircraft Corporation acquired possession of Sections 36 and 31 as well as the south one-half of the south one-half of Sections 25 and 30, a total of 1,600 acres. Most recently, the development of Saddle Club Acres has involved the creation of numerous 2 to 5 acre lots and subsequent homebuilding. There are presently 15 relatively new homes in this development, all owner-occupied with the exception of one vacant home being offered for rent.

1880

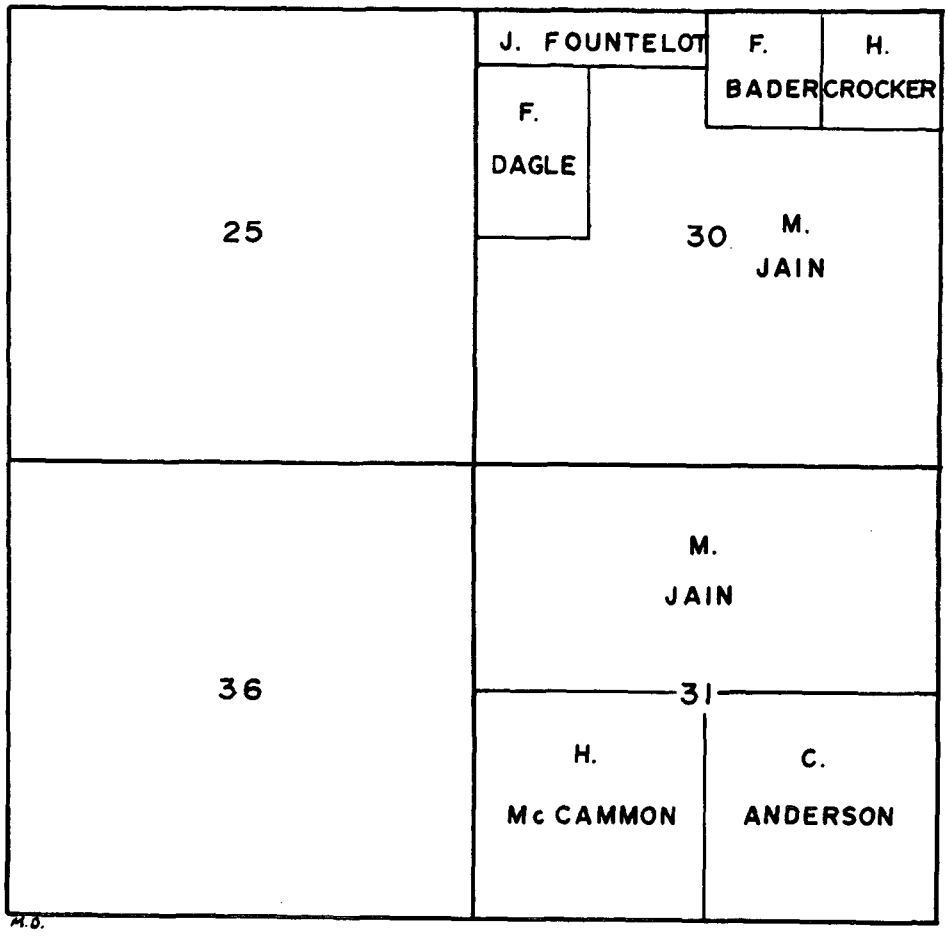


Figure 15

1910

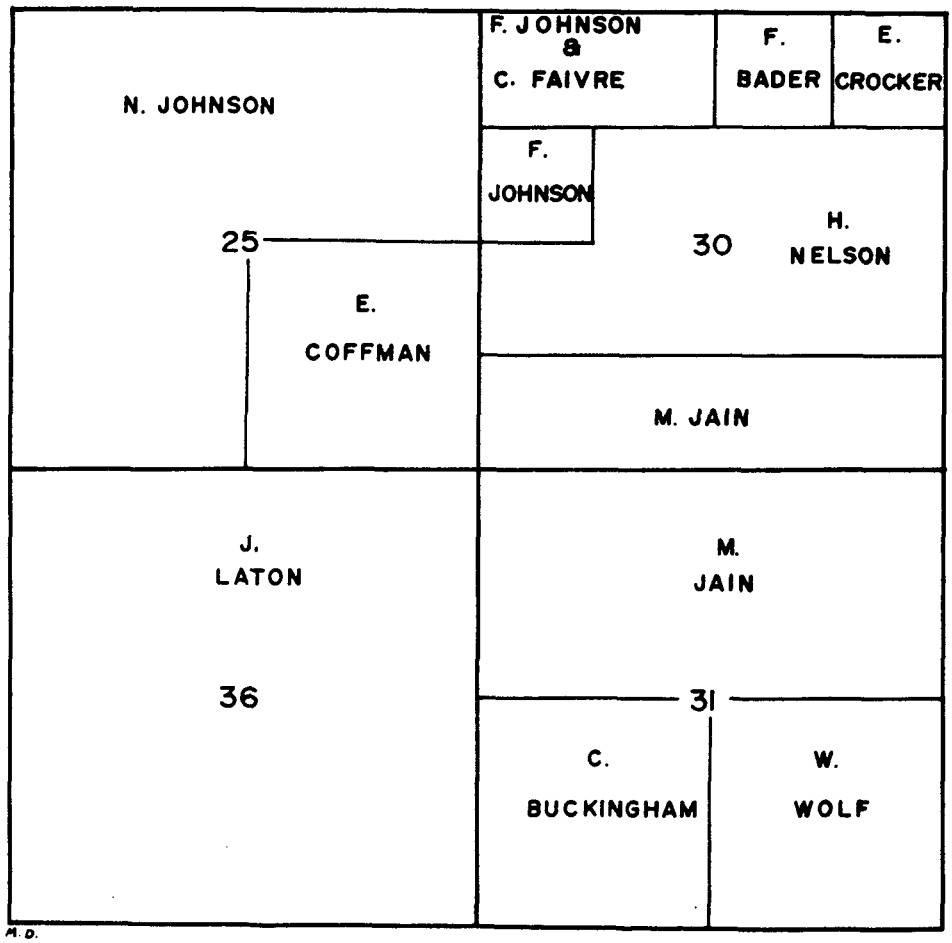
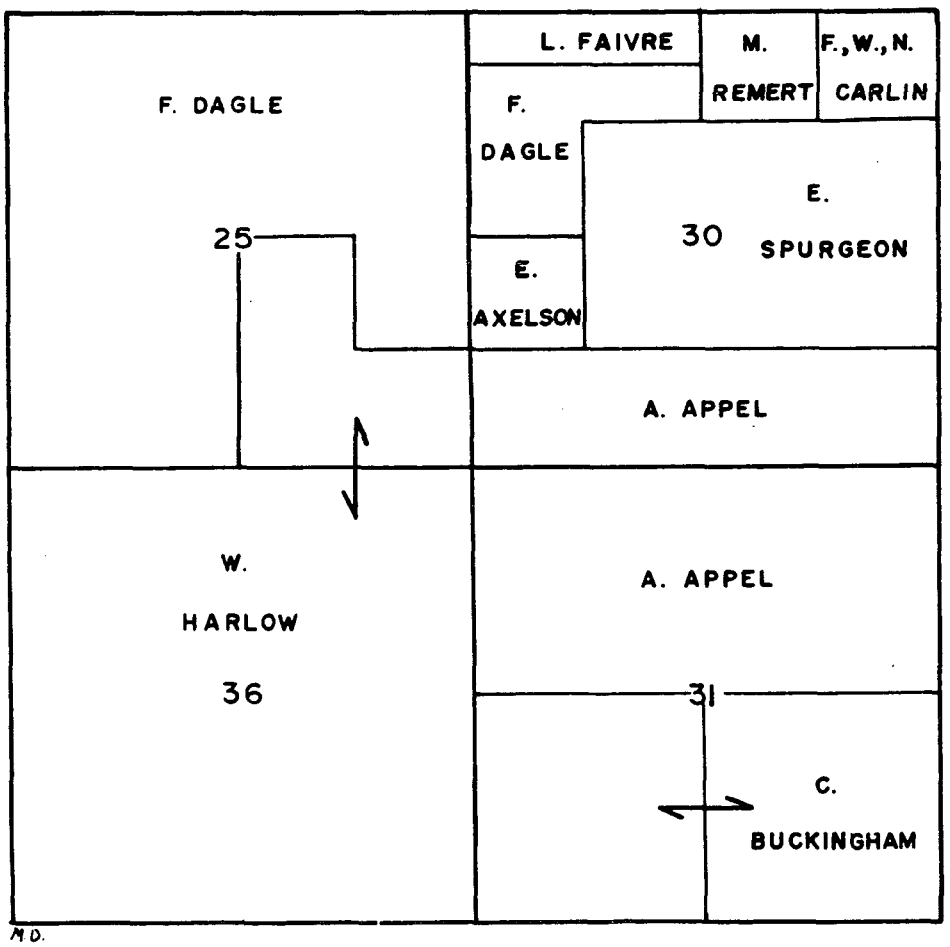


Figure 16

1930


F. DAGLE
25
L. FAIVRE
M.
REMERT
F., W., N.
CARLIN
F.
DAGLE
E.
AXELSON
30
E.
SPURGEON
A. APPEL
W.
HARLOW
36
A. APPEL
31
C.
BUCKINGHAM
M.D.

1950

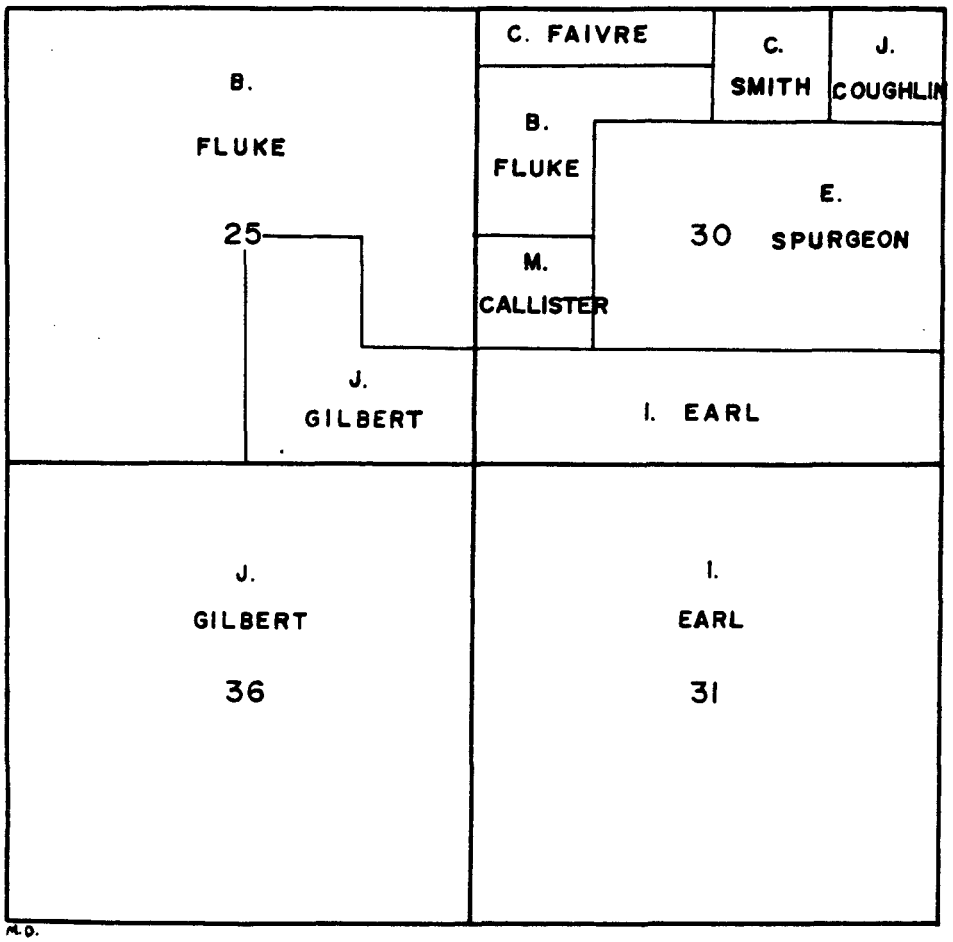


Figure 18

1970

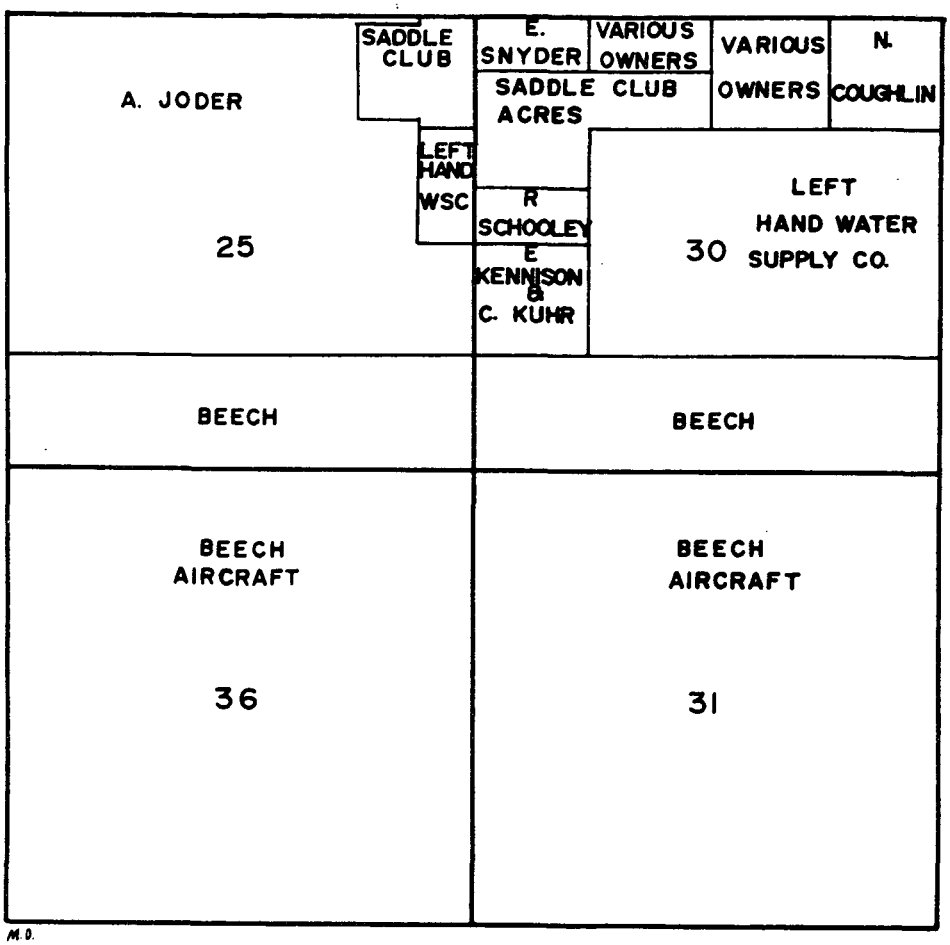


Figure 19

Land Tenure

Residential and industrial expansion adjacent to the study area is evident. Land tenure data indicates most of the acreage in the four sections is owner-occupied, with a few plots in Section 30 being offered for sale by the owners. The Beech Aircraft Corporation allows some grazing on their peripheral land in Sections 26 and 31 for use by some of their employees, but does not actually lease or rent any of their land.

CHAPTER VI. SUMMARY

Dean G. Wilder and Gary Heaslet

In 1968, the population for the City of Boulder was approximately 57,000. According to projections made by the Denver Regional Council of Governments, the population will increase to 171,000 by the year 2000. Such growth is sure to mean increased urban encroachment on peripheral rural land surrounding the city.

If the above predictions are realized, the results would have a detrimental effect on the preservation of the Six-Mile Fold site as a natural area. Changes in land use and land values in the past indicate that the area surrounding Six-Mile Fold will probably change to a suburban residential area. Saddle Club Acres is an example of this type of change. This will result in more people using the area and thereby modifying its natural ecosystems.

It is unlikely that the Six-Mile Fold site itself will become subdivided for residential development. This is due primarily to the uneven terrain within the area. Other reasons include the problem of drainage and access to power and water. It is also unlikely that Beech Aircraft Corporation will develop its peripheral land in the near future. However, the areas to the north and east have a high probability of becoming residential suburbs of a growing Boulder. Therefore it is important that due consideration be given to Six-Mile Fold as soon as possible to ascertain its value as a natural area site.

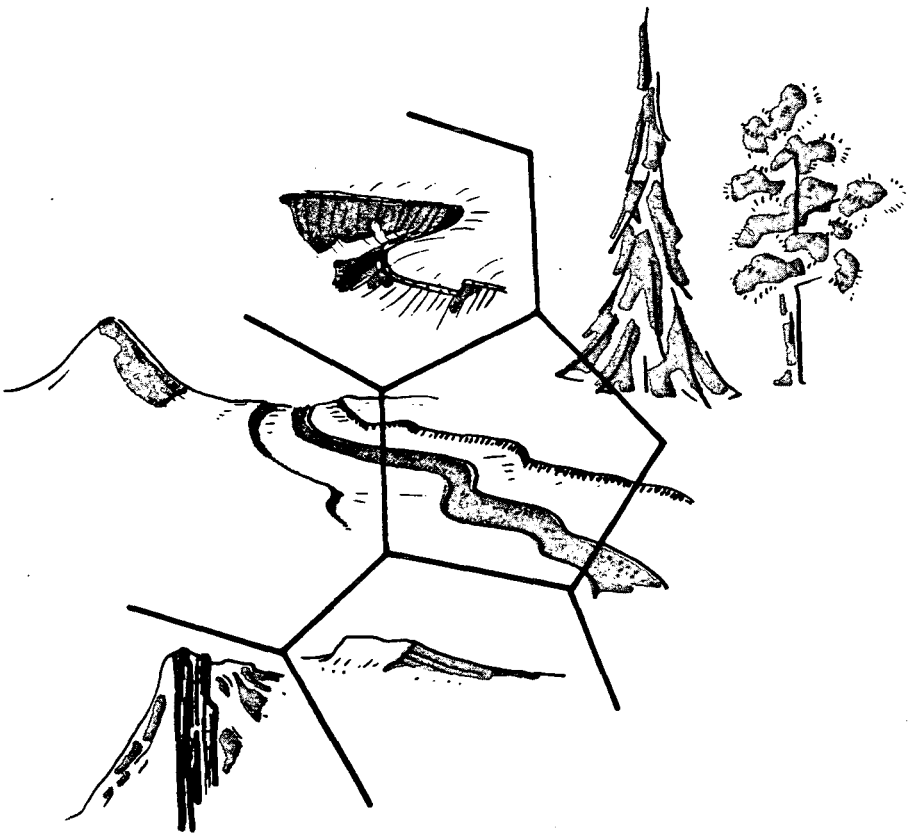
Six-Mile Fold is limited in its potential use as a park or recreation area. However the site does have a number of unique aspects which make it of considerable value for research and educational purposes. The intense folding of the substrata resulting in the plunging synclinal-anticlinal structure, the evidence of faulting in the vertical sides of the Niobrara Formation, the occurrence of fossils in the limestone, and the distribution of vegetation along the eastern edge of the Front Range provide a valuable Laboratory for study in the fields of geography, geology and biology. In addition, the site could also be used as a part of a county-wide open space or greenbelt system that would attempt to protect the foothills from exploitation by private interests.

If designated as an area of interest for natural studies or as part of a greenbelt, steps should be taken to protect the environmental quality of the site. For example, consideration should be given to the problem of accidental, unintentional damage to the area. Extensive grazing, fossil collectors, litterers and motorcycle riders could seriously reduce the value of the site for research and instructional purposes. Fire is another serious hazard during the dry months. One solution might be to control access to the area by means of a designated access road and ac-

companying parking lot. Visitors could be required to walk from this point, thereby preserving the natural character of the area and allowing eventual restoration of the natural vegetation patterns.

In summary, this study would seem to indicate that Six-Mile Fold is a unique natural area site in Boulder County. It has a considerable potential for use as either a natural study area or as a part of a greenbelt. Therefore, it is suggested that further consideration be given to this area for the purpose of determining if acquisition of this site for the purpose of preserving it in its natural state is feasible.

THE DODD PROPERTY
Natural Area Study



Department of Geography / University of Colorado

THE DODD PROPERTY

NATURAL AREA STUDY

Wilbert J. Ulman and Helen Louise Young

Editors

DEPARTMENT OF GEOGRAPHY

UNIVERSITY OF COLORADO

Boulder, Colorado

1970

TABLE OF CONTENTS

Chapter		Page
	FOREWORD . . . . . Donald D. MacPhail	v
	ACKNOWLEDGMENTS	vii
1.	INTRODUCTION . . . . . Wil. Ulman and Helen Louise Young	1
2.	ENVIRONMENTAL SURVEY . . . . . James Biggins and William G. Callahan	4
	Geomorphology Climate Flora and Fauna General Soil Descriptions	
3.	PAST, PRESENT AND FUTURE LAND USE. . . . . Max H. Dodson and John L. Harper	19
	Past Land Use Present Land Use Future Land Use	
4.	CADASTRAL AND LAND TENURE . . . . . Gary A. Heaslet, George R. Greenbank, and Robert E. Key	28
	Cadastral Survey Land Tenure	
5.	LAND ECONOMICS . . . . . Michael R. Tripp, Manik Hwang, and Scott Mernitz	38
6.	CONCLUSIONS . . . . . Wil. Ulman and Helen Louise Young	43
APPENDIX I.	SELECTED PHOTOGRAPHS OF THE DODD PROPERTY.	46
APPENDIX II.	AIR PHOTO OF AREA - 1969	49
APPENDIX III.	NATURAL AREAS COMMITTEE MEETING MINUTES.	52
APPENDIX IV.	MEMORANDA FROM ROBERT S. GREGG	56
APPENDIX V.	ANALYSIS OF POSSIBLE FUNDING	62
APPENDIX VI.	NEWSPAPER CLIPPING - HISTORIC CABIN.	67

FIGURES

		Page
1.	Location	2
2.	Relief Map	5
3.	Lefthand Creek Floodplain	6
4.	Lefthand Creek Cross-Section	7
5.	Terraces and Vegetation	8
6.	Climograph	10
7.	Vegetation	12
8.	Soils	14
9.	Land Use - 1955	21
10.	Current Land Use	22
11.	Original Patent Map	29
12.	Cadastral Map - 1910	30
13.	Cadastral Map - 1930	31
14.	Cadastral Map - 1950	32
15.	Cadastral Map - 1970	33
16.	Increase of Average Assessed Valuation	39
17.	Average Assessed Evaluations	40
18.	Land Evaluation by Owner	41
19.	The Historic Old Settler's Cabin Built Circa 1859	48
20.	An Example of an Old-Style Rail Fence Along the Dodd Property	48
21.	Property for Sale East of Haystack Mountain	48
22.	Aerial View of the Dodd Property from the North	51

TABLES

Page

1. General Soil Descriptions (Slope). 15

2. Partial History of Land Transactions, Section 27 34

3. Partial History of Land Transactions, Section 28 35

NOTE

Since the preparation of this report, the old settler's cabin has been moved from the original site to Hermitage Park in Longmont, Colorado.

FOREWORD

This report is one of six undertaken this year in the Department of Geography at the University of Colorado. It has become almost a tradition for the graduate seminar in land use to initiate a project in the local area in cooperation with an agency of the Boulder community on either the municipal or county level, sometimes both.

These studies achieve a number of objectives. The participating students undertake a realistic project which they are able to plan, execute, and publish within the brief span of one semester. Also, these studies provide new information for municipal and county officials and citizen groups concerned with planning and guiding the growth and development of the City of Boulder and Boulder County. In short, these are professional training exercises for graduate geographers and are a serious effort in providing new planning perspectives in the interest of public service.

In response to a suggestion by the Natural Areas Committee of the University of Colorado, the land use seminar elected to study and analyze a number of natural sites in the Boulder Valley. The group was also joined in the endeavor by the graduate field seminar of the Department of Geography.

The cooperative base within the Boulder community was wider than usual this year. The sites chosen for study seemed to have potential for a variety of uses beyond their present development. These included instruction, greenbelt, and open space. The graduate students involved worked in cooperation with the resident property owners, the Parks and Recreation Department and the Planning Office of the City of Boulder, the Department of Development and the Parks and Open Space Advisory Committee of Boulder County, the Boulder and Longmont Offices of the Soil Conservation Service, the Science Director of the Boulder Valley RE-2 School District, the Planning Office and the Natural Areas Committee of the University of Colorado, and the Denver Regional Council of Governments.

Sometimes the graduate researchers felt they would have liked to pursue certain themes in greater depth if there had been more time available. Nonetheless, they join me in expressing the hope that this report provides informative insights on a fascinating part of Boulder County.

The various chapters which appear in this study were originally submitted as special reports by the individuals indicated. They represent the endeavors and views of the authors and in no way should be interpreted as the official views of the Department of Geography or any other cooperating agency or organization previously mentioned. Because of this independence from official views, the participants in this project are especially grateful to the Graduate School of the University of Colorado, the City of

Boulder, the Boulder County Commissioners, the University of Colorado Foundation, and the Boulder Valley RE-2 School District for sharing the costs of printing this report.

This is the collective and individual effort of a group of dedicated geographers concerned about the quality of the local environment and its attendant stresses. Boulder County residents, students, and local officials may gain understanding from this report that will assist them in their efforts to perpetuate the Boulder area as a pleasant and attractive place to live.

Donald D. MacPhail, Ph.D.
Professor of Geography

Boulder, Colorado
June, 1970

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The graduate students participaing in the 1970 geography Land Use Seminar are indebted to many persons whose cooperation helped make this report possible. Within the Boulder County offices, thanks go to the following: Mr. Harold Copeland, Mrs. Carol Musser and others in the County Assessor's Office for use of land ownership records; Mr. Harold Nesbitt and Mr. Ross Campbell of the U.S. Soil Conservation Service for use of aerial photographs of the study area; and to various realtors, landowners, and other parties who willingly provided information through interviews. A special thanks is extended to Mr. John Dodd for his cooperation and support throughout the study. Mr. Don Look of Look Photo Services has been particularly helpful in solving some of the photographic problems. Finally, the editors also wish to acknowledge the assistance and guidance provided by Professor Donald D. MacPhail during all phases of this report; to Mrs. Nancy Stonington for the cover design and to Mrs. Sue Middleton for final typing; Mr. Wilbert J. Ulman completed the final preparation of the maps for publication with the copy camera and contact printer of the Geography Department.

Helen Louise Young
Wilbert J. Ulman

CHAPTER 1. INTRODUCTION

Wil Ulman and Helen Louise Young

Accelerated urban and population growth along Colorado's Rocky Mountain Front Range during the past two decades has resulted in striking changes upon the landscape. Boulder, with its constantly growing university enrollment and numerous research oriented industries is ranked as a leader in Colorado community growth. Constant encroachment of urban facilities onto Boulder's fringe results in a changing land use pattern. Open space becomes less apparent as the land is subjected to more intensive use. Cornfields are replaced by residential tracts and gravel roads become expressways as the natural landscape is pushed ever further into the hinterland.

Boulder is unique among most rapidly growing communities in that a high degree of planning has resulted in setting aside land for greenbelts to provide some semblance of openess for area residents. There are, however, still a number of areas within close proximity to Boulder which possess unique natural characteristics of value to the community and should be set aside as parks or areas of special use. Hereafter these areas will be referred to as natural areas.

For the purposes of this report, a natural area is described as one which has unique ecological characteristics--floristic, geologic, or combinations thereof. Naturally, such an area would be a valuable site to observe plant and animal habitats and topographic or geologic phenomena. Presently several observation and study sites still exist within a relatively short driving distance from Boulder. One such site, and the subject of this report, is the Dodd property.

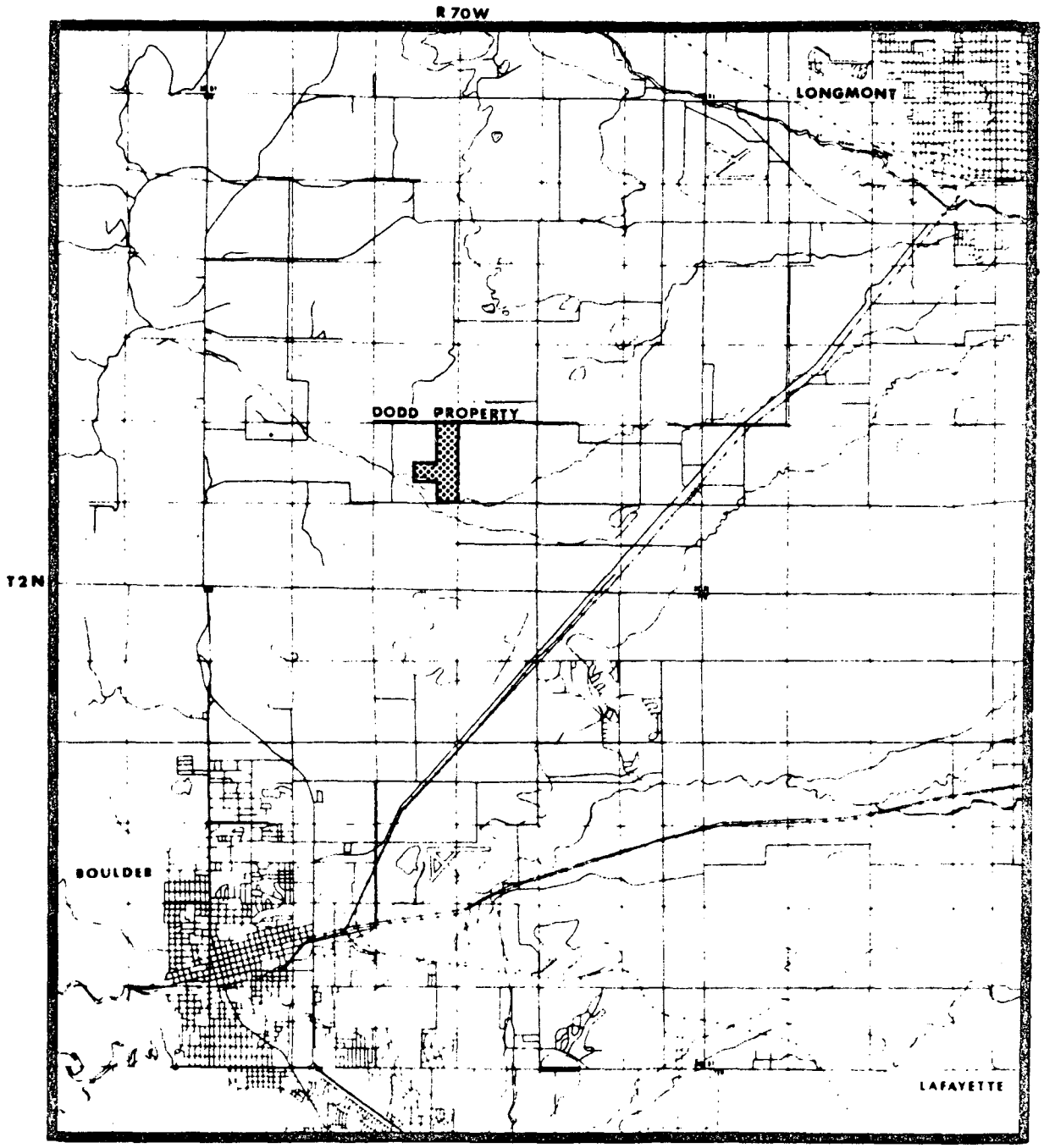
The Dodd property, a 193-acre tract, located 2.65 miles west of Niwot, Colorado, on Boulder County Road No. 34 (Figure 1) possesses certain unique qualities which in the past have been the object of interest to the natural sciences of the University of Colorado (biology, geography, geology, for example). Observable phenomena on the Dodd property have stimulated a close study by the Boulder Natural Areas Committee who have tried unsuccessfully to acquire this area as an outdoor classroom.

This report includes an inventory of the qualities associated with the Dodd property in which four teams conducted intensive research. An initial environmental survey of the area was made to assess the physical characteristics. Three other phases of investigation followed; these covered: land use, land tenure and cadastral, and finally land economics.

Methodology

The methodology involved in preparation of this report included the following steps: 1) field reconnaissance of the area; 2) assemblage of

DODD PROPERTY



SCALE 1 INCH— 2 MILES

Fig. 1

maps and aerial photos; 3) collection of land value, tenure and cadastral data; 4) intensive research of pertinent literature; 5) interviews with persons having some knowledge or interest in the area, and 6) editing of the individual reports.

The field reconnaissance involved several visits to the Dodd property to survey the topography and to discern spatial relationships between subdivisions and other types of land use and the Dodd property. Base maps for the study were constructed from the 1950 and 1967 U.S. Geological Survey Niwot, Colorado Quadrangle. Aerial photos of the area were flown by the U.S. Department of Agriculture, Soil Conservation Service. Data for the land values, tenure and cadastral surveys were obtained from the land books in the Boulder County Assessor's Office and the Transamerica Title Company. Library research augmented all phases of the report. Background materials for the environmental survey of topography and flora and fauna and Lefthand Creek Floodplain documents were valuable in report preparation.

Interviews were conducted mainly with landowners, realtors and city and county planners in order to gain a well-rounded view of all parties interested in this natural area. Finally, the four reports, done by separate teams, were compiled and edited resulting in this volume.

CHAPTER 2. ENVIRONMENTAL SURVEY

James Biggins and William G. Callahan

The Dodd property comprises about 193 acres of the eastern half of Section 28, Township 2 North, Range 70 West (T 2 N, R 70 W) in Boulder County. The property is immediately west of Haystack Mountain (elevation 5,589 feet) and is located about 10 miles from Boulder and 3 miles from Niwot. Lefthand Creek flows through the southern portion of the property. Near the creek, the terrain is relatively flat and contains a grove of cottonwoods and several varieties of grass. The remainder of the property is grassland on the moderate to steep lower slopes of Haystack Mountain. Elevations within the property range from 5,235 feet on Lefthand Creek, where it crosses the eastern property line, to about 5,340 feet at the top of a knob just west of the summit of Haystack Mountain. The summit of the mountain is not on the Dodd property (Figure 2).

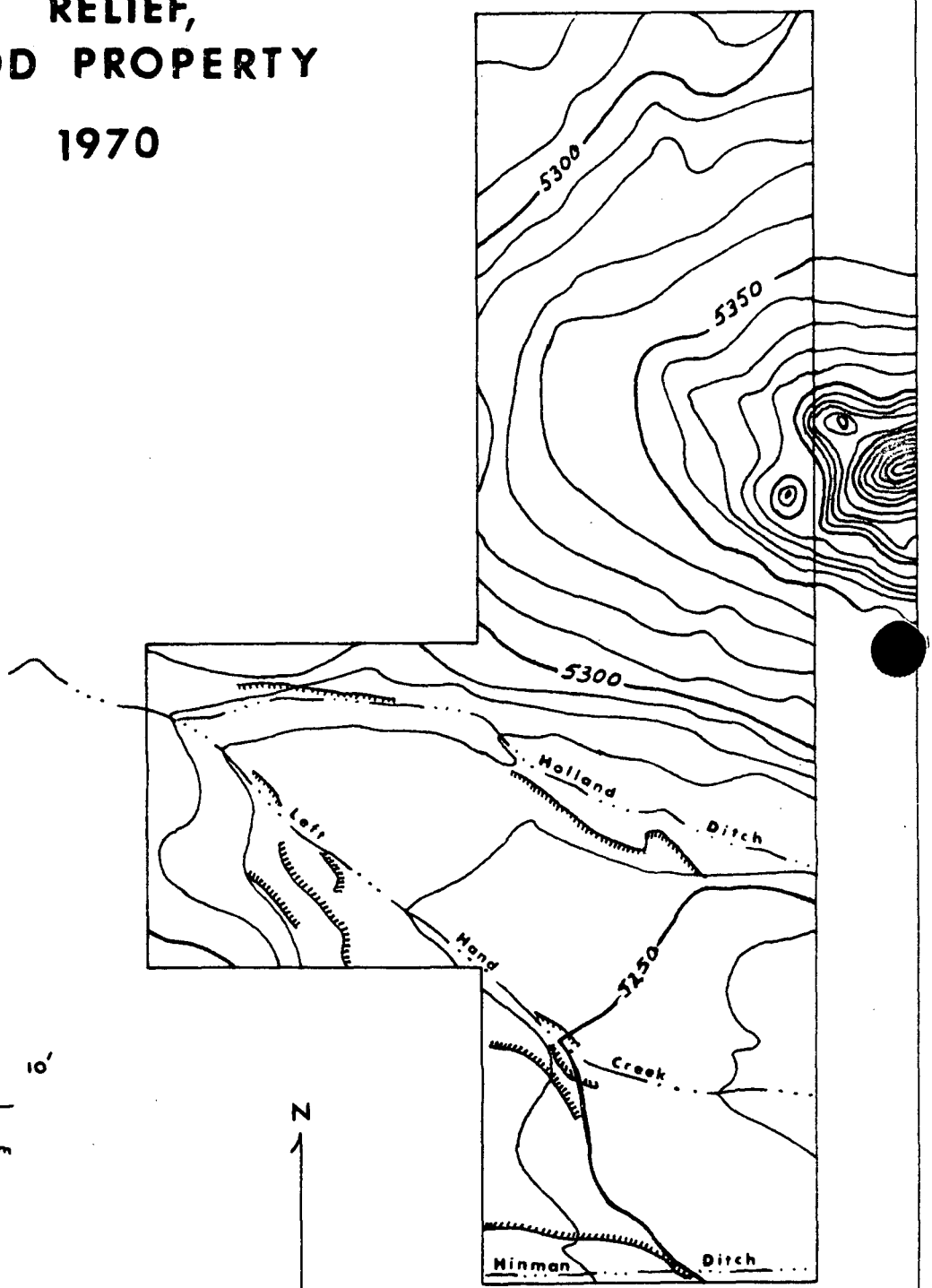
Geomorphology

The area including the Dodd property is underlain by Creatceous shale - the only definite outcrops being on the slopes of Haystack Mountain. A low anticline is found in the shale, but is not responsible for any surface features (Hunter, 1947). The nature of the surface results from erosion and deposition, with Lefthand Creek being the chief agent (Figure 3).

Lefthand Creek has a gradient averaging 80 feet per mile. The floodplain averages about 50 feet in width, and is composed of sand and gravel. The gravel includes well-rounded boulders of granite and other igneous rocks, gneiss, and at least three varieties of sandstone. Five low, discontinuous terraces, three south of the floodplain and two north of the floodplain form the gently sloping ground that makes up the southern property (Figure 4). The terraces are recognizable only at the edge of the floodplain and on the western portion of the property. The lowest and most recent terraces adjacent to the floodplain have been eroded along the inner edges by recent floods and the exposed parts of the terraces contain alluvium or loess and thin layers of gravel (Figure 5). All the terraces contain small, shallow, ovate depressions, including a partially filled oxbow on the lowest terrace south of Lefthand Creek in the western part of the property. Because the origin of most of these depressions is not clear they may be subsidence pits, nearly closed meander scars, or subsidence depressions in settling alluvium. All depressions appear to be relatively impervious to seepage, and apparently collect water by runoff, spring-feeding, or both.

The western slopes of Haystack Mountain are concave, ranging from gradients of 1:200 feet in the lower portions of 1:7 feet on the upper slopes. The lower slopes have been plowed and are cobble-strewn. The upper slopes,

RELIEF, DODD PROPERTY 1970



CONTOUR INTERVAL, 10'

STREAMS

TERRACES

N

SCALE

1000' 0 1000'

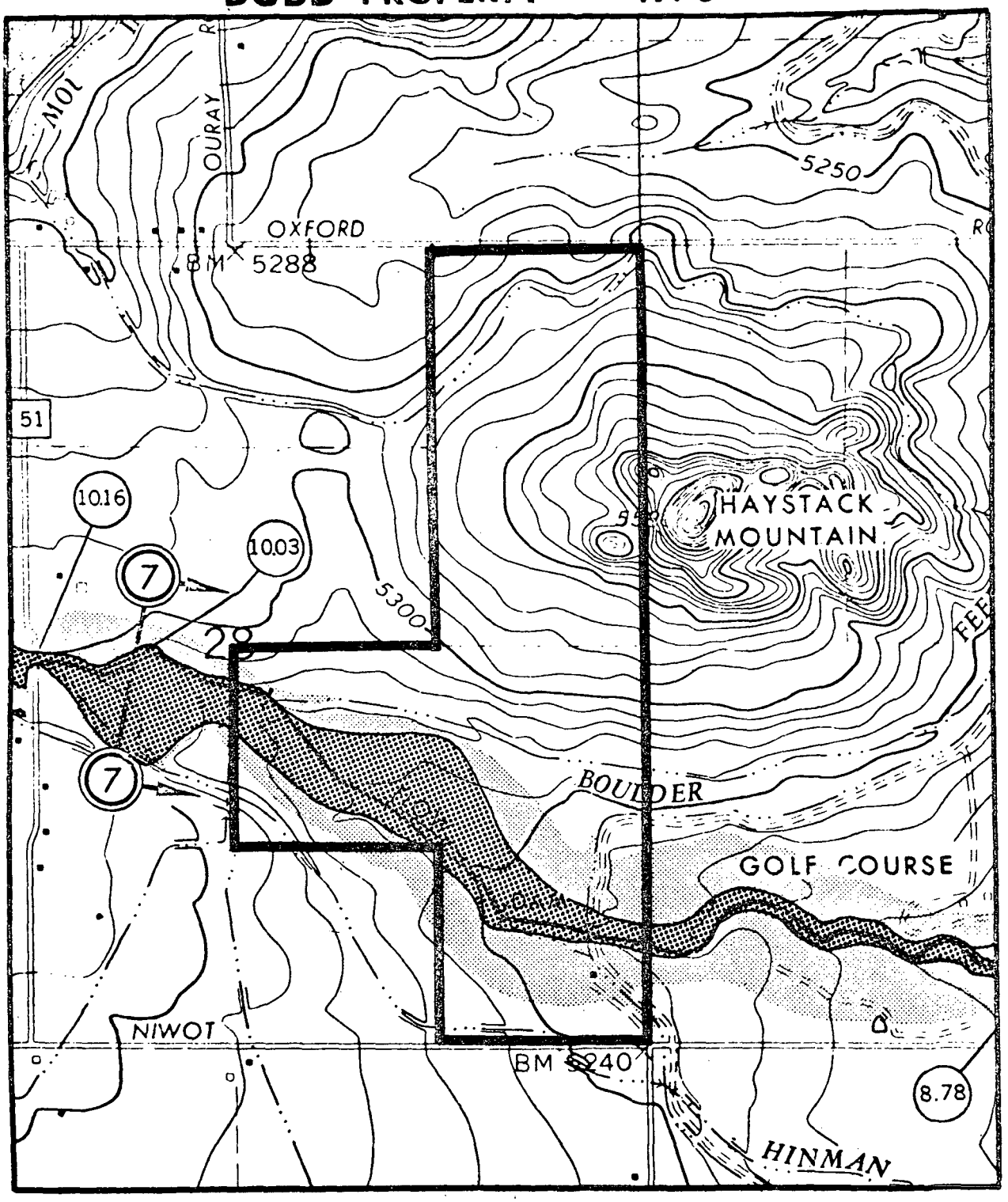
Fig. 2

T. 2N., R. 70W. SEC. 28

LEFT HAND CREEK FLOOD PLAIN

IN THE VICINITY OF THE

DODD PROPERTY — 1970



INTERMEDIATE REGIONAL FLOOD

STANDARD PROJECT FLOOD

N

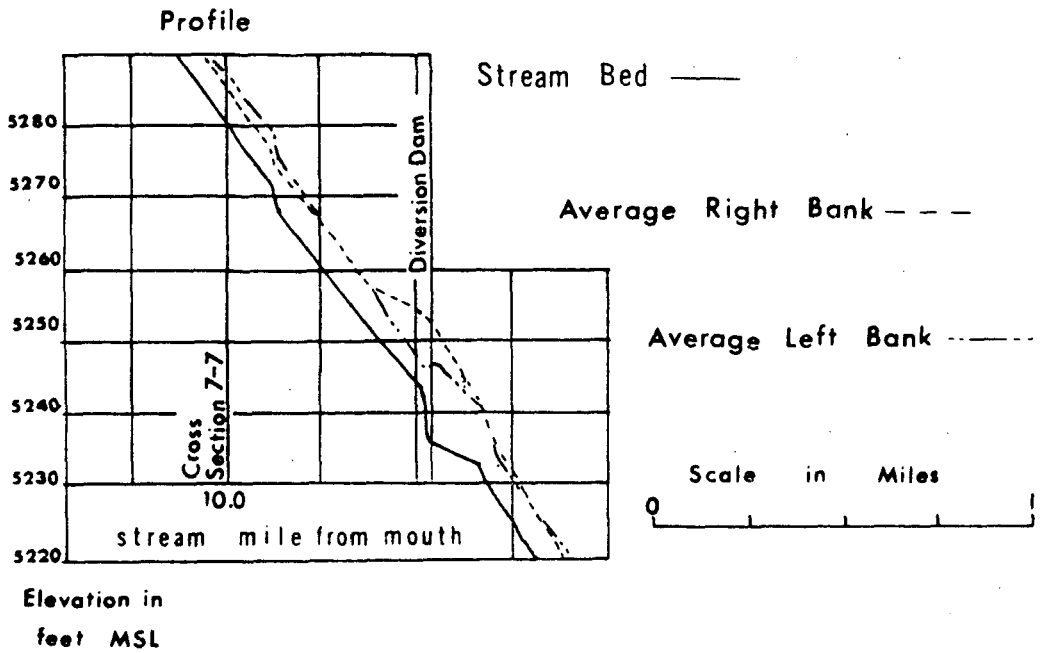
SCALE IN FEET

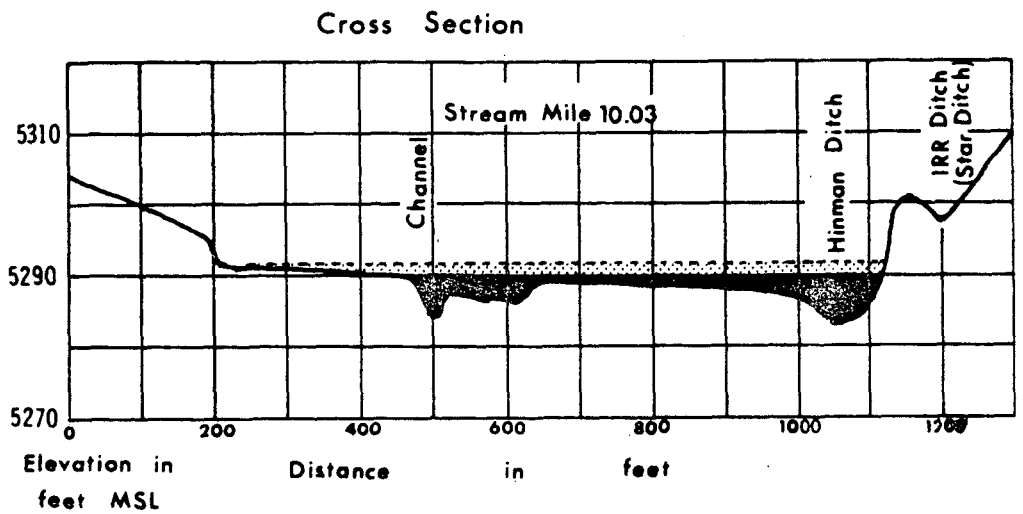
1000 0 1000 2000

Fig. 3

LEFT HAND CREEK

CROSS SECTIONS

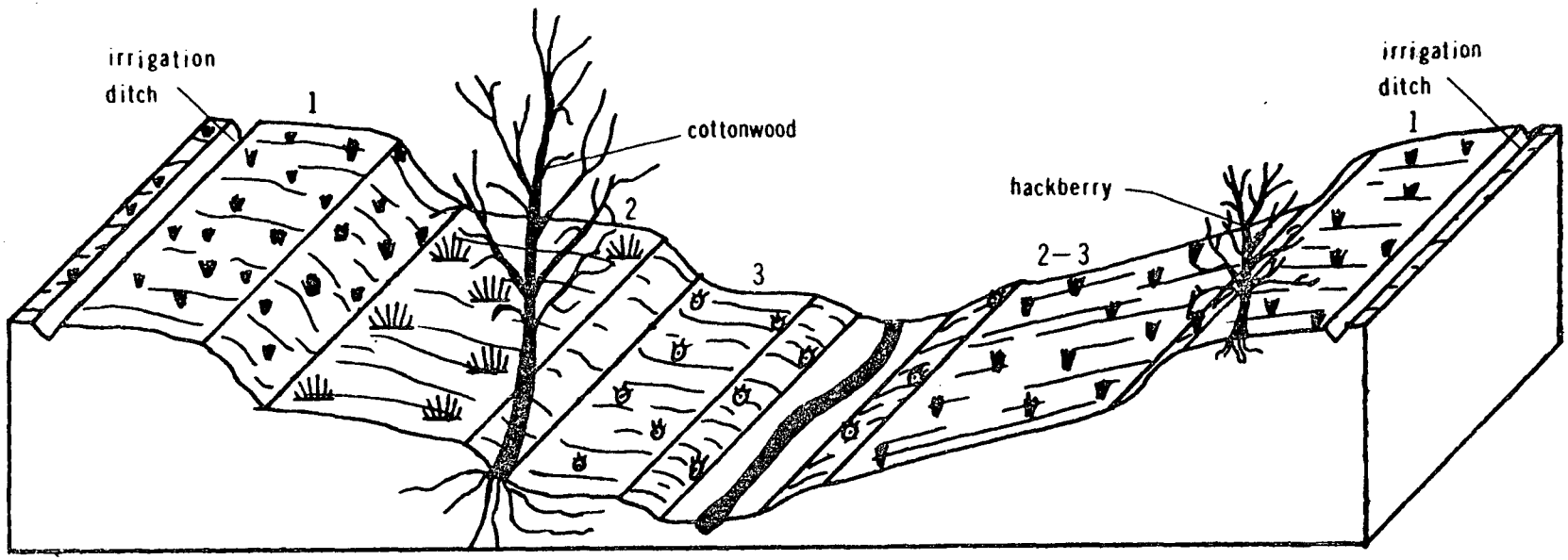




INDEX CROSS SECTION 7-7

Fig. 4

Source: U.S. Army Corps of Engineers



1 Upper Terrace

2 Middle Terrace

3 Lower Terrace

VEGETATION

Mixed Prairie

Marsh Lands

Poorly Vegetated

Consult report for descriptive data.

N →

IDEALIZED TERRACE REPRESENTATION

Fig. 5

terminating in a knob west of the mountain top, are apparently underlain by poorly sorted gravel, including boulders over one foot in diameter, set in a soft, gray matrix partially cemented by discontinuous caliche about 2 feet below the surface.

Lefthand Creek is the only stream of any kind on the property. A shallow gully, 500 feet long, in plowed land south of the knob on Haystack contains cobble-capped pedestals about 2 inches high, giving some measure of the depth of the most recent erosion, much of which may be due to wind. Since most of the surface is porous, drainage may be subsurface; underground drainage could also supply water to the low depressions on the terraces.

The topography of this area is due to a combination of changing stream patterns and protective caps of gravel on ancient surfaces. Remnants of a once-continuous sheet of gravel,that presumably was spread by streams over the whole area,is preserved on the upper parts of Haystack Mountain and Table Mountain, one mile to the northwest. This gravel layer may be the source of the cobbles and boulders scattered over the lower slopes of Haystack Mountain. The similarity of gravels on Table Mountain and Haystack Mountain and the conformity of their summits give support to the idea of a widespread gravel layer. The assumption is that Lefthand Creek has diverted from its former course between the two mountains into a shorter, but deeper stream valley south of Haystack Mountain after it had cut through some of the land between the two mountains. Lefthand Creek gradually assumed its present course, while the zone between the mountains could have been deepened by smaller streams because the layer of gravel had its bounding terraces formed later. The present gravel bed has been excavated and widened artificially in the eastern part of the property to reduce the risk of overflow during flooding.

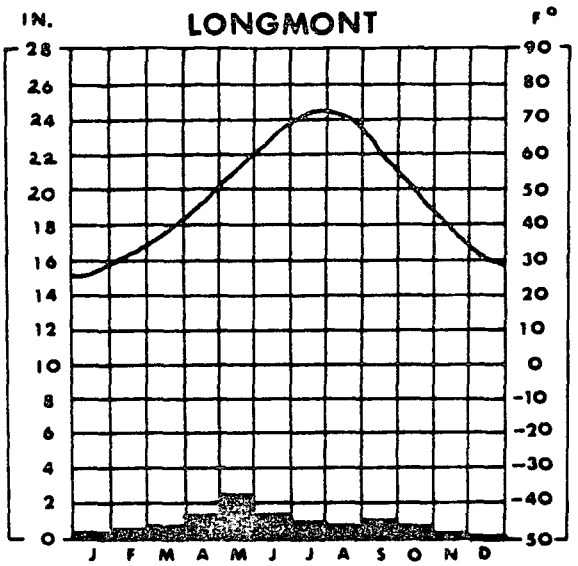
Climate

The Dodd property, located between Boulder and Longmont, can be typified climatically as having temperatures and rainfall values somewhat between those of Boulder and Longmont (Figure 6). Although temperature and precipitation are the major climatic controls, intermittent, strong winds are not uncommon to the area. These westerly winds, known locally as "chinooks," undoubtedly affect vegetation and soil to some degree.

As with many streams issuing from the Front Range, Lefthand Creek has been subjected to periodic flooding as a result of local climatic extremes. The U.S. Army Corps of Engineers has noted that flooding occurs along Lefthand Creek on the average of once every 15 years. The most severe modern floods were June, 1949 (1,140 cubic feet per second [cfs] water flow), 1938 (812 cfs, no month given), and August, 1951 (785 cfs) (U.S. Army Corps of Engineers, 1969). Although floods are not predictable and are quite variable in volume, they are most frequent in spring and summer when sporadic thundershowers accompany alpine snowmelt. The area adjacent to Lefthand Creek in the Haystack Mountain vicinity that the Corps of Engineers believe would be affected by flooding as indicated by Figure 3.

CLIMOGRAPHS

Station elev. 4950'
Mean annual temp. 48.3°
Mean annual precip. 12.03"
Mean annual snowfall 34.2"
Highest rec. temp. 105°
Lowest rec. temp. -38°



Station elev. 5385'
Mean annual temp. 52.3°
Mean annual precip. 18.57"
Mean annual snowfall 80.5"
Highest rec. temp. 104°
Lowest rec. temp. -33°

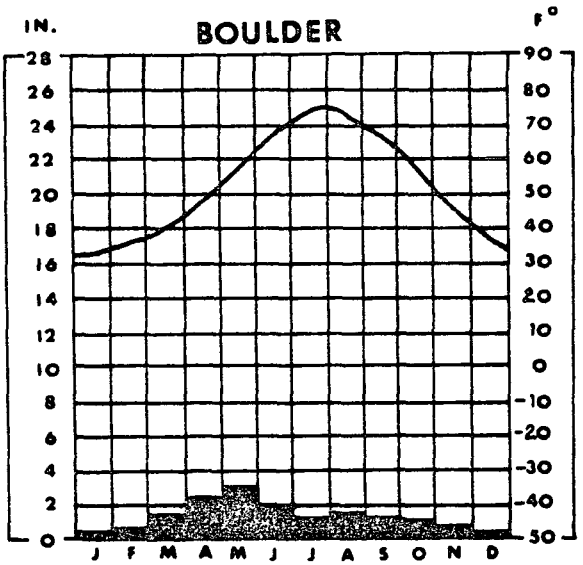


Fig. 6

Source: U.S. Weather Bureau Data (Average 1931-1964)

Flora and Fauna

The Dodd property, lying within the transition zone of subalpine to grassland, portrays plant and wildlife characteristics typical of this zone. Numerous animal burrows are found on the stream terraces. The inhabitants were not seen, but common piedmont mammals: skunks, rabbits, squirrels, prairie dogs and mice and birds would be expected to live in the area.

The vegetation is predominantly native and introduced grasses scattered throughout the area. Hackberry, wild cherry, alder, skunkbrush, and numerous herbs may be found. Although there is a change in elevation of about 195 feet, plant distribution does not seem to be determined by elevation; rather it is controlled by local variations on microclimate and edaphic factors. Thus, there is a distinct localization of cottonwood along Lefthand Creek, rushes in marshy depressions on the terraces, and yucca and skunkbrush on open hillsides (Figure 7). An unusual plant feature on the property is a single ponderosa pine, 35 to 40 feet high, in the western segment of the property - possibly a remnant of a former grove.

Vegetation Categories (Weaver and Albertson, 1956), (See Figure 7)

High Dry Grassland (Category I): The predominant grasses are blue gramma (*Bouteloua gracilis*), western wheat grass (*Agropyron smithii*), and little bluestem (*Andropogon scoparius*), with needle-and-thread (*Stipa comata*). Skunkbrush, (*Rhus trilobata*) and small soapweed (*Yucca glauca*) are scattered throughout.

High Dry Grassland (Category II): The predominant grasses are big bluestem (*Andropogon gerardi*), little bluestem (*Andropogon scoparius*), side oats gramma (*Bouteloua curtipendula*), switchgrass (*Panicum virgatum*), sand dropseed) (*Sporobolus cryptandrus*), and indian ricegrass (*Oryzopsis hymenoides*) with minor amounts of Category I intermixed.

Mixed Prairie: Mixed prairie reduced by overgrazing to a short-grass disclimax. Short grasses and cactus (*Opuntia polyacantha*) are the chief species. A wide mixture of soapweed (*Yucca glauca*), sand milkweed (*Asclepias arenaria*), and yellow spined thistle (*Crisium ochrocentrum*) are intermixed.

Cottonwood: Plains cottonwood (*Populus sargentii*) are situated primarily along the banks of Lefthand Creek. A few smaller stands can be found along the irrigation ditches.

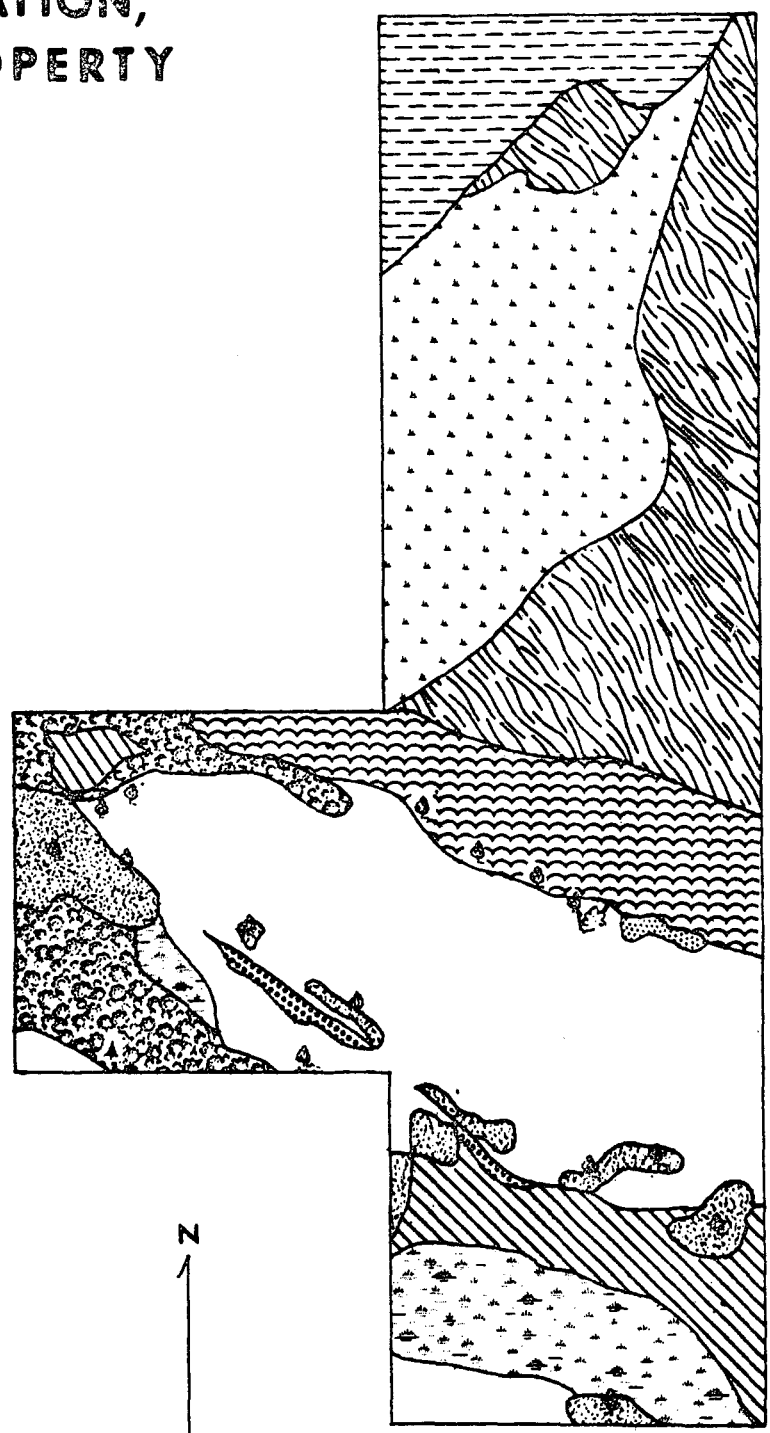
Poorly Vegetated: Extremely reduced grass cover - possibly a result of overgrazing. In scattered but frequently occurring areas the vegetation is entirely absent exposing bare soil and rock.

Bunch Grass: Plains bluegrass (*Poa arida*) predominates in conjunction with blue gramma (*Bouteloua gracilis*) and small amounts of grasses listed in Categories I and II.

Cultivated Areas: areas presently being cropped.

Marsh Lands: Here a fairly uniform layer of sedges exist in which rushes (*Carex filifolia*) predominate. Water is collected on the surface to a depth of approximately one-half inch.

VEGETATION, DODD PROPERTY 1970



LEGEND

- High Dry Grassland I
- High Dry Grassland II
- Cottonwood
- Poorly Vegetated
- Bunch Grass
- Cultivated Area
- Marsh Land
- Gravel Unvegetated
- Fallow Land
- Hackberry
- Alder
- Wild Cherry
- Ponderosa Pine
- Mixed Prairie

SCALE

1000′ 0 1000′

Fig. 7

Gravel: no vegetation present.

Fallow Areas: not presently being cropped.

Hackberry: These trees (Celtis occidentalis) are restricted to the south bank of the Holland Ditch on the upper terrace in the center of the property.

Alder: (Alnus serrulata) Only one small stand was observed in the area in which the hackberries were previously noted (as above).

Wild Cherry: (Prunus pennsylvanica) Limited clusters exist along the Holland Ditch only.

Ponderosa Pine: (Pinus ponderosa) Only one tree of this type exists on the property, and is located in the southwest corner of the western extension of the property.

Soils

The "Soils Handbook for Boulder Survey Area," a report for the U.S. Department of Agriculture (Moreland, 1966) gives the following soils descriptions for the area. Figure 8 shows the distribution of the soil types in the study area and Table I provides the slope designations.

Samsil Clay (51-CD): A shallow well-drained soil with clay or clay loam surface soil and underlain by shale at less than 20 inches. These soils are on uplands. Water intake rate is slow and water-holding capacity is low. These soils are best suited for pasture. If irrigated, frequent light irrigations will probably be necessary to maintain sufficient available moisture and avoid erosion. If not irrigated, proper range use is necessary to maintain desirable grasses and avoid erosion. These soils have severe limitations for septic tank filter fields and for foundations.

Hargreave Fine Sandy Loam (52-CD): A moderately deep, well-drained soil with fine sandy loam surface soils and fine sandy clay loam subsoils. These soils are underlain by sandstones at 20 to 40 inches, and are located on uplands. The water intake rate is moderately rapid and the water holding capacity is medium. These soils are used for irrigated and dry cropland and pasture. Erosion control is necessary to prevent wind erosion. There are severe limitations for septic tank filter fields because of the depth to bedrock.

Kutch Clay Loam (53-CD): A moderately deep, well-drained soil with clay loam surface soils and clay subsoils. These soils are underlain by shale at 20 to 40 inches and are located on uplands. The water intake rate is slow and the water-holding capacity is medium. This soil is used for irrigated and dry cropland, but is better suited for pasture than crops. Careful irrigation is needed to avoid water-logging. There are severe limitations for septic tank filter fields because of the depth to the bedrock and the slope, but these soils are moderately easy to excavate.

SOILS, DODD PROPERTY 1970

LEGEND

12G–B Calkins Sandy Loam

18–A Niwot Soils

22-B Valmont Clay Loam

22K-C Valmont Cobbly & 22K-B Clay Loam

26-C Heldt Clay

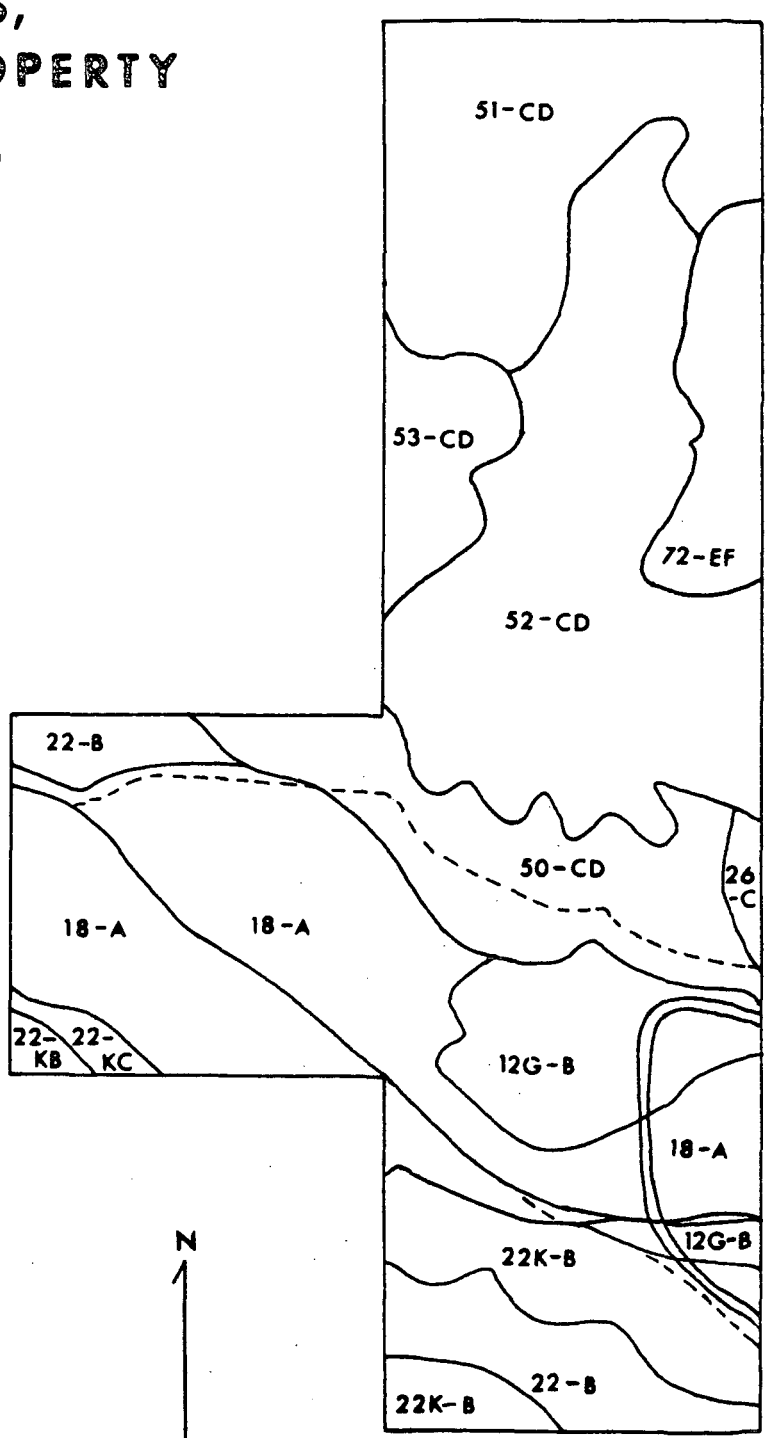
50-CD Renohill Silty Clay Loam

51-CD Samsil Clay

52-CD Hargreave Fine Sandy Loam

53-CD Kutch Clay Loam

Terrace Escarpments



SCALE

1000′ 0 1000′

Fig. 8

TABLE I. GENERAL SOIL DESCRIPTIONS

(Slope Designations)

Soil Code*	Percentage of Slope
A	0 - 1
B	1 - 3
AB	0 - 3
C	3 - 5
D	5 - 9
CD	3 - 9
E	9 - 25
CE	3 - 25
DE	5 - 25
DF	5 - 55
EF	9 - 60
F	Over 25

*Code identified in general soil description immediately preceding and can be related to those letters above which appear in Figure 8.

Renohill Silty Clay Loam (50-CD): A moderately deep, well-drained soil with silty clay loam surface soils and silty clay or clay subsoils. These soils are underlain by shale at 20 to 40 inches and are located on uplands. The water intake rate is slow while the water holding capacity is medium. This type soil is used for irrigated and dry cropland, but is better suited for close growing crops and pasture to help control erosion. On slopes of over five per cent, these soils should not be dry farmed because of the erosion hazard. There are severe limitations for septic tank filter fields.

Terrace Escarpments (72-EF): This is a land type consisting of a thin layer of cobble material over shale which occurs mainly on the side slopes of old high terraces and pediment surfaces. The water intake rate is slow although the cobble on the surface may help. The water-holding capacity is low. These soils are best suited for range or pasture. With good range management, fairly good amounts of forage can be obtained. There are severe limitations for septic tank filter fields, and for foundations.

Valmont Clay Loam (22-B): A moderately deep, well-drained soil with clay loam surface soils and clay or clay loam subsoils. This type is underlain by cobbly and gravelly layers at 20 to 40 inches, and is located on terraces and high pediments or outwash fans. Water inflitration is moderately slow while the water-holding capacity is medium. This soil is used for irrigated and dry cropland and pasture. Erosion control is important. Moisutre conservation is necessary on dry farmed areas. There are moderate limitations for septic tank filter fields, and excavation may be somewhat difficult because of cobble in the substrata.

Valmont Cobbly Clay Loam (22K-C and 22K-B): These soils are like 22-B except that there are large amounts of cobble and gravel on the surface and throughout. Cultivation is difficult, and most areas are used for pasture or rangeland. There are moderate limitations for septic tank filter fields, and excavation is difficult.

Niwot Soils (18-A): A shallow, somewhat poorly drained soil with loam or clay loam surface soil and underlain by sand and gravel at less than 20 inches. These soils are on low bottomlands and terraces, usually adjacent to stream channels. The water intake rate is medium and the water-holding capacity is low. This type is used primarily for irrigated and dry pasture. More frequent irrigation may be necessary although most areas have a seasonal watertable and may receive infrequent flooding. There are severe limitations for septic tank filter fields. These soils are good sources of sand and gravel.

Calkins Sandy Loam (12G-B): A deep, somewhat poorly drained soil with sandy loam surface soils and sandy loam subsurface layers. The water intake rate is moderately rapid while the water holding capacity is moderately low. These soils are on low terraces and bottomlands and are used for irrigated farming, being well suited for this use. Wind erosion may be a hazard and drainage may be necessary to lower the watertable. There are severe limitations for septic tank filter fields because of the high watertable.

Heldt Clay (26-C): A deep, well-drained soil with clay loam or clay surface soils and clay subsoils. This type is located on terraces and uplands. The water intake rate is slow and the water-holding capacity is high. This soil is used for irrigated and dry farming and pasture, but is best suited for pasture because of workability. There are severe limitations for septic tank filter fields because of a slowly permeable subsoil.

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CHAPTER 3 . PAST, PRESENT AND FUTURE LAND USE

Max H. Dodson and John L. Harper

Past Land Use

Historically, the Dodd property and the Haystack Mountain area have undergone few major changes in land utilization until the past five or six years. The Haystack Mountain area was first legally settled in 1864 and 1865 and was first irrigated shortly thereafter (Lang, 1932). Cropland is conjectured to have been initially confined to the floodplain, but after the Holland Ditch was completed in 1866 cropland was assumed to have advanced up the southern slopes of Haystack Mountain.

Soils in and around Haystack are, according to D. C. Moreland, soil scientist for the Longmont Soil Conservation Service, generally unfavorable for any extensive crop production but are good for grazing and pasture areas. With this information, combined with that from various personal interviews with John Dodd, landowner, it was ascertained that up until the Dodd family purchased the property in 1940, pasture and grazing was the predominant land use of their property. The raising of cereal grains and cattle feed was of secondary importance.

An interesting past land use of the Dodd property is found in the history of the old log cabin southwest of Haystack Mountain (Appendix V). This cabin was built by Jacob Affolten, a homesteader, in the early 1860s. It was used as a residence until 1950, but has had some rather interesting visitors and residents. In the 1860s it was used to muster out Civil War soldiers. While Affolten was living in the house in the mid-1860s, the Arapahoe Chief Niwot (meaning "lefthand" in English) visited and camped around the cabin (Darby, 1970). The Dodd property was a favorite wintering spot for the Arapahoe Indians who found a good supply of game and drinking water in the vicinity. Stone rings about 20 feet in diameter are still visible some 200 yards southwest of the cabin. These stones were used to hold down the edges of the tepees. Between 1867 and 1876 the cabin was used periodically as the headquarters of the F. V. Hayden Survey which made geological maps and reports of the Rocky Mountains (Johnson, no date).

When the Dodds first obtained the 200 acres, it had previously been a dairy farm which supported approximately 20 milk cows. The grazing area was confined to the acreage just below the Holland Ditch but not including the 40 acres extending to the west. Here was located a considerable amount of swamp area which was successfully drained by the Dodds shortly after they assumed ownership

The first use the Dodd family made of its newly acquired land was dairy farming. They, like their predecessors, grazed and milked approxi-

mately 20 cows. The milking area was the small barn and corral area adjacant to the log cabin in the southern part of their property just north of Niwot Road. The Dodds continued the dairy operation for approximately two years and eventually had to terminate operations due to increased health-sanitation regulations and expense of operation.

The pasture area which was used for the grazing of the dairy cattle has been continued in use as grazing land. On the upper slopes of Haystack Mountain where irrigation was not possible dryland farming was conducted, which is presently the practice.

The first significant change in land use of the Dodd property since the Dodds terminated their dairy business was the construction of the Boulder Feeder Canal in 1954, which connected the Colorado-Big Thompson system at Carter Lake to the north with Boulder Reservoir to the south. In early 1964, a diversion canal between Lefthand Creek and the Boulder Feeder Canal was completed by the Lefthand Creek Water Supply Company. The structure is bounded on all sides by the Dodd property. Also, the Lefthand Creek Water Supply Company purchased approximately 1.4 acres of land in 1961, just west of the Haystack summit on the eastern edge of the Dodd property, for the purpose of a right-of-way to repair water pipelines. According to John Dodd, the Company had tentative plans to construct a water tank on this property but to date no such efforts have been made.

For the area surrounding the Dodd property in Sections 27 and 28, land use has changed to a much larger degree. Agriculturally, the Rhinehart and Platt properties show a possible trend that has taken place in the adjacent area. The land use map of 1955 (Figure 9) shows that these properties had a preponderance of cropland. The Rhinehart cropland consisted largely of alfalfa and cereal grains with non-irrigated grassland to the west. The Platt cropland consisted of corn, alfalfa and possibly a small acreage in sugar beets. The current land use map (Figure 10) shows a greater proportion of acreage of pasture/grazing land for both properties. One possible reason for this is a matter of economics. The soils and terrain do not favor croplands under increasing costs of operation and upkeep. The feasibility of growing cultivated crops in quantity does not exist. Also, both Rhinehart and Platt accrued some income from selling parcels of their land to individual home builders, and this may have negated the desire or necessity to plant crops.

The most significant change in land use for the Haystack Mountain area has been the encroachment of the rural residential settlement of Brigadoon Glen which was first subdivided in September, 1964. It occupies what had previously been a pasture/grazing area with some irrigated cropland to the east. The Haystack Mountain Golf Course was first in operation in 1966 and, like the land encompassing Brigadoon Glen, was earlier a pasture/grazing area.

A land use which has not been previously mentioned but nevertheless bears significance was the drilling activity conducted by various oi. and gas companies. According to John Dodd, drilling operations in the area were being conducted as far back as the late 1910s. Several producing gas wells were established but were soon abandoned.

LAND USE 1955

RHINEHART, DODD AND PLATT PROPERTIES

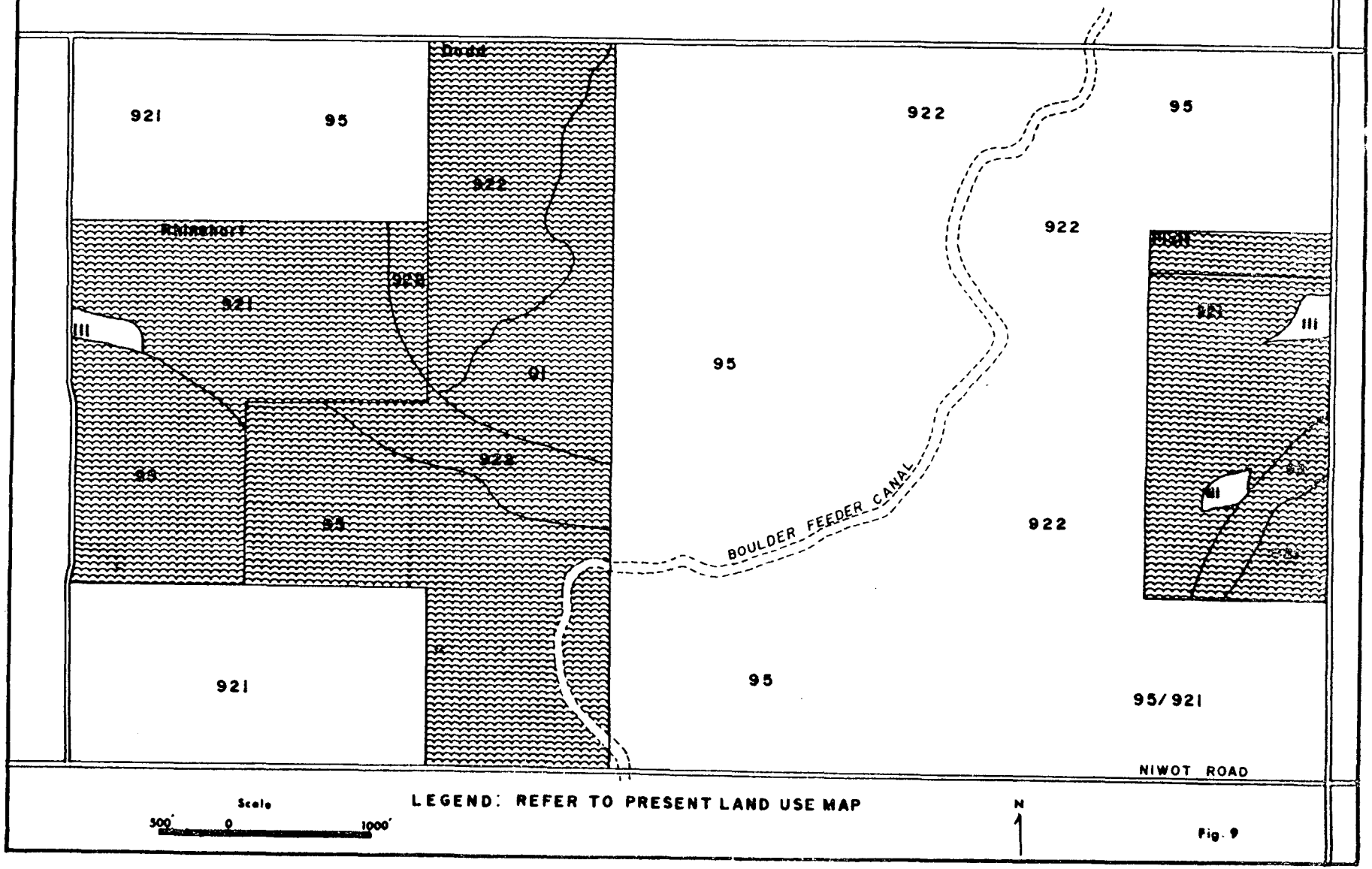

Fig. 9

In conclusion, the historic picture of the Haystack Mountain area and the Dodd property shows two trends. First, the shift from cropland to pasture is readily apparent; secondly, urban leap-frogging and development is starting to show its influence on the land use. Future land use can be postulated by noting the historical record of change in the area. It can be seen that saturation by urban sprawl, whether in the form of rural residential settlement or as tract homes, is inevitable unless action is taken to preserve some of the more unique open spaces in this area between Boulder and Longmont.

Present Land Use

The predominant land use activities observed in the vicinity of the Dodd property today are related to agriculture. Of these, the grazing of livestock and cultivation dominate, in that order of significance.

Agricultural Activities

The map of current land use in the area (Figure 10) discloses that the majority of the acreage included in the study is devoted either to improved pasture or to unimproved, natural range. Pasture lands tend to be situated on lower slopes and the Lefthand Creek floodplain, and irrigated pasture is the rule. The expanse of pasture east of and below Haystack Mountain, in the NE¼, Section 27, shows evidence of a rather extensive sprinkler system which is no longer operational (Dodd, 1970). The Hygiene Dairy, east across North 63rd Street (County Road No. 39) in the NW¼, Section 26, was responsible for the improvement of the pasture in question to serve as added grazing space for the dairy herd.

Unimproved pasturage is generally restricted to the upper reaches of the steeper topography that culminates in Haystack Mountain, in the E½, NE¼, Section 28 and NW¼, Section 27. The natural short-grass range on the Dodd property located just south of the Haystack summit area has been abandoned to grazing for the past several seasons. The Dodd brothers confine their livestock presently to the lower slopes south of the Holland Ditch.

Cropland within the study area is limited in extent and in crop variety. The Dodds have some 13 acres of spring wheat seeded in the NE¼, NE¼, Section 28, but this acreage is presently lying fallow. Besides wheat, other grains planted sparingly in the vicinity of the Dodd property are corn and barley. Alfalfa hay is produced on some low-lying lands, although most of the pasturage is in grass.

Livestock numbers, predominantly in cattle, are not available for the grazing season. During this winter field season the only animals in evidence in Sections 27 and 28 were some two dozen head of dairy-breed cows and calves in an enclosed feeding area, plus a few head of mixed-breed cattle on pasture to the east, at the Sellmer farm in the SE¼, NW¼, Section 28.

Residential Development

Aside from several individual farm residences and the Brigadoon Glen subdivision, single-family residences are scattered along area roads on 1- to 5-acre lots, mostly within a hundred feet or so of the roadside. These occurrences are noted on Figure 10 with the single-family residence code and pattern. Farm homes, in addition, are keyed with the letter "f" to denote farmsteads.

Brigadoon Glen, located in the S½, SE¼, Section 27, represents the classical rural residential area in which relatively expensive homes are situated on lots of approximately 1 acre. Presently, only 15 of 62 platted lots are occupied by homes (Figure 10); the majority of them are facing Lefthand Creek, either on the existing floodplain or on the first or second terraces above it. Two homes are under construction.

East of Brigadoon Glen, across County Road No. 19 and north of Niwot Road, two platted subdivisions are well established. The trend toward rural, single-family residential land use is growing steadily in this area as a reflection of the proximity of the IBM plant and of the general urbanization of rural lands between Boulder and Longmont.

Recreational Activities

Of primary consideration in analyzing the future of the Dodd property as a natural area site is the long-term effect of an adjoining land use, the Haystack Mountain Golf Course, in the SW¼, Section 27, This 32-par nine-hole course began operation in 1966 as a small-scale enterprise, in which category it remains today. It includes grassed fairways and manicured greens, and it is complemented with a 200-yard driving range. There is no clubhouse per se, but the owner-manager's residence functions as one.

Other Forms of Land Utilization

The study area is traversed by Lefthand Creek which courses southeastward through Section 28 to arc around the base of Haystack Mountain. Along the reach of this stream (Figure 3) the floodplain is quite narrow and subject to severe flooding under conditions approximating those of the May, 1969 four-day rains. No zoning of the floodplain exists, but the U.S. Army Corps of Engineers is presently conducting studies and hearings, in conjunction with Boulder County, to affect restrictive zoning.

The major ditch line shown on Figure 10, running southwestward through the W½, Section 27 and into the SE¼, Section 28, is the Boulder Feeder Canal (Boulder Creek Supply Canal). On the Dodd property a siphon structure channels this flow under that of Lefthand Creek, and a diversion structure just upstream on Lefthand Creek was completed in 1964 to deflect creek waters into the canal.

Two smaller ditch systems, and a host of laterals and diversions, are depicted on Figure 10. The Holland Ditch branches from Lefthand Creek in the center of Section 27. Originating in the W½, W½, Section 28, the Hinman Ditch follows the lip of the major terrace south of Lefthand Creek in the SW¼, Section 28 and then angles southeastward into Section 33 south of Niwot Road.

A small, undeveloped 1.37 acre parcel within the Dodd block of land (NE¼, Section 28) is owned by the Lefthand Water Supply Company. It reportedly is the future site of a water tank to be constructed when and if residential pressure demands. Three plots of waste disposal are shown within the two-section study area; they are dumps for construction materials and abandoned automobiles and farm equipment.

Future Land Use

The historical and present land use studies of the Dodd property give some indications as to what the future land use of the area will be. Urbanization has recently begun on former agricultural land and for several reasons this trend should persist. The location of the area would definitely lend itself to further development as a place to live in that it lies between two urbanized areas, Longmont and Boulder, whose populations, according to the Bureau of Census have increased 55 and 191 per cent respectively in the 20-year period since 1940.

The present urbanization in the area, Brigadoon Glenn, is quite accessible to the IBM plant which is located just 1.5 miles southeast of the Dodd property. According to several individual realtors handling property in the area, the geographic location of the area is very much responsible for the high selling price of the land. The 97 acres for sale in the NW¾, Section 27 is being handled by Boulder Realty which expects that the area will be purchased for urban development. An unconfirmed amount of $2,000 per acre is the asking price. In Section 27 (NW¾) there are 80 acres for sale by the Alpine Realty and the asking price is $1,500 per acre and again development is assumed to be the prime incentive for buying the land. The Arapahoe Realty has unofficially sold a 100-acre farm in the S½, NW¾, Section 28 to a Boulder attorney who supposedly bought it as a future development. Mr. C.L. Ebel of Haystack Mountain Golf Course has intentions of selling homesties on his property along the Niwot Road frontage according to the information printed on his golf course score cards. The Dodd brothers willfully point out that agriculturally the land could and would sell for a large sum of money.

It can be noted that it would be naive indeed to assume that the Dodd property naturally will remain relatively unchanged for the next few years. Lefthand Creek offers an attractive location for homesites with full-grown trees lining the banks and the slopes of Haystack Mountain would offer a spectacular vista for homesites.

Presently, the majority of the area is zoned for agriculture with Brigadoon Glen the only rural residential zoning in the immediate vicinity.

The trends toward urbanization, however, may be modified by other developments. The only significant resistance to urbanization is twofold. First, the U.S. Army Corps of Engineers' floodplain study of Lefthand Creek could lead to floodplain zoning which could hinder or stop further development. A considerable amount of the southern half of the Dodd property adjacent to Lefthand Creek would be affected. Secondly, if Boulder and Longmont continue their rapid expansion perhaps portions of the area would fall under a program similar to the Boulder Greenbelt.

References

Darby, Lorena. 1970. "Niwot," Town and Country Review. April 22, p. 12.

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Johnson, Rudolph. 195? (date unknown). "Log Cabin Built by Jacob Affolten Still Stands," Longmont Ledger.

Lange, Marjorie E. 1932. "The Appropriation to Private Use of Land and Water in the St. Vrain Valley before the founding of the Chicago-Colorado Colony (1871)." Unpublished M.A. thesis, University of Colorado.

Maps

Boulder County, Colorado. October 1965. County Zoning Map No. 6.

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References

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Lange, Marjorie E. 1932. "The Appropriation to Private Use of Land and Water in the St. Vrain Valley before the founding of the Chicago-Colorado Colony (1871)." Unpublished M.A. thesis, University of Colorado.

Maps

Boulder County, Colorado. October 1965. County Zoning Map No. 6.

CHAPTER 4. CADASTRAL AND LAND TENURE

Gary A. Heaslet, George R. Greenbank and Robert E. Key

Information on cadastral and land tenure survey is represented by Figures 11, 12, 13, 14, and 15. The maps present a graphic pattern of existing land ownership as of the date of original grants, and in 1910, 1930, 1950, and 1970. This information was gathered primarily from the Boulder County Assessor's Office and personal interviews.

Essentially, only two sections (Sections 27 and 28 of T 2 N, R 70 W) are involved. Property transaction records are complete only from 1922 and the sequence of conveyances is included in the report (Tables 2 and 3). This information enables one to determine intermittent land transactions not shown on the maps.

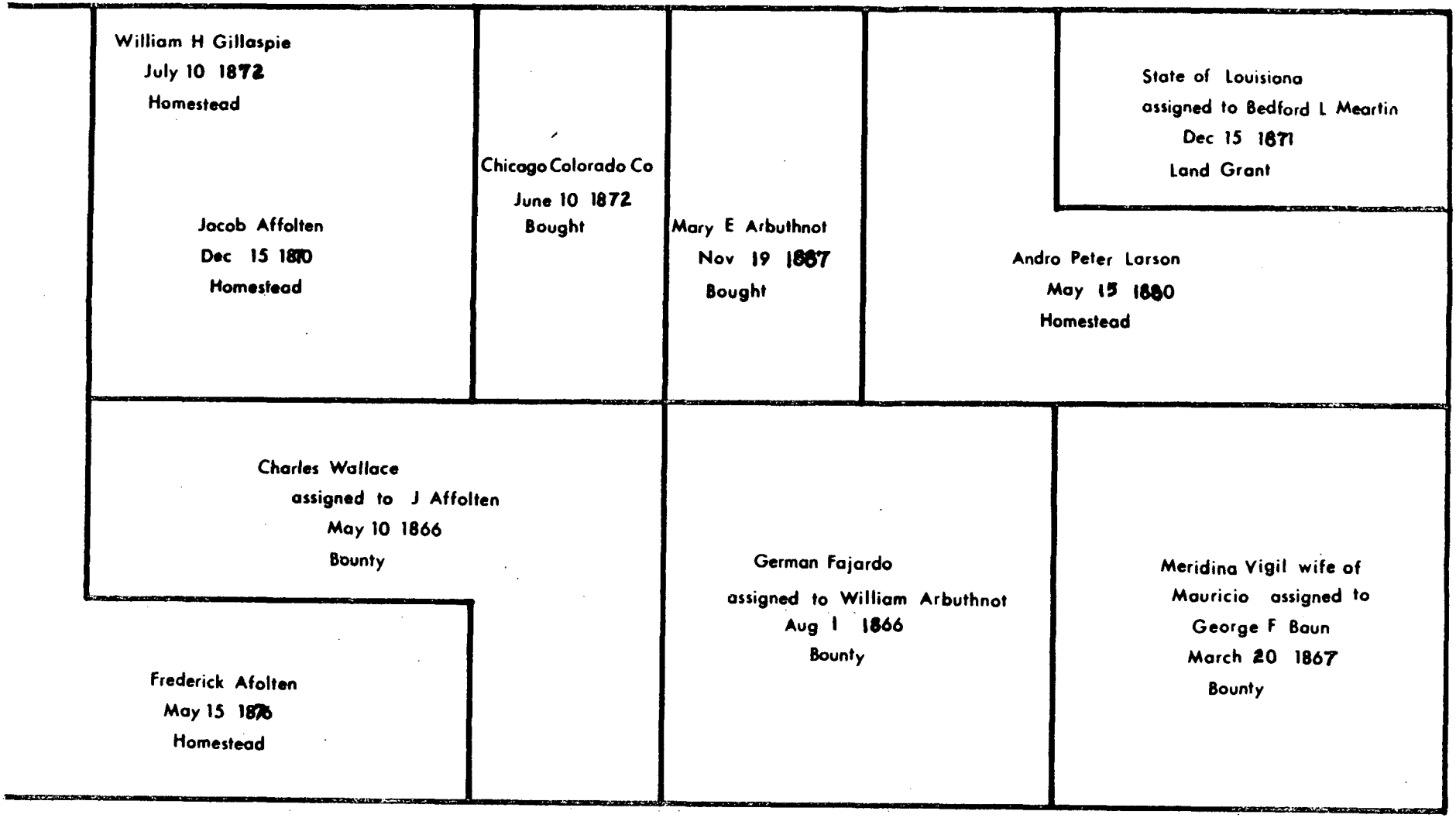
The number and types of ownership have proliferated moderately through the years, but have accelerated greatly in the last decade. The ownership pattern and resulting development has paralleled census figures which reveal a doubling of population in the Boulder area roughly every 10 years. Undoubtedly, the establishment of IBM and Beech Aircraft plants nearby has had an impact on this area.

The 1970 map (Figure 15) shows several areas of multiple ownership, represented as Brigadoon Glen, "various owners," C. & M. Platt, and the Boulder Seven Corporation. The latter three contain in-holdings of several acres each and are developed as suburban-country residential properties; however, Brigadoon Glen is a platted subdivision containing 1 to 2-acre lots. Cadastral patterns indicate a trend toward suburban, fringe-type residential development encroaching upon the proposed natural area site.

Land Tenure

Land tenure in the two sections of the study area is divided into three general classifications. Approximately 800 of the 1,280 acres in the study are farmed and operated by the owners, most of whom live on their property or in the near vicinity. Three hundred and twenty acres are leased by owners for farming purposes. The remaining 160 acres consist of individual homes and adjacent property. Private residential property sizes range from 1 acre sites in Brigadoon Glen to sites as large as 10 acres. These smaller residential properties often have summer crops but are farmed by the owners in every case.

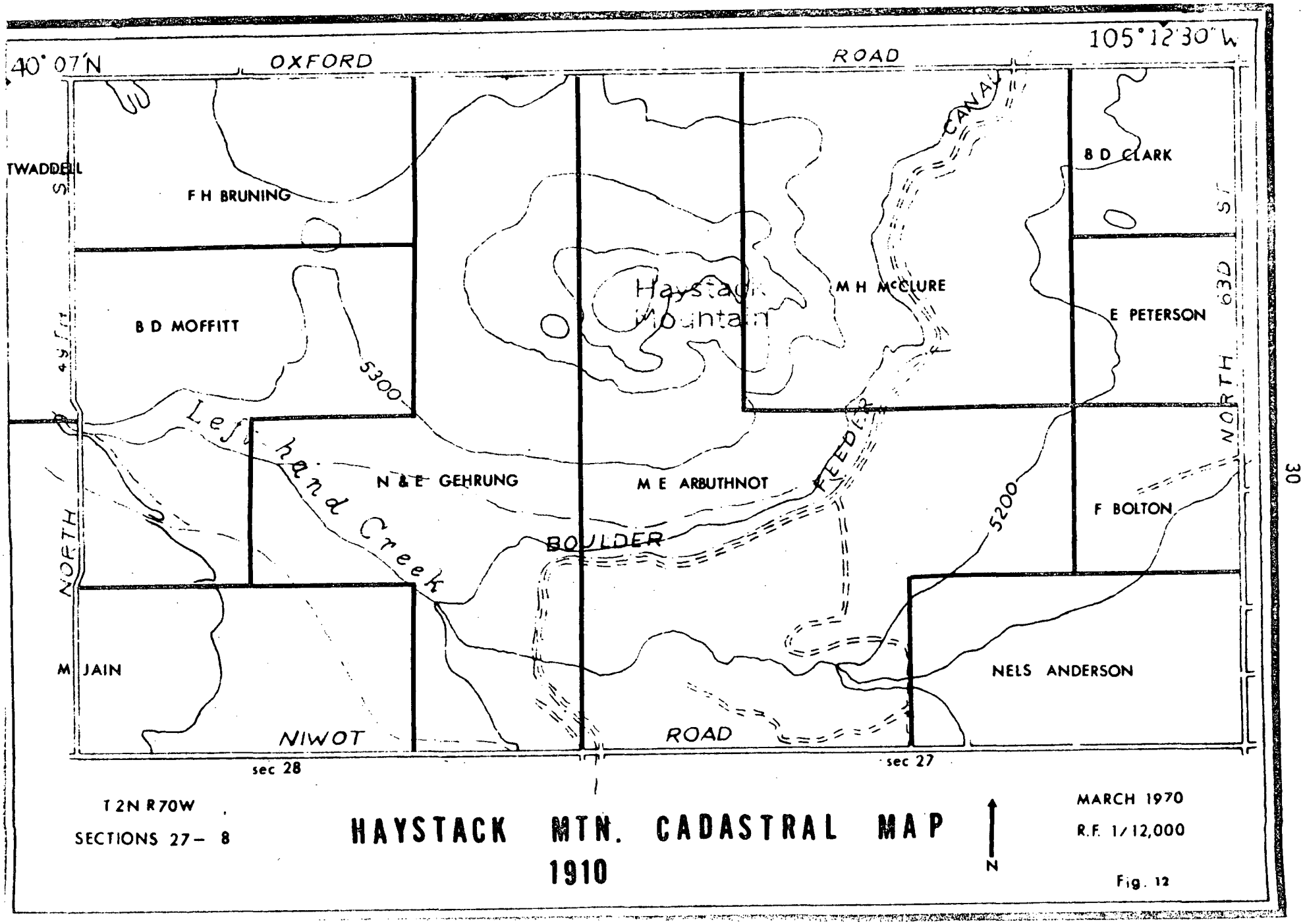
Although portions of the area reflect gradual residential encroachment, there are still some fairly large land holdings that remain in agricultural use. For example, the Brunings have 160 acres in Section 28, as well as 40



ORIGINAL PATENT MAP[3] — SECTIONS 27 – 28

T 2 N, R [illegible] W

Fig. 11



T 2N R70W

SECTIONS 27 – 8

HAYSTACK MTN. CADASTRAL MAP 1910

MARCH 1970

R.F. 1/12,000

Fig. 12

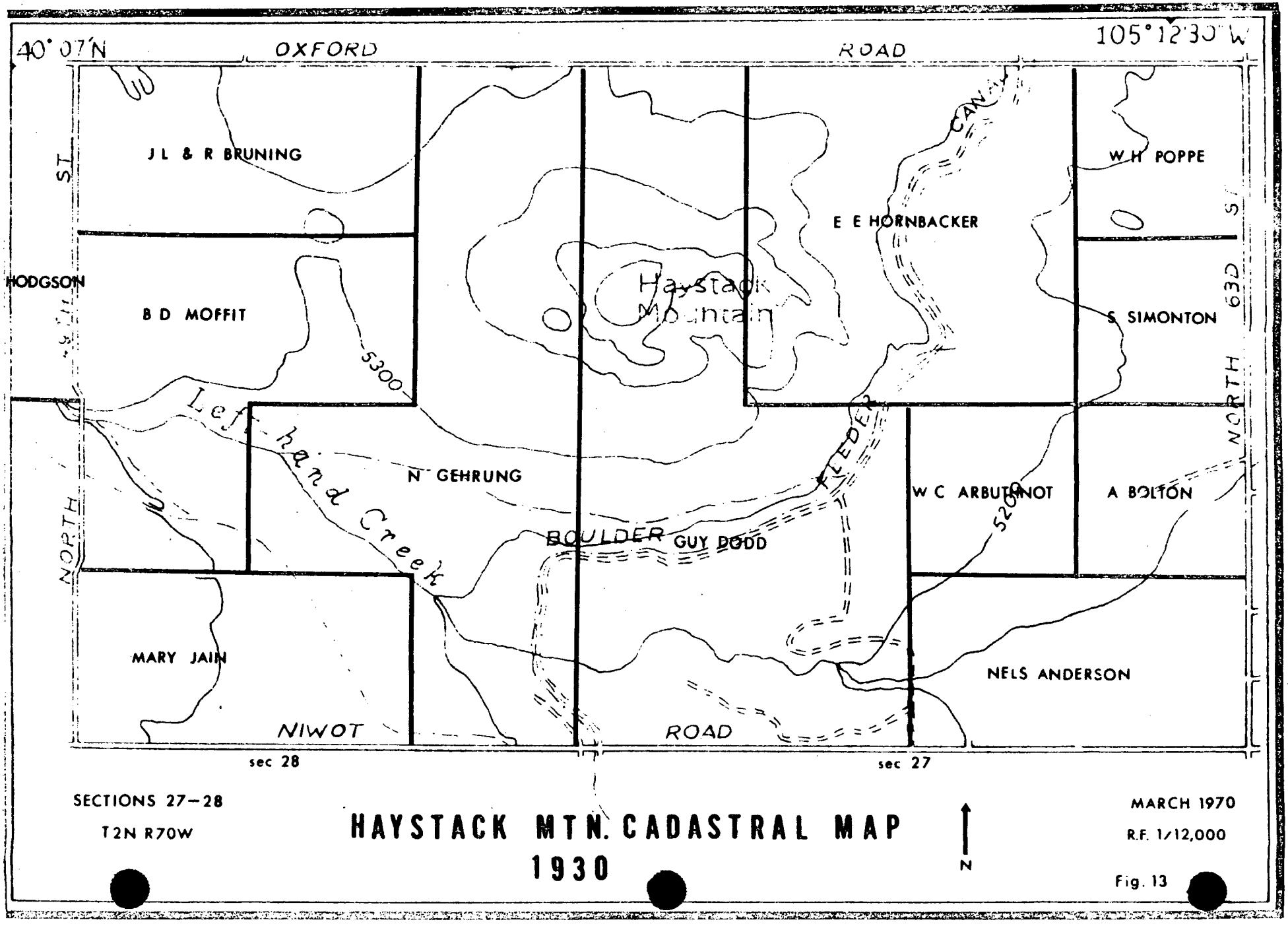
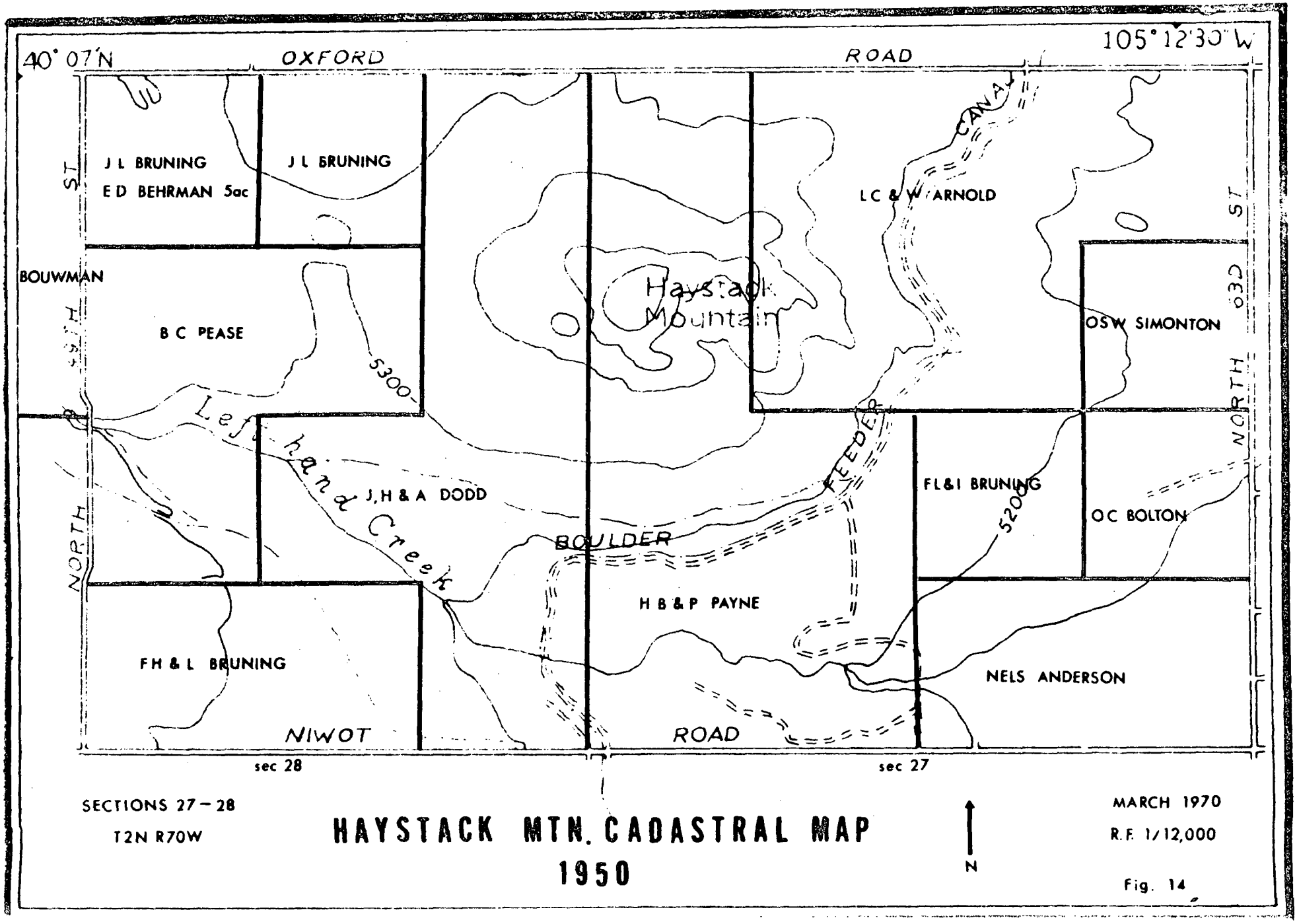

40° 07'N
OXFORD
ROAD
105° 12'30" W
J L & R BRUNING
W H POPPE
E E HORNBACKER
HODGSON
B D MOFFIT
Haystack Mountain
S SIMONTON
5300
Left hand Creek
N GEHRUNG
FLEDER
W C ARBUTHNOT
A BOLTON
5200
BOULDER
GUY DODD
MARY JAIN
NELS ANDERSON
NIWOT
ROAD
sec 28
sec 27
NORTH
ST
63D
SECTIONS 27–28
T2N R70W
HAYSTACK MTN. CADASTRAL MAP
1930
N
MARCH 1970
R.F. 1/12,000

Fig. 13



SECTIONS 27 – 28

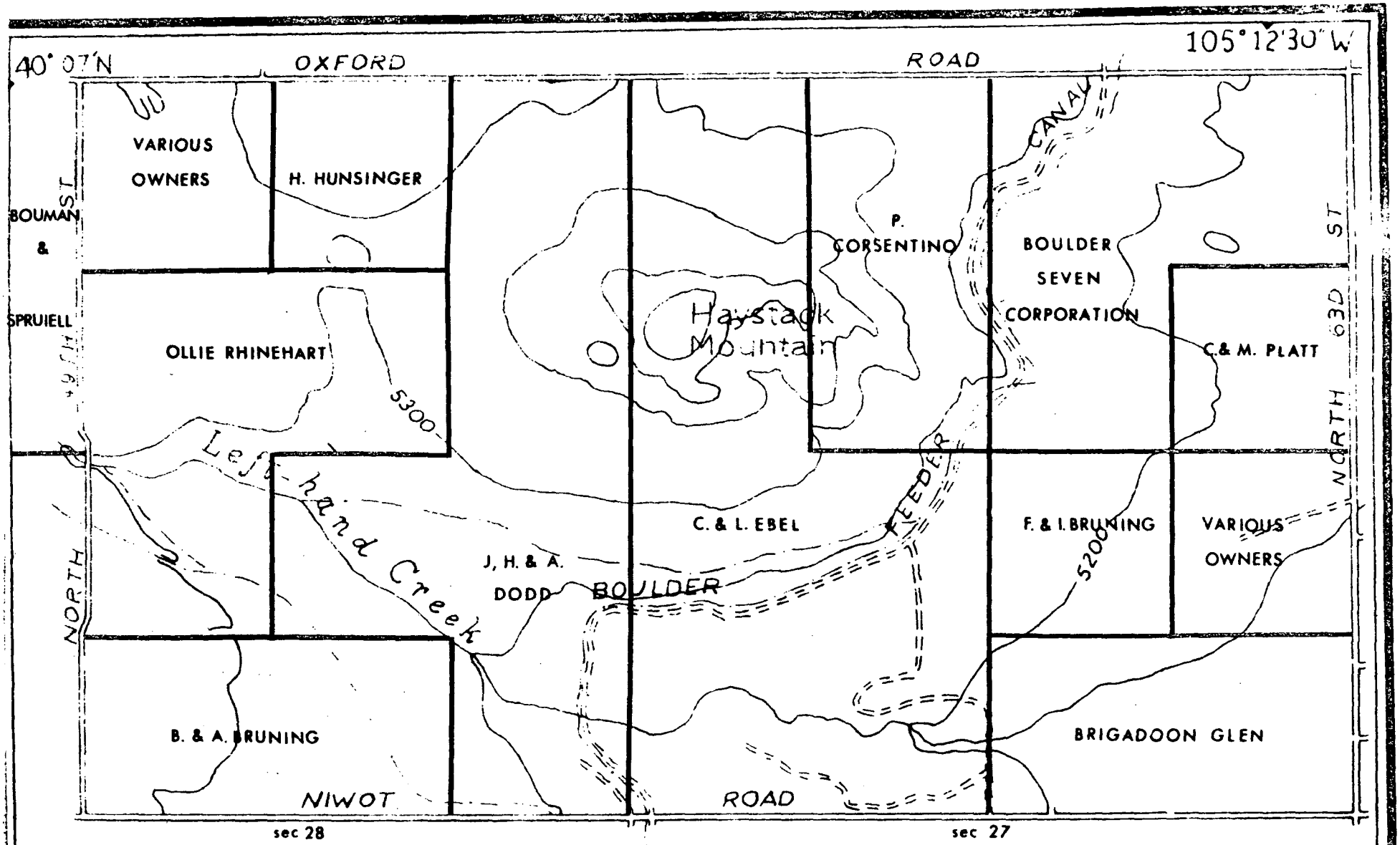
T2N R70W

HAYSTACK MTN. CADASTRAL MAP 1950

MARCH 1970

R.F. 1/12,000

Fig. 14



SECTIONS 27 & 28
T2N R70W

HAYSTACK MTN. CADASTRAL MAP
1970

Fig. 15
MARCH 1970
R.F. 1/12,000

TABLE 2. PARTIAL HISTORY OF LAND TRANSACTIONS, SECTION 27

Township 2, Range 70

Description	Grantee	Filing Date
NE¼ NE¼	W. H. Poppie	2-9-1922
W½ NW¼ & SW¼	Stella M. & S. A. Arbuthnot	9-14-1922
W½ NW¼ & SW¼	Guy Dodd	2-13-1924
NE NE¼	W. H. Poppie	12-1-1924
NE¼ SE¼	Francis L. Bolton	1-28-1926
NE¼ SE¼	Almira Bolton	12-29-1926
E½ NE¼ & N½ NE¼	E. E. Hornbaker	11-17-1928
½ in NE¼ SE¼	Otis C. Bolton	4-27-1931
W½ NW¼ & all SW¼	F. H. Pounds	12-18-1935
SW¼ & W½ NW¼	Arthur E. Hammans	3-5-1940
SW¼ & W½ NW¼	Anne O. & Arthur E. Hammans	8-15-1940
NE¼ NE¼	Louisa G. & William G. Arnold	4-18-1944
E½ of NW¼ & W½ NE¼	James H. Hornbaker exal	8-28-1944
E½ of NW¼ & W½ NE¼	Louisa G. & William G. Arnold	10-26-1944
SW¼ & W½ NW¼	Holland B. & Pearl B. Payne	1-7-1946
NW¼ SE¼	Francis L. & M. R. Bruning	8-6-1947
SE½ NE¼	Otis C. Bolton	7-11-1952
SE¼ NE¼ & NE¼ SE	Carl D. & Myrtle E. Platt	7-12-1952
E½ NW¼ .32 acs.	U.S.A.	9-10-1953
W½ NE¼ 6.45 acs.	U.S.A.	9-10-1953
SW¼ 6.26 acs.	U.S.A.	7-21-1953
NE¼ NE¼ & E½ of NW¼ W½ NE¼	Pete Corsentino	12-28-1953
S½ SE¼	Henry L. Anderson & Helen A. Bloon	2-18-1954
S½ SE	Henry L. Anderson	4-5-1954
S½ SE¼	Henry L. Anderson & Helen A. Bloon	4-12-1954
SE¼ NE & NE¼ SE¼	Carl D. & Myrtle E. Platt	3-9-1957
SE¼ SE¼	Henry L. Anderson	11-26-1957
NE¼ NE¼	Martin L. & Anne M. Hall	9-11-1962
SE¼ & W½ NW¼	Clarence J. & Lois J. Ebel	3-26-1963
NE¼ NE¼ & W½ NE¼ & 1½ E½	Leonard P. Cresentino	4-25-1963
NE¼ & NE¼ NW¼	Martin L. & Anne M. Hall	9-12-1963
S½ SE¼	Development Enterprize, Inc.	6-1-1964
NE¼ NE¼ & W½ NE¼ & 1½ E½ NW¼	Bou Her Seven Corp.	3-15-1966
1 ac. NE SE	Fr. Paul Jlosephean	7-22-1968
1 ac.NE SE	J. & Ralph D. Brower	7-22-1968
1 ac.NE SE	Margo J. & Allan H. Nelson	7-22-1968
20 acs. NE SE	Ralph D. Bower etal	7-29-1968
NE¼ SE¼	Francis E. & Revat Dennhardt	7-7-1969

TABLE 3. PARTIAL HISTORY OF LAND TRANSACTIONS, SECTION 28

Township 2 N, Range 70

Description	Grantee	Filing Date
W½ NW¼	C. W. Bell	12-28-1923
W½ NW¼	Lloyd E. & Carrie Hodgson	11-1-1926
SE¼ NW¼ & NW¼ SW¼ & SW¼ NE¼	Atra A. & Milton D. Moffitt	1-14-1932
NE NW less 5 acs.	John I. Bruning	11-28-1932
E½ NE¼ & E½ SE & NW SE	Emma Gehrung	7-30-1935
W½ NW¼	Aisee & Margaretha Bouwman	1-3-1939
W½ SW¼ & SE¼ SW¼ & SW¼ SE¼	Frank H. & Lottie J. Bruning	7-8-1940
E½ NE¼ & E½ SE¼ & NW¼ SE¼	John J., Hugh J., & Alva M. Dodd	12-9-1940
SE¼ NW¼ & SW¼ NE & NE¼ SW¼	Wm. S. & Florence Turley	9-4-1942
NW¼ NE¼	John I. Bruning	2-14-1944
5 acres in NE¼ NW¼	Ernst D. Behrman	7-14-1945
SE¼ NW¼ & NE¼ SW¼ & SW¼ NE¼	Beatrice C. Pease	4-2-1946
5 acs in NE¼ NW¼	Ernst D. & Evelyn A. Behrmann	4-9-1951
SE¼ NW¼ & SW¼ NE¼ & NE¼ SW¼	W. A. & Allie F. Rhinehart	1-11-1952
1.48 ac. N½ SE¼ 1.65	U.S.A.	7-25-1953
NW¼ NW¼ & SW¼ NW¼	Aisse Bouwman	12-30-1960
S½ SW¼ & NW¼ SW¼ & SW¼ SE¼	Frank H. Bruning	1-27-1961
1.377 acs. SE¼ NW¼	Left Hand Land & Water Co.	10-30-1961
1.377 acs. SE¼ NE¼	Left Hand Water Supply Co.	12-11-1961
5 acs. in NE¼ NW¼	John H. & Hedwig H. Meyer	9-11-1962
2.4 acs. E½ SE¼ SE¼	Left Hand Ditch Co.	1-16-1963
NE¼ SW¼ 1.30 acs.	Algons & Patricia J. Reining	4-26-1963
5 acs. in NE¼ NW¼	Richard S. & Agnes M. Baker	2-25-1964
3.9 acs in NE¼ NW¼	Keith R. & Mary R. Morgan	2-25-1964
NW¼ NW¼ & SW¼ NW¼ SE¼ NE¼	Aisse Bouwman & Gino Spruiell	2-15-1966
SE¼ SW¼ & SW¼ SE¼	Boyde B. & Ruth E. Bruning	1-17-1966
NW¼ NE¼ 40 acs.	Howard D. Hunsinger	10-31-1966
NE¼ NW¼ less 5 acs.	John I. Bruning	11-22-1966
NE¼ NW¼ 5.3 acs.	Minie R. & Jenny Lee Van Arsdale	12-8-1966
NE¼ NW¼ 11 acs.	Willard J. Humpal	12-20-1966
NE¼ NW¼ 10 acs.	Harold Trey	12-20-1966
NE¼ NW¼ 9.3 acs.	Arason Brenker	12-21-1966
5.3 acs. NE¼ NW¼	Jenny Lee Van Arsdale	6-7-1967
NE¼ NW¼ 10 acs.	Thomas D. & Carole A. Lynch	2-23-1968
SE¼ NW¼ & SW¼ NE¼ & NE¼ SW¼	Ollie F. Rhinehart	5-8-1969
NW¼ 11 acs.	A. G. Jr. & Virgeen H. Hedgecock	9-2-1969
NE¼ NW¼ 10 acs.	John F. & Phyllis M. Olson	10-16-1969
NE¼ NW¼ 9.3 acs.	Robert H. & Bernadine D. Tschody	10-17-1969

acres in Section 27. Frank Bruning originally homesteaded the area in 1904, and has farmed the area since that time. The Dodd property encompasses almost 200 acres, much of which is still farmed.

Section 27 shows the greatest change in ownership and tenure patterns. The 80 acres belonging to Pete Corsentino are leased to a nearby dairy for pasture and grazing. Mr. Corsentino is presently residing in California and the Boulder Realty is advertising the property as ideal for residential development. The Ebel property includes a nine-hole golf course and 12 homes sites fronting on Niwot Road. Lot sizes are approximately an acre. The trend would seem to indicate a gradual reduction in property sizes as residential development moves into an area still dominated to some extent by agricultural use.

References

Boulder County Assessor's Office. 1922 to 1970. Land ownership transaction records for Boulder County, Colorado.

Maps

Freeze, Samuel. Map of Boulder County, compiled in part from official data, and in part from actual surveys made for the purpose, by Samuel Freeze, in October, November, December, and January, A.D. 1880-81. Norlin Library Historical Collection, University of Colorado, Boulder, Colorado.

CHAPTER 5. LAND ECONOMICS

Michael R. Tripp, Manik Hwang, and Scott Mernitz

Information on land values in the area of the Dodd property are shown graphically on three attached maps. Figure 16 indicates changes in value between 1960 and 1970 expressed as percentages, and Figure 17 shows current appraised valuations. Data for both maps were gathered from the Boulder County Assessor's Office. A third map is included to record the owner-estimated values, and asking prices (where applicable) of land in the area (Figure 18).

Land valued by production capacity has distinct limits imposed on its economic evaluation by the costs of production. The cost of the land logically will not rise above the point at which the operator can expect to receive a fair return on his investment of time, money, and effort.

Once agricultural land comes to be viewed as desirable for residential purposes, the basis for evaluation changes sharply. Not only is a different group of users and potential users involved, but the criteria employed to assign value to the land now consists of such factors as distance from place of employment, shopping and schools, availability of utility services, and site advantages as a location on which to build a home.

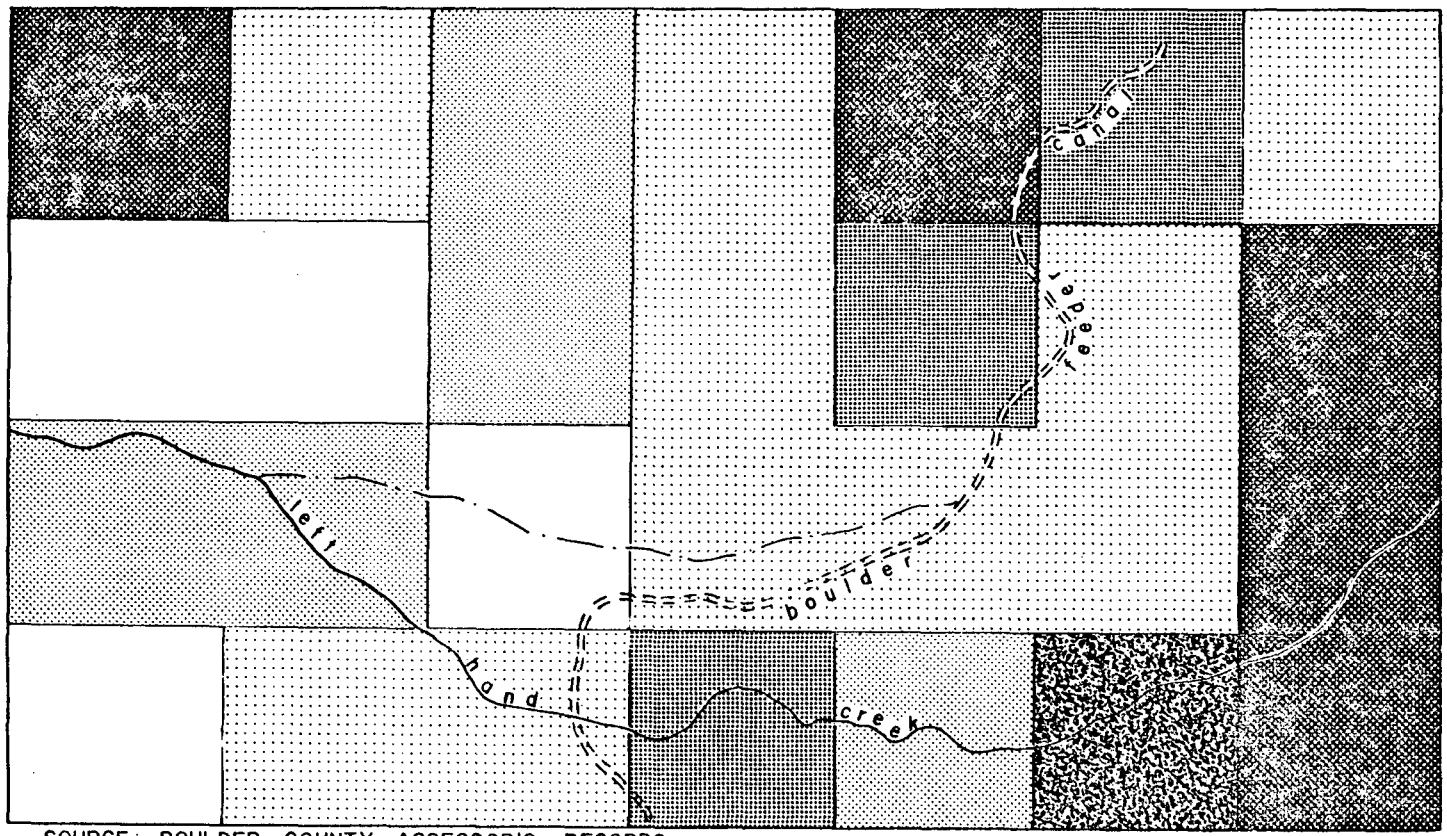
There has been a continuing decline of farming in the area due to increasing production costs unaccompanied by corresponding financial returns; however, the resulting land use shift to pasture has maintained the low assessed values characteristic of Haystack Mountain itself as well as immediately adjacent land including nearly all of Section 28 during the 1960 and 1970 period (Figure 16). The much higher assessed values, reflected in the appraised values (Figure 17), on numerous small one-or two-acre parcels primarily located on the floodplain of Lefthand Creek in the southeast portion of the study area indicate the conversion of this land to subdivision and rural residential development.

This development, perhaps most directly attributable to the presence of the IBM plant 1.5 miles southeast, has been of sufficient duration and intensity to cause the other landholders in the area to readjust what they consider to be the market value of their land as potential residential and/or industrial property to amounts several times above what even the best agricultural land parcels would have brought based on the value of the crops that would have been produced.

Figure 16 reveals the two principal patterns in this trend. The largest proportion of land in the study area is held in blocks of at least 40 acres. All of the owners or realtors handling these properties (who were contacted) set values on them from $1,000 to $2,000 per acre, and in one case, $2,500 per acre if sold in parcels as small as 10 acres. The

LAND ECONOMICS: DODD PROPERTY AREA

INCREASE OF AVERAGE ASSESSED VALUATION BY QUARTER SECTION BETWEEN 1960 & 1970



SOURCE: BOULDER COUNTY ASSESSOR'S RECORDS

INCREASE VALUATION CLASSES

0 10 50 100 200 400 1600 %

sec. 28 | sec. 27

T2N R70W

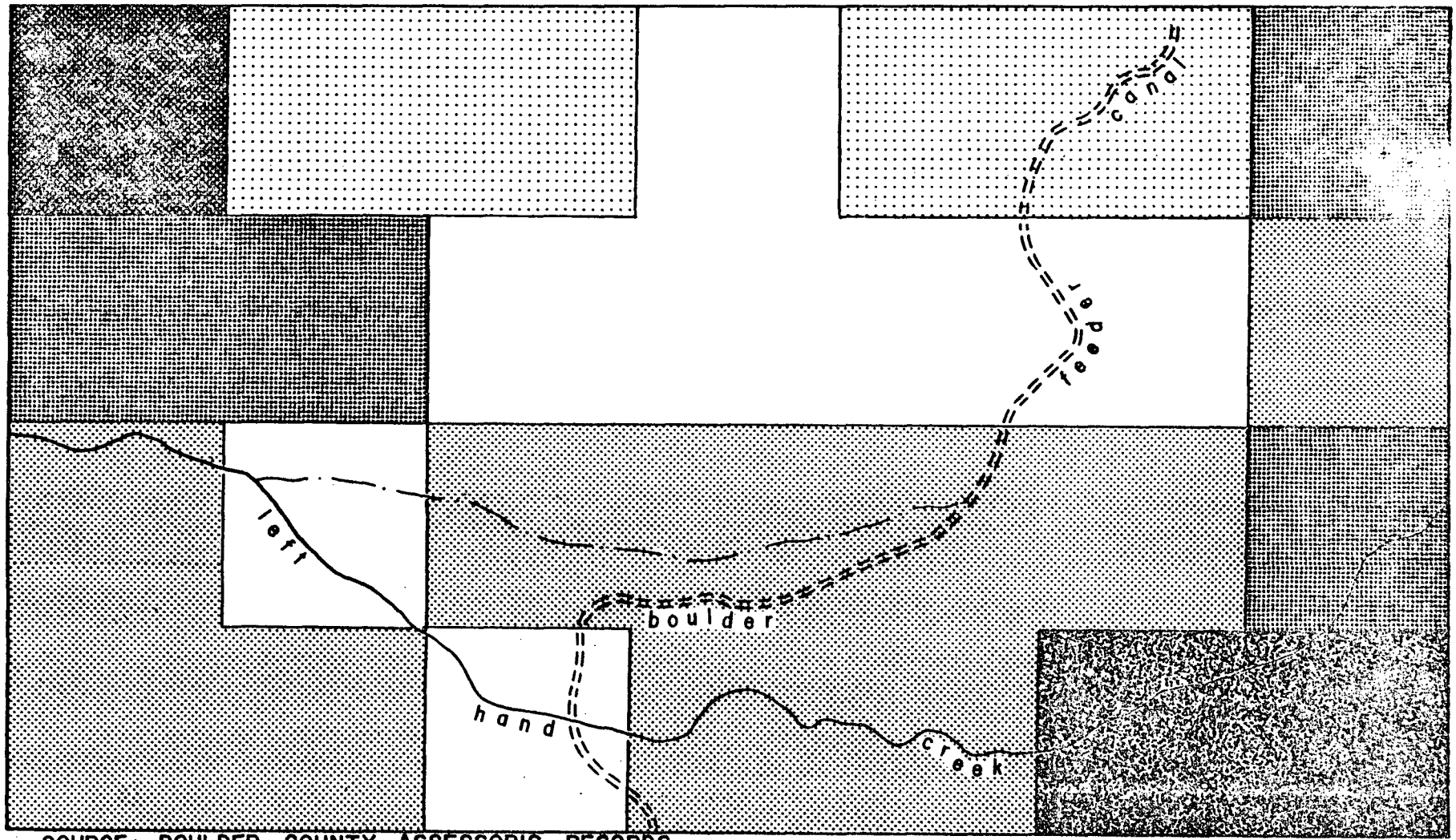
SCALE

500 0 500 FT.

Fig. 16

LAND ECONOMICS: DODD PROPERTY AREA

AVERAGE APPRAISED VALUATIONS per ACRE, 1970



SOURCE: BOULDER COUNTY ASSESSOR'S RECORDS

VALUATION CLASSES

0 50 100 150 200 400 1850 dollars

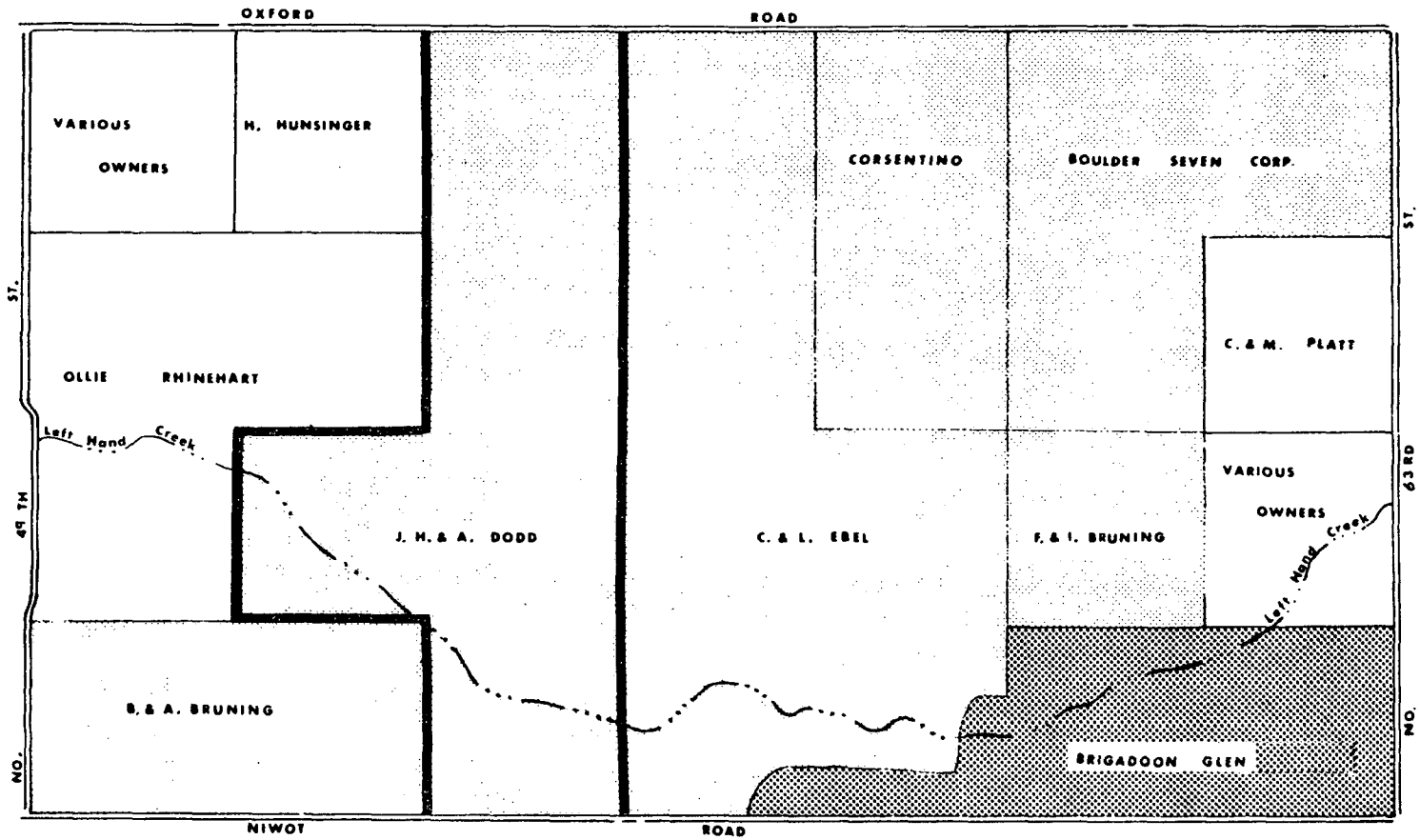
sec 28 | sec 27

T2N R70W

SCALE

500 0 500 FT.

Fig. 17



VALUE PER ACRE

Data Unavailable

$1000-2000

$5000-6000

N

Scale

2000' 0 2000'

LAND EVALUATION BY OWNER

DODD PROPERTY AND VICINITY

1970

Fig. 18

other pattern includes a portion of Mr. Ebel's property fronting on Niwot Road as well as all of Brigadoon Glen, both situated in the southeastern corner of the study area. This land has been subdivided and improved in varying degrees with building lot sizes averaging slightly over 1 acre and each evaluated at $5,000 and move.

Both Mr. Flanders (John Dodd's attorney in Longmont) and Mr. Art Palmer of the Boulder County Planning and Zoning Commission consider the present fair market value of undeveloped land in the study area to be be-between $750 and $1,000 per acre.

In view of the changing land use pattern in the study area from agricultural to residential uses and the concommitant upward shift in property values, it seems very reasonable to assume that such a trend will continue to intensify and thereby not only bring increasing population pressure to bear on the study site but also result in a steadily rising market value for the land comprising the site.

CHAPTER 6. CONCLUSION

Wil Ulman and Helen Louise Young

The conservation or preservation of our natural areas necessitates the consideration of changing land uses and values. Each area is unique with its own social, cultural, and land use changes affecting future development.

The Dodd property is presently in a state of semi-isolation. Housing projects have not been built in the immediate area and few individuals wander onto the property or climb the slopes of Haystack Mountain. Typically, as with other areas on Boulder's fringe, the trend toward more intensive occupance of the land has begun. Subdivisions are in evidence less than 2 miles to the east. Someday in the near future, the Dodd property may be subdivided and houses may possibly flank the slopes of Haystack Mountain.

Preserving the quality of the Dodd property may take the form of several alternative uses of the land. Certainly the least desirable alternative would be intensive subdivision of the land, permanently altering the attributes of this site. More desirable alternatives to using the Dodd property including the following: purchase by the University of Colorado or by the Boulder Valley School district for use as an educational experimental or observational site; permanent agricultural zoning of the area or preserving of the floodplain in its natural state; preservation in parks or greenbelt with public access allowed; or preservation of the area as an historical site.

Biologists consider the property and nearby Haystack Mountain to provide a wide variety of habitats in close proximity to each other. These habitats include marsh, ponds, a creek, grassland, slopes of varying exposure and a cobble-covered, conical hill. Adding to the value as a study area is the short distance, hence easy accessibility to the University and to Boulder Valley Schools (Gregg, 1970).

As recently as December, 1969, John Dodd offered the University of Colorado the opportunity to purchase the Dodd property as a study area. Efforts to instigate the purchase were conducted by Dr. Robert Gregg Professor of Biology; however, his efforts to buy the property were unsuccessful (Appendix IV).

The zoning policies of Boulder County may affect development of the site. Boulder County planners have not officially projected development for this area. Presently all of Sections 27 and 28 are zoned for agriculture except for the SW¼, Section 27 which is zoned rural residential (Brigadoon Glen subdivision). The county's study of Lefthand Creek floodplain zoning revisions may significantly alter development within the area. Construction of homes, for instance, may be prohibited within 100-year floodplain limits.

The Parks and Open Space Council of Boulder County is presently studying natural areas within Boulder County and will formulate a list of properties which the council will suggest purchasing or preserving (Porreca, 1970). The Council presently has no intention of purchasing the land for greenbelt but wishes to see it undeveloped and would favor some type of private land dedication or a tax easement to keep the land undeveloped.

The historical significance of the old settler's cabin, the stone rings with which the Arapahoes' tepees were held down and the old fence posts on the Dodd property, are ample reason to suggest preservation of the site by some state or local historical society. Certainly relics of Colorado's early history warrant active interest by citizens.

In order to determine the feasibility of saving this natural and historic area, the attitude and plans of the landowners and the trends in surrounding development must be considered. Local governmental and university attitudes are also important.

The Dodd property is owned jointly by three brothers, Alva, Sr., Hugh, and John--all of whom live near Niwot, Colorado, several miles east of the property. Interviews were conducted with two of the three brothers, Hugh and John. In addition, John reflected on the attitude of the third brother, Alva, Sr. There exists a difference in opinion among the brothers as to the future of the property. John wishes to see the property preserved in its natural state by either the University or some conservation agency. Hugh offered little information in the interview, therefore, his true attitude remains unknown. John Dodd offered his observation of Alva's intentions to hold the land in its present state only until the "best price" was offered for the land, whether for residential development or for conservation. Of all the Dodd properties, the particular site studied in this report is less intensively used for agriculture than any of their other holdings. It is quite likely that this particular parcel might be the first to be sold. John Dodd has been approached by Boulder realty agents in the past (Dodd, John, 1970).

The owner of Haystack Mountain, Mr. C. L. Ebel, is proprietor of the Haystack Mountain golf course. His future plans would include recreational development of Haystack Mountain. He reported that someday he might be able to convert the slopes of Haystack into toboggan or junior ski runs. An ice skating rink would be constructed on the small Haystack Lake with warming houses nearby. A revolving restaurant might possibly be built on top of the mountain. The plans for such development are not drawn up, and Mr. Ebel stresses that the development is "only a dream" at present (Ebel, 1970).

The aesthetic qualities of the Dodd Property are evident. Stream-based land is at a premium not only for recreation, but also for residential development purposes. Land developers are quick to assess this fact and as urbanization continues, this land will not lie idle long. If the Dodd property is to be preserved, prolonged efforts toward this end will only result in a greater cost and more intensive deterioration of the values of this natural and historic site.

References

Dodd, John. May, 1970. Landowner. Personal interview.

Ebel, C. L. April. 1970. Landowner. Personal interview.

Gregg, Robert. May, 1970. Professor of Biology, University of Colorado, Personal interview.

Porreca, Vincent. May, 1970. Assistant Boulder County Planner, Personal interview.

Maps

Boulder County, Colorado. October, 1965. County Zoning Map No. 6.

APPENDIX I

SELECTED PHOTOGRAPHS OF THE DODD PROPERTY

Figure 19

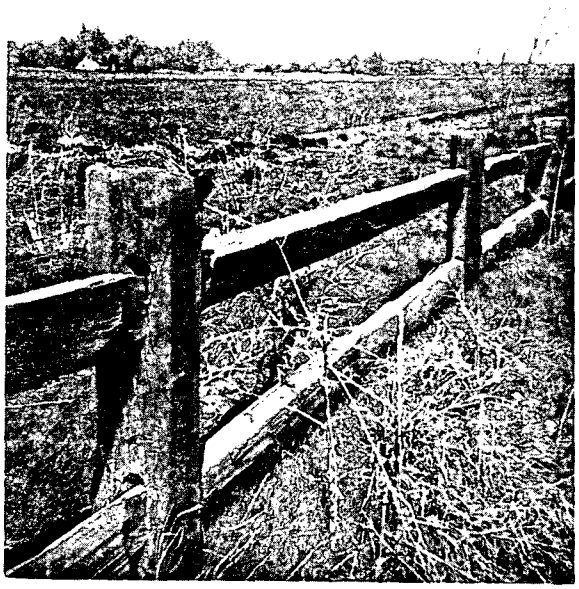


Fig. 20

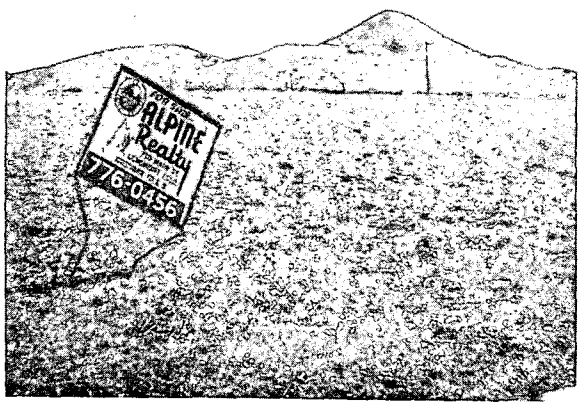
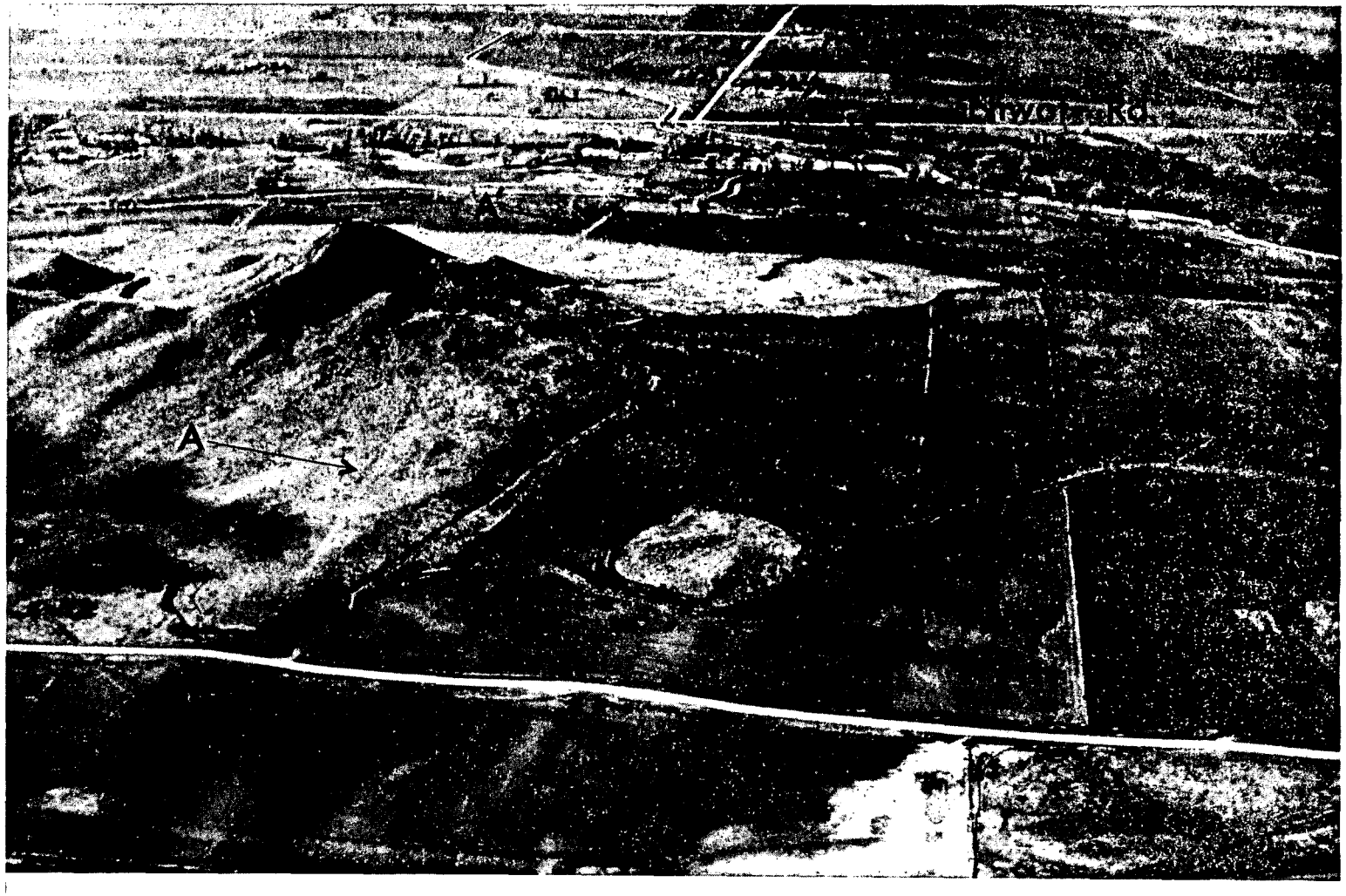


Fig. 21

APPENDIX II

AIR PHOTO OF AREA - 1969

Figure 22



APPENDIX III

NATURAL AREAS COMMITTEE MINUTES

NATURAL AREAS COMMITTEE

Meeting -- January 12, 1968

MINUTES

The meeting was called to order with 14 members present.

DODD PROPERTY:

Dr. Gregg reported on his talks with Dean Manning about the Dodd property and the possibility of establishing a natural area system for the University. Dean Manning was interested and took considerable time with him. Dr. Gregg was then referred to Homer Ball to discuss the financial aspects of the proposal. Mr. Ball was present at the luncheon and told of the various approaches to this matter. He felt the first step was to have an appraisal made. He outlined the following potential sources of funding:

1. Sale of University land
2. Development Fund
3. State appropriations
4. Federal Education Resources grant
5. City greenbelt program
6. Matching funds from Land and Water (use) Fund
7. The Nature Conservancy
8. Donation by seller
9. Long-term purchase in small parcels; money from Ball's office.

After considerable discussion it was moved, seconded and passed that an appraisal be made. Mr. Ball said that his office had funds for this purpose. Bob Gregg is chairman, Kurt Gerstle and Bettie Willard are on the committee.

It was suggested that the committee compile a list of other lands that should be purchased by the University so that the magnitude of the Natural Area project could be assessed by the Administration. White Rocks was identified as high priority.

It was pointed out that the cabin on the property is of historic significance in that it was used by the Hayden Survey.

OTHER BUSINESS:

BOULDER - GRANBY TURNPIKE:

The imminent danger of a bill to authorize $100,000 for a feasibility study of a Boulder-Granby Turnpike was emphasized. The committee voted to send a wire to Governor Love, urging him not to place this bill on his legislative call, to be signed by individuals rather than the committee. Al Bartlett suggested the alternative of cars riding "piggy-back"

through the Moffat Tunnel - a proposal that needs to be more fully investigated and pushed if feasible. It would certainly be a unique experience.

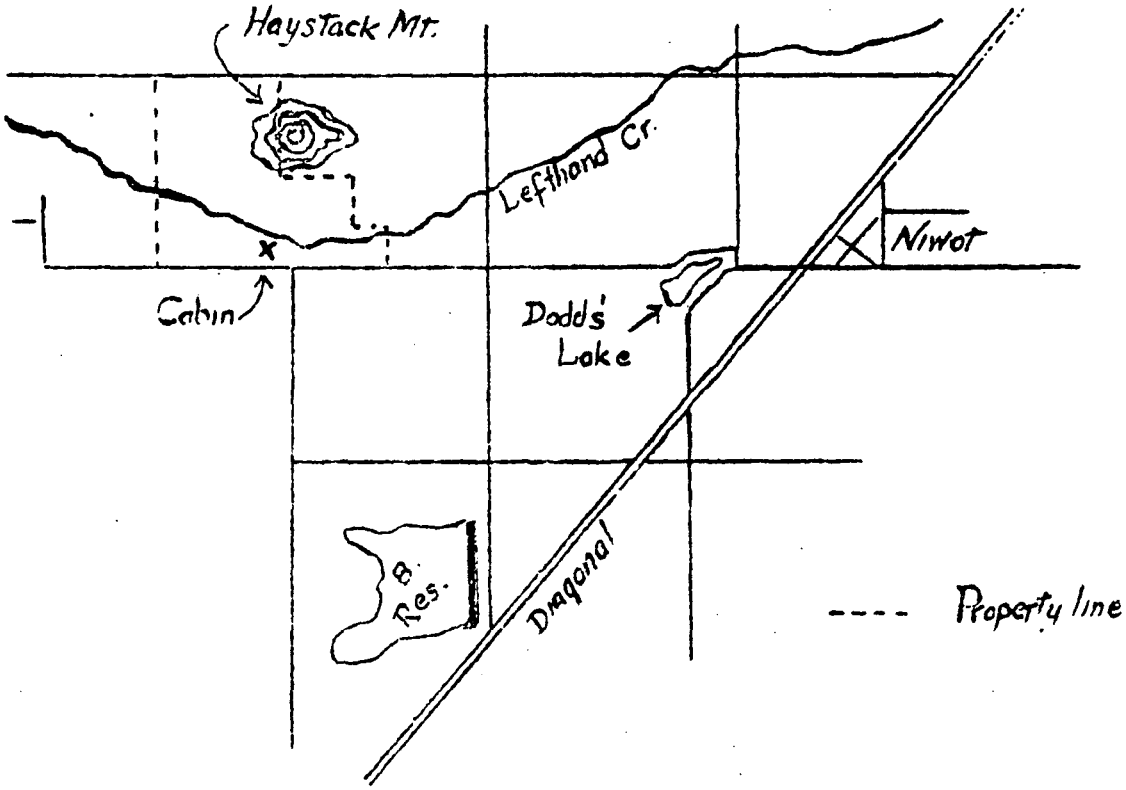
FLORISSANT:

The statement is readon on (sic) Florissant and will go to appropriate State and Federal politicians. This is the time for individual correspondence with Dominick.

Respectfully submitted,

Bettie Willard, Secretary

DODD PROPERTY



APPENDIX IV

MEMORANDA FROM ROBERT E. GREGG

"May 12, 1969

"TO: All members of the faculty of the Department of Biology

FROM: Robert Gregg

SUBJECT: The Dodd Property.

As a member of the NATURAL AREAS COMMITTEE, I have worked for more than four years to have the University acquire the parcel of land belonging to the John Dodd Family.

The object of these activities was to secure a sizable tract near to the University and in the plains vegetation zone (an area in semi-natural state that would quickly return to natural conditions when vacated by grazing) that could be used by members of our department for teaching and research in varying aspects of field biology.

These objectives were twice unanimously and enthusiastically endorsed by the staff in biology, and I was directed to proceed with negotiations.

The Information was prepared in detail for the consideration of the administration. Twice we were given an encouraging reception and felt there was a real possibility that something definitive would be accomplished. But when it reached the point where the University was asked to take positive steps we were turned down (a pattern wholly consistent with its past performance where Biology is concerned).

My last letter to the administration, that is to say, Eugene Wilson, Director of Business Affairs, set forth our request and our needs, and was to have been signed by Robert Pennak, Askell Löve, and myself as chairman for the negotiations. Dr. Löve refused to sign, because, among other things, I had not made a request also for land to create a botancial garden. This last point is entirely irrelevant to the objective we had followed. The letter was redrafted, signed by Pennak, and by Gregg, and sent to Wilson. The latter responded promptly and told me there was no chance of our securing the funds necessary for the purchase of the Dodd Property, and that there were no other avenues of approach. In fact, he said, what we needed was an 'Angel' to provide us with required money. (This is not news!)

At the meeting of the N.A.C. on March 21 of this year, Dr. Löve at his request, appeared to present his views on the question of obtaining the afore-said Dodd property. I quote from the minutes of this meeting which record Dr. Löve's comments. 'He stated unequivocally that he could say nothing about the Dodd Property as a representative of the Biology Department. He was firm in his conviction that he was in no position to represent what the Biology Department wants since it in in the process of working out its goals at present. He cited two letters written to Dean Manning about the property, one which he wrote in March 1968 and one which Dr. Gregg wrote in April 1968. Claims that he did not know anything about the second letter as Chairman, and that the second letter was written as though it were representing the Biology Department. He was then asked what his personal opinion of the land was. He had two specific comments: 1) It is

too far away from the campus 2) It has no usefulness from the botanical point of view. He also felt that the University should invest its money first in equipment for experimental biology rather than in land acquisition. A short discussion resulted in which the original purposes of the Committee were reviewed: To bring together people on the University campus who had a common interest in environmental issues, wise land use, planning, and preservation of natural areas.'

All my correspondence with Mr. John Dodd and with the University Administration has been turned over to Dr. Betty Willard, Secretary of the N.A.C.

I have withdrawn from all further efforts to convince the University of the desirability and the necessity of obtaining the Dodd Property. I regret to say that the real losers in this fiasco are the Department of Biology, the University of Colorado, and the present and future students and classes in field biology who desperately need an outdoor laboratory.

I might add as a postscript, that the reaction of the Committee to Dr. Love's presentation has been, to put it mildly, one of utter astonishment and amazement.

R. E. Gregg"

DODDS LAKE PASTURE

"Location: 2 1/2 miles west of Niwot, Colorado

Legal Description: T.2N - R.70W., Sec. 27-28 (portions of) - Approx. 192 acres

Elevation: approx. 5240 ft.

Geology: bottomland of Lefthand Creek: Haystack Mt. (an erosional remnant)

Geography: valley of Lefthand Creek, passing just south of Haystack Mountain
permanent stream
moist stream banks
spring
drier river benches (above water table)
ponds (water filled swales)
irrigation ditch and head gate with spillway
sloping base of Haystack Mt.

Flora: sparse cottonwood bottomland
meadow
pasture
spring brook?
upland prairie (would be under nature conditions)

Fauna: has not been intensively investigated, but with the variety of ecological conditions (and especially the presence of permanent moisture), there is no doubt that a substantial local sample of the regional fauna is present or would regenerate. Wild ducks and hawks have been observed; insects have been collected.

Unusual feature: an original settler's cabin (logs with tin roof) still stands on the site; it could be preserved and would provide some archaeological or sociological interest.

Significance: with the fast disappearance of natural areas on the plains near Boulder, the preservation of such becomes critical. Much mountain land is protected in public ownership of one sort or another, but it seems not to be realized by people in general that flat prairie should be preserved also. This type of land does not offer majestic scenery, but it usually has a wealth of biological forms that exceeds some mountain areas, especially the higher altitudes. The parcel of land near Niwot offers an opportunity to save some of our vanishing prairie, and it is particularly attractive because of the presence of good moisture supply and a variety of habitat forms.

Ownership: Mr. John Dodd, and his two brothers - Niwot, Colorado"

"Use of the site: at present, verbal permission, obtained in 1960, from the owners, is still in force; use is limited to small classes, however, with due respect for the owner's interests.

Outlook: Mr. John Dodd is interested in selling a portion of the land, but with the hope that the new owners would preserve its natural features and use for scientific purposes. He is also interested in having the University acquire and preserve the unique features of this land, and use it for research and instructional purposes.

Robert E. Gregg"

UNIVERSITY OF COLORADO

BOULDER, COLORADO 80302

Department of Biology

"October 7, 1968

Mr. William T. Garrett, Chairman
Colorado Chapter
The Nature Conservancy
2916 Perry
Denver, Colorado 80212

"Dear Mr. Garrett:

For a number of years The Natural Areas Committee, of the University, has been trying to have the University purchase or otherwise acquire a parcel of land near the city which could be used by the Biology Department as an outdoor laboratory for teaching and research. The accompanying correspondence, etc., will supply the details, and I would particularly call your attention to my description of the Dodd's Lake Pasture, the legal description of the property, and my letter to Dean Manning which sets forth the various uses that our Department would make of this land.

After more than a year-and-a-half of negotiations with Mr. Dodd and the University Administration, including investigation of details of the legal description (which see) and a real estate appraisal, we have finally received an unequivocal refusal by the University to take any further steps toward the acquisition of the property. Needless to say, this has been very discouraging, especially in view of the fact that Mr. Dodd definitely wishes to see Haystack Mountain and surrounding acreage preserved in a natural state. He has offered to negotiate with the University, and has offered to make concessions regarding the sale or transfer of all or part of the land.

We are all committed to the belief that the Dodd Property would make an excellent site for field studies by the Department of Biology, and at the same time preserve its natural features. The situation is urgent owning to the fact that wild land in the vicinity of Boulder is rapidly disappearing under the impact of development. Therefore, we are appealing to you and the Nature Conservancy to investigate and consider this area for purchase, lease, or otherwise acquire by the Conservancy. If we can answer questions or provide additional information, we shall be most happy to do so.

Very sincerely yours,

(Sgd.)

Robert E. Gregg
Professor of Biology
Member: Natural Areas Committee"

APPENDIX V

ANALYSIS OF POSSIBLE FUNDING

UNIVERSITY OF COLORADO
Business Office
Boulder, Colorado 80302

Office of the
Vice President and
Business Affairs
and Treasurer

"January 9, 1968

MEMORANDUM

"TO: Professor Robert Gregg

FROM: Homer Ball, Business Manager

RE: Dodds Lake Pasture

"After our conversation on December 15 about acquisition of the Dodd property, I have done some further checking. To review the various possibilities we discussed:

1. Gift. Attached is some information about acquisition by the Dodd family. They must certainly have quite an appreciation in the land and would face rather heavy capital gains taxes if they sold. I believe a partial sale-partial gift or life estate arrangement (except there would be no income from the land unless a caretaker salary could be arranged) has possibilities and I will ask Mr. Dwight Roberts to call you about further information along these lines.

2. Purchase. The two University accounts which might be used are both pledged for the funding of Physical Science Research Building No. 3. I know of no available funds for the purchase.

A grant is a possibility, I suppose, but I am not knowledgeable in this area.

Another possibility is the sale of some presently owned land, such as the East Campus Arapahoe frontage, to raise money to buy less expensive land. You should probably discuss such an idea with Mr. Jim Bowers, Planning Director.

3. Lease - Purchase. If adequate current funds could be provided for rent, the University could at least tie up the land by a lease-purchase agreement.

Perhaps some combination of two or more of these ideas might be developed.

If you (or the Committee) feel the prospects for acquisition are good

enough, we should have an appraisal of the land made. I can arrange for (and pay for) such an appraisal.

Any land sale or purchase would require prior approval of the Regents but could be tentatively negotiated if funding were in sight.

Finally, although you and the Committee would recommend the acquisition for long term natural area use, if the "price is right", the acquisition could be partially justified as a good investment.

Please let me know if I may help.

(Sgd.)

Homer Ball
Business Manager

HB:jh

Enclosure

cc: Mr. Dwight Roberts"

UNIVERSITY OF COLORADO
Business Office
Boulder, Colorado 80302

Office of the
Vice President for
Business Affairs
and Treasurer

"March 1, 1968

"MEMORANDUM

TO; Professor Robert Gregg

FROM: Homer Ball (Initialed HB)

RE: Dodd Farm Acquisition

Mr. Bowers has found two sources of federal grants which might work:

1. Open Space Land Program, HUD, 50-50 matching grant

2. A land acquisition program under Title I, Office of Education, HEW

He is inquiring further into these programs and will get a better idea if the Dodd acquisition could meet the criteria.

Attached is a financial scheme which must be checked by someone more knowledgeable than I for legality, feasibility, etc. I am sending Dwight Roberts a copy for verification by him or by Dean King.

In the meantime, if you talk to Mr. Dodd, I suggest you inquire of him if he would consider leasing with an option to buy. You could explain that it will take months to secure assurance of total funds and accumulate sufficient cash to make the first year payment. (I assume he will definitely not want to take all the money in one year. The income tax would be exorbitant.) The shortest lease would be one year, two might be preferable. Of course, the purchase price would have to be agreeable to him. I am not sure what the lease payment should be--perhaps up to $2,000 a year would be about right for a lease to graze cattle or horses. The lease arrangment would gain us time to apply for a grant and raise our part of the money. I assume Dean Manning would be likely to allocate the funds for a lease if he feels our chances for a grant are reasonably good and that the attached scheme is reasonable.

HB:jh

cc: Mr. Dwight Roberts"

Analysis of Possible Funding
Dodd Farm Purchase (192.573 acres)

March 1, 1968

"1. Assume C.U. can acquire for appraisal figure of $96,000
Purchase price (indicated) for 200 acres 7,000
$89,000

Or, say $90,000 capital gain
Or, taxable long-term gain of $45,000 (taken in one year)
Assume additional annual income of 5,000
$50,000
Tax would be about $16,000
Producing $80,000 net

2. Assume take payments as follows

1st year	$28,000	(taxable long-term gain $13,000)
2nd year	28,000	" " " " "
3rd year	28,000	" " " " "
4th year	12,000	" " " " 6,000

Assume additional income of $5,000, then in first 3 years

capital gain	$13,000
ordinary income	5,000
	$18,000

Tax would be about $3,260 x 3 years or $9,780
Fourth year taxes about 1,600
$11,380

Producing $84,620 net

Unfortunately, the interest earning available by taking the net in one year may equal or exceed the tax savings.

It does not appear that a partial gift arrangement would be beneficial to Mr. Dodd unless his other income is significantly greater than the assumed $5,000 per year.

If we assume no gift and a $96,000 purchase price, and further assume we could get a 50-50 matching grant, the University would have a goal of $48,000 to raise. If the payments could be spread over 4 years and if we had a one year lease, it might be possible to allocate that much money from:

1. Research overhead?
2. Gifts via Development Foundation
3. Purchase of Land account
4. other sources - specific appropriation from the Senate?

In summary, I must admit that I am not hopeful of success in this project."

APPENDIX VI

NEWSPAPER CLIPPING - HISTORIC CABIN

Clipping from Town and Country Review, October 5, 1967. Clipping provided by Mr. J. Schooland.

Boulder County's Oldest Cabin

By Marlene Morton

Less than two miles from that epitome of the computer-age, the IBM installation, and right next door to that testimony to modern leisure, the golf course, stands a weathered log cabin, circa 1859, the year of the Boulder County gold discovery.

This year it is 103 years of age, the oldest cabin still standing in Boulder County. Used as a dwelling place until 1940, it also bears the distinction of being the area's longest-inhabited pioneer home.

To bring this timing into perspective, take a look at Boulder's situation at that time. Boulder's first prospectors arrived in 1858, and it was in 1859 that the first city streets were being laid out and the first cabins being built along Pearl Street. The Pearl Street cabins have long since capitulated to progress.

Boulder's oldest cabin is located just off the Niwot Road, almost due south of Haystack Mountain, and the 160-acre tract on which it was built is still intact. It has been owned since 1940 by John, Hugh, and Alva Dodd, who farm land in the Niwot area.

Because it was so recently inhabited, the cabin mingles the very old original materials with materials of modern vintage. Square nails gave way to round ones as improvements and repairs were made over the years. An addition made of boards was added, along with a front entrance, a cement sidewalk, and some cement "chinking" replacing original mud plaster. The cabin is quite nice inside, with a brick fireplace, boarded walls, several spacious rooms downstairs, and an upstairs sleeping loft, and it was probably quite a house in its day.

Certainly it was considered nice enough, in the 1860's, for the Hayden Geological Survey to headquarter there while it surveyed for silver, gold, coal, limestone, etc., and prophesied oil wells.

This was during the Civil War, and while the war was being fought, this country was hungering after the newly discovered gold and contending with Indian uprisings in this area. Soldiers were sent to Colorado to put down Indian uprisings, and it was on this tract that the soldiers were stationed, in army tents.

At a later date, Niwot area residents used the cabin for weddings and funerals, because there was no building in Niwot large enough to house such events.

To go back to the beginning, this is not a piece of homesteaded land. (The Homestead Act was enacted in 1862.) Rather, it was an earlier grant from the United States government to a veteran of the War of 1812, Charles Wallace. Record-keeping being somewhat lackadaisical in those days, we have no information as to when Charles Wallace received the land.

The cabin-building is attributed to a man named Jacob Affolter, who sent a son to the Colorado legislature and still has descendents in Boulder County. Since the cabin was built in 1859, we can speculate that Jacob Affolter had at least informal title to the land by that time, although it was not recorded until 1876, with a notation that Andrew Johnson,

See Page 14

Boulder County's Oldest Cabin (Cont.)

while President, had caused letters to be made patent by the General Land Office in Washington in 1860. Colorado was still a territory.

By this time, however, Affolter had deeded the land to Christin Nelson (1872), with the deed being recorded in 1878, two years after Affolter's ownership was recorded. Such informal trading contrasts sharply with today's very proper and quickly recorded real estate dealings. Today's land is far too valuable for any possible slip-up on who owns it at what time.

In 1901, the cabin changed hands again; this time the Gehrung brothers purchased it for $3,000. The boys took their three sisters in in 1960, by means of a quit-claim deed which yielded each a 1/5 interest in the property.

Niwot area residents remember some lively parties at the Gehrungs. The Gehrung name is familiar in Boulder: Emma taught until her recent death; Estella was a stenographer and later became assistant editor of the Steamboat Springs newspaper; and Adist became a nature artist of national stature. (She now lives in California.) When the Gehrungs moved to other homes, they rented the cabin, and the last people to live in the house were Mr. and Mrs. Ed Hurtzeler.

The Hurtzelers, who operated a dairy farm on the property, are retired now, but they still live in the neighborhood. Mrs. Hurtzeler recalls that the cabin may have been a bit chilly, but they had heaters of one kind or another in all the rooms. Boulder's notorious winds, however, didn't worry her. "Those walls are sturdy," she declares.

Today the cabin stands alone amid the trees and weeds that grow along Left Hand Creek. It shares its quiet setting, and its historical importance, with "tepee rings" which oldtimers say still exist from the days the Indians camped along Left Hand Creek. "Tepee rings" are circles of stones the Indians placed around the edges of their tents. If you have an exploring bent, you might like to find them.

Indebtedness is acknowledged to Rudolph Johason, 735 16th, retired Boulder lawyer and former state legislator, who supplied much of this information.

Boulder's oldest cabin is located "east half, southeast quarter, and northwest quarter of southeast quarter and northeast quarter of the southwest quarter all in Section 28, Township 2 North, Range 70 W." You can find it just south of Haystack Mountain.

HYGIENE HOGBACK
Natural Area Study

Department of Geography / University of Colorado

HYGIENE HOGBACK

NATURAL AREA STUDY

Robert E. Key, John L. Harper
and Scott Mernitz

Editors

DEPARTMENT OF GEOGRAPHY
UNIVERSITY OF COLORADO

Boulder, Colorado

1970

TABLE OF CONTENTS

Chapter		Page
	FOREWORD Donald D. MacPhail	iv
	ACKNOWLEDGMENTS	vi
I.	INTRODUCTION Robert E. Key, John L. Harper and Scott Mernitz	1
II.	ENVIRONMENTAL SURVEY Gary A. Heaslet, Max H. Dodson and Manik Hwang	4
III.	LAND USE Wil. Ulman, Wm. G. Callahan and Michael R. Tripp	14
IV.	LAND OWNERSHIP AND TENURE Dean G. Wilder and Helen Louise Young	21
V.	LAND ECONOMICS George R. Greenbank and James Biggins	29
VI.	CONCLUSIONS AND RECOMMENDATIONS Robert E. Key, John L. Harper and Scott Mernitz	32
APPENDICES		
A	SOIL INTERPRETATIONS	35
B	TELECOMMUNICATION RESEARCH FACILITIES LEGISLATION - SUMMARY	37

FIGURES

		Page
1.	Hygiene Hogback Natural Area Site	2
2.	Bedrock Geology	3
3.	The Crest of the Hogback, View Northeasterly Along Strike	5
4.	The Hogback and the Willow Zone on Its Northwest Slope	5
5.	The Dip Slope of the Hogback, Davis Reservoir, ESSA Antennas	5
6.	Vegetation	7
7.	A Single Ponderosa Pine and Hackberry on the Hogback Dip Slope	9
8.	Close View of the Trees in Figure 7	9
9.	Waterfowl on Davis Reservoir	9
10.	Soils	11
11.	Land Use in the Vicinity of Hygiene Hogback, 1970	17
12.	Land Ownership, 1870 and 1880	22
13.	Land Ownership, 1902 and 1920	23
14.	Land Ownership, 1940 and 1950	24
15.	Land Ownership, 1960 and 1970	25
16.	Land Tenure, Hygiene Hogback and Vicinity, 1970	26
17.	Increase in Assessment, 1950 to 1970, Hygiene Hogback and Vicinity	30
18.	Estimated Land Values in 1970, Hygiene Hogback and Vicinity	31

FOREWORD

This report is one of six undertaken this year in the Department of Geography at the University of Colorado. It has become almost a tradition for the graduate seminar in land use to initiate a project in the local area in cooperation with an agency of the Boulder community on either the municipal or county level, sometimes both.

These studies achieve a number of objectives. The participating students undertake a realistic project which they are able to plan, execute and publish within the brief span of one semester. Also, these studies provide new information for municipal and county officials and citizen groups concerned with planning and guiding the growth and development of the City of Boulder and Boulder County. In short, these are professional training exercises for graduate geographers and are a serious effort in providing new planning perspectives in the interest of public service.

In response to a suggestion by the Natural Areas Committee of the University of Colorado, the land use seminar elected to study and analyze a number of natural sites in the Boulder Valley. The group was also joined in the endeavor by the graduate field seminar of the Department of Geography.

The cooperative base within the Boulder community was wider than usual this year. The sites chosen for study seemed to have potential for a variety of uses beyond their present development. These included instruction of public school and university students, scientific research, recreation, greenbelt, and open space. The graduate students involved worked in cooperation with the resident property owners, the Parks and Recreation Department and the Planning Office of the City of Boulder, the Department of Development and the Parks and Open Space Advisory Committee of Boulder County, the Boulder and Longmont Offices of the Soil Conservation Service, the Science Director of the Boulder Valley RE-2 School District, the Planning Office and the Natural Areas Committee of the University of Colorado, and the Denver Regional Council of Governments.

Sometimes the graduate researchers felt that they would have liked to pursue certain themes in greater depth if there had been more time available. Nonetheless, they join me in epxressing the hope that this report provides informative insights on a fascinating part of Boulder County.

The various chapters which appear in this study were originally submitted as special reports by the individuals indicated. They represent the endeavors and views of the authors and in no way should be interpreted as the official views of the Department of Geography or any other cooperating agency of organization previously mentioned. Because of this independence from official views, the participants in this project are especially grateful to the Graduate School of the University of Colorado, the City of

Boulder, the Boulder County Commissioners, the Boulder Valley RE-2 School District, and the University of Colorado Foundation for sharing the costs of printing this report.

This is the collective and individual effort of a group of dedicated geographers concerned about the quality of the local environment and its attendant stresses. Boulder County residents, students, and local officials may gain understanding from this report that will assist them in their efforts to perpetuate the Boulder area as a pleasant and attractive place to live.

Donald D. MacPhail, Ph.D.
Professor of Geography

Boulder, Colorado
June, 1970

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CHAPTER I. INTRODUCTION

Robert E. Key, John L. Harper, and Scott Mernitz

The Hygiene Hogback natural area is situated approximately 10 miles north of Boulder and 7 miles west of Longmont in northern Boulder County, Colorado (See Figure 1). The site is in the zone of transition from livestock grazing on grassy pediment surfaces, which extend east from the Rocky Mountain front, to more intensively managed, irrigated farmland on low-lying gently undulating topography to the east.

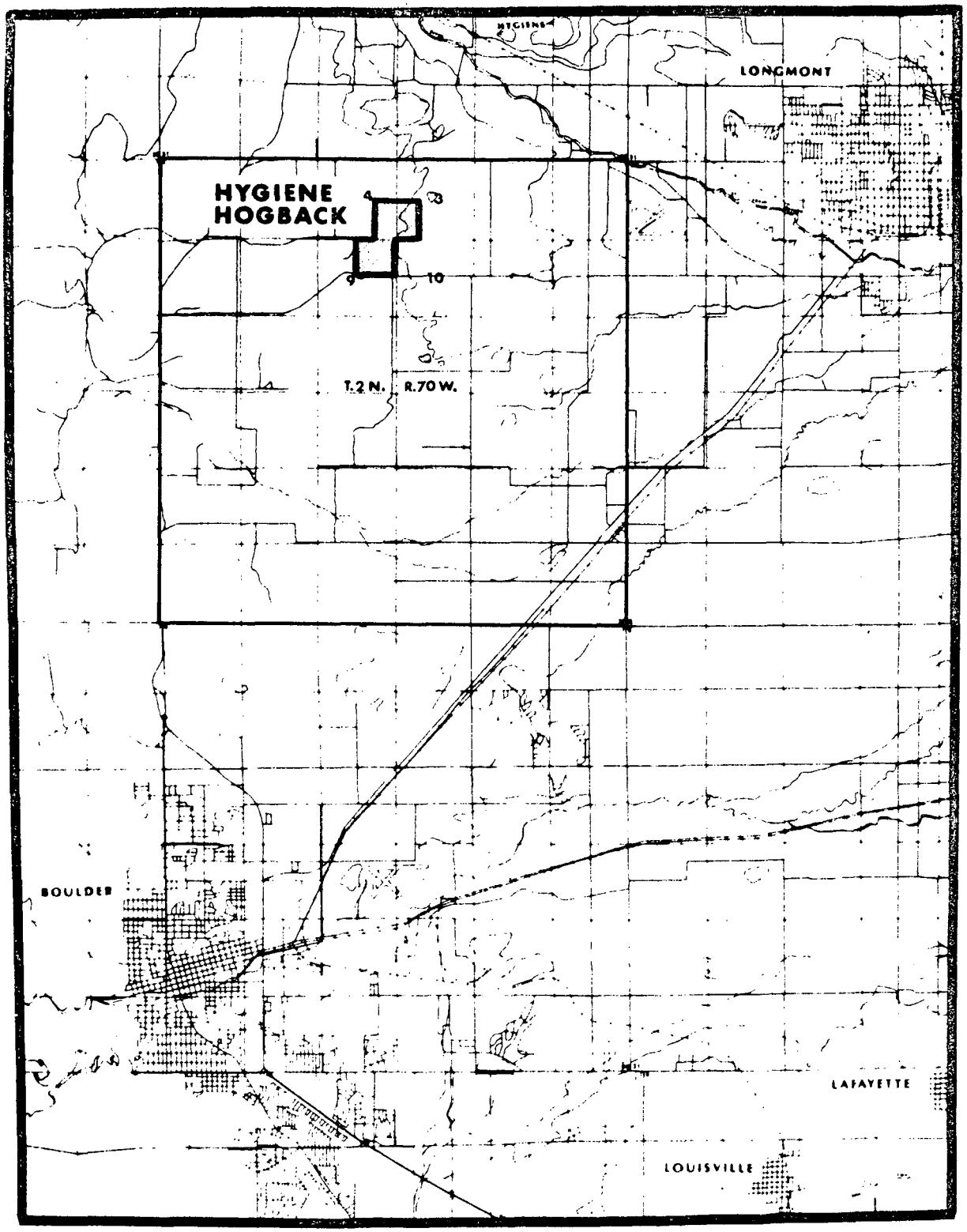
The study area proper encompasses some 200 acres in Section 3, 4, and 9 of Township 2 N R 70 W. Trending diagonally northeast-southwest through the study area is the hogback, a resistant ridge of Cretaceous Hygiene sandstone that rises prominently between expanses of rolling pastureland. Total relief in the study area is about 175 feet with the highest point, at 5,375 feet above sea level, in the southwest corner. The general slope inclination is northeastward at about 250 feet per mile.

The potential natural vegetation at the site is the short-grass prairie community which, in turn, is a function of the mid-latitude steppe (Köppen system Bsk) climate prevailing there. The preponderance of a mean annual precipitation of about 15 inches falls as rain from principally convectional storms in spring and summer months. Heavy late spring and early fall snowstorms contribute significantly to the total, but heavy snow accumulation during the winter is rare.

Basically, the region is quite dry with a relatively large diurnal temperature range, abundant sunshine, and low humidity. Since the prevailing westerly winds lose much atmospheric moisture in the transit over the high Rockies to the west, grassland predominates at the study area in spite of its location just 22 miles east of the Continental Divide.

Access to the area from Boulder is provided from the Foothills Highway (U.S. Highway 36) on surfaced Nelson Road which runs along the southern edge of the study site. An unsurfaced county road parallels the west edge while the northern and eastern boundaries are less well-defined (See Figure 2).

The Hygiene Hogback is one of six areas studied by students of the land use seminar in the Department of Geography at the University of Colorado. The seminar members were grouped into small teams that rotated through five of the six sites so that each member was exposed to every site and to every topic of investigation (the topics were standardized for all sites). Each chapter in this report represents the efforts of a given team to secure and analyze the information appropriate to that particular topic.



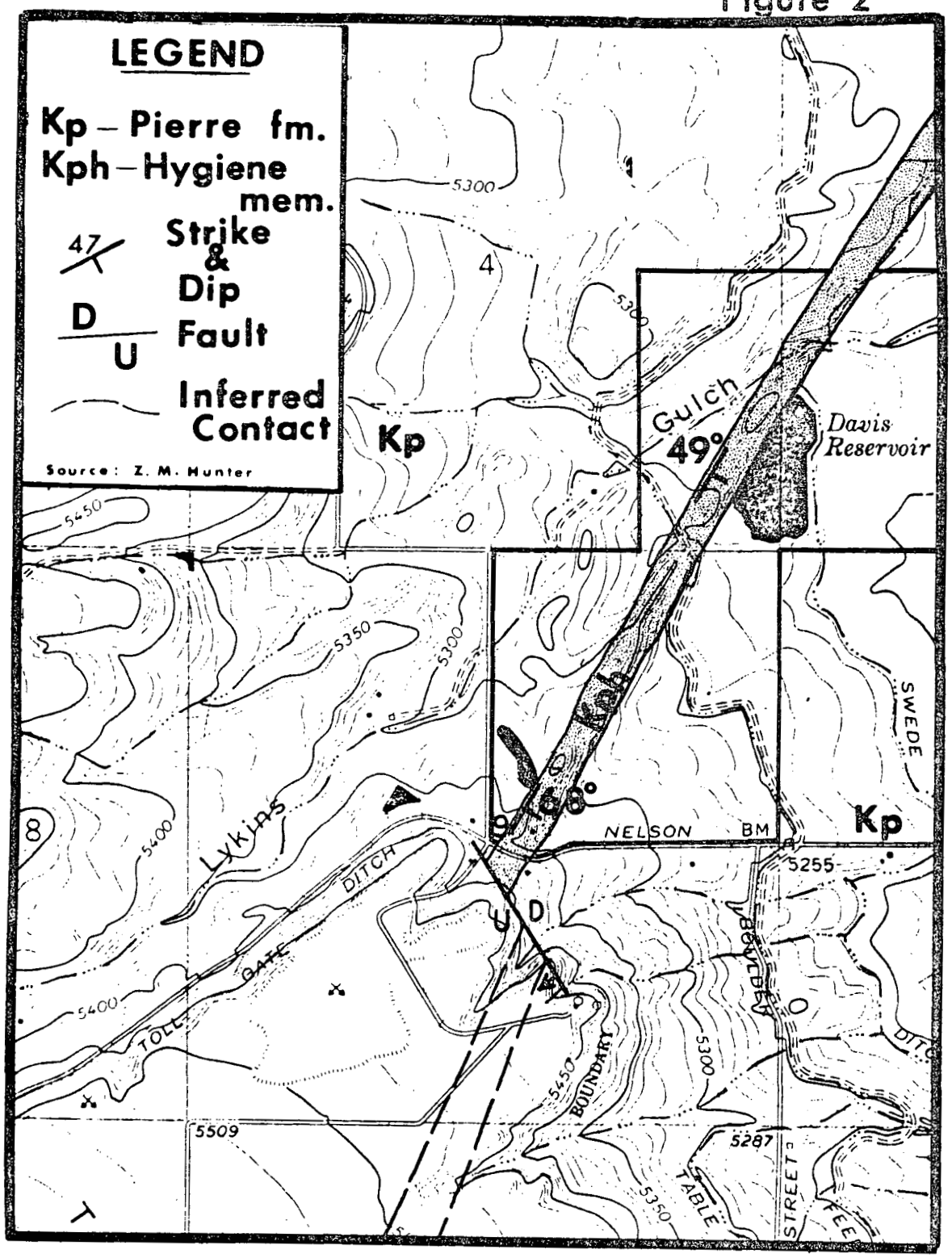
HYGIENE HOGBACK NATURAL AREA SITE

1 0 1
SCALE MILES

Figure 1

Source: Denver Regional Council of Governments

Figure 2



BEDROCK GEOLOGY

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CHAPTER II. THE ENVIRONMENTAL SURVEY

Gary A. Heaslet, Max H. Dodson, and Manik Hwang

The Boulder area contains a number of unusual geological features. Some of these features are related to the folding of sedimentary rocks during the uplift of the Rocky Mountains to the west. As a result of the variable resistance of the different sedimentary strata, weathering and erosion have helped create a series of hogbacks and strike valleys. These landscape features have a north-south orientation and lie along the east front of the Rocky Mountains.

One such feature, of relatively small scale, caused by differential weathering and erosion is the Hygiene Hogback, north of Boulder. This prominent outcrop is formed by the Hygiene sandstone, one of five sandstone units included within the Pierre formation (See Figures 3, 4, and 5). North and south of the hogback area the Hygiene sandstone has an obscured contact with surficial materials and does not occur as a ridge. However, in the study area the yellow-gray to buff-colored sandstone is exposed as a mile-long outcrop, giving a rather distinctive appearance to the topography.

The terrain of the study area is, for the most part, typical of the flat to gently rolling lands on the Colorado Piedmont. Amidst this gentle topography is the Hygiene Hogback, the crest of which stands approximately 160 feet above the surrounding terrain. The hogback first appears just north of Table Mountain, in the vicinity of Nelson Road, and can be traced one mile to the northeast with a strike of about N. 17°E. (magnetic) and a dip from 49° to 68° East.

The hogback separates grazing and pasture areas on either side. Small intermittent drainages parallel the hogback on its west side. A number of wind gaps are found along the ridge, as well as one large water gap. The water gap is now occupied by the Boulder Feeder Canal which supplies Big Thompson River water to Boulder Reservoir to the south. A second water gap has been filled to make a small basin for irrigation storage along the southwest edge of the hogback.

Geologic Description

The Hygiene Hogback is the surface expression of the Hygiene zone, one of five zones of the Pierre formation. The Pierre consists of some 5,000 feet of gently dipping shales and interbedded sandstones which are exposed well out into the plains of eastern Colorado (Hunter, 1947).

Overlying the Niobrara formation, black fissile shales form the lowest Sharon Springs zone of the Pierre. Next in ascending order, the Rusty zone is a sequence of dark shales which contains large, rusty, lentil-

Figure 3 - The crest of the Hogback, view northeasterly along strike.

Figure 4 - The Hogback and the willow zone on its northwest slope.

Figure 5 - The dip slope of the Hogback; Davis Reservoir, left foreground; ESSA antennas on Table Mountain, background.

shaped concretions. Above the Rusty zone, the hard shale in the narrow Baculites zone bears abundant Baculites remains. The Hygiene zone above is composed of buff to yellow sandstones and sandy shales. This zone contains characteristic concretions and the greatest faunal assemblage in the Pierre formation. The fauna are predominantly pelecypods, cephalopods, and gastropods. Above the Hygiene zone, the Transition zone is a thick succession of alternating shales and shaly sandstones. The zone grades vertically upward through an indefinite contact into the overlying Fox Hills formation.

Fenneman, in discussing the stratigraphy of the Pierre formation in the Boulder area (Fenneman, 1905), notes the ridge-forming sandstone which could be traced for many miles (Dunn, 1955). He named it the Hygiene sandstone, after a town to the north of Boulder and 3 miles northeast of the study area. The sandstone can be followed in the subsurface as far north as Fort Collins and as far south as Coal Creek Canyon.

The sandstone that Fenneman named and described is actually the lowest member of a group of sandstones found in the Hygiene zone. The other members are the Richard, Larimer, Rocky Ridge, and Terry, in descending order.

The sandstones are, by most definitions, fine to medium-grained graywacke sandstones. According to Dunn (Dunn, 1955), Krumbein and Sloss in 1951 define a graywacke as having the following composition: "Quartz, 30 to 40 per cent; feldspar, 10 to 50 per cent; rock fragments and detrital chert, 5 to 10 per cent; chlorite; sericite matrix, greater than 20 per cent. Minor amounts of carbonate and pyrite."

The Pierre sandstones, because of the abundance of matrix material and relatively immature condition, are thought to be the result of mass transport. The agent of transport is believed to be shelf-type turbidity currents. The sediments were deposited in a shallow, unstable shelf environment and were derived from sources to the west of the depositional site during late Cretaceous times.

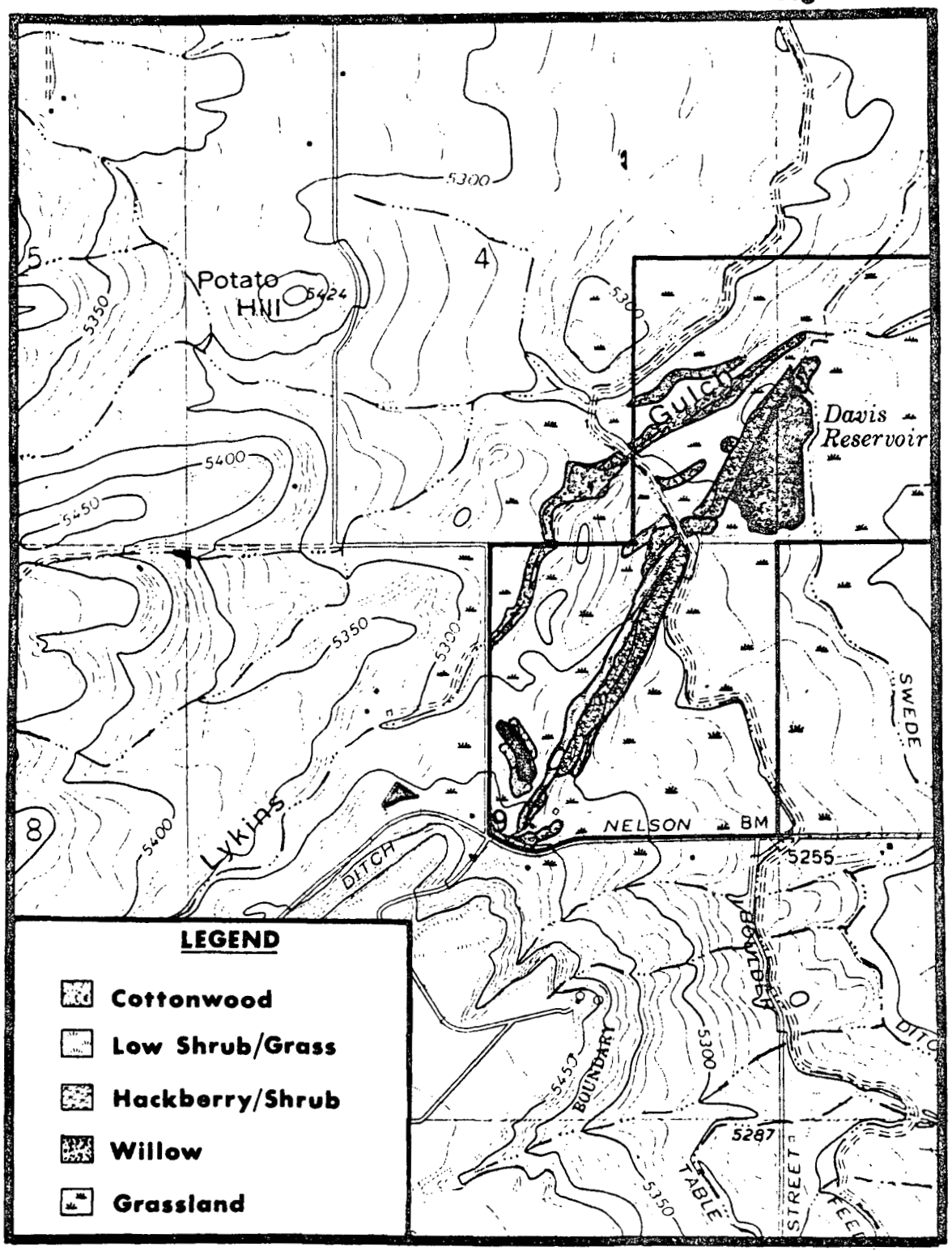
Fossils

The Hygiene sandstone member is approximately 600 to 800 feet thick in its location near Hygiene. The hogback itself consists of a lower soft sandstone separated from an upper hard, glauconitic, ridge-forming sandstone by shale that contains ironstone concretions. "Baculites perplexus is found sparingly in the basal beds of the Hygiene" (Dunn, 1955). Baculites gregoryensis is rare in the lower 140 to 250 feet of the Hygiene, and the lowest range of this Baculites zone is about the base of the Hygiene. This zone of B. gregoryensis also contains a species of Didymoceras. This is the earliest appearance of that spirally-coiled ammonite in the Western Interior. In the southern part of the Hygiene Hogback area Baculites scotti is common in the upper part of the Hygiene sandstone and in the overlying 100 to 200 feet of sandy shale.

Vegetation

The Hygiene Hogback and its immediate surroundings lie in what Weber refers to as a "Plains" plant community (Weber, 1967). Such a community

Figure 6



VEGETATION

0 — 1

Scale Miles

is developed on level or rolling grassland with fringes of trees existing along the watercourses, below 5,800 feet elevation.

Along the drainages, patches of willows and cottonwood are encountered. The natural vegetation appears to be modified by over-grazing, as is indicated by plots of open ground and the presence of cactus in the grassy pastures east and west of the hogback. Shrub vegetation has been heavily browsed by cattle, resulting in hedged and stunted plants. Skunkbrush, hackberry, yucca, and prickly-pear cactus are seen scattered along the rocky surface of the hogback. A variation in species abundance is notable on the eastern and western sides. Three small Ponderosa pine dot the ridge at short intervals. In addition, brightly-colored lichens spot the sandstone rocks along both sides of the ridge.

Grassland vegetation aptly describes the dominant floral character of the hogback area. It should be borne in mind, however, that the distribution of the predominating short grasses and other associated species rarely is found as distinct, well-demarcated stands. Patterns can be mapped, as on Figure 6, but the boundaries should be considered to be gradational between vegetative types.

The grassland category mapped consists of grazed, improved pastures and represents a mixture of herbage--small isolated patches of blue grama grass (Bouteloua gracilis (H.B.K.) Lag.), low mats of buffalo grass (Buchloe dactyloides (Nutt.) Engelm.), certain unpalatable grasses, and forbs, Prickly-pear cactus (Opuntia rafinesquei Engelm.) and yucca (Yucca glauca Nutt.) intermingle with the grasses on the west side of the hogback where over-grazing has been extreme.

Over most of the grassland area the ground cover ranges from 50 to 75 per cent, but only slight erosion has taken place. At no place is there a vegetative stand that suggests stable, climax conditions. Most of the vegetation is closely hedged, and it is assumed that grazing has been the most significant land use for a long period of time (See Chapter III).

In the ravines and along the few watercourses, plains cottonwood (Populus sargentii Dode) and willows (Salix spp.) are common. Many cottonwood trees exceed 4 feet in diameter. There are sites where willows dominate the tree layer, but for simplicity of mapping they are included in the cottonwood category.

A hackberry (Celtis reticulata Torr.) zone is found on the eastern dip slope of the hogback (See Figure 7 and Figure 8). The hackberries are very sporadic in occurrence and are quite scrubby, ranging in height from near ground level to approximately 8 feet. The east side of the hogback, in places barren sandstone outcrop, supports little vegetation of any consequence other than hackberry. Some skunkbrush (Rhus trilobata Nutt.) and a few mountain mahogany specimens (Cercocarpus montanus Raf.) are present. Prickly-pear cactus and several colorful lichens are found. Grass is restricted to small pockets where soil has been formed on the bare rock.

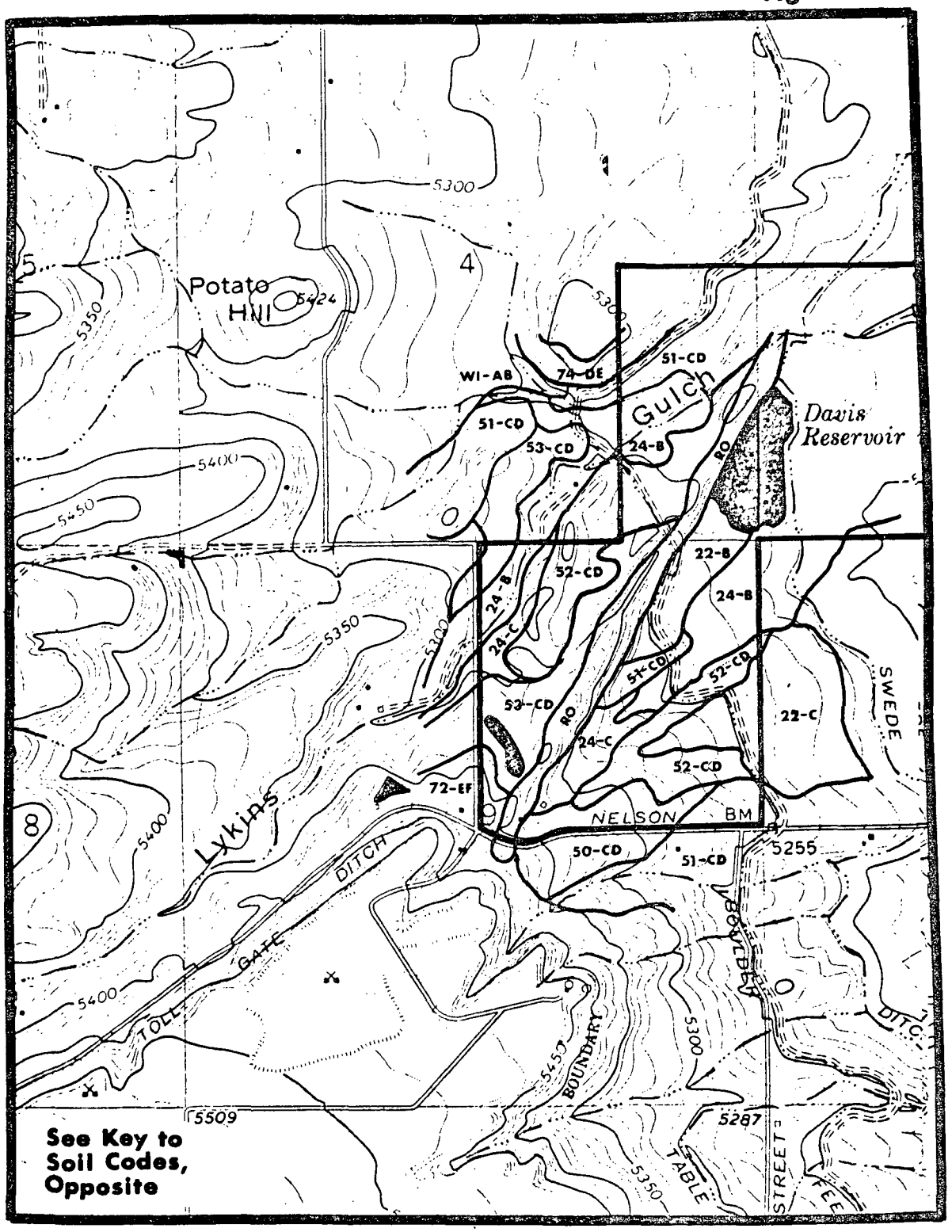
The low shrub/grass area is located on the west side of the hogback and is transitional between the hackberry zone on the east slope of the hog-

Figure 7 - A single Ponderosa pine and Hackberry on the Hogback dip slope.

Figure 8 - Close view of the trees in figure 7.

Figure 9 - Waterfowl on Davis Reservoir.

Figure 10



SOILS

0 — 1

Scale Miles

back and grassland to the west. Skunkbrush, prickly-pear cactus, and yucca constitute the common shrub flora; buffalo and grama grass patches are scattered along the slope. Ground cover is approximately 60 per cent, and over-grazing is quite apparent.

The willow category, shown on Figure 6 only along the northwest flank of the hogback in one location, indicates a marshy area where a stand of willows reaches 10 feet in height (See Figure 4). Willows are also found in concentrated cottonwood stands along some of the ravines west of the hogback.

At its low water mark, Davis Reservoir is skirted on its southwestern end by a small stand of cocklebur (Xanthium strumarium L.), a feature too restricted in scale to include on the vegetation map.

Fauna

Wildlife is found in this area, including white-tailed jackrabbits and coyote. Squirrel nests can be seen in trees along one of the marshy stream beds, and a number of rodent burrows can be seen among the cracks and crevices of the hogback. Immediately northeast of the ridge on Davis Reservoir about 150 mallard ducks and nearly 50 greater Canadian geese were seen feeding (See Figure 9). Other faunal indications included a number of different species of birds and numerous ant hills.

Soils

The dominant zonal soil within the study area is the brown soil, characterized by a light to medium-dark A horizon with a relatively low organic-matter content above an alkaline, carbonate-rich C horizon. Generally, a limited supply of moisture is the chief controlling factor in the genesis and resulting morphology of the soils (See Figure 10). Low temperature in winter and periods of summer drought combine to limit the soil-forming processes for a substantial portion of the year. The soils are generally productive, however, when modern irrigation methods are employed.

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CHAPTER III. LAND USE

Wil. Ulman, Wm. G. Callahan and Manik Hwang

An Historical Setting

When the first settlers arrived in the valleys of Left Hand and St. Vrain creeks (ca. 1850), the locale was a distant portion of the Nebraska Territory. The Federal Surveyor did not reach the area until August of 1863. Consequently, these first settlers were squatters with no legal means of securing their claims.

Because these valleys were conveniently located in relation to the mining communities in the mountains, it has been reasoned that many of the original settlers in the vicinity of the Hygiene Hogback were unsuccessful miners who found it easy and natural to follow the creeks down from the mountains in search of tillable land (Large, 1932). Their first occupation was harvesting wild hay, which was hauled to the various mining camps for sale or trade. Because these farmers originally had to depend on outside sources for most of their food and supplies, they probably engaged in mining or freighting to supplement their incomes. A few years would elapse before the development of sufficient local markets and before the preparation of the land for more intensive cultivation would allow these settlers to maintain permanent residence on the land.

Usually the bottom lands were taken first, but the bottoms became narrower and the slopes became steeper to the west. The need for irrigation was soon realized:

> "We, in '60, '61, and '62, considered these little valleys--Boulder, St. Vrain, Thompson, and Cache la Poudre--of more real value for farming purposes than all the high, dry land between these streams;...We expected, or many people did, that these between lands would be useful as a stock and game range, but we did not anticipate a time when there would be people enough in this country and with capital enough to construct irrigation ditches...to irrigate high land though we soon learned the soil was alright if it had water" (Coffin, 1914).

The number of ditches multiplied rapidly. Nearly all were small; most were partnerships in which a few neighbors cooperated. The first ditch constructed in the vicinity of the Hygiene Hogback was named the Toll Gate Ditch (May, 1870). One year later the Swede Ditch was completed. Both names still appear on current U.S.G.S. topographic quadrangle maps of the area. Irrigation encouraged the taking of what the surveyors would later classify as "rolling, second rate land" farther away from the streams.

Here, short buffalo grass, which was deemed excellent for grazing, flourished, and herds of antelope were frequently reported (Coffin, 1914). Irrigation farming gained an early foothold in the area.

Speculation was also evident. Prior to 1870, no land had been legally secured in the four sections under study. An 1871 cadastral map shows property holdings by six individuals. By 1880, however, five of these six holdings had changed hands, showing the effects of the heavy colonization which had occurred between 1870 and 1880.

This colonization was due to the advent of the Chicago-Colorado Company whose representatives, in January of 1871, visited northern Colorado in search of good, irrigable farming land on which to establish a colony. On the second of February, land was purchased for this purpose at what is now Longmont, Colorado. This date marks the transition from an era of agricultural prominence in the region. As the population grew and the land was settled, an expanding local market was provided for the farmers in the area. A short list of average farm yields at the time will show the capability of the land to support this expansion:

Wheat	26 to 28 bushels per acre
Oats	40 to 80 bushels per acre
Barley	30 to 60 bushels per acre
Potatoes	100 to 300 bushels per acre
Cabbage	10 to 20 tons per acre.

The fertile soils and "unequaled pasture lands" of the area would assure continued growth (Chicago-Colorado Colony Constitution, 1871). By the turn of the century a strong agricultural foundation had already been laid.

Although change occurred frequently during the various stages of development in the area, an absence of change was typical afterwards. A review of aerial photographic coverage of the area beginning in 1955 and continuing through 1969 reveals a remarkable degree of continuity.[1] The only significant alteration of land use patterns was due to the residential development along North 75th Street.[2] With this exception, variation between the two vintages of the photos was minimal. Areas used for cropland in 1950 were under the same usage in 1969. The same can be said for irrigated pasture land, and those areas which were unused due to stoniness, slope, or poor drainage. In general, therefore, it can be said that within the immediate vicinity of the hogback changes in land use were rare and insignificant after an initial era of development had passed.

---

[1]Three sets of serial photographs were examined, the dates of which were September, 1955; August, 1963; and August, 1969. All three sets are available at the Longmont Soil Conservation Service (SCS) and/or the Longmont Agriculture Stabilization Conservation Service (ASCS), Longmont, Colorado.

[2]This residential development presents a deep contrast to the more static character of land use patterns further to the west. In the period between 1955 and 1963 twenty-one dwellings were constructed along North 75th Street. By 1969 the number had increased to 35.

Current Land Use

Although the bulk of Hygiene Hogback lies within the northeast quarter of Section 9, T 2 N R 70 W, land use activities in the immediate vicinity may be employed as a barometer for changes within the foreseeable future. Current land use combined with recent trends provide a mechanism for extrapolating future changes on this rural landscape. For the current land use investigation, Section 3 and parts of Sections 2, 4, 9, 10, and 11 have been reviewed (See Figure 11).

This area of Boulder County lies in an agricultural transition zone. The rolling land extending westward to the foothills is devoted almost totally to grazing. Cropping predominates on the flattened piedmont to the east. Agriculturally, stock grazing appears to dominate land use in the study area itself. Dry-land farming consists of wheat and/or barley cultivation, while irrigated cropland produces hay and a few acres of corn. Off-season grazing of stock on cropped lands was evidenced in some of the area by the actual presence of stock, and elsewhere by scattered fecal droppings. Livestock are predominantly cattle, but also include horses and hogs.

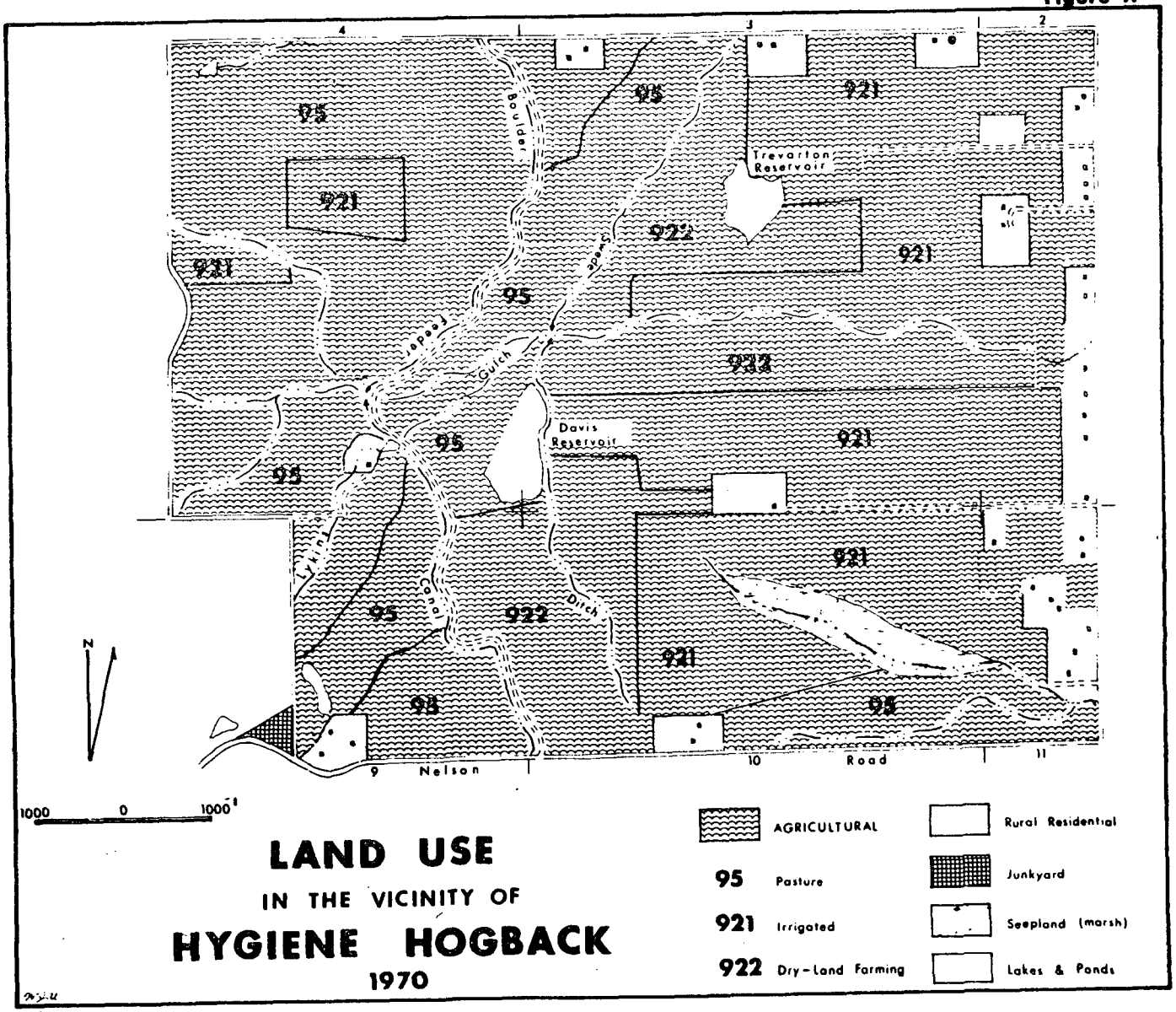
Crossing the study area from north to south is the Boulder Feeder Canal, which supplies water to the Boulder Reservoir. Paralleling this canal is the Swede Ditch, a secondary irrigation ditch which feeds numerous small lateral ditches lacing the study area. Two small reservoirs and four small farm ponds are also included within the area. The reservoirs provide water storage and, in addition, serve as a natural habitat for wild ducks and geese and as a water source for other small game. Farm ponds serve mainly for stock watering and, in at least one case, for irrigation. Some of the irrigation ditches in areas marked (See Figure 11) as predominantly pasture appear to be in a state of neglect, and are possibly no longer in use.

The study area is primarily a typical pastoral landscape. However, signs of man's influence are readily visible. A series of telecommunication antennas, both tower and saucer shaped, occupy the eastern end of Table Mountain, a flat pediment surface rising approximately 100 feet above the general elevation of the study area. This equipment is operated by the Environmental Science Service Administration (ESSA) of Boulder. In this same general vicinity an automobile junkyard fronts on Nelson Road. Many old cement block silos no longer in use still dot the landscape. Their presence usually marks the site of old farmsteads.

Evidence of development pressure is most visible along the eastern edge of the study area, defined by a 1.5 mile section of paved road extending north from Nelson Road. Although some of the houses along this portion of the road are older farm dwellings, the majority are of recent construction with all the earmarks of rural non-agricultural living. Included in the residential development along this road are moderate homes as well as expensive, custom-built homes having attractive stables.

Diffusion of similar residential development is a possibility throughout this area. The aesthetic quality of Hygiene Hogback, with its profusion of rock outcrops and very desirable views of both mountains and

Figure 11


Trevarton Reservoir
Davis Reservoir
Boulder Creek
Gulch
Canal
Ditch
Nelson Road
95
921
922
N
1000 0 1000'
LAND USE
IN THE VICINITY OF
HYGIENE HOGBACK
1970
AGRICULTURAL
95 Pasture
921 Irrigated
922 Dry-Land Farming
Rural Residential
Junkyard
Seepland (marsh)
Lakes & Ponds

plains, gives this immediate area a quality high in demand among land developers. The quarter-section on which much of the hogback is located is presently for sale. Van Schaack and Company in Denver carries the listing, and is asking $1,000 per acre. Interest in the purchase of this quarter-section was expressed to the investigation team by a Mr. Jack Pate of Boulder. While Mr. Pate's main interest in this acreage is to build a home for himself, he also concluded that if he purchased this land he would subdivide it into 10- to 15-acre plots for custom residential development. Although reluctant to elaborate on his particular interest in this area, Mr. Pate does recognize the ideal nature of the area for homesite development, especially near Davis Reservoir. Any potential developer should be aware, however, of the provisions of the Telecommunications Research Facilities Protection Act of 1969 (see Appendix B).

Future Land Use

Since the early development of the area around Hygiene Hogback, few changes have occurred. Crop yields have remained nearly the same (MacPhail, 1965), and those areas originally used for pasture have generally remained under that usage. Transitions from cropland to irrigated pasture have occurred, and some pasture areas have been severely overgrazed. In general, land use in the area has been static.

At first glance, there may be reason to believe that this trend will continue. The Beech Aircraft Corporation and IBM are the only industrial facilities near the Hogback employing a substantial number of people. A land use study of the area around the IBM plant was prepared in 1965 by The Boulder County Department of Development. Future land use in the area is projected to 1990. Even by this distant date little change is expected around the Hogback due to IBM influence. The area under study seems to be located just far enough north of Boulder, west of Longmont, and northwest of the Boulder-Longmont Diagonal to be immune from urban-industrial encroachment in the immediate future.

A second glance, however, reveals some contradictions. Many potential building sites in the study area would be "view lots" (estate-residential). Unlike the lands along the floodplains, few problems exist for residential development because elevations are higher in the vicinity of the Hogback, the water table is lower and the danger from floods is minimal. Furthermore, the area does not coincide with prime agricultural land. A transition to residential use is, therefore, more easily negotiated. Water is available (the Davis and Trevarton Reservoirs are located immediately to the west of the Hogback), and access via Nelson Road from either the Boulder-Longmont Diagonal or the Foothills Highway offers sufficient convenience to support residential development. Evidence of this type of development is already seen along the north-south arteries west of the Hogback. In 1955, most of the dwellings located here did not exist.

The idea of living rural and working urban is aesthetically pleasing and a common philosophy in this age of the commuter. As families continue to sacrifice proximity to their place of work for the sake of large, semi-rural sites on which to raise horses, perform limited farming or simply escape the urban syndrome, it can be expected that the Hogback environs will

offer prime settings. The usual side-effects can also be expected once this process is substantiated; the formation of neighborhoods eventually implies shopping outlets, service stations and highway extensions.

In terms of land use, the past is generally a key to the future. Past trends, once identified, can usually be used in interpreting the direction future land use will take. The Hygiene Hogback area, however, may be viewed as an exception to this rule. Although change has not occurred to any great degree since the turn of the century, it should not be assumed that this trend will continue. This study area cannot be expected to urbanize as rapidly as points directly between Boulder and Longmont, but it will not remain untouched. People in search of aesthetically pleasing homesites will certainly be drawn to this locale.

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CHAPTER IV. LAND OWNERSHIP AND TENURE

Dean G. Wilder and Helen Louise Young

Introduction

The area selected for the study of land ownership and tenure in the vicinity of Hygiene Hogback includes the following: W½, W½, Section 2; all Section 3; all Section 4; N½, Section 9; N½, Section 10; W½, NW¼, Section 11; T 2 N, R 70 W. Because of the small number of holdings in 1870, all of Sections 2, 3, 4, 9, 10, and 11 were mapped to better indicate significant ownership changes between 1870 and 1880.

The sources used for data on land ownership in 1870 and 1880 were a Master's thesis by Marjorie Large (Large, 1932) and a wall map from the Western Historical Collection in Norlin Library at the University of Colorado. Land ownership from 1902 until the present time was determined from entries in the Boulder County Land Books. Land tenure for the study area was determined from interviews with residents of the area.

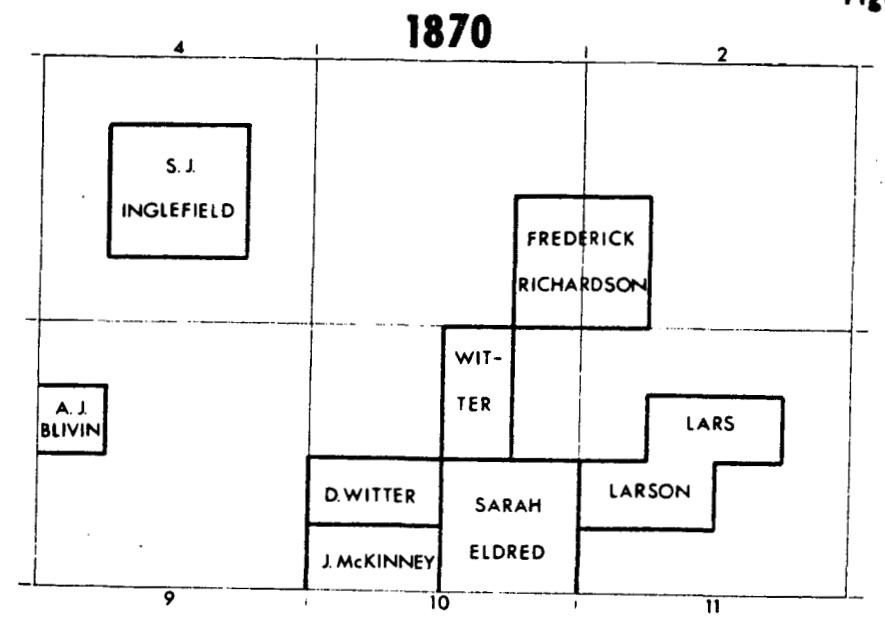
Land ownership as determined from the above sources was gathered. From this data a series of cadastral maps was compiled (see Figures 12 through 15). The years portrayed on the maps were selected because they best depict significant changes in ownership patterns. Current land tenure is also presented and tenure patterns plotted (see Figure 16).

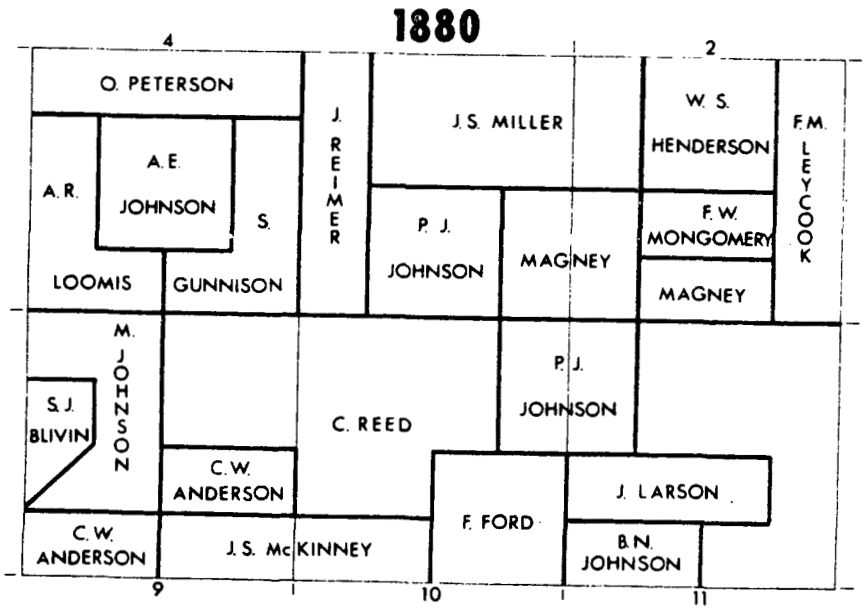
Land Ownership Patterns: An Historical Perspective

The pattern of land ownership in 1870 was one of few owners with large areas of unclaimed land. By 1880, the pattern had changed drastically, with very little of the land left unclaimed (see Figure 12). Five of the original six holdings had changed hands by that time. The major influence for this change was the settlement by members of the Chicago-Colorado Colony. The growth of nearby Longmont in 1871 is indicative of the settlement of the surrounding lands. In April, 1871, nearly 200 colonists had arrived in Longmont, and by November, 1871, there were 500 people in the town (Willard, 1926). By 1902, the land had changed owners several times, and the size and shape of the holdings had been re-defined (see Figure 13).

From 1902 until 1940, the pattern of land ownership was one in which individual holdings remained unchanged in size and shape despite a turnover of owners (see Figures 13 and 14). A significant change of owners was noted between 1920 and 1930, with nearly all of the holdings changing hands. This large change in ownership may be attributed to the economic depression which affected all of the United States in the late 1920s and early 1930s.

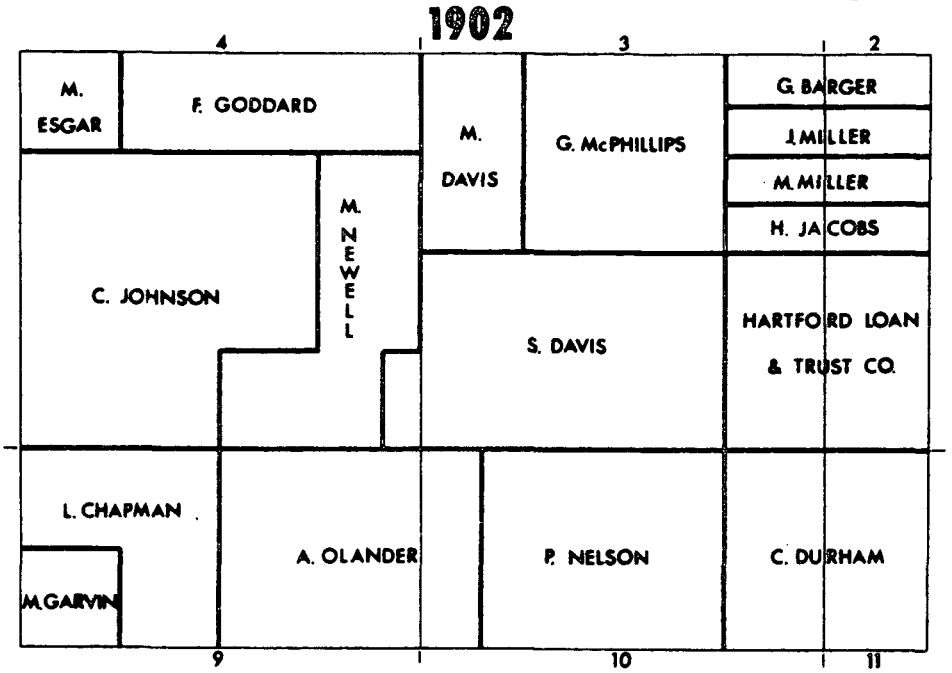
Figure 12

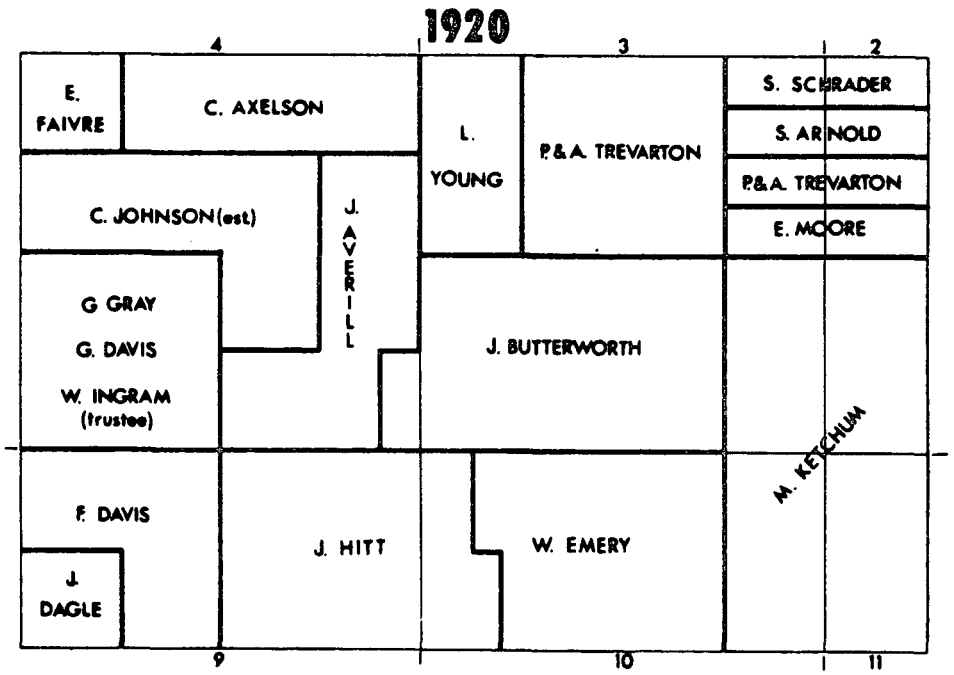

1870
4
2
S. J.
INGLEFIELD
FREDERICK
RICHARDSON
WIT-
TER
A. J.
BLIVIN
LARS
D. WITTER
SARAH
ELDRED
LARSON
J. McKINNEY
9
10
11


1880
4
2
O. PETERSON
J. REIMER
J. S. MILLER
W. S.
HENDERSON
F. M.
LEYCOOK
A. R.
A. E.
JOHNSON
S.
P. J.
JOHNSON
MAGNEY
F. W.
MONGOMERY
MAGNEY
LOOMIS
GUNNISON
M. JOHNSON
S. J.
BLIVIN
C. REED
P. J.
JOHNSON
C. W.
ANDERSON
J. LARSON
F. FORD
C. W.
ANDERSON
J. S. McKINNEY
B. N.
JOHNSON
9
10
11

DW

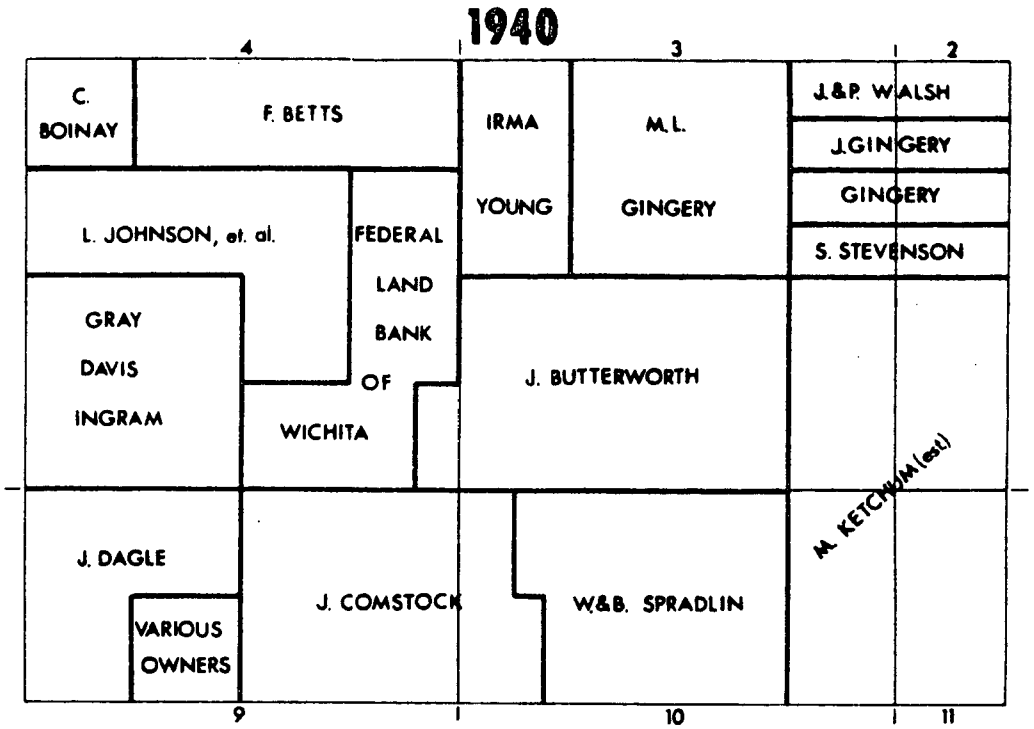
Figure 13

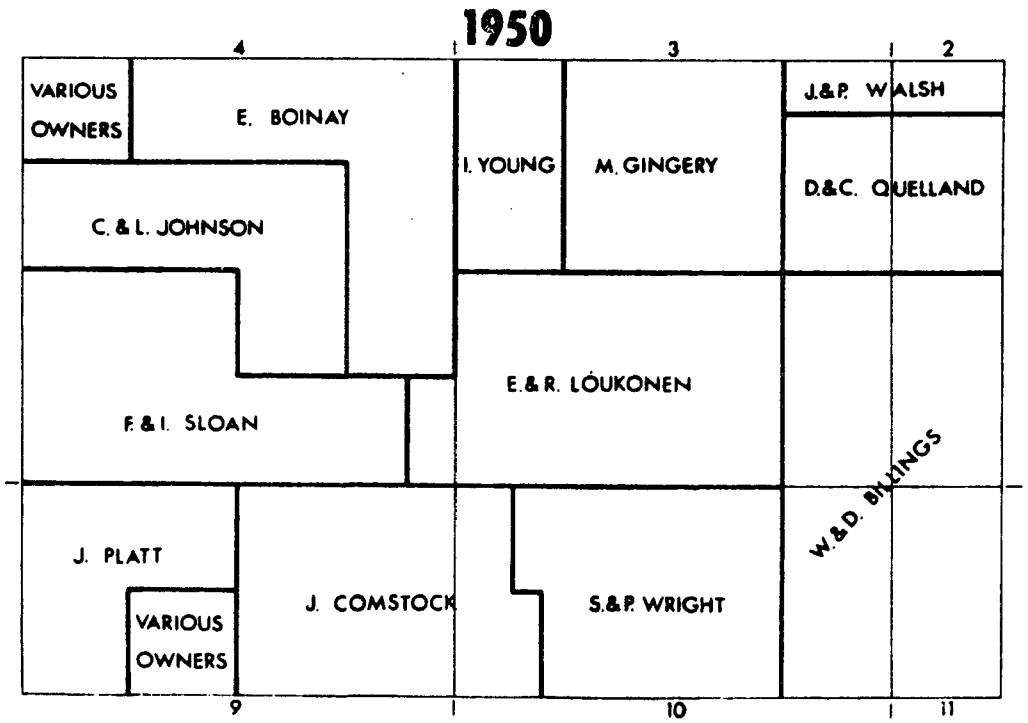

1902
4
3
2
M. ESGAR
F. GODDARD
M. DAVIS
G. McPHILLIPS
G. BARGER
J. MILLER
M. MILLER
H. JACOBS
C. JOHNSON
M. NEWELL
S. DAVIS
HARTFORD LOAN & TRUST CO.
L. CHAPMAN
M. GARVIN
A. OLANDER
P. NELSON
C. DURHAM
9
10
11


1920
4
3
2
E. FAIVRE
C. AXELSON
L. YOUNG
P.& A. TREVARTON
S. SCHRADER
S. ARNOLD
P.& A. TREVARTON
E. MOORE
C. JOHNSON (est.)
J. AVERILL
G. GRAY
G. DAVIS
W. INGRAM (trustee)
J. BUTTERWORTH
M. KETCHUM
F. DAVIS
J. DAGLE
J. HITT
W. EMERY
9
10
11

D.W.

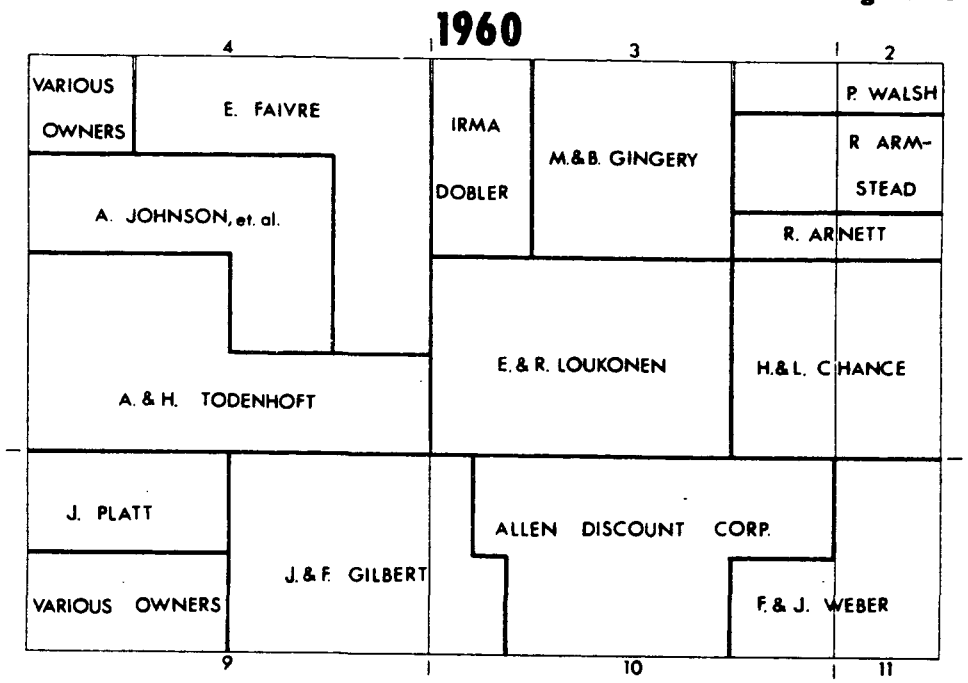
Figure 14

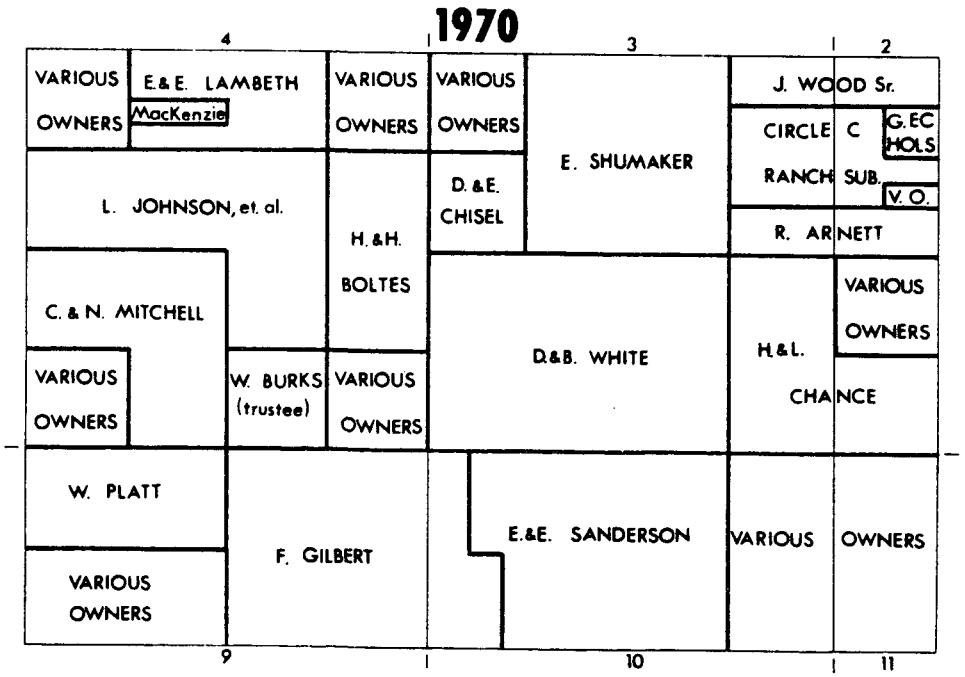

1940
4
3
2
C. BOINAY
F. BETTS
IRMA YOUNG
M.L. GINGERY
J.&P. WALSH
J.GINGERY
GINGERY
S. STEVENSON
L. JOHNSON, et. al.
FEDERAL LAND BANK OF WICHITA
GRAY DAVIS INGRAM
J. BUTTERWORTH
M. KETCHUM (est)
J. DAGLE
VARIOUS OWNERS
J. COMSTOCK
W&B. SPRADLIN
9
10
11


1950
4
3
2
VARIOUS OWNERS
E. BOINAY
I. YOUNG
M. GINGERY
J.&P. WALSH
D.&C. QUELLAND
C. & L. JOHNSON
E.& R. LOUKONEN
F. & I. SLOAN
W.& D. BILLINGS
J. PLATT
VARIOUS OWNERS
J. COMSTOCK
S.&P. WRIGHT
9
10
11

D.W.

Figure 15

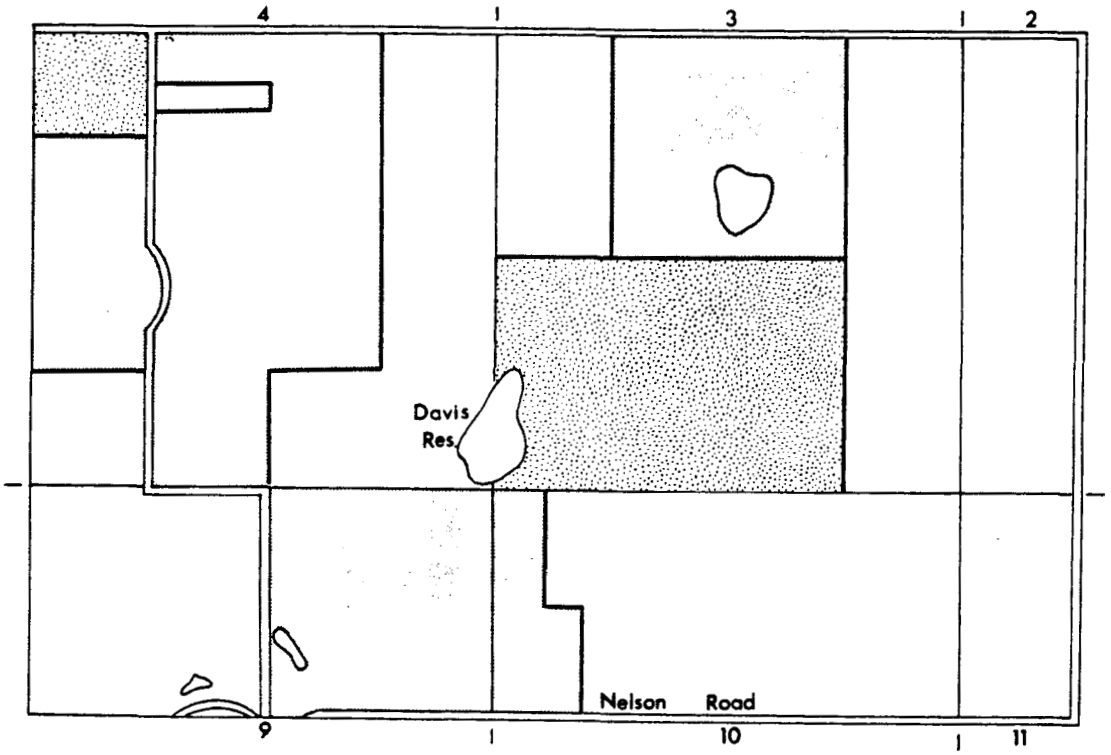

1960
4
3
2
VARIOUS OWNERS
E. FAIVRE
IRMA DOBLER
M.&B. GINGERY
P. WALSH
R ARM-STEAD
A. JOHNSON, et. al.
R. ARNETT
A. & H. TODENHOFT
E. & R. LOUKONEN
H.& L. CHANCE
J. PLATT
ALLEN DISCOUNT CORP.
J. & F. GILBERT
VARIOUS OWNERS
F. & J. WEBER
9
10
11


1970
4
3
2
VARIOUS OWNERS
E.& E. LAMBETH
MacKenzie
VARIOUS OWNERS
VARIOUS OWNERS
E. SHUMAKER
J. WOOD Sr.
CIRCLE RANCH SUB.
C
G.EC HOLS
V. O.
L. JOHNSON, et. al.
D. & E. CHISEL
R. ARNETT
H. & H. BOLTES
C. & N. MITCHELL
D.&B. WHITE
H.& L. CHANCE
VARIOUS OWNERS
VARIOUS OWNERS
W. BURKS (trustee)
VARIOUS OWNERS
W. PLATT
F. GILBERT
E.&E. SANDERSON
VARIOUS OWNERS
VARIOUS OWNERS
9
10
11

D.W.

Figure 16

LAND TENURE HYGIENE HOGBACK AND VICINITY



Tenure Arrangement

Full Owner

Cash Tenant

Crop-Share Tenant

N

0 1/2 1

miles

April, 1970

Location: Town 2 north; Range 70 west

D.W.

Between 1940 and the present, the pattern of land ownership has shown significant change. The trend has been toward a greater division of land among many more owners. From 1940 to 1950, there were only minor changes (Figure 14). By 1960, the trend towards further division of the land among several owners had established itself, and at the present time the pattern has become well-established (see Figure 15). Although land has changed hands and boundaries have shifted, proprietorships have remained fairly stable.

Land Tenure

Land tenure in the vicinity of Hygiene Hogback falls into three distinct groups: owner-operators, cash tenants and crop-share tenants. The majority of cash renters lease the land to graze cattle or horses, although one cash renter does farm the land. Crop-share tenants in the NW¼ , NW¼, Section 4 and the SW¼ and W½, SE¼, Section 3 farm the land and pay a share of the crop as rent. Along the eastern edge of the study area several non-farm rural residences are to be found. Significant tenure patterns for this area are indicated (see Figure 16). From this map, it can be seen that owner-operators and cash tenants are almost equally divided in total area, with sharecroppers being less important.

Summary

Land ownership in the vicinity of Hygiene Hogback has been characterized by three periods. In the late 1800s the land was rapidly divided among various owners into distinct holdings. By 1900, these holdings had changed shape as well as owners, and a new pattern had been established which remained essentially the same until 1940. From 1940 to the present time, the pattern of land ownership has changed with individual holdings changing in both size and shape. The present trend appears to be one of many more owners with smaller land holdings, but with a relatively high percentage of absentee ownership. Thus, the beginning stage of transition from rural to suburban occupance has begun.

References

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Willard, James F. and Colin B. Goodykoontz (eds.). 1926. Experiments in Colorado Colonization 1869-1871. University of Colorado, Boulder Colorado:280-281, 328.

Maps

Wall Map, "Compiled in part from official data and in part from actual surveys made for the purpose, by Samuel Freeze, in October, November, December, and January, A.D. 1880-1881." Western History Collection, Norlin Library, University of Colorado, Boulder, Colorado.

CHAPTER V. LAND ECONOMICS

George R. Greenbank and James Biggins

The following figures were compiled to aid in comparing assessments. made in 1950 and 1970, and to enable cross-reference with cadastral information. These maps were prepared from assessment data obtained from the office of the Boulder County Assessor. Increase in assessment was calculated by determining the assessed values per acre in 1950 and 1970.

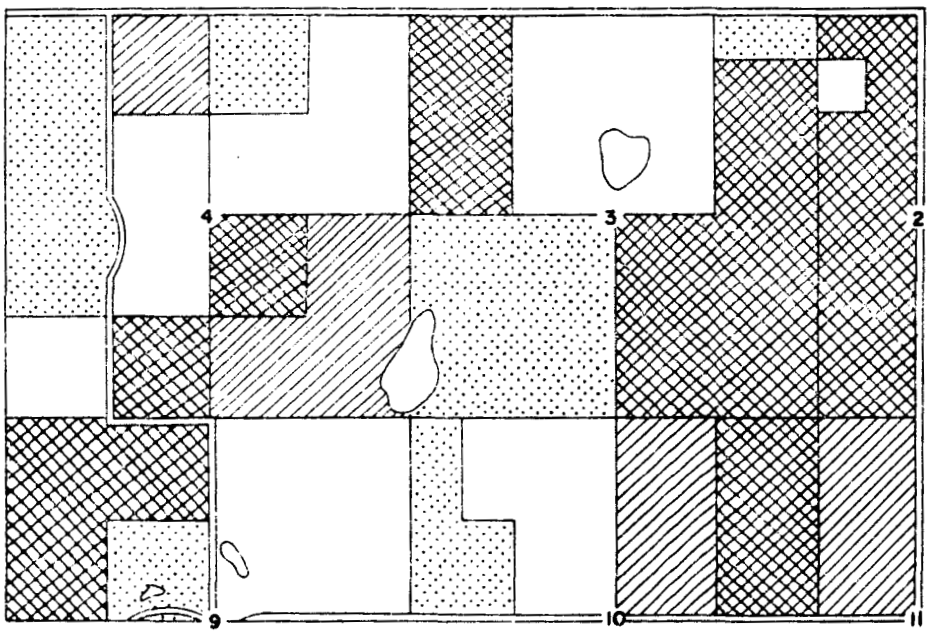
The purpose of the maps is to show distributions in time and space. Assessment has increased over the whole vicinity except for 160 acres in the center of the north one-half of Section 3. This acreage represents only about seven per cent of the area shown on the maps. It should be noted that current assessment, assumed at 30 per cent of market value, is five per cent greater than the average 25 per cent in 1950. Some of the areas mapped as having an assessment increase of less than 25 per cent probably reflect this change in policy, as well as an increase in land value. This may be at least partly true in the Hygiene Hogback area (the northeast quarter of Secion 9) where the 1950 to 1970 increase was about 8.5 per cent. (Figure 17). Nevertheless, about one-third of the acreage in the vicinity of Hygiene Hogback has increased more than 100 per cent in assessed values in the last 20 years. Significantly, this increase is peripheral to the hogback.

The higher estimated land values are not as widespread as distinct increases in assessment (Figure 18). These highest values are in the subdivided parts of Section 2 and are more than one mile from Hygiene Hogback. Although a directional trend cannot be predicted from the information in this report alone, it can be seen that estimated values of $50 to $250 per acre are somewhat peripheral to the hogback.

Mr. Harold Copeland of the Boulder County Assessor's Office estimated current land prices in the vicinity at approximately $1,000 to $1,500 per acre. Speculative values and greenbelt (protective) designations which have been assigned to particular land parcels may have a direct effect on current values, and Mr. Copeland noted this trend when interviewed. These values will generally be much higher than those of simply productive (agricultural) significance assigned to the land when assessed by the County. Mr. Copeland believed that the three different values which land may have (productive, speculative, and protective) in Boulder County causes the assignment of a current fair market value to be a difficult task.

Figure 17

INCREASE IN ASSESSMENT, 1950–1970
HYGIENE HOGBACK AND VICINITY



INCREASE IN ASSESSED VALUES, 1950–1970

- less than 25 %
- 25–50%
- 50–100%
- more than 100%

N

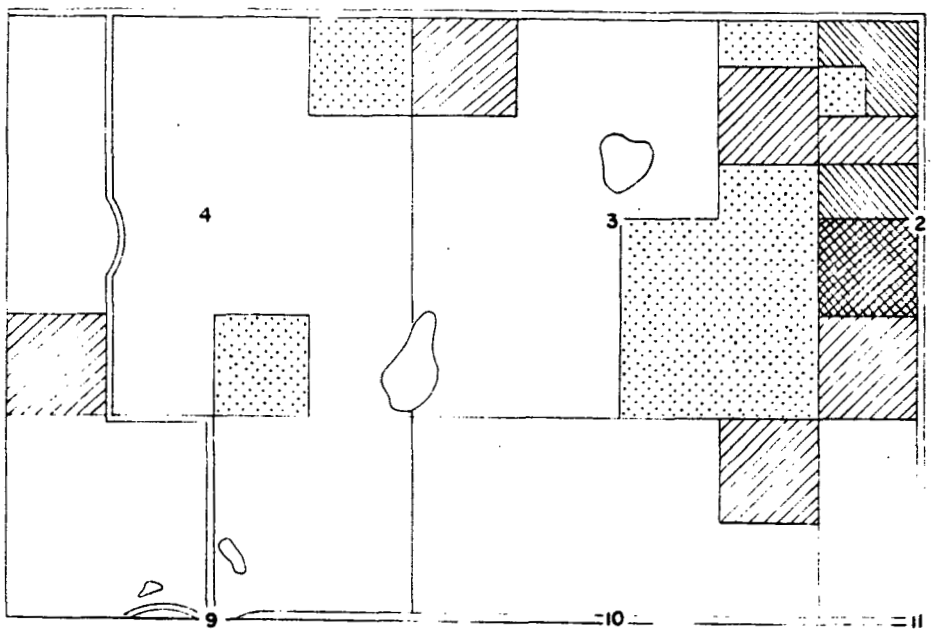
0 1/2 1

miles

Township 2 North, Range 70 West

Figure 18

ESTIMATED LAND VALUES IN 1970
HYGIENE HOGBACK AND VICINITY



ESTIMATED APPRAISAL, 1970 (dollars per acre)

- 1-50
- 51-100
- 101-250
- 251-500
- more than 500

N

0 1/2 1
miles

Township 2 North, Range 70 West

CHAPTER VI. CONCLUSIONS AND RECOMMENDATIONS

Robert E. Key, John L. Harper, and Scott Mernitz

The Hygiene Hogback presently seems relatively secure from immediate residential or industrial development. A number of factors point to the perpetuation of this security. These opinions were gathered from personal and telephone interviews and other factual data, and will be discussed briefly here.

Mr. N. W. Stiewig of Envrionmental Science Services Administration (ESSA) of Boulder, Colorado, was interviewed to determine the extent of that agency's interest in the area surrounding Table Mountain. ESSA operates an extensive telecommunications research facility located on Table Mountain, immediately south of and adjacent to the hogback. According to Mr. Stiewig, ESSA has considerable interest in what occurs on all of the property within a 2-mile radius of its operation on Table Mountain. The reason for this interest is protection of the highly sensitive equipment from anything which would produce radio interference. This includes heavy auto traffic, commercial or industrial development, overhead electric transmission lines, or residential development exceeding one dwelling unit per acre in density. Mr. Stiewig singled out heavy auto traffic, industrial development, and overhead wires as having the most potential for causing difficulty.

ESSA is highly desirous of the property surrounding Table Mountain, including Hygiene Hogback, being developed in such a manner as to preclude radio interference to its facilities there. State legislation giving ESSA the power to review any further action of this type in the immediate vicinity, supports this interest strongly (see Appendix B). Mr. Stiewig expressed enthusiastic support for greenbelt or academic study area designation for the site in particular.

Interviews with city and county officials seemed to provide added protection for the hogback area. The City of Boulder is not considering planning in the area for approximately 10 to 20 years, according to Mr. William Lamont, Boulder City Planner. Boulder County officials Mr. Robert Trenka and Mr. Art Palmer have heard no reports of further development or continuance of programs other than agricultural ones. The philosophy of the county offices appears in favor of maintaining the present 5-acre agricultural zoning. They also are in favor of doing all within their power to prevent changes in this zoning. At worst, 5-acre "residential" sites could be established by those wishing to supply their own utility services. This would also involve an additional expense for paving 300 feet of county road (approximately $2,300 according to Flatiron Paving Company, Boulder) in order to satisfy county regulations. These sites would not harm the scientific value of the hogback unless located on the feature itself, and would satisfy the requirements of the previously mentioned legislation. These and other "blocks" to a change in zoning appear formidable.

Mr. Jon Pope, Longmont City Planning Director, expressed a definite interest in the area. Control over the site, however, is the responsibility of Boulder County (Longmont having no direct jurisdiction). Longmont presently has services only within the city proper, and very little beyond. The city is at present expanding to the northwest, north of the St. Vrain. Mr. Pope would like to see the hogback area become park or open space.

Comments by residents of the immediate locale were not useful in determining current feelings concerning the natural feature itself. Most of these residents occupy their land on a non-owner basis, and are not aware of the existence or concerned with the future of the hogback. This general feeling was conveyed in three telephone conversations with these residents. The actual owners of the land were not available for comment, since many reside elsewhere. It is believed that they would have the same feeling of unawareness and unconcern about the significance and future of the site.

The site characteristics and unusual quality of Hygiene Hogback and environs are described in the foregoing report, accompanied by appropriate tables and maps. It is the recommendation of the editors that all of the northeast quarter of Section 9, the eastern half of the southeastern quarter of Section 4, and the western half of the southwestern quarter of Section 3 be protected by any possible means. This would bring the entire area of Davis Reservoir within the study area and would also provide a buffer zone to help maintain and perpetuate the natural ecology of the reservoir and hogback.

For academic purposes, the area can best be used for the study of geology and geomorphology with field trip access to both the Geology and Geography Departments of the University. It is conceivable that the area would also be of interest to high school study groups. Davis Reservoir has some potential interest to those wishing to pursue biological studies at the site.

From a public standpoint, the area has good visual qualities and would be attractive to residential developers. There is undoubtedly a number of prime building sites on both sides of the hogback. While low density residential development would not be in the best interest of preserving the hogback, it is certainly preferable to allowing exacvation and removal of the outcrop for commercial purposes.

Because of the interesting characteristics of the outcrop and its pleasing visual appearance, preservation through a potential county greenbelt program would be desirable but probably not possible within the foreseeable future. Boulder County is not involved in a park or greenbelt program at this time. Other techniques of protection and preservation should be explored. Among these are:

1) Continuation of agricultural zoning or establishment of "Special Agricultural Districts" to relieve or waive land taxes, thus permitting its continued agricultural use. This would be conditioned upon the landowners' permission for access to the site.

2) Under the covenant restricting residential density to one dwelling unit per acre, the County Department of Development might permit more dense grouping of structures far enough away from the hogback to ensure protection while transferring the increased density to the open space surrounding the hogback. The overall average density would still not exceed the maximum limit. If this technique does not result in sufficient acreage, the remaining portion of the study area could be leased or purchased outright by the University.

3) A long-term lease with an option to purchase might be negotiated with the present owners. This would result in immediate protection of the study site and would buy time for the agency most interested in acquiring the property to gather the necessary financial resources.

In the meantime, the Telecommunication Research Facilities Protection Act of 1969 may provide a degree of protection to the site by discouraging heavy traffic arteries and intensive development that could lead to serious radio interference locally.

APPENDIX A

SPECIAL SOIL INTERPRETATIONS, BOULDER SOIL SURVEY AREA, COLORADO

March 8, 1969

by

D. C. Moreland, Soil Conservationists

52-CD Hargreave fine sand loam

Moderately deep, well-drained soils with fine sand loam surface soils and fine sand clay loam subsoils. The soils are underlain by sandstone at 20 to 40 inches. Water intake rate is moderately rapid and water holding capacity is medium. The soils are used for irrigated and dry cropland and pasture. Erosion control is necessary to prevent wind erosion.

W1-AB Hygiene clay

These are deep, poorly drained soils with clay surface soils and subsoil. These soils have high water tables and high alkalinity. The soils are in upland valleys and terraces. Used for pasture and range. Water intake rate is slow and water holding capacity is high.

53-CD Kutch clay loam

These are moderately deep, well-drained soils with clay loam surface soils and clay subsoils. They are underlain by shale at 20 to 40 inches. These soils are on uplands. Water intake rate is slow and water holding capacity is medium. These soils are used for irrigated and dry cropland, but are better suited for dryland pasture than crops. Careful irrigation is needed to avoid water logging the soils.

24-B, 24-C Nunn clay loam

These are deep, well-drained soils with clay loam surface soils and clay loam or clay subsoils. These soils are on terraces and uplands. Water intake is slow. Water capacity is high. These are good irrigated soils and capable of producing good yields with good management.

50-CD Renohill silty clay loam

These are moderately deep, well-drained soils with silty clay loam surface soils and silty clay or clay subsoils. These soils are underlain by shale at 20 to 40 inches. These soils are on uplands. Water intake rate is slow. Water holding capacity medium. These soils are used for irrigated and dry cropland. They are better suited for close growing crops and pasture to help control erosion.

RO Rock outcrop

These are areas of nearly bare rock outcrop. They include some areas of shallow soils and moderately deep soils that are on such steep slopes as to be unsuitable for anything but very limited grazing or for wildlife and recreation.

51-CD Samsil clay

This is a shallow, well-drained soil with clay or clay loam surface soil and underlain by shale at less than 20 inches. These soils are on uplands. Water intake is slow and water holding capacity is low. These soils are best suited for pasture. If irrigated, frequent light irrigation will probably be necessary to maintain sufficient available moisutre and wind erosion.

72-EF Terrace Escarpment

This is land type consisting of a thin layer of cobble material over shale. These occur mainly on the side slopes of old high terraces and pediment surfaces. Water intake rate is slow although the cobble on the surface may help. Water holding capacity is low. The soils are best suited for range or pasture.

22-B, 22-C Valmont clay loam

These are moderately deep, well-drained soils with clay loam surface soils and clay or clay loam subsoils. These soils are underlain by cobbly and gravelly layers at 20 to 40 inches. These soils are on terraces and high pediments or outwash fans. Water intake rate is moderately slow. Water holding capacity is medium. These soils are used for irrigated and dry cropland and pasture. Erosion control is important.

74-DE Valmont cobbly clay loam

These soils are like Valmont clay loam, except that there are large amounts of cobble and gravel on the surface and throughout. Cultivation is difficult because of cobble and stone, and most areas are used for pasture or rangeland.

APPENDIX B

TELECOMMUNICATIONS RESEARCH FACILITIES OF THE UNITED STATES ACT OF 1969.

It is worthwhile to note that the telecommunications research facility near Hygiene Hogback is now protected by state legislation concerning zoning. This act, known as the "Telecommunications Research Facilities of the United States Protection Act of 1969" provides as follows:

1) When considering requests for rezoning or variances from existing zoning on property within 2 miles of the perimeter of telecommunications research facilities (TRF), the local governing body must consider the effect of any resulting interference caused to the facilities by the emanation of electrical impulses from electrical equipment.

2) If approval of a request for rezoning, zoning variance, or change in land use which will permit hospitals, industrial, business, or commercial uses is sought within a distance of 2 miles from the perimeter of a TRF, the governing body may request reasonable information concerning the proposed use to be made from the applicant, including a summary of the kinds of industrial electrical equipment to be installed.

3) If residential development through subdivision is sought, a covenant limiting density to a maximum of one dwelling unit per acre is imposed.

---

[1]State of Colorado: Telecommunications Research Facilities of the United States Act of 1969. General Assembly, State of Colorado.

MARSHALL MESA

NATURAL AREA STUDY

James Biggins and Max H. Dodson

Editors

DEPARTMENT OF GEOGRAPHY

UNIVERSITY OF COLORADO

Boulder, Colorado

1970

CONTENTS

		Page
FOREWORD		vi
I.	INTRODUCTION.....	1
	James Biggins and Max H. Dodson	
II.	ENVIRONMENTAL SURVEY.....	6
	John L. Harper, Michael R. Tripp & Dean G. Wilder	
	Physical Character	
	Relief	
	Topography	
	Drainage	
	Geology	
	Stratigraphy	
	Structure	
	Surficial deposits	
	Origin of the planar surfaces	
	Soils	
	Biotic Community	
	Environmental Quality	
III.	PAST, PRESENT AND FUTURE LAND USE.....	20
	George R. Greenbank, Robert E. Key & Scott Mernitz	
	Introduction	
	Past Land Use	
	Present Land Use	
	Future Land Use	
IV.	LAND OWNERSHIP AND LAND TENURE.....	32
	William G. Callahan and Manik Hwang	
	Present Land Ownership	
	Present Land Tenure	
	Past Ownership and Tenure	
	Future Ownership and Tenure	
V.	LAND ECONOMICS.....	38
	Gary A. Heaslet, Wil Ulman & Helen Young	
	Methodology	
	Changing Land Values	
	Future Economic Trends	

Page

VI. RECOMMENDATIONS..... 43
James Biggins and Max Dodson

APPENDIX A LAND OWNERSHIP OF MARSHALL MESA AND SURROUNDINGS..... 46

APPENDIX B ACTUAL AND ASSESSED LAND VALUES - 1946.....51

APPENDIX C ACTUAL AND ASSESSED LAND VALUES - 1970.....53

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FIGURES

		Page
1.	Site Location	2
2.	Marshall Mesa, Ground Photo	5
3.	Marshall Mesa, Ground Photo	5
4.	Marshall Mesa, Ground Photo	5
5.	Marshall Mesa Natural Area Site, Index Map	7
6.	Profile - A-A'	8
7.	Bedrock Geology	9
8.	Surficial Geology	10
9.	Soils and Topography	14
10.	Vegetational Patterns	15
11.	Land Use - 1885-1915	21
12.	Land Use - 1922	22
13.	Land Use - 1940	23
14.	Current Land Use	24
15.	Future Land Use	25
16.	Marshall Consolidated Coal Mining Company, Ground Photo	26
17.	"Langford," Colorado, Ground Photo	27
18.	Cadastral Map of Marshall Mesa Area - 1970	33
19.	Past Cadastral Map of Marshall Mesa Area - 1949	36
20.	Land Value - 1946	39
21.	Land Value - 1970	40

TABLES

Page

1. Two-Digit Land Use Classification Code 29
2. Present Land Ownership 34

FOREWORD

This report is one of six undertaken this year in the Department of Geography at the University of Colorado. It has become almost a tradition for the graduate seminar in land use to initiate a project in the local area in cooperation with an agency of the Boulder community on either the municipal or county level, sometimes both.

These studies achieve a number of objectives. The participating students undertake a realistic project which they are able to plan, execute, and publish within the brief span of one semester. Also, these studies provide new information for municipal and county officials and citizen groups concerned with planning and guiding the growth and development of the City of Boulder and Boulder County. In short, these are professional training exercises for graduate geographers and are a serious effort in providing new planning perspectives in the interest of public service.

In response to a suggestion by the Natural Areas Committee of the University of Colorado, the land use seminar elected to study and analyze a number of natural sites in the Boulder Valley. The group was also joined in the endeavor by the graduate field seminar of the Department of Geography.

The cooperative base within the Boulder community was wider than usual this year. The sites chosen for study seemed to have potential for a variety of uses beyond their present development. These included instruction of public school and university students, scientific research, recreation, greenbelt, and open space. The graduate students involved worked in cooperation with the resident property owners, the Parks and Recreation Department and the Planning Office of the City of Boulder, the Department of Development and the Parks and Open Space Advisory Committee of Boulder County, the Boulder and Longmont Offices of the Soil Conservation Service, the Science Director of the Boulder Valley RE-2 School District, the Planning Office and the Natural Areas Committee of the University of Colorado, and the Denver Regional Council of Governments.

Sometimes the graduate researchers felt that they would have liked to pursue certain themes in greater depth if there had been more time available. Nonetheless, they join me in expressing the hope that this report provides informative insights on a fascinating part of Boulder County.

The various chapters which appear in this study were originally submitted as special reports by the individuals indicated. They represent the endeavors and views of the authors and in no way should be interpreted as the official views of the Department of Geography or any other cooperating agency or organization previously mentioned. Because of this independence from official views, the participants in this project are especially grateful to the Graduate School of the University of Colorado, the City of

Boulder, the Boulder County Commissioners, the Boulder Valley RE-2 School District, and the University of Colorado Foundation for sharing the costs of printing this report.

This is the collective and individual effort of a group of dedicated geographers concerned about the quality of the local environment and its attendant stresses. Boulder County residents, students, and local officials may gain understanding from this report that will assist them in their efforts to perpetuate the Boulder area as a pleasant and attractive place to live.

Donald D. MacPhail, Ph.D.
Professor of Geography

Boulder, Colorado
June, 1970

ACKNOWLEDGMENTS

We wish to thank everyone who supplied information, allowed access to information, or assisted in the preparation of this report. Mr. Samuel L. Rudd gave permission to enter his property which contains Marshall Mesa, Mrs. Joanna C. Sampson supplied historical and contemporary information, Dr. John W. Marr gave technical advice and permitted the use of his files, Mr. Larry Blick informed us of some aspects of the Boulder Greenbelt Plan, Mr. Lawrence T. Paddock of the Boulder Daily Camera gave permission to use the J. B. Sturtevant photographs. Personnel in the following offices were very helpful: Boulder Soil Conservation Service, Department of Agriculture, Boulder County Assessor's Office, Boulder County Clerk and Recorder's Office. Without the help of these people, this report would have been the result of no more than cursory, remote examination. Nor could it have appeared in its present form without the assistance of Mrs. Sue Middleton who typed the report and Mrs. Nancy Stonington who designed the cover. We are indebted to Mr. Wilbert J. Ulman for his work with the copy camera and contact printer in the final preparation of the maps for publication.

James Biggins
Max H. Dodson

CHAPTER I. INTRODUCTION

James Biggins

Max H. Dodson

The Marshall Mesa natural area is on the northwest-facing slope that overlooks Marshall. The site is about four and one-half miles south of Boulder and can be easily approached via Colorado Highway 93 (South Foothills Highway or Boulder-Golden road) and Colorado Highway 170 (Marshall-Superior road) (Figure 1).

"Marshall Mesa" designates in this report the elongated ridge just west of Marshall Lake. This northeast-trending landform is not named on any modern topographic maps, but it has been referred to as part of "Lake Mesa," as "Belmont Bluff," and "Pine Ridge" by different authors. This discrepancy in nomenclature was noticed by the environmental study team, John L. Harper, Michael R. Tripp, and Dean G. Wilder; the other names that have been used for the landform appeared in the literature that was referred to by this team.

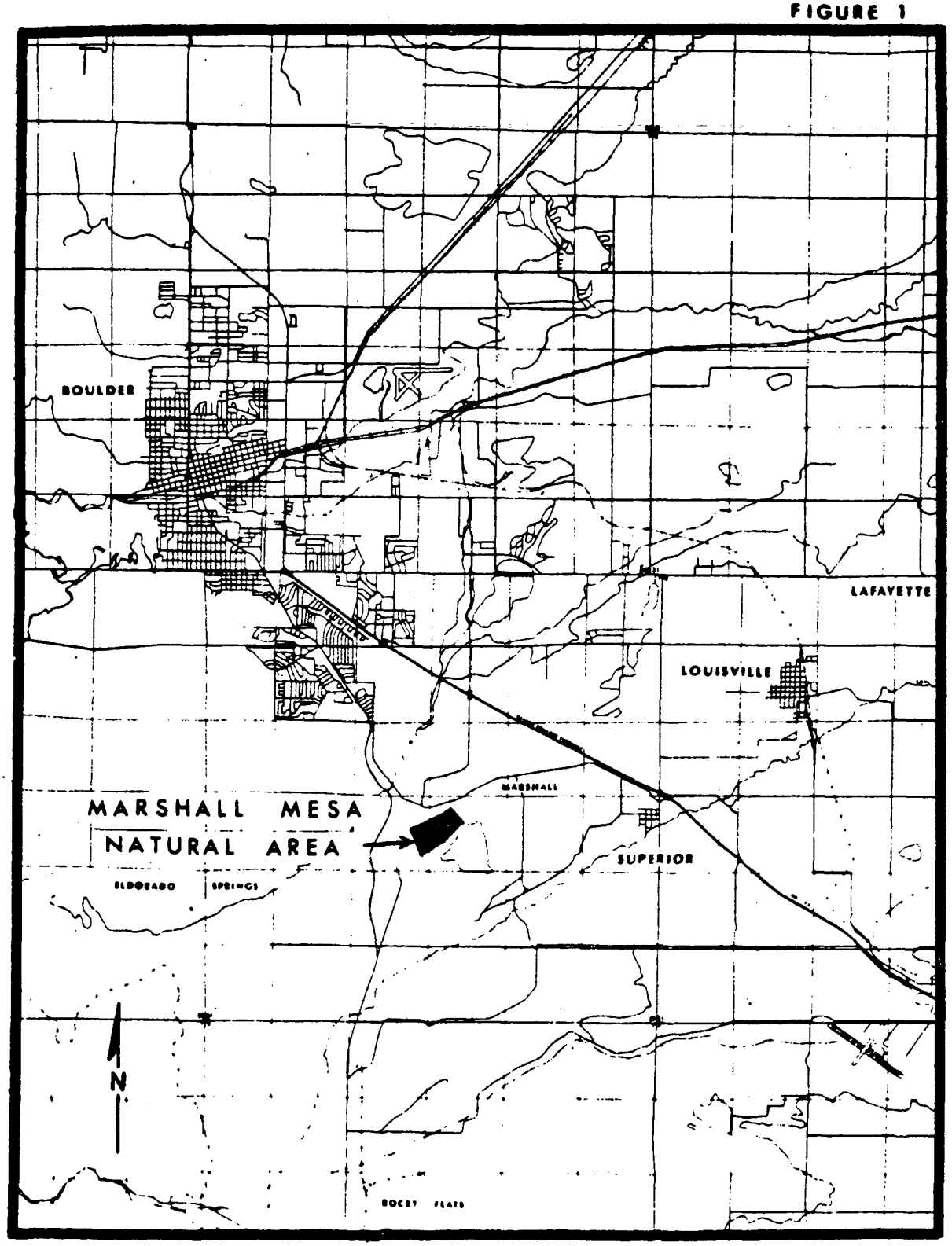
The site proper is an attractive pine-covered sandstone shelf or terrace, part way up the slopes that form the northern edge of the Rocky Flats pediment. The conjunction of several physical phenomena at this particular place has resulted in a distinctive array of interesting features. Among these is the occurrence of coal, which was extensively mined for several years. The mining resulted both in an important and complex local history and a residue of prospect pits and collapsing tunnels that would be a potential hazard for prospective residents.

The information in this report was collected by study teams who made their investigations during the winter season of 1970. Because of the necessary brevity of the investigations and the season of the year, the information that was collected is certainly only a beginning. Thus, besides its aesthetic appeal, the Marshall Mesa area has rich potential for a variety of research. The site and adjacent sectors have been studied intermittently for several years by geologists from the University of Colorado. More recently, biologists have made studies in this locality. Further geologic and biologic investigations, and research in climatology, historical geography, geomorphology, and soil science should be quite productive.

An important aspect of the area is that of change, as indicated in the following pages. Coal produced from the Marshall field was historically significant in the Denver area. Soon after the turn of the century, coal mining languished and the population of Marshall dwindled. Most of the land was given over to cattle grazing. Now the area may become included in

SITE LOCATION

FIGURE 1



1 INCH = 2 MILES

the residential expansion of Boulder, but not without considerable alteration of the environment and potential risks for housing developers and occupants.

The results of the studies that were made of the physical and cultural landscape in the Marshall Mesa area are presented in the following chapters, along with conclusions drawn from these studies.

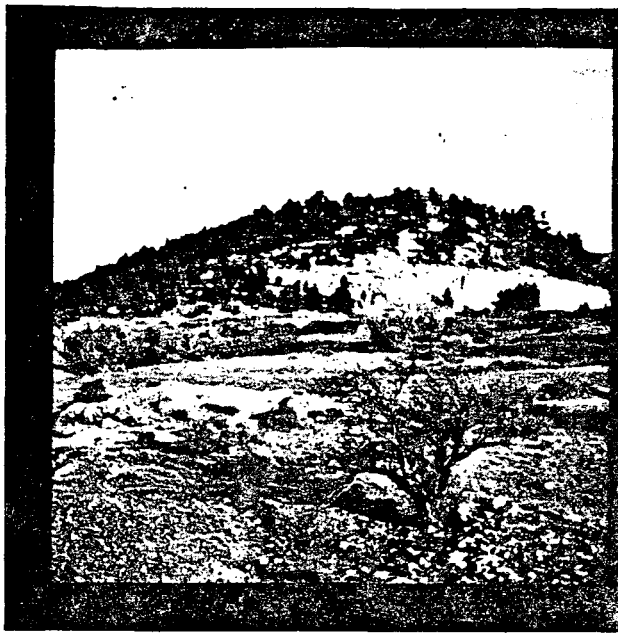


Figure 2

Figure 3

Figure 4

CHAPTER II. ENVIRONMENTAL SURVEY

John L. Harper
Michael R. Tripp
Dean G. Wilder

Physical Character

Relief

The relief of the Marshall Mesa area is about 300 feet. Elevations range from around 5,500 feet in the northern, lower part of the area to over 5,300 feet along the summit of the Mesa. The maximum elevation of the prominent shelf in the center of the area is 5,700 feet (Figure 5).

Topography

Although it varies considerably, the topography of the area can be divided into three general categories.

Slopes in the lower elevations range from 2 to 7 degrees and form a gently rolling surface, which is littered with colluvial deposits derived primarily from the bedrock of the area (Figure 6). The bedrock is also exposed at the surface (Figure 7). A northwest-facing outcrop of well-jointed sandstone rises abruptly in this area; the joints form a polygonal pattern.

A prominent shelf dominates the central part of the Marshall Mesa area. Along its western edge, the shelf is bounded by a cliff about 20 feet high. Above the cliff, the slope to the top of the shelf approximates 30 degrees. Along the north side of the shelf, the slopes range from 13 to 25 degrees. The top of the shelf is nearly level, with a maximum inclination of 3 degrees. The sloping sides are covered with talus derived from the Laramie bedrock; some of these rock fragments are quite large. The top of the shelf is veneered with stream-deposited gravels and weathered fragments of the sandstone bedrock (Figure 8).

In the higher parts of the study area, the surface is a series of faint steps, with slopes ranging from 7 to 20 degrees. The summit is a linear, nearly flat surface approximately 100 feet wide. South of the summit, the surface slopes at 70 degrees. A thick gravel deposit of boulders and cobbles covers the summit and the adjacent slopes (Figure 8). The lower slopes of the upper part of the Mesa are also covered with a gravel deposit, but it is not as deep or extensive as the gravel on the upper slopes.

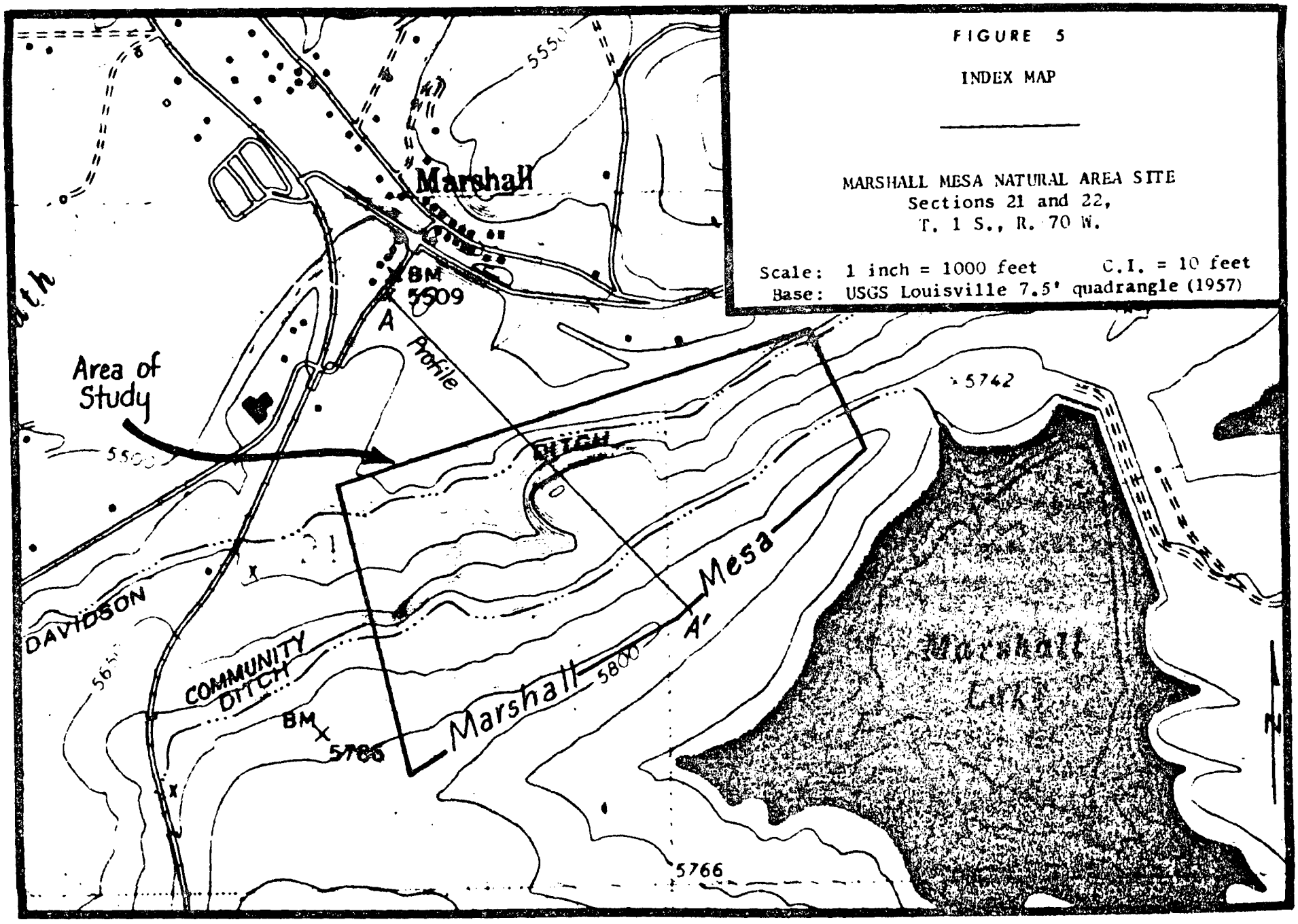
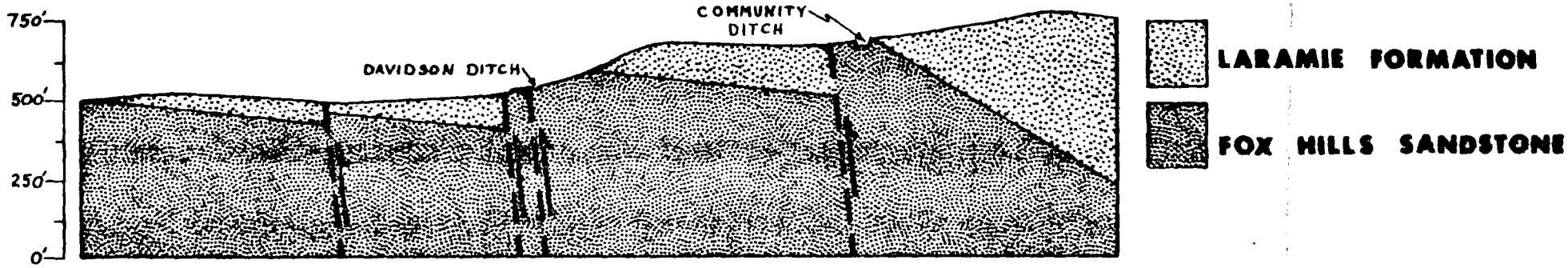


FIGURE 5

INDEX MAP

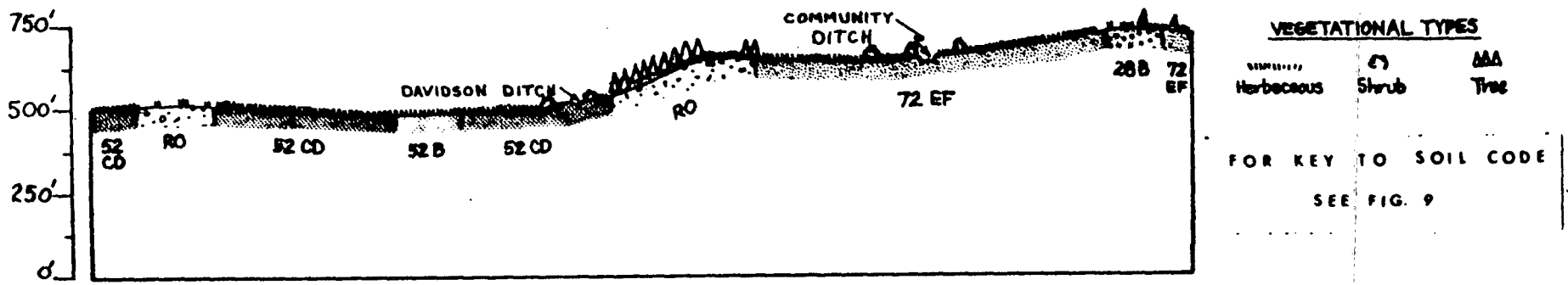
MARSHALL MESA NATURAL AREA SITE
Sections 21 and 22,
T. 1 S., R. 70 W.

Scale: 1 inch = 1000 feet C.I. = 10 feet
Base: USGS Louisville 7.5' quadrangle (1957)



GEOLOGIC RELATIONSHIPS

H and V SCALES: 1" = 500'



SOIL - VEGETATION RELATIONSHIPS

PROFILE A-A' MARSHALL MESA AREA

FIGURE 6

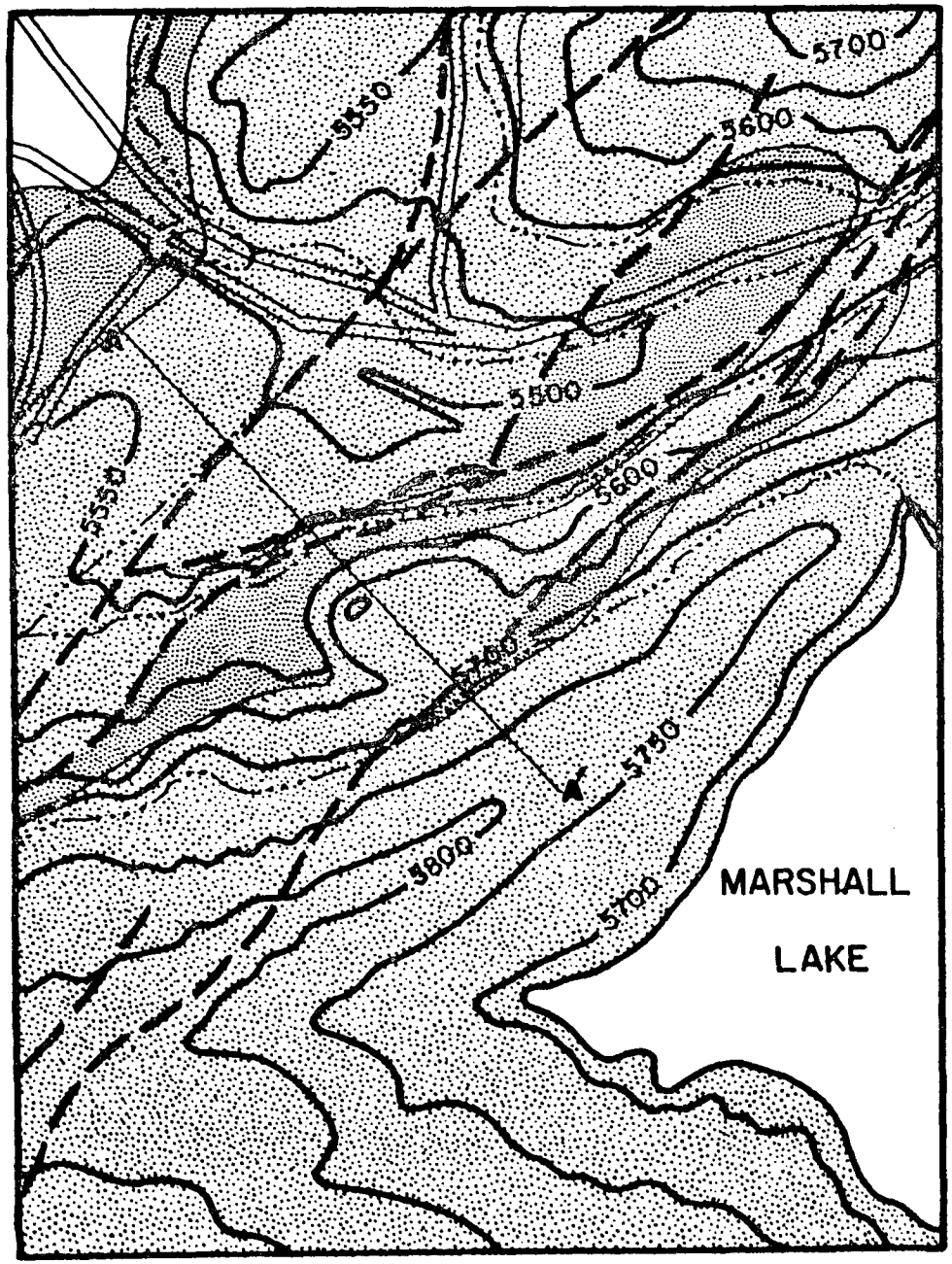


FIGURE 7

BEDROCK GEOLOGY
MARSHALL MESA AREA

EXPLANATION

LARAMIE FORMATION

FOX HILLS SANDSTONE

CONTACT

FAULT

SCALE 1:12,000

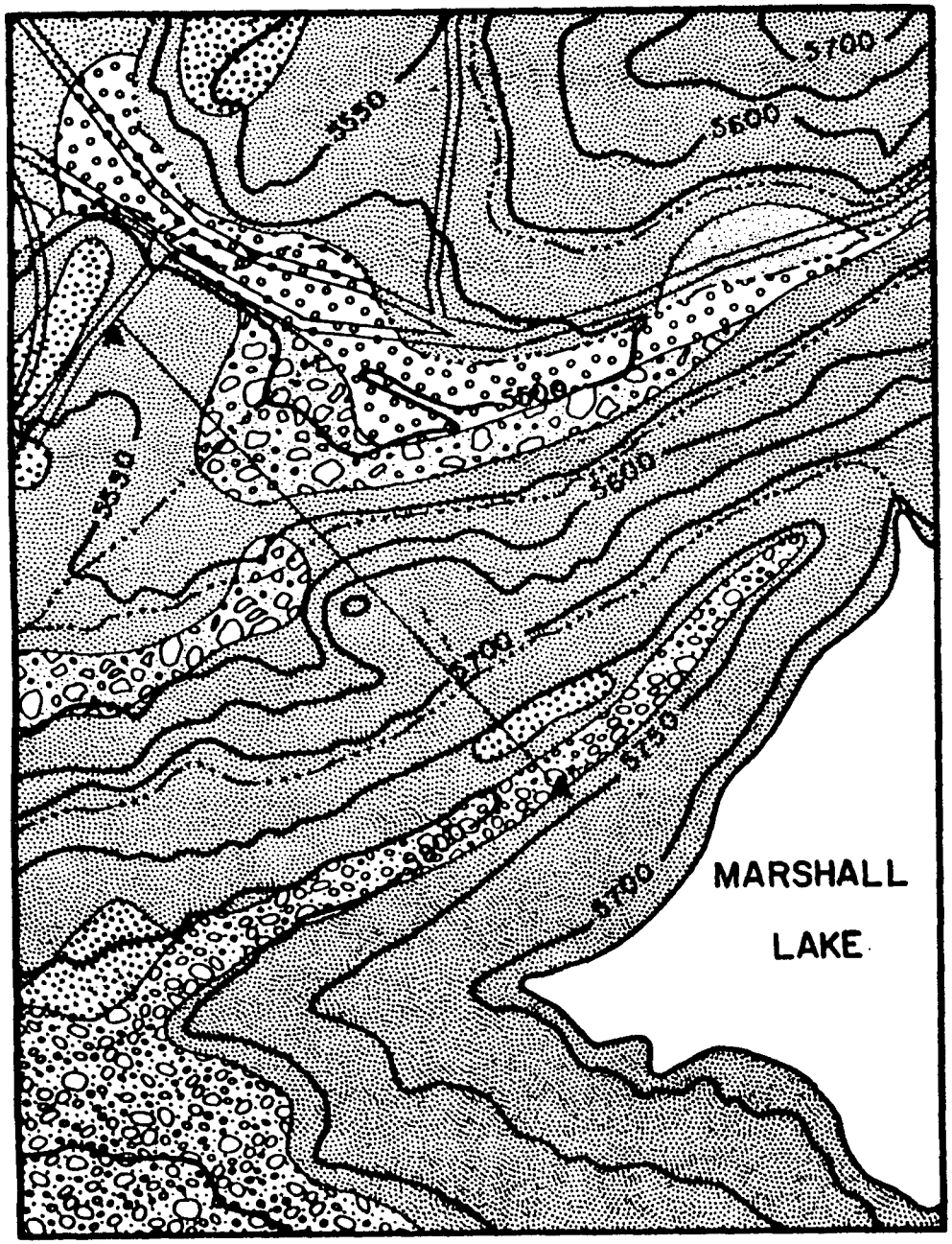
C.I.=50 FEET

SOURCE: AFTER F. SPENCER

DW.

FIGURE 8

SURFICIAL GEOLOGY
MARSHALL MESA AREA



EXPLANATION

- PINEY CREEK ALLUVIUM
- COLLUVIUM
- GRAVEL FILL
- EOLIAN SILT AND SAND
- UNDIFFERENTIATED DEPOSITS
- UPLAND GRAVEL
- UNDIFFERENTIATED BEDROCK

C.I. = 50 FEET

SCALE 1:12,000

SOURCE: AFTER H. MALDE

D.W.

Drainage

The natural drainage is interrupted by two large irrigation ditches that traverse the area. Davidson ditch is along the base of the shelf and intercepts the flow of three springs (Figure 9). The middle spring is the only one with sustained flow; it issues from an opening into a large gully just southwest of the shelf. The opening may be natural but appears to have been modified by man, perhaps during the coal mining period. The stream from this spring has cut only a shallow channel. It empties into Davidson Ditch at the northwest base of the shelf. A dark red stain on wet surfaces near the stream suggests that the water is rich in iron oxides.

Higher on the slope Community Ditch nearly parallels the contours. Outside the study area it crosses the summit of Marshall Mesa and empties into Marshall Lake (Figure 5).

Geology

Stratigraphy

Formations that represent several geologic ages and rock types underlie the Marshall Mesa area. The two youngest formations are the Fox Hills and the Laramie (Figure 7).

The Fox Hills formation is a massive, cross-bedded and ripple-marked sandstone. The lower two-thirds of the formation is a fine to coarse-grained, yellow to greenish-buff sandstone. It contains numerous iron-stained concretions which range in length from 2 to 14 feet; it also contains an abundance of the "fucoid," Halymenites major. The upper one-third of the formation is a fine to medium-grained, light gray to yellow sandstone. The Fox Hills is believed to be of marine or brackish water origin. In the Marshall area,the formation is more than 160 feet thick (6).

The Laramie formation overlies the Fox Hills sandstone. Four key beds are recognized in the Laramie formation: B, M, C, and D, in ascending order (2).

The top of bed B is about 100 feet above the base of the Laramie formation. Bed B is a fine-grained, massive, white sandstone composed almost entirely of quartz grains. The sandstone weathers into semi-spheroidal forms. The best exposure of bed B is at the base of the west end of the prominent shell. A 2-foot coal bed overlies bed B. Between the coal and the base of bed M are several feet of alternating shale and sandstone.

Bed M is a fine-grained, white sandstone about 10 feet thick. The bed is an aggregate of several layers 6 to 12 inches thick, some of which contain considerable iron oxide. Coal beds lie between beds M and C. The lower bed is 2 feet above bed M and the upper coal bed, which is 6 feet thick, is 15 feet above the lower coal and 15 feet below bed C. Alternating shales and sandstones make up the intervening sequence.

Bed D, above bed C, is nearly identical lithologically to bed B. The shelf in the center of the area is capped by remmants of bed D.

Structure

The general strike of the bedding in these formations is approximately N. 40° E. The regional dip is southeasterly, but it is modified locally by folding and faulting (2).

A system of faults comprising three major faults and two branch faults forms the principal structural feature of the area (Figure 7). Minor structural features consist of a northwest-plunging anticline, a southeast-plunging syncline, and a southwest-plunging anticline. The latter, the Marshall anticline, is quite prominent.

Surficial deposits

At least six different kinds of deposits mantle the surface of the Marshall Mesa area (Figure 8). They vary from very fine-grained wind-deposited sand and silt to very coarse stream-deposited gravel.

The youngest deposit in the area is Piney Creek alluvium. Most of it is fine silty sand and clayey silt, but it also includes gravel lenses at its base. In most places it is more than 10 feet thick. The alluvium was deposited in relatively narrow, deep arroyos, which indicates that an interval of erosion preceded deposition. The deposit was later gullied (3).

Colluvial deposits cover most of the gentle slopes (Figure 8). These deposits are less than 2 feet thick in most places. They vary in composition from stoney to clayey depending on the nature of the source material upslope. Their occurrence is the result of downslope slumping of loose material.

A gravel fill covers the floodplain of South Boulder Creek north of the study area. The fill consists of very well-rounded pebbles and cobbles and has a maximum depth of 14 feet.

Eolian (wind-deposited) silt and sand more than 2 feet thick cover two small parts of the area (Figure 8). The distribution of these deposits indicates that they were blown from a source area to the west. The source was probably floodplains of large streams.

Undifferentiated upland deposits mantle the sloping valley sides and are preserved in discontinuous outcrops on bedrock hills and as low mounds surrounded by finer materials. These deposits include alluvium, colluvium, and wind-blown deposits of several ages. Gravel is the most abundant material in these deposits.

The uppermost surface of the area is covered with upland gravel (Figure 8). The coarseness of the deposit depends upon the source from

which the gravel was derived. The abundance of large rock fragments and the composition of the gravel indicate that the gravel was derived from the mountains. The gravel deposits are composed of subangular quartzite and sandstone boulders as much as 3 feet across and rounded granitic and gneissic cobbles as much as 10 inches in diameter. The deposit is generally less than 5 feet thick and is deeply weathered.

Origin of the Planar Surfaces

A prominent landscape feature in the region is a series of rather extensive accordant surfaces. The summit of Marshall Mesa is one of these. Fenneman believed that the surfaces are remnants of fluvial terraces formed by streams which carried glacial and post-glacial runoff across exposed bedrock areas (1). Degradation of the bedrock was accompanied and followed by aggradation of stream gravels. The resulting surfaces closely approximated in eastward slope the profile of the streams responsible for planation and deposition. The highest accordant surfaces today are farthest from present stream courses and the lowest ones are nearest the present streams. This relationship is identical to that of modern terrace development on floodplains.

Soils

A soil survey of Boulder County was concluded by the U. S. Soil Conservation Service in 1967. The Marshall Mesa area was mapped on air-photos at a scale of 1:10,000, and the soils in the study area were categorized in five types (Figure 9). Two of these are fine sandy loams found mostly north of Davidson Ditch; they differ primarily in slope angle and in water holding capacity. Much of the slope south of Davidson Ditch is classified as steep cobbly land having shallow soils of varied nature. Some nearly level surfaces are practically devoid of soil, although the summit of Marshall Mesa is mapped as supporting a cobbly sandy loam. In the vicinity of the springs and a few minor seeps at some sandstome exposures, local boggy variations of these general soil types can be found.

The five soil types shown in Figure 9 are accompanied by brief summaries of the Soil Conservation Service descriptions of their respective soil properties.

The Biotic Community

From a physiognomic viewpoint, the plant community in the Marshall Mesa natural area provides an unusually rich variety of landscape-modifying elements in a relatively small space. A rather complex mosaic of plant-associational units (see Figure 10) reflects the sensitive response of the flora to climatic, topographic, geologic, edaphic, and hydrologic influences on a micro-environmental scale. Floristically, the species composition of the tree and shrub layers is quite simple and uniform, although

notable isolated exceptions do occur. The herbaceous stratum is more diverse in species, but the study team felt incompetent to analyze this layer in detail because field study was made in the winter.

Seven categories of vegetational association, based principally on dominant life-form in rather broad synusia, are shown in Figure 10 to indicate the degree of variability within the plant community. These categories are:

1) predominantly needle-leaf evergreen trees,
2) predominantly shrub with scattered conifer trees,
3) shrub thickets,
4) mixed shrub and grass,
5) predominantly grasses/forbs,
6) rocky ground with some grasses/forbs, and
7) barren ground.

Ponderosa pine (Pinus ponderosa Laws.) is distinctly the most common species of tree, although a few individuals of Juniperus spp., Douglas fir (Pseudotsuga menziesii [Mirbel] Franco) and assorted broadleaf deciduous species were noted.

The most common shrub in the area is skunkbrush (Rhus trilobata Nutt.). Wax current (Ribes cereum Dougl.) dominates under the ponderosa pine canopy and is found sparingly elsewhere.

Hackberry (Celtis reticulata Torr.) is both a tree and a shrub, but it is not common. Of the herbs, the blue grama grass (Bouteloua gracilis [HBK] Lag.) and buffalo grass (Buchloe dactyloides [Nutt] Engelm.) are the most common native species. Muhlenbergia sp. is less prominent. Other grass and forb species in winter conditions were not recognizable to the team. Two common associates of the grasses are yucca (Yucca glauca Nutt.), found extensively wherever the top soil horizon is relatively coarse and well-drained, and prickly pear cactus (Opuntia rafinesquei Engelm.), which favors a habitat similar to yucca but is less common.

Ecology students under the direction of Professor John W. Marr, University of Colorado, have compiled in an unpublished report some data relating to the ponderosa pine stand on and about the shelf in the center of the study area (4). Quadrats of 100 meters^2 were sampled and increment borings were taken. The mature trees on the north-facing slope of the shelf make up a uniformly even-aged stand, the oldest individual sampled being 80 years. Regeneration is apparent throughout the study area.

The anomaly of a well-established, vigorous stand of pine at this site, about 3 miles east of the Rocky Mountain front and 2 miles from the nearest continuous pine forest in the forest-grassland ecotone, was not studied in depth because of its potential as a research effort. Presumably, peculiarities of edaphic, hydrologic, and micro-climatic conditions favor the perpetuation of ponderosa pine at this site well into the dominant grassland regional ecosystem. A few old, gnarled individuals within the stand may be descendants from a once-continuous woodland that

may have extended southeastward from the existing forest that blankets the upper slopes of Shanahan Hill (in close accordance with the shelf surface at Marshall Mesa) just south of Boulder. Downcutting by South Boulder Creek could have isolated the Marshall Mesa stand.

Faunal elements of the natural area site were not investigated. Birds typical of the forest-grassland ecotone and of the Colorado piedmont were either observed or would be expected to visit the site. No nesting areas were seen. Likewise, no small mammals other than rabbits were observed, and evidence of burrows and dens were meager. Throughout the study area, evidence of rather intense browsing of shrubs, deciduous tree branches below 7 feet above ground level, and even of yucca blades was noticeable; some of the browsing may have been by deer, but most of it can probably be attributed to overstocking of a poor range with cattle.

Ant colonies were not observed as much as expected, although one large active hill was seen at the summit of the shelf in the center of the study area.

Environmental Quality

The Marshall Mesa area has long been exposed to littering by man and over-grazing by cattle. Below Davidson Ditch, the spoils of coal mining activity are still prominent. The grounds in this low-lying part of the area are strewn with litter, and little semblance of natural habitat remains. West of the prominent shelf, the litter problem is moderate to severe; much of the litter has been blown by prevailing west winds from the highway and frontage areas one-half mile away. The site of the abandoned Pine Ridge Mine is seriously disturbed. Prospect hole areas east of it and on the north flanks of the shelf are similarly altered; ruins of a small building just across Davidson Ditch from the shelf are scattered in a shrub stand. Crossing the study area from southwest to northeast, immediately north of Davidson Ditch, a recent pipeline right-of-way has dissected a meadow with a continuous barren strip 30 feet wide.

With the exception of the withering remains of a few old vehicle trails, the upper slopes of the study area are relatively undisturbed, although the sizeable ditch banks lining the lower sides of both irrigation ditches have especially altered the drainage and soils. The upper portion of Community Ditch has been recently maintained and deepened. This has provided a habitat for pioneering exotic plant species scattered along the ditch banks.

The shelf and immediate surroundings retain a character sufficiently little-disturbed to be valuable to researchers of several disciplines. The generally deteriorated environmental quality of the northern and western peripheral parts of the study area is not found on the shelf. With natural-area management it is felt that the shelf environment could be restored to a fairly reasonable facsimile of the native habitat.

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CHAPTER III. PAST, PRESENT, AND FUTURE LAND USE

George R. Greenbank
Robert E. Key
Scott Mernitz

Introduction

This study depended on several sources of information: field reconnaissance, personal interviews, county records, air photographs furnished by the City of Boulder and the Soil Conservation Service in Boulder, and ground photographs dated prior to 1900.

The following figures show land use during the time indicated: Figure 11, the coal mining era (1885-1915); Figure 12, the agricultural impact (1922); Figure 13, the transition from mining to agriculture (1940); and Figure 14, current land use (1970). A prediction of future land use appears in Figure 15.

To obtain a perspective of trends in the area, land use was mapped not only for the study area itself, but also for the surrounding area.

The land use classification code of the Inter-County Regional Planning Commission (also called Denver Regional Council of Governments - DRCOG) was used in order to standardize the mapping (see Tables 1 and 2).

Past Land Use

Most of the information regarding past land use was acquired by William R. Callahan and Manik Hwang.

Coal mining dominated the early history of land use in the area. "Joseph M. Marshall was the 'company' of Langford and the original discoverer of the exposures of coal deposits on South Boulder Creek" (4). Augustine Langford controlled a large portion of the area during the 1870s. He chose the name "Langford" for the community and persuaded the photographer to use this name on the early photographs (Figures 16 and 17). However, "Langford" was never accepted, and "Marshall" became the official and popular name (3).

"The coal mines at Marshall were developed in the early 1860s and soon were supplying the entire region with coal" (2). Joseph Marshall retired before 1900 and his holdings in the area were transferred to the Northern Coal and Coke Company. This company held both surface and subsurface rights to the land until 1911. At this time, labor problems and the discovery of anthracite in Wyoming caused Colorado lignite to diminish rapidly in importance (1). Northern Coal and Coke was consolidated into the larger and more prosperous Rocky Mountain Fuel Company. However,

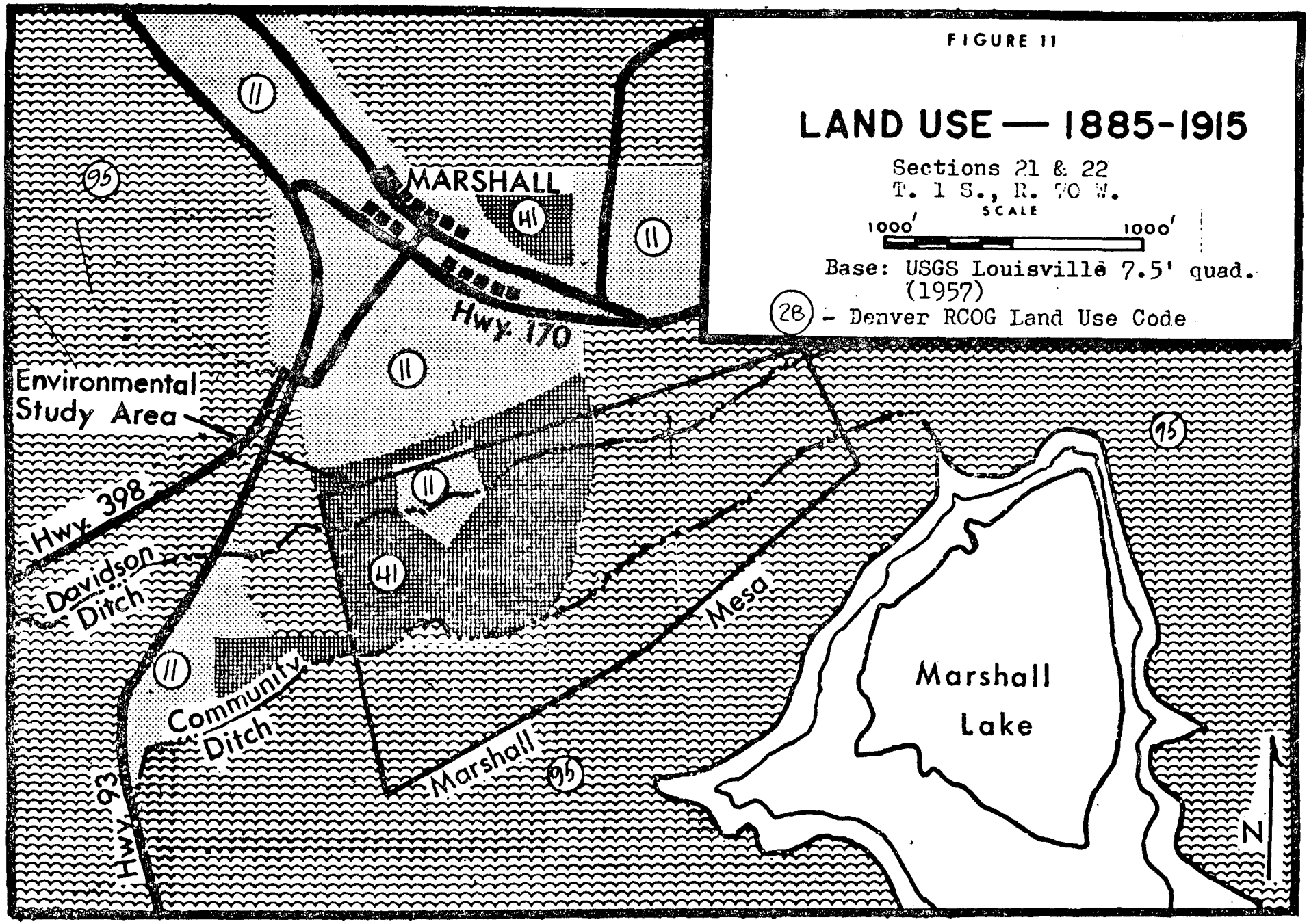


FIGURE 11

LAND USE — 1885-1915

Sections 21 & 22
T. 1 S., R. 70 W.

Base: USGS Louisville 7.5' quad. (1957)

(28) - Denver RCOG Land Use Code

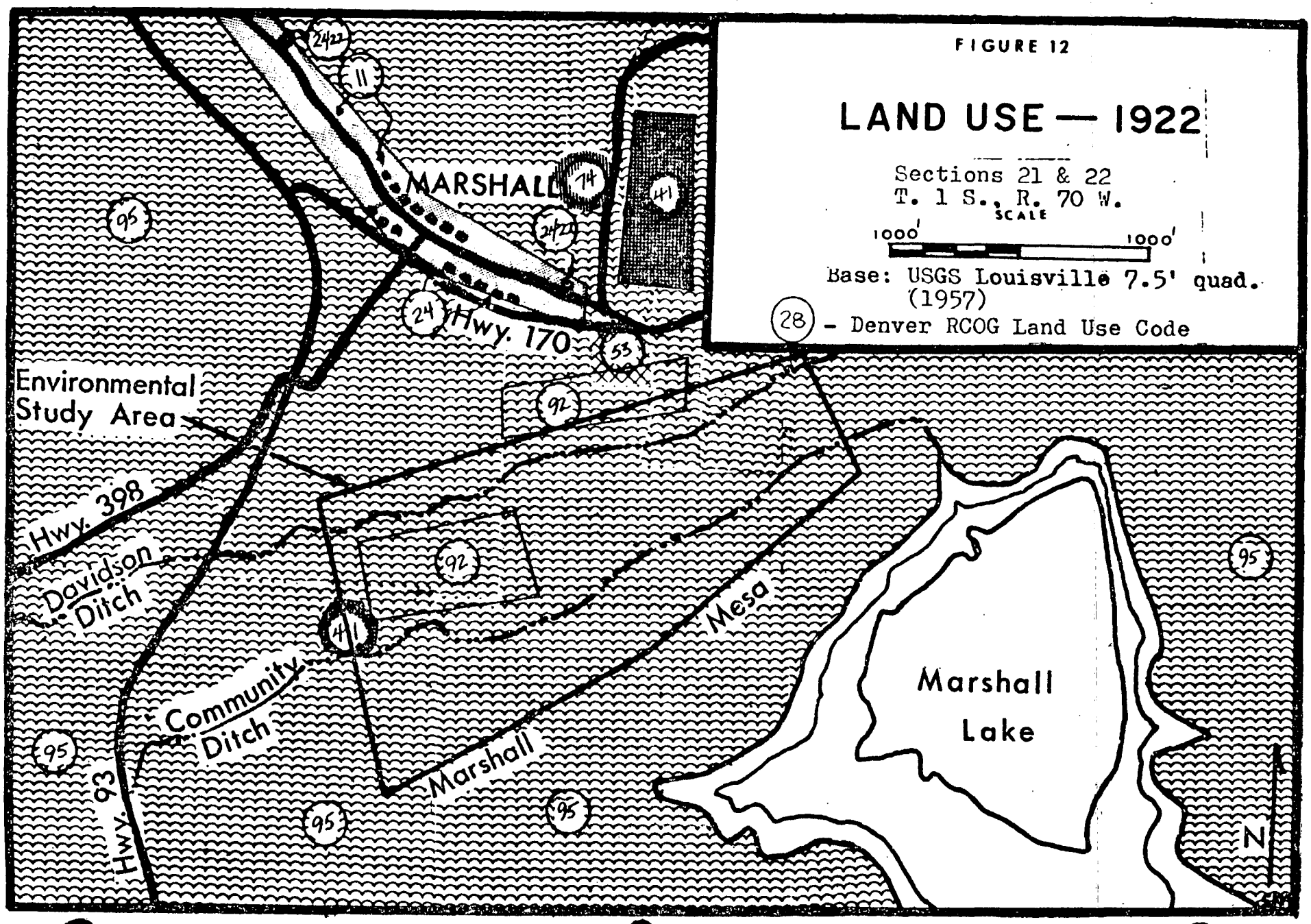


FIGURE 12
LAND USE — 1922
Sections 21 & 22
T. 1 S., R. 70 W.
SCALE
1000'
1000'
Base: USGS Louisville 7.5' quad. (1957)
28 - Denver RCOG Land Use Code
MARSHALL
Hwy. 170
Environmental Study Area
Hwy. 398
Davidson Ditch
Community Ditch
Hwy. 93
Marshall Mesa
Marshall Lake
N
2422
11
74
41
24
53
92
95

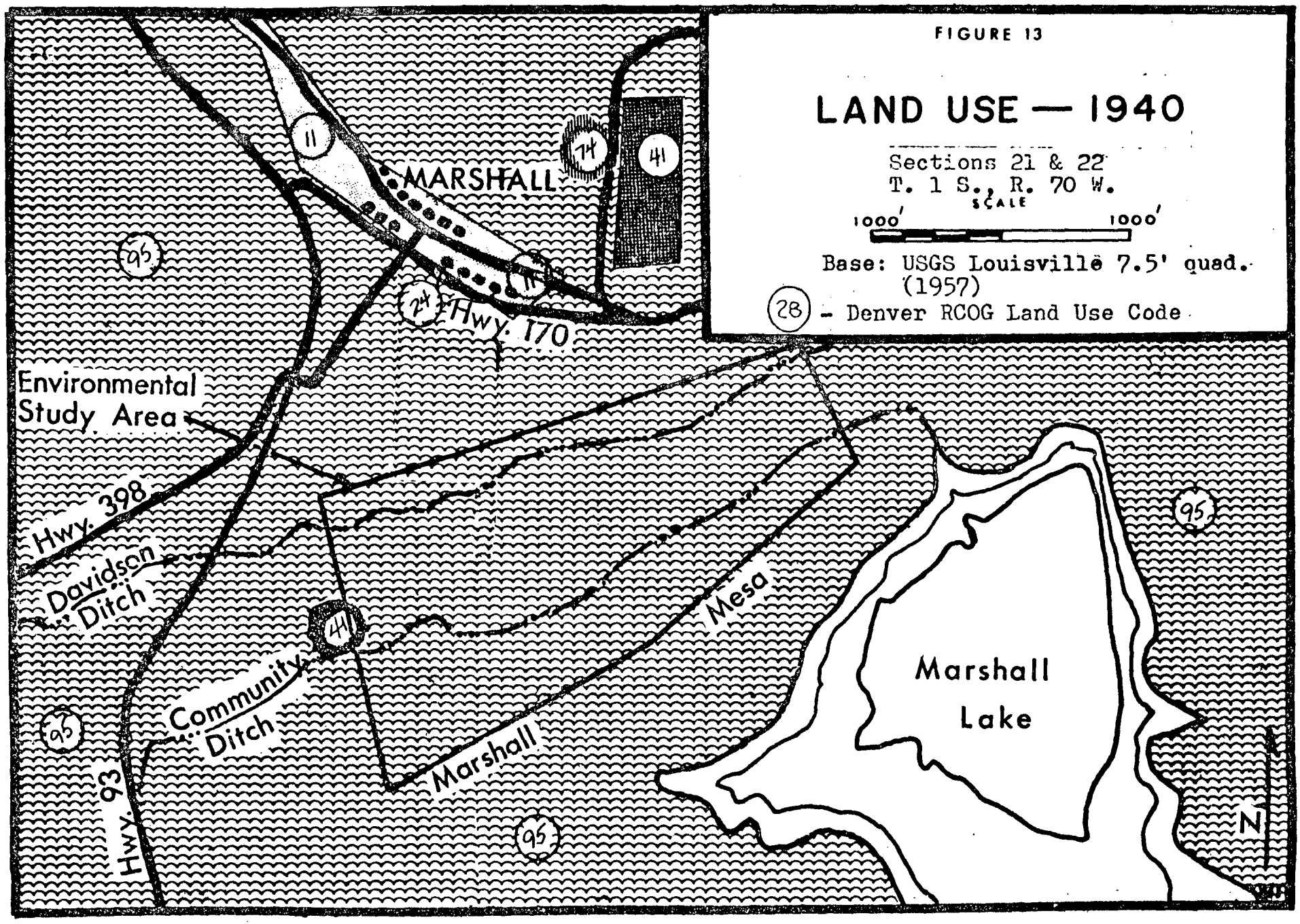


FIGURE 13
LAND USE — 1940
Sections 21 & 22
T. 1 S., R. 70 W.
SCALE
1000'
1000'
Base: USGS Louisville 7.5' quad. (1957)
28 - Denver RCOG Land Use Code
MARSHALL
11
74
41
95
24
Hwy. 170
Environmental Study Area
Hwy. 398
Davidson Ditch
Community Ditch
Hwy. 93
Marshall Mesa
Marshall Lake
N

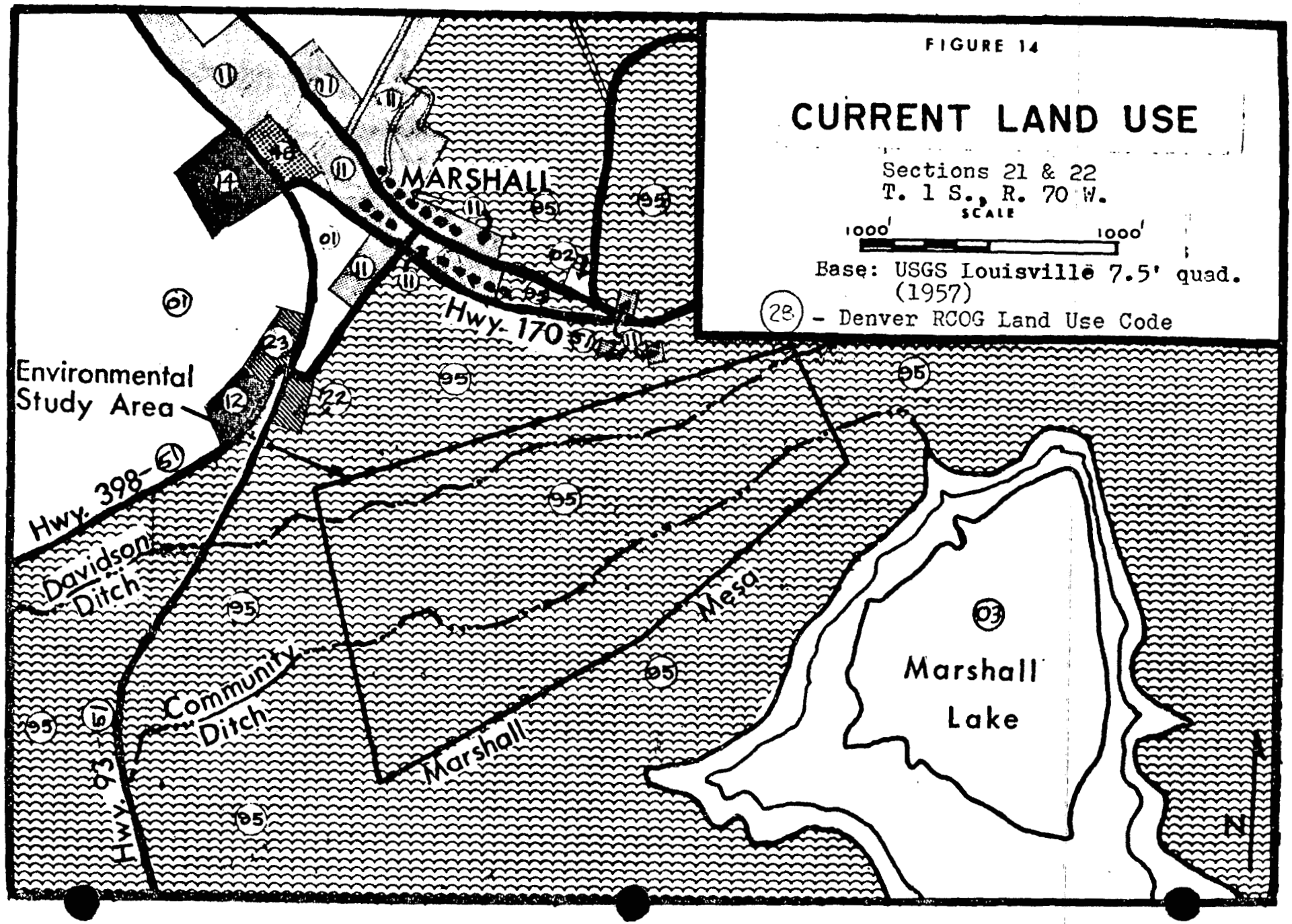


FIGURE 14
CURRENT LAND USE
Sections 21 & 22
T. 1 S., R. 70 W.
SCALE
1000'
1000'
Base: USGS Louisville 7.5' quad. (1957)
(28) - Denver RCOG Land Use Code
MARSHALL
Hwy. 170
Environmental Study Area
Hwy. 398
Davidson Ditch
Community Ditch
Hwy. 42
Marshall Mesa
Marshall Lake
N

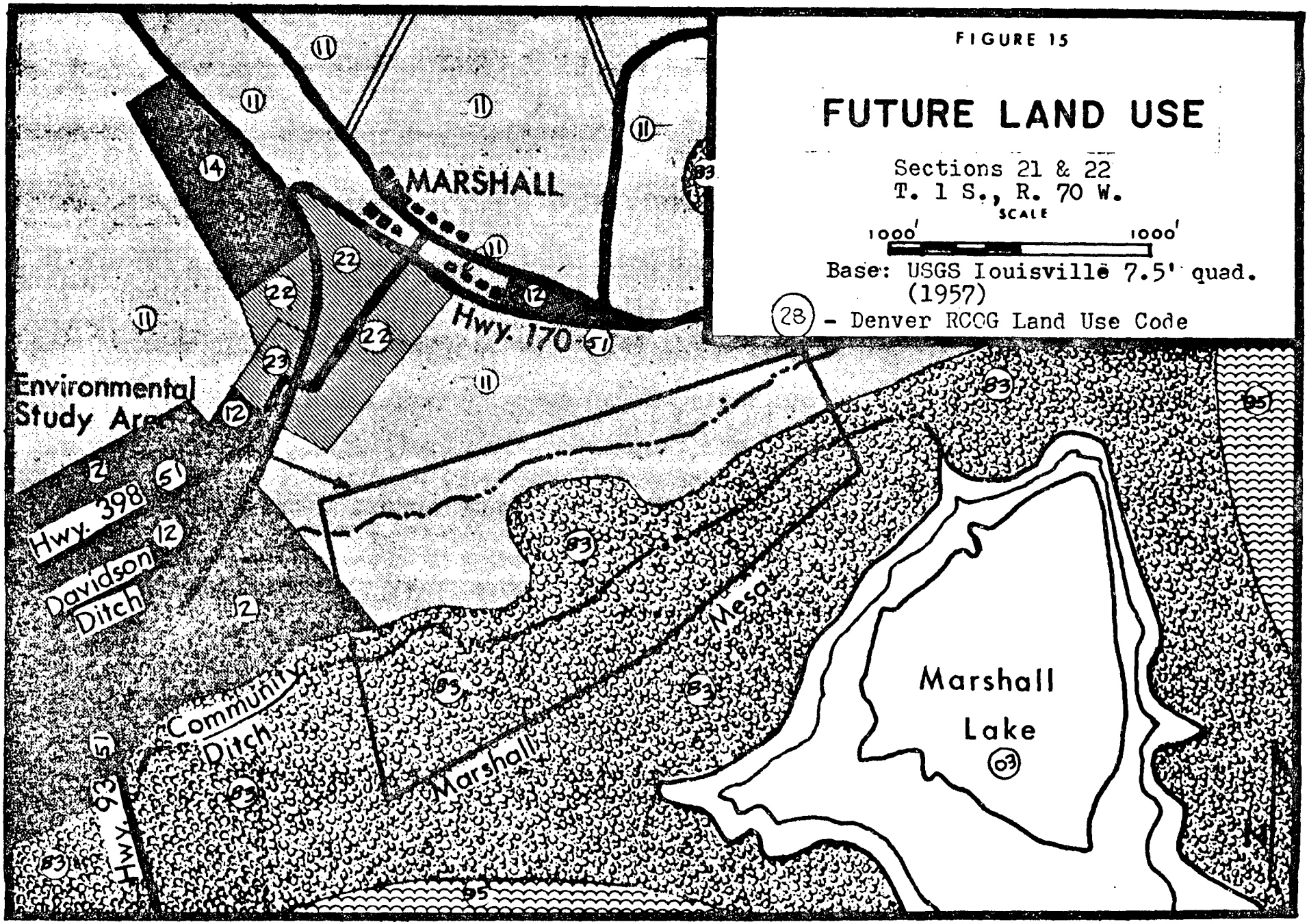


FIGURE 15
FUTURE LAND USE
Sections 21 & 22
T. 1 S., R. 70 W.
SCALE
1000'
1000'
Base: USGS Louisville 7.5' quad. (1957)
(28) - Denver RCOG Land Use Code
MARSHALL
Hwy. 170
Environmental Study Area
Hwy. 398
Davidson Ditch
Community Ditch
Hwy. 63
Marshall Mesa
Marshall Lake

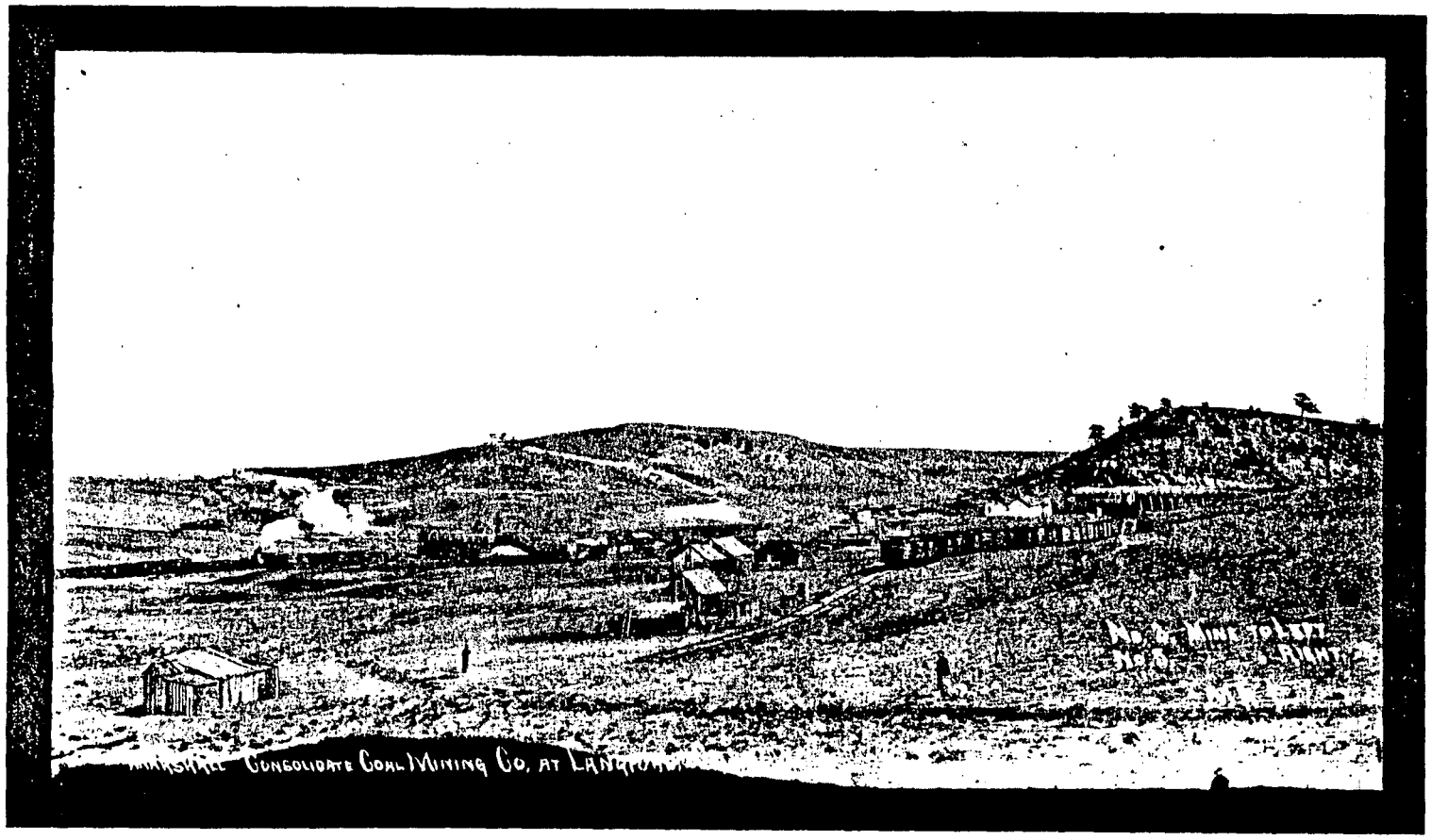


Figure 16 The Marshall Consolidate Coal Mining Co. at "Langford" Colorado. Photo dated prior to 1900. Marshall Mesa is shown at the right background.

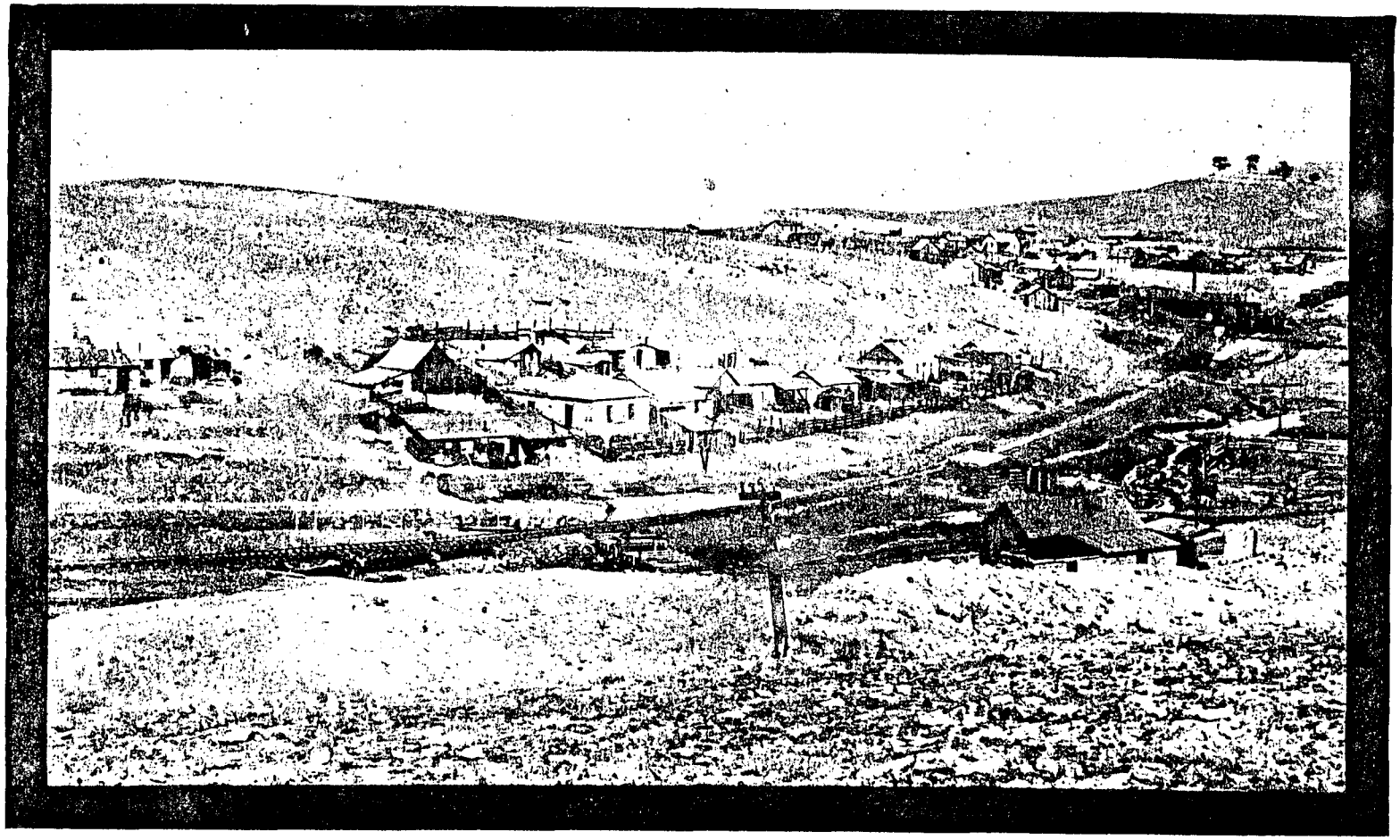


Figure 17 "Langford," Colorado. The historic site of the present community of Marshall. Photo dated prior to 1900.

coal mining in the Marshall area continued to decline and the Rocky Mountain Fuel Company eventually became just a land holding company.

Except for livestock grazing, agriculture was not practiced to a noticeable degree until the 1920s (Figure 12) when crop production was attempted from land in and near the study area.

Present Land Use

Figure 14 shows present land use in the Marshall area. Grazing is the only agricultural land use in and around the study area. Land use in the community of Marshall is almost entirely residential; only a small portion of the land is used for industrial and commercial purposes.

Future Land Use

The future land use map (Figure 15) is speculative. However, it seems to be a reasonable forecast in terms of the city of Boulder's present Greenbelt plans. Wind is a significant natural hazard on top of the Mesa and because of the absence of utilities in the area, it appears that open space uses will continue.

On the eastern end of the study area, recent spring precipitation has caused new cave-ins and ground slumpings over abandoned coal mines. Davidson Mesa, north of the study area, has fires that continue to burn at low intensity in several of the abandoned mines. Because of this and ground slumping new home construction has been hindered.

TABLE 1. TWO-DIGIT CLASSIFICATION CODE (DRCOG)

1. Residential

    11 Single-Family Dwelling
    12 Multi-Family Dwelling
    13 Group Quarters
    14 Mobile Home Dwelling

2. Commercial

    21 Commercial Residential
    22 General Retail Business
    23 Personal, Commercial Services
    24 Intensive Business

3. Services

    31 Administrative Services
    32 Finance, Insurance, Real Estate Services
    33 Business Services
    34 Professional Services
    35 Wholesaling Services, Without Stock
    36 Miscellaneous Services

4. Industrial

    41 Extractive
    42 Primary Products Manufacturing
    43 Secondary Metal Products Manufacturing
    44 Secondary Non-Metal Products Manufacturing
    45 Wholesaling, With Stock
    46 Non-Manufacturing, Warehousing
    47 Non-Manufacturing, Open Storage
    48 Construction, Contractors Storage

5. Transportation

    51 Transportation R.O.W.
    52 Passenger Terminal
    53 Freight Terminal
    54 Transportation Equipment Maintenance
    55 Transportation Services
    56 Automobile Parking

(continued)

TABLE 1. TWO-DIGIT CLASSIFICATION CODE (DRCOG)

(continued)

6. Communication and Utilities

61 Telephone and Telegraph Communications System
62 Radio, Television Communication
63 Postal Communications
64 Gas, Electric Utility System
65 Water Supply Irrigation System
66 Sewerage System
67 Disposal Facilities

7. Public and Quasi Public

71 Correctional, Protective Facilities
72 Cultural Facilities, Civil Organizations
73 Religious Facilities
74 Educational Facilities
75 Medical and Related Facilities
76 Cemeteries, Mausoleums
77 Military Bases, Installations

8. Parks and Recreation

81 Indoor Sporting, Recreation Facilities
82 Outdoor Sporting, Recreation Facilities
83 Open Space Parks and Recreation Areas
84 Unimproved Forest Land

9. Agricultural

91 Specialty Crop Production
92 Crop Production
93 Animal Production
94 Animal Husbandry Services
95 Pasture, Grazing Land

0. Vacant

01 Land
02 Structure
03 Water Area

References

1. Parnall, Mark. Descendent of an early Colorado coal miner. Telephone interview, April 2, 1970.

2. Perrigo, Lynn I. "A condensed history of Boulder, Colorado." The Colorado Magazine. Vol. XXVI, No. 1, 1949, p. 41.

3. Sampson, Mrs. Joanna C. Marshall area resident. Personal interview, March, 1970.

4. Sanford, Albert B. "The First Iron Manufacturing in Colorado." The Colorado Magazine. Vol VIII, No. 4, 1931, p. 143.

CHAPTER IV. LAND OWNERSHIP AND LAND TENURE

William G. Callahan
Manik Hwang

Present Land Ownership

A summary of present land ownership is shown in Table 3 and the complete present land ownership record is shown in Appendix A. Figure 18 is an ownership (plat) map of the Marshall area.

In Sections 21 and 22 there are six major land owners with holdings of over 65 acres. Fourteen persons have holdings between 2 and 12 acres, which are designated by tract numbers.

The larger properties are located south of the community of Marshall on or near the mesa and the smaller properties are concentrated in or around Marshall where the topography is less undulating, the degree of slope is not as great, and transportation facilities are numerous. The largest holding is owned by Samuel A. Rudd who owns 45 per cent or 578 acres of the total 1,280 acres in Sections 21 and 22. Approximately 28 per cent or 356 acres of the total acreage is owned by two irrigation and reservoir companies.

Present Land Tenure

There are three major classes of tenure in Sections 21 and 22: full owner (one who owns all the land he operates), manager (one who operates land for someone else on a salary basis), and cash tenant (one who pays rental in cash as a lump sum or on a per acre basis).

With six exceptions all the land designated by tract numbers (Appendix A) is owner operated. Tract 2514-A is a trailer court, and most of it is occupied by cash tenants. The portion of the tract which is occupied by the owner is small. In terms of tenure, therefore, this tract is classified as cash tenant. Four tracts, 2154, 1428, 1421-A, and 1423-A, are occupied by tenants who rent for cash.

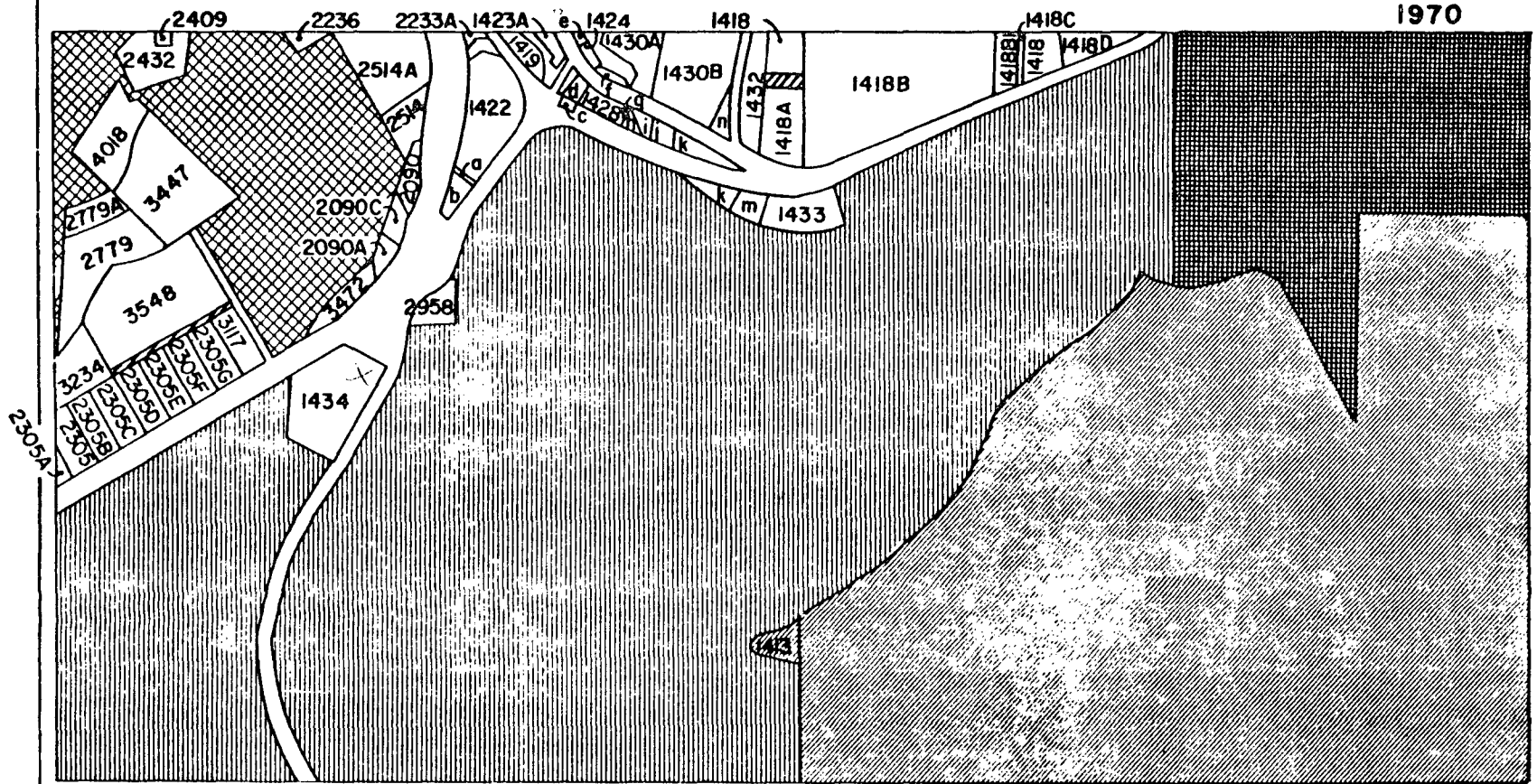
Tract 1434 contains a small house which is rented to a University of Colorado student. The remainder of this tract, however, is unused due to the owner's desire that the land be allowed to return its natural state (3). Because of this, tract 1434 is owner operated.

Of the total acreage, 747 acres, or 58.2 per cent of the land is rented for grazing on an annual basis to farmers who own land in the immediate vicinity. These farmers are, in effect, cash tenants in Sections 21 and 22. The Rudd, Thomas, and Debacker properties are classified,

CADASTRAL MAP OF MARSHALL MESA AREA

FIGURE 18

1970



a - 1422 C
b - 2036
c - 1421A
d - 1421
e - 1425
f - 1427
g - 1428A
h - 1431 A
i - 1431
j - 1429A
k - 1429
m - 1433A
n - 1432

SEC. 21 & 22
OF
R. 70W, TOWNSHIP 1 S

SCALE
1000 0 1000 ft.

PROPERTY OF MRS. HAROLD L. DEBACKER
PROPERTY OF MR. SAMUEL L. RUDD
PROPERTY OF MRS. WILLIAM J. THOMAS
PROPERTY OF FARMERS R. & I. CO. AND COMMUNITY, C. & R. CO.
VARIOUS OWNERS

therefore, as cash tenant land. Both Mrs. William J. Thomas' and Mrs. Harold L. Debacker's holdings were owner operated recently. The owners are now widows, who intend to sell their holdings if zoning is changed to permit sewers and other utilities to serve the area (2).

TABLE 2. PRESENT LAND OWNERSHIP (1)

Name	No. of Tracts	Acres	Per cent of Total
Samuel L. Rudd	-	578.18	45.1%
Community Canal and Reservoir Company	-	236.02	18.4
Farmers Reservoir and Irrigation Company	-	120.00	9.4
Mrs. Harold L. Debacker	-	103.07	8.0
Mrs. William J. Thomas	-	65.75	5.1
County and State Roads and Easements	-	65.45	5.1
William S. Jeske	2	6.40	7.2%
Wesley Conda	3	4.50	
Carmella Gabriella	1	9.01	
E. L. Smith	1	6.66	
E. L. Rose	1	11.79	
San Soucie Trailer Court	1	3.00	
C. E. Shannon	3	3.00	
Robert Keefer	5	10.50	
Town of Lafayette	2	2.20	
William T. Bullard	1	2.37	
Vincent Theis	1	3.00	
Jack Taylor	2	10.80	
Robert Sisemore	1	2.10	
Joanna F. Sampson	2	16.00	
Remaining	25	20.20	1.7
Totals	51	1280.00	100.0

The remainder of the land, 356 acres, is managerially operated. Mr. Maynard Ludwig is employed by the Farmers Reservoir and Irrigation Company and by the Community Canal and Reservoir Company. Although his job title is "Marshall Lake Tender," he is actually in charge of the entire holdings of these two firms. As partial payment for the responsibilities he has undertaken, he is allowed to run cattle on the land. Mr. Ludwig is thus both a manager and a tenant, but because his primary duties are managerial, the land is classified as under manager tenure. However, the lake is leased to the Louisville Rod and Gun Club, so that three of land tenure actually exist on the same parcel of land. Mr. Ludwig is a cash tenant and manager for land which is leased, in part, to another party.

Past Ownership and Tenure

Past land use was described in the land use study, where it was emphasized that coal mining dominated in the area until the market for coal collapsed. While coal was mined, land ownership consisted in large holdings. Since the decline of coal mining the trend has been toward smaller ownerships. Evidence of this trend is apparent in comparison of the 1949 and 1970 cadastral maps (Figures 18 and 19).

Comparison of these maps also demonstrates that land ownership patterns on the mesa and in the surrounding area have remained intact since 1949. However, the Thomas property of 1949 has become divided among 23 owners.

In 1930, a few tracts of land in Section 21 were sold by the Rocky Mountain Fuel Company to Nick Conda, Tom Gabriella and son, and Wilbert Hale. All three parties and their descendants still live in the vicinity.

Marshall Lake has been owned by the Community Consolidated Canal and Reservoir Company since 1900. The Farmers Reservoir and Irrigation Company bought their holdings in 1925.

The Thomas property was a farmstead that was purchased from the Rocky Mountain Fuel Company in 1946 and was eventually subdivided into six separate properties by 1958. Eighteen more tracts, totaling nearly 40 acres, were partitioned from the farmstead between the present and 1969.

Samuel Rudd did not purchase his holdings until 1963-64. At that time the entire Bixler property (see Figure 19) and more than 400 acres of the Debacker farmstead were transferred.

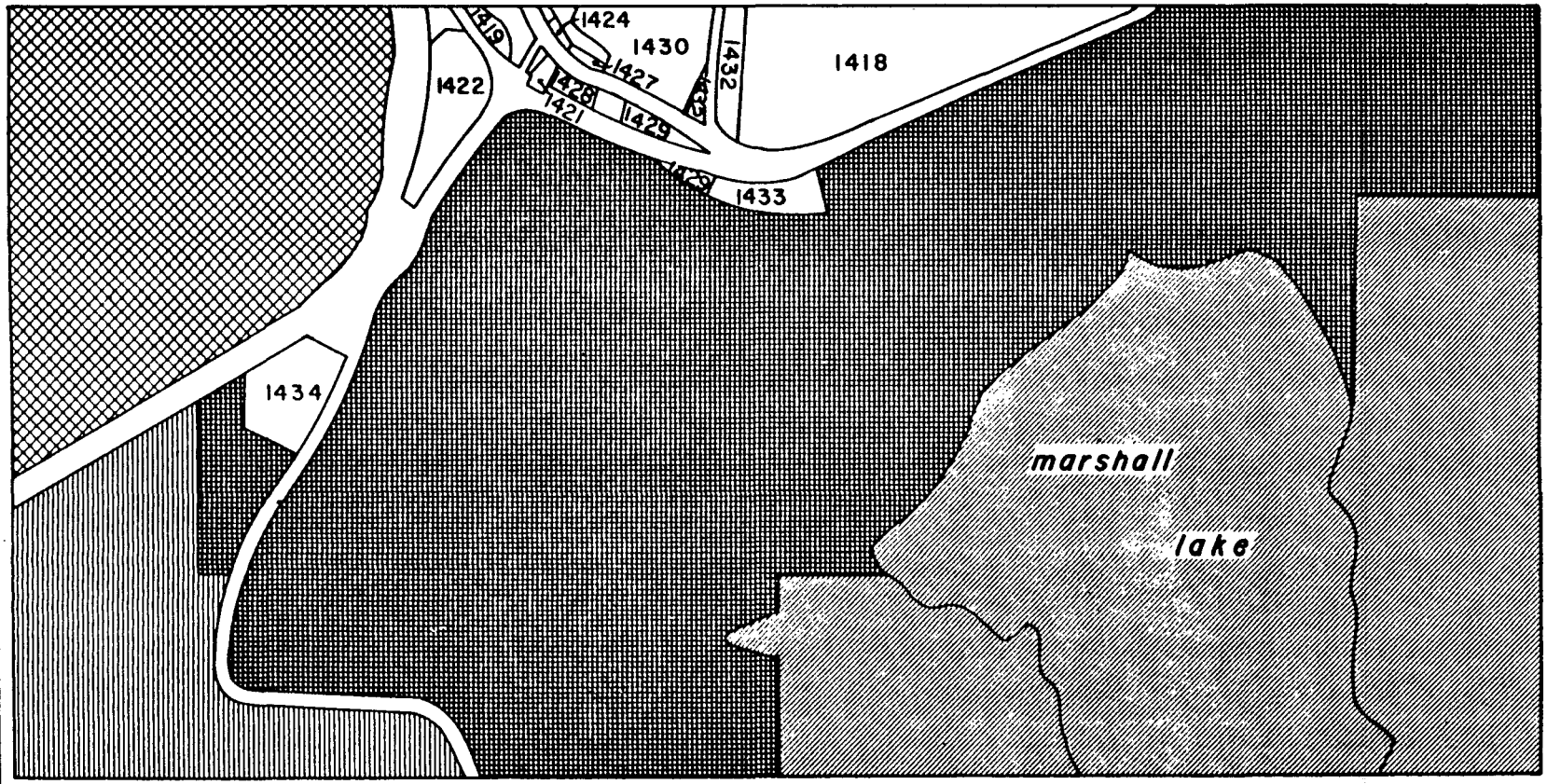
Future Ownership and Tenure

A large portion of the area around Marshall Mesa may be included in the Boulder greenbelt system in the future. If this change in land use occurs, a significant change in land ownership and tenure will probably occur. If these plans do not formulate, it seems reasonable to project that current land use patterns will fade into rural residential and corresponding commercial patterns as land owners, such as Mrs. William J. Thomas, continue to sell accessible strips of their farms to people with these intentions.

PAST CADASTRAL MAP OF MARSHALL MESA AREA

FIGURE 19

1949



SEC. 21 & 22
OF
R. 70W, TOWNSHIP 1 S.

SCALE
1000 0 1000 ft.

PROPERTY OF BIXLER
PROPERTY OF DEBAKER
PROPERTY OF THOMAS.
PROPERTY OF FARMERS R. & I. CO. AND COMMUNITY C. & R. CO.
VARIOUS OWNERS

1418 – ECHOLS
1419 – HALE
1421 & 1422 – CONDA
1424 – BRIERLEY
1427 – MILLER
1428 – WILLIAMSON
1429 – H. GABRIELLA
1430 – J. GABRIELLA
1432 – BUSHEFF
1433 – ECHOLS
1434 – ROSE

References

1. Boulder County Assessor's Office Land Book, 1970. Sections 21 and 22, T 1 S R 70 W.

2. Debacker, Mrs. Harold L. and Mrs. William J. Thomas, Marshall area land owners. 1970. Telephone interviews, March.

3. Rose, Edward L. Marshall area land owner. 1970. Telephone interview, March 24th.

CHAPTER V. LAND ECONOMICS

Gary A. Heaslet
Wil. Ulman
Helen Young

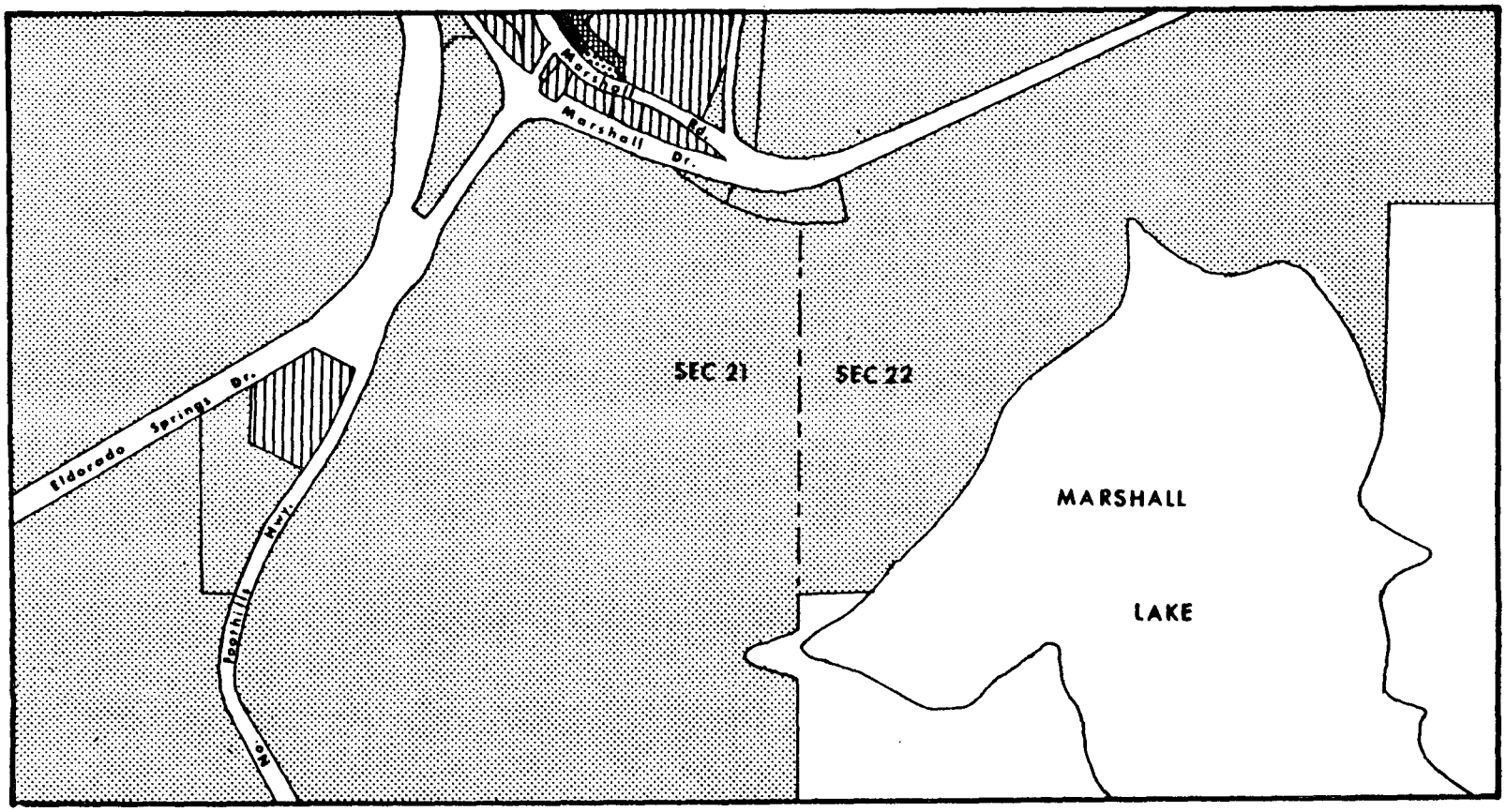
Methodology

This study compared land values in 1946 and 1970. The year 1946 was chosen because it reflects the immediate post-World War II land values. Both assessed and actual market values of the land are listed in Appendix B and Appendix C, and the actual market value per acre is shown in Figures 20 and 21. Assessed value represents only a percentage of the land's actual market value. In 1946, the Boulder County Assessor's Office assessed land at 16 per cent of its actual worth, whereas in 1970 the rate was 30 per cent (2). Only data on assessed value were available from the Assessor's Office; therefore, market value was computed from assessed value.

Changing Land Values

In order to make more meaningful comparisons between land value in 1946 and 1970, the purchasing power of the U.S. dollar should be considered. In 1947 the worth of the retail dollar was $1.25, compared with $0.864 in 1968. The retail dollar is computed by dividing the national average price index for the 1957-1959 base period (100.00) by the price index for a given period and expressing the result in dollars and cents (6). The reduced value of the dollar is important in comparing change in land value. Maps of 1946 and 1970 land values in the Marshall Mesa area illustrate this change (Figures 20 and 21). For ease in plotting, the area was divided on the basis of six categories of actual market values per acre. Appendices B and C list each tract and the acreage, followed by a comparison of actual market value and assessed value of the entire tract. One problem in mapping was the lack of land value information for land around Marshall Lake, because the land is owned by canal and reservoir companies which are tax exempt.

Land values are closely related to accessibility and frontage location along arterial roads. The higher-priced property is in homesites along Eldorado Springs Drive, Marshall Drive, and Marshall Road, and businesses located on the South Foothills Highway (Colorado Highway 93). An interesting aspect of land values in the area is that some of the more expensive land in the NW 1/4 of Section 21 is within the probably 100-year flood limit (3). The aesthetic appeal of a water-base frontage apparently outweighs the danger of building within the floodline boundary.



VALUE PER ACRE

- Tax Exempt
- $ 25 - 100
- $ 100 - 500
- $500 - 1000
- $1000 - 5000
- > $5000

N

SCALE 1000' 1000'

FIGURE 20

LAND VALUE

IN VICINITY OF

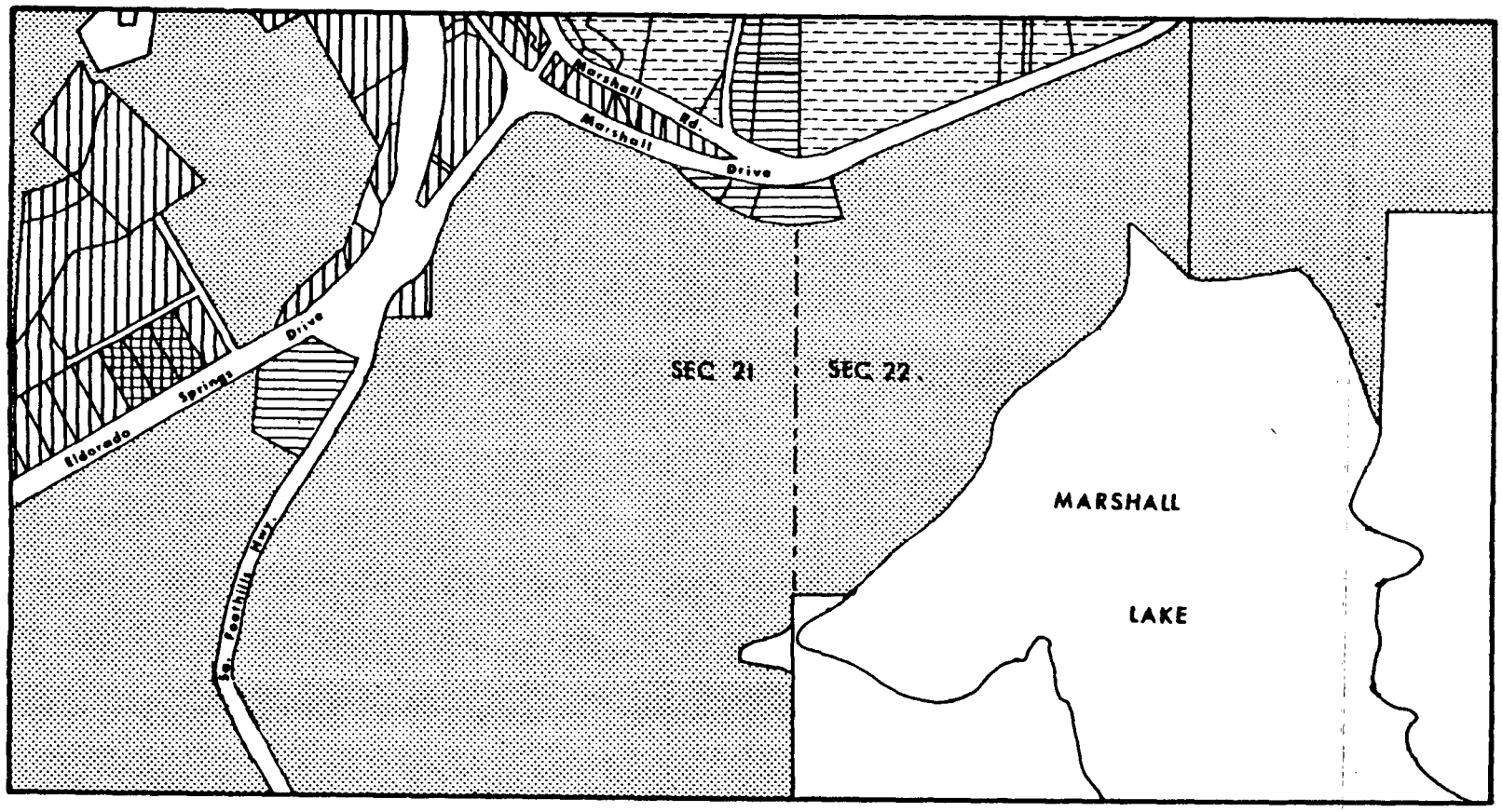
MARSHALL MESA

1946

Estimated property values

Data source – Assessor's office, Boulder County, April 1970

W.J.U.



VALUE PER ACRE

- Tax Exempt
- $10 - 200
- $200 - 500
- $500 - 1000
- $1000 - 5000
- > $5000

N

SCALE 1000' 1000'

FIGURE 21

LAND VALUE

IN VICINITY OF

MARSHALL MESA

1970

Estimated property values (land plus improvements) Data source - Assessor's office, Boulder County, April 1970

Future Economic Trends

Because the area is only 4 miles south of Boulder and is on the southern edge of Boulder's residential expansion, future growth with increasing land values may be expected. Accessibility presents no problem, as the area is well-supplied with all-weather roads. The recent widening of the South Foothills Highway may stimulate growth in the area. Since this is not a limited access highway, business along the highway probably will increase.

Field reconnaissance and interviews indicate that only two parcels of land are presently for sale in the area. A one-acre plot immediately south of the Matterhorn Restaurant, with 150 feet of frontage along the South Foothills Highway, is being offered through the Frank R. Komatz Agency in Denver, at $27,500. It has been for sale for some time (4). More than 250 acres belonging to Samuel Rudd and located south of the intersection of Marshall Drive and the South Foothills Highway and south along both sides of the highway, are for sale (5). Lack of data from which to infer the price of land and of details as to its location or sale prevent analysis of possible trends.

References

1. Boulder County Assessor's Office Land Books. 1956 and 1970.

2. Copeland, Harold, Bollder County Assessor's Office. 1970. Personal interview, April.

3. Kroeck, William, ed. 1968. South Boulder Creek: A Greenbelt Feasibility Study. Boulder City Planning Office and Department of Geography, University of Colorado, Boulder. Colorado.

4. Spokesman for Frank R. Komatz Realty Agency. 1970. Telephone Interview, Denver, Colorado, April.

5. Spokesman for office of Samuel Rudd. 1970. Telephone interview, Evergreen, Colorado, April.

6. The World Almanac. 1970.

CHAPTER VI. RECOMMENDATIONS

James Biggins

Max H. Dodson

The Marshall Mesa area is a micro-environment that has much research potential and educational value for biologists, ecologists, geologists, and geographers. Aspects of special interest include relative complexity in geologic structure, evidence of landform development, and diversity in vegetation. The site is particularly valuable because of proximity to the University and ease of access.

The following possible fields of research were suggested by the environmental study team (John L. Harper, Michael R. Tripp, and Dean G. Wilder):

1) biogeographical, plant ecological, and paleo-environmental studies to determine the origin and history of the ponderosa pine stand;

2) investigations of the complex of faults and associated structures;

3) genetic studies of the planar surfaces that form the summits of Marshall Mesa and the central shelf;

4) geomorphic studies of the shelf and the smaller bluff-like exposures of sandstone;

5) analyses of surface and subsurface hydrologic characteristics of the slope; and

6) micro-scale ecological and pedogenic studies on the shelf and its slope.

With respect to the last suggestion, the establishment of a series of permanent quadrats would be useful, in order to observe the relationships of the biota to a variety of topographic, edaphic, and micro-climatic situations and the rate of natural recovery of the area after protection is assured. The environmental study team also suggests that an automatically recording weather station, similar to those maintained by the Institute of Arctic and Alpine Research, would provide valuable data. The site could be used to great advantage by educational institutions in the Boulder area. It is believed that <u>organized</u> large groups would not damage the site.

However, damage of the natural environment and the risk of personal injury would incur with public use of the site. Cattle- and vehicle-proof peripheral fencing would be required to insure protection of the natural environment. The environmental study team noticed signs of littering, motorbike riding, overgrazing, and even camping. There also exists the danger of falls from steep escarpments and into old mining pits. Residential development of the area would have similar disadvantages, but with the added hazard of damage to houses in the event that underground

mine workings collapse. The companies that control Davidson and Community Ditches must maintain the ditches, but they should be impressed with the importance of preserving the landscape.

The Boulder Greenbelt Plan would be enhanced by acquisition of the Marshall Mesa natural area, providing that limitations are imposed on the use of the site. According to Mr. Larry Blick, Assistant City Manager of Boulder, the Marshall Mesa area has low priority in the greenbelt acquisition time table. Mr. Blick estimates that it will be at least five years before the area is actually considered for acquisition (1). In view of this, the City and the University should be constantly alert to any changes in land use of the area and to signs of possible change. If change in use become imminent, acquisition priority should be reviewed.

Mrs. Joanna F. Sampson, a resident of Marshall, believes that the community, especially the owners of small properties, are favorable towards greenbelt/open space uses (3). However, when and if the City, County, or University acquire rights to exclusive use of the site, they should be aware that Mr. Samuel L. Rudd, owner of the site and most of the adjacent land to the south, favors incorporation of the site in a greenbelt only if this would be "economically feasible." Mr. Rudd said that he would cooperate with any governmental or University officials in determining future uses of the area (2).

References

1. Blick, Larry N., Assistant City Manager of Boulder, Colorado. 1970. Telephone interview, May 11th.

2. Rudd, Samuel L., Land owner, Marshall area. 1970. Telephone interview, May.

3. Sampson, Joanna C., Resident and land owner, Marshall, Colorado. 1970. Personal interview, May.

APPENDIX A

LAND OWNERSHIP OF MARSHALL MESA AND SURROUNDINGS

T.1S., R.70W. SEC. 21 & 22

Section 21

1/4 Sec	1/4 1/4 Sec	Acres	Name Name
NW	NE (Less Tracts)	26.53	Lavina Thomas
	NW (Less Tracts)	26.33	Lavina Thomas
	SE (Less Tracts)	9.18	Lavina Thomas
	SW (Less Tracts)	3.71	Lavina Thomas
SW	NE (Less Tracts & Hwy.)	37.34	Samuel L. Rudd
	NW (Less Highway)	34.55	Samuel L. Rudd
	SE	40.00	Samuel L. Rudd
	SW (Less Highway)	40.00	Samuel L. Rudd
NE	NE (Less Tracts & Hwy.)	12.00	Samuel L. Rudd
	NW (Less Tracts)	23.00	Samuel L. Rudd
	SE	40.00	Samuel L. Rudd
	SW (Less Tract 2958)	37.50	Samuel L. Rudd
SE	NE	40.00	Samuel L. Rudd
	NW	40.00	Samuel L. Rudd
	SE (Less Tract 1413)	39.00	Samuel L. Rudd
	SW (Less Highway)	40.00	Samuel L. Rudd
Note: Mineral Reserves under Section 21		640.00	Rocky Mountain Fuel Company

LAND OWNERSHIP OF MARSHALL MESA AND SURROUNDINGS

Section 21

Tracts

1/4 Sec	1/4 1/4 Sec	Tract Number	Acres	Name
NE	NW	1421	0.14	Wesley Conda
NE	NE	1418-A	2.20	William S. Jeske
NE	NW	1421-A	0.20	Wilbert J. Hale
NE	NW	1419	1.00	William W. Bright
NE	NW	1422	4.16	Wesley Conda
NE	NW	1422-C	0.20	Gary J. Moon
NE	NW	1423-A	0.60	Louis A. Geolfos
NE	NW	1424	0.20	Wesley Conda
NE	NE	1427	0.25	Angelo Gabriella
NE	NW	1428	0.50	Mary J. Williams
NE	NE	1428-A	0.10	Angelo Gabriella
NE	NE	1431-A	0.20	Angelo Gabriella
NE	NE	1429	1.00	Henry Gabriella
NE	NE	1429-A	1.08	Vincent Gabriella
NE	NE	1430-A	1.20	Mary Vickery
NE	NE	1430-B	9.01	Carmella Gabriella
NE	NE	1431	0.20	Joe Gabriella
NE	NE	1432	4.20	William S. Jeske
NE	NE	1433	6.66	E. L. Smith
NE	NE	1433-A	0.60	Lester E. Whetstine
NW	SE	1434	11.79	E. L. Rose
NE	NW	2036	0.80	Gary J. Moon
NW	NE	2090	1.30	B. P. Miller
NW	SE	2090-A	0.70	Evergreen Girls Ranch, Inc.
NW	NE	2090	*	Terrace Swimming Company
NW	SE	2090	*	The Chimes, Inc.
NW	SE	2090-C	1.00	Supernac Oil Company
NW	NE	2514-A	3.00	San Soucie Trailer Court
SW	NW	2305		C. E. Shannon
SW	NW	2305-C	3.00	C. E. Shannon
SW	NW	2305-D		C. E. Shannon
SW	NW	2305-A	1.00	Arnold E. Ingram
SW	NW	2305-B	1.00	Michael Harris
SW	NW	2305-E	1.00	Robert Keefer
NW	SW	2305-F	2.00	Robert Keefer
NW	SW	2305-G		Robert Keefer

LAND OWNERSHIP OF MARSHALL MESA AND SURROUNDINGS

Section 21

Tracts

(Contd.)

1/4 Sec	1/4 1/4 Sec	Tract Number	Acres	Name
NW	NW	2409	0.30	Town of Lafayette
NW	NW	2432	1.90	Town of Lafayette
NW	NE	2514	1.70	Montford Whiteley
NW	SW	2779	10.50	Robert Keefer
NW	SW	2779	10.50**	G. A. Belding
NW	SW	2779-A	1.50	Alberta M. Kingery
NW	SE	2958	2.37	William T. Bullard
NW	SW	3117	1.003	Henry Hogan
NW	SW	3234	3.00	Vincent Theis
NW	NW	3447	7.40	Jack Taylor
NW	SE	3472	2.084	Robert Sisemore
NW	SW	3548	5.00	Robert Keefer
NW	NW	4018	3.40	Jack Taylor
SE	SE	1413	1.00	Community Canal & Res. Co.

* Improvements Only

** Mineral Rights

LAND OWNERSHIP OF MARSHALL MESA AND SURROUNDINGS

Section 22

1/4 Sec	1/4 1/4 Sec	Acres	Name
NW	NE (Less Tracts)	30.00	Samuel L. Rudd
	NW (Less Tracts)	24.00	Samuel L. Rudd
	SE	25.00	Samuel L. Rudd
		15.00	Community Canal & Res. Co.
	SW	40.00	Samuel L. Rudd
SW	NE	37.00	Community Canal & Res. Co.
		3.00	Samuel L. Rudd
	NW	32.79	Samuel L. Rudd
		7.21	Community Canal & Res. Co.
	SE	40.00	Community Canal & Res. Co.
	SW	40.00	Community Canal & Res. Co.
NE	NE	40.00	Mrs. H. L. Debacker
	NW	40.00	Mrs. H. L. Debacker
	SE	40.00	Farmers Res. & Irrigation Co.
	SW	16.93	Community Canal & Res. Co.
		23.07	Mrs. H. L. Debacker
SE	NE	40.00	Farmers Res. & Irrigation Co.
	NW	38.88	Community Canal & Res. Co.
		2.12	Chicago Title & Trust
	SE	40.00	Farmers Res. & Irrigation Co.
	SW	40.00	Community Canal & Res. Co.
Note: Mineral Reserves under Section 22		640.00	Rocky Mountain Fuel Company

LAND OWNERSHIP OF MARSHALL MESA AND SURROUNDINGS

Section 22

Tracts

1/4 Sec	1/4 1/4 Sec	Tract Number	Acres	Name
NW	NE	1418-D	1.00	Ira Albert
NW	NW	1418-B	16.00	Joanna F. Sampson
NW	NW	1418-C		Joanna F. Sampson
NW	NE	1418-B1	1.06	Gale R. Horsman
NW	NW	1418	0.50	Luke Echols
			0.125	Linda Harris
			0.125	Phyllis Echols
			0.125	Galdys Frye
			0.125	Mary Pease

APPENDIX B

ACTUAL AND ASSESSED LAND VALUES - 1946

Section 21

Legal Description or Tract Number	Acreage	Assessed Value	Actual Value
1418 & 1433	24.7	$200.00	$1,250.00
1432	4.18	50.00	312.50
1430 & 1431	26.38	500.00	3,125.00
1422	4.88	50.00	312.50
1421	0.31	50.00	312.50
1423	0.42	30.00	187.50
1424	0.12	50.00	312.50
1419	0.36	20.00	125.00
NE¼, NE¼	12.0	60.00	375.00
NW¼, NE¼	8.0	80.00	500.00
NW¼, NE¼	23.0	120.00	750.00
1426	0.59	50.00	312.50
1427	0.30	50.00	312.50
1428	0.96	50.00	312.50
SE¼, NE¼	40.0	180.00	1,125.00
SW¼, NE¼	40.0	180.00	1,125.00
NE¼, SE¼	40.0	180.00	1,125.00
NW¼, SE¼	40.0	180.00	1,125.00
SE¼, SE¼	39.0+	180.00	1,125.00
SW¼, SE¼	40.0	180.00	1,125.00
property in NW¼ (Thomas property)	113.0	640.00	4,000.00
property in NW¼ (Debacker property)	11.0	50.00	312.50
1434	6.0	200.00	1,250.00
NE¼, SW¼	34.0	140.00	875.00
NW¼, SW¼	40.0	180.00	1,125.00
SE¼, SW¼	28.0	130.00	812.50
SE¼ SW¼	12.0	50.00	312.50
SW¼, SW¼	40.0	180.00	1,125.00
1429	7.17	150.00	937.50

ACTUAL AND ASSESSED LAND VALUES - 1946

Section 22

Legal Description or Tract Number	Acreage	Assessed Value	Actual Value
NE¼, NW¼	30.0	$200.00	$1,250.00
NW¼, NW¼	24.0	180.00	1,125.00
SE¼, NW¼	25.0	180.00	1,125.00
SW¼, NW¼	40.0	270.00	1,687.00
NE¼, SW¼	40.0	no tax	----
NW¼, SW¼	45.3	310.00	1,937.00
SE¼, SW¼	40.0	no tax	-----
SW¼, SW¼	40.0	no tax	----
NE¼, NE¼	40.0	270.00	1,687.50
NW¼, NE¼	40.0	270.00	1,687.50
SE¼, NE¼	40.0	no tax	----
SW¼, NE¼	23.0+	290.00	1,812.50
SE¼	160.0	no tax	----

APPENDIX C

ACTUAL AND ASSESSED LAND VALUES - 1970

Section 21

Legal Description or Tract Number	Acreage	Assessed Value	Actual Value
property in NW¼ (Thomas property)	66.75	$ 2,820.00	$ 9,298.00
property in SW¼ (Rudd property)	151.89	1,570.00	5,181.00
property in NE¼ (Rudd property)	112.50	1,330.00	4,379.00
property in SE¼ (Rudd property)	159.0	1,240.00	4,412.00
1421	0.14	270.00	891.00
1418-A	2.20	490.00	1,617.00
1421-A	0.20	270.00	891.00
1419	1.00	270.00	891.00
1422	4.16	1,320.00	4,356.00
1422-C	0.20	110.00	363.00
1423-A	0.60	270.00	891.00
1424	0.20	160.00	528.00
1427	0.25	120.00	396.00
1428	0.50	330.00	1,089.00
1428-A & 1431-A	0.30	270.00	891.00
1429	1.00	500.00	1,650.00
1429-A	1.08	330.00	1,089.00
1430-A	1.20	380.00	1,254.00
1430-B	9.01	880.00	2,904.00
1431	0.20	270.00	891.00
1432	4.20	490.00	1,617.00
1433	6.66	550.00	1,190.00
1433-A	0.60	270.00	891.00
1434	11.79	2,000.00	6,600.00
2036	0.80	770.00	2,541.00
2090	1.30	1,920.00	6,336.00
2090-A	0.70	no tax	---
2090-C	1.00	1,510.00	4,420.00
2514-A	3.00	15,630.00	51,579.00
2305, 2305-C & D	3.00	1,970.00	6,501.00

ACTUAL AND ASSESSED LAND VALUES - 1970

Section 21

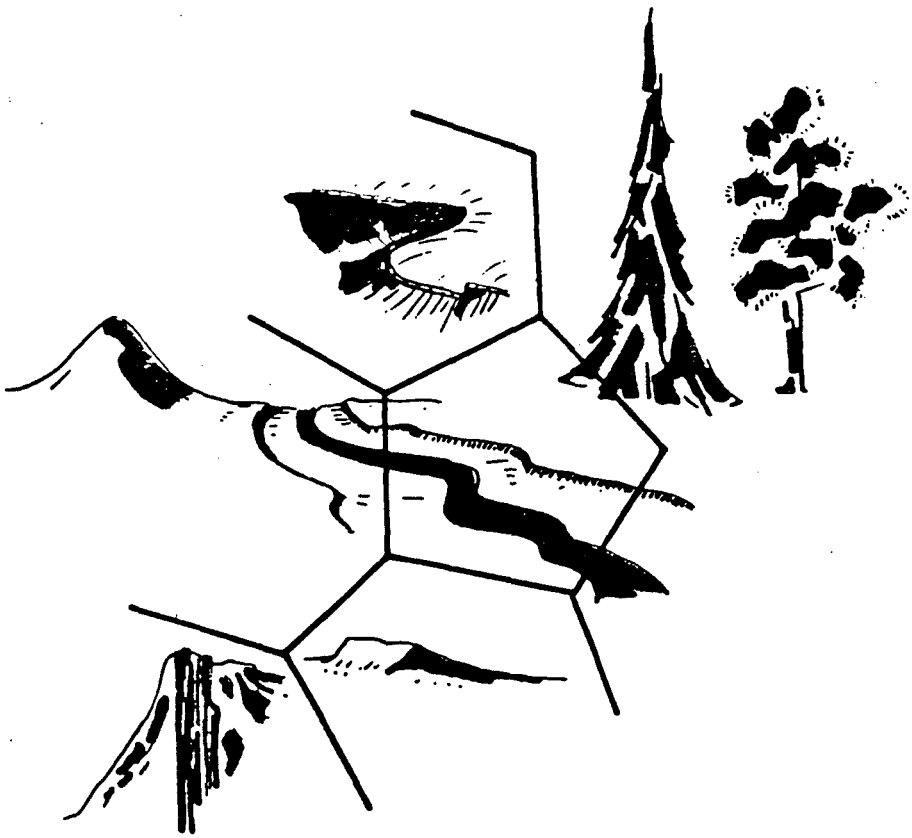
(Contd.)

Legal Description or Tract Number	Acreage	Assessed Value	Actual Value
2305-A	1.00	$ 820.00	$ 2,706.00
2305-B	1.00	820.00	2,706.00
2305-E, F, & G	3.00	14,820.00	48,906.00
2409 and 2432	0.30	no tax	---
2514	1.70	1,320.00	4,356.00
2779	10.50	3,000.00	9,900.00
2779-A	1.50	880.00	2,904.00
2958	2.37	2,060.00	6,798.00
3117	1.003	820.00	2,706.00
3234	3.00	990.00	3,267.00
3447	7.40	2,500.00	8,250.00
3472	2.084	880.00	2,904.00
3548	5.00	1,100.00	3,630.00
4018	3.40	900.00	2,970.00
1413	1.00	no tax	---

Section 22

property in NW¼ (Rudd property)	119.0	$ 1,110.00	$ 3,663.00
property in NW¼ (Canal & Reservoir)	15.0	no tax	---
property in SW¼ (Rudd property)	35.79	400.00	1,320.00
property in SW¼ (Canal & Reservoir)	124.2	no tax	---
property in NE¼ (Debacker property)	103.0	920.00	6,660.00
property in NE¼ (Canal & Reservoir)	23.07	no tax	---
property in SE¼	121.00	no tax	---

WHITE ROCKS
Natural Area Study



Department of Geography / University of Colorado

WHITE ROCKS

NATURAL AREA STUDY

Donald D. MacPhail
Editor

with

Helen Louise Young
and

Dennis I. Netoff

DEPARTMENT OF GEOGRAPHY
UNIVERSITY OF COLORADO

Boulder, Colorado
1970

TABLE OF CONTENTS

Chapter		Page
	FOREWORD Donald D. MacPhail	v
	ACKNOWLEDGEMENTS	vii
I.	INTRODUCTION Helen Louise Young	1
II.	THE ENVIRONMENT Dennis I. Netoff and Helen Louise Young	4
	General Geologic Structures Upper Cretaceous Stratigraphy Occurrence of Polygonal Patterns Types of Polygonal Jointing The "Turtleback" Form Origin of Stress Moisture Content of Polygons Origin of the "Turtleback" Form Local Anomalies Other Geomorphic Features Vegetation Fauna	
III.	EFFECTS OF CHANGING LAND USE Helen Louise Young	22
	The Soil and Agricultural Potential Urban Growth and Expansion Present Utilization of White Rocks Adverse Effects of Encroachment	
IV.	CONCLUSIONS AND RECOMMENDATIONS Helen Louise Young	37
	Conclusions Recommendations	
	BIBLIOGRAPHY	40
APPENDIX A	FLORA FOUND AT WHITE ROCKS AS RECORDED BY THE UNIVERSITY OF COLORADO MUSEUM HERBARIUM	45
APPENDIX B	FAUNA FREQUENTLY SIGHTED AT WHITE ROCKS	47
APPENDIX C	SELECTED BIBLIOGRAPHY OF WORKS RELATING TO WHITE ROCKS	49
APPENDIX D	LIST OF INDIVIDUALS CONTACTED THROUGH INTERVIEWS AND THOSE WHO SUBMITTED LETTERS RELATING TO THE VALUE OF WHITE ROCKS	51

FIGURES

		Page
1.	Location of White Rocks	3
2.	Idealized Plan View Map of Joint Systems	5
3.	Surface Outcrop of Polygonal Joint Patterns in Laramie Sandstone	6
4.	South-facing Cliff Exposes Highly Pitted Laramie Formation	8
5.	Tall Grass and Scrubby Brush Grow at Base of Outcrops	8
6.	Polygonal Joint Patterns - Orthogonal and Non-orthogonal	12
7.	The "Turtleback" Form	14
8.	Rolling, Rocky Exposure of the Laramie Sandstone at White Rocks	14
9.	Weathering Pits at White Rocks	18
10.	Aerial View of the White Rocks with High-angle Reverse Fault	18
11.	Land Capability - White Rocks and Vicinity	23
12.	Aerial View of White Rocks Area, Looking Northwest	25
13.	The Vertical Cliff at White Rocks, Striking Stratigraphic View	25
14.	Land Use, 1941 - White Rocks Area	28
15.	Land Use, 1955 - White Rocks Area	29
16.	Land Use, 1963 - White Rocks Area	30
17.	Land Use, 1969 - White Rocks Area	31

TABLES

Page

1. Population Growth, City of Boulder 27

2. Changing Land Use in the White Rocks Area 32

Publication of this report is made possible through grants from the following:

University of Colorado Foundation
The City of Boulder
The Boulder County Commissioners
The Graduate School, University of Colorado
Boulder Valley School District No. RE 2(J)

FOREWORD

This report is one of six undertaken this year in the Department of Geography at the University of Colorado. It has become almost a tradition for the graduate seminar in land use to initiate a project in the local area in cooperation with an agency of the Boulder community on either the municipal or county level, sometimes both.

These studies achieve a number of objectives. The participating students undertake a realistic project which they are able to plan, execute, and publish within the brief span of one semester. Also, these studies provide new information for municipal and county officials and citizen groups concerned with planning and guiding the growth and development of the City of Boulder and Boulder County. In short, these are professional training exercises for graduate geographers and are a serious effort in providing new planning perspectives in the interest of public service.

In response to a suggestion by the Natural Areas Committee of the University of Colorado, the land use seminar elected to study and analyze a number of natural sites in the Boulder Valley. The group was also joined in the endeavor by the graduate field seminar of the Department of Geography.

The cooperative base within the Boulder community was wider than usual this year. The sites chosen for study seemed to have potential for a variety of uses beyond their present development. These included instruction of public school and university students, scientific research, recreation, greenbelt, and open space. The graduate students involved worked in cooperation with the resident property owners, the Parks and Recreation Department and the Planning Office of the City of Boulder, the Department of Development and the Parks and Open Space Advisory Committee of Boulder County, the Boulder and Longmont Offices of the Soil Conservation Service, the Science Director of the Boulder Valley RE-2 School District, the Planning Office and the Natural Areas Committee of the University of Colorado, and the Denver Regional Council of Governments.

Sometimes the graduate researchers felt they would have liked to pursue certain themes in greater depth if there had been more time available. Nonetheless, they join me in expressing the hope that this report provides informative insights on a fascinating part of Boulder County.

This particular report on the White Rocks area departs in format and content from the companion studies in this series. The various chapters which appear in this volume are excerpts from two master's theses in geography completed this year at the University of Colorado. The White Rocks is such an interesting and important natural area in the Boulder Valley that everyone concerned felt the need for publishing this information now. The more detailed theses are available in Norlin Library on the Boulder campus of the University. We are grateful to Miss Helen Louise Young and

Mr. Dennis I. Netoff in cooperating with us in this effort and allowing us to combine portions of their fine studies as a rather complete report on the area.[1] The chapters included here represent the endeavors and views of the authors and in no way should be interpreted as the official views of the Department of Geography or any other cooperating agency or organization previously mentioned. Because of this independence from official views, the participants in this project are especially grateful to the Graduate School of the University of Colorado, the City of Boulder, the Boulder County Commissioners, the Boulder Valley RE-2 School District, and the University of Colorado Foundation for sharing the costs of printing this report.

This is the collective and individual effort of a group of dedicated geographers concerned about the quality of the local environment and its attendant stresses. Boulder County residents, students, and local officials may gain understanding from this report that will assist them in their efforts to perpetuate the Boulder area as a pleasant and attractive place to live.

Donald D. MacPhail, Ph.D.
Professor of Geography

Boulder, Colorado
June, 1970

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[1]Netoff, Dennis I., Polygonal Jointing in Sandstone Near Boulder, Colorado, M.A. Thesis in Geography, University of Colorado, Boulder, 1970.

Young, Helen Louise, White Rocks: Social, Cultural and Land Use Changes Affecting A Natural Area, M.A. Thesis in Geography, University of Colorado, Boulder, 1970.

ACKNOWLEDGEMENTS

Mr. Netoff notes that helpful suggestions and cricicisms have been made by professors and graduate students in geology and geography. He feels especially indebted to Dr. William C. Bradley and Dr. Albert W. Smith for their advice and encouragement, and to Dr. Peter Birkeland for assistance and direction. Appreciation is also expressed to the owner of part of the White Rocks area, Mr. Tel Ertl, for permitting intensive field work to be conducted.

Miss Young mentions her appreciation to many individuals who aided her study efforts. She extends thanks to the following persons: to Professor M. John Loeffler for time spent in direction and guidance throughout the thesis preparation and for the use of the Colorado Piedmont base map; to Dr. Horace F. Quick for helpful suggestions; to many geography graduate students for aid and advice in research, mapping, and photography of the study area; to Mr. Ross Campbell and Mr. Harold Nesbitt for the use of U.S.D.A. aerial photography and soil maps of the area; to Dr. William Weber for supplying records of plants collected at White Rocks; to all individuals who willingly provided information in interviews and to Mr. Tel Ertl, landowner, for allowing access to his portion of the rock outcrop. Special thanks are extended to Mrs. Martha R. Weiser, owner of the western half of the outcrop, for her cooperation in allowing access to the area, providing documents helpful in the thesis preparation and her enthusiastic support and aid throughout the research. Miss Young also wishes to express appreciation to her parents for their support and encouragement.

Finally, our thanks go to Mrs. Nancy Stonington for her creation of the cover design, and to Mrs. Sue Middleton, Secretary of the Department of Geography for typing the report. To Mr. Wilbert J. Ulman, we are indebted for his work with the copy camera and contact printer in the final preparation of the maps for publication.

Donald D. MacPhail

CHAPTER I. INTRODUCTION

Helen Louise Young

Many planners and private citizens are acutely aware of the change from land in open space to land in urban use. This awareness has, however, been created after urban expansion has already taken place; therefore, a nation-wide information program stressing present needs for more careful consideration of how land should be used is essential.

In order to adequately understand the need for open space, one must understand the meaning of the term. A universally acceptable definition has not been formulated. In the course of a University of California study on open space, Herring (1965) interprets the term as "encompassing any space which allows contact with Nature, though it may serve other utilitarian functions, such as conservation or postponement of urban development." A more precise definition is offered by J. M. Davis (1963). Stressing that open space is not merely vacant space, Davis lists three requirements: 1) the space must be relatively free of man-made structures and give the apperance of a natural landscape; 2) relatively free of vehicular traffic; and 3) must meet acreage requirements that vary in proportion to the intensity of use and the density of development in surrounding areas (U.S.D.A., 1963, p. 337). Open space, then, can be described as land left undeveloped for the purposes of recreation, scientific study, protection of wildlife, watersheds, or a buffer to urban encroachment.

Until the 1960s, Colorado was not acutely aware of the pressing need for open space simply because the problem did not exist in this state. The abundance of a resource, open land, masked the necessity for its conservation at that time. Beginning in the 1960s, an increase in population and industrial expansion has taken place on the eastern slope of the Front Range of the Rocky Mountains. One cannot drive along the Colorado Piedmont from Pueblo to Fort Collins without noticing urban development. Seeing former open space occupied by haphazard suburban and industrial development, planners instigated conservation practices. The trend toward conservation increased in importance during the latter part of the 1960s and now continues into the 1970s.

The growth of the Boulder Metropolitan Area[1] exemplifies the type of urban expansion occurring on the Colorado Piedmont. According to a recent Chamber of Commerce estimate, the population of Boulder has nearly doubled in the past ten years. An 86 per cent increase in population has taken

---

[1]A term used by the Boulder, Colorado Chamber of Commerce referring to persons living within the City's water and sewer service area.

place from 1960 to 1970 (Boulder Chamber of Commerce, 1970). Much of the growth has been south and east of the city. Two striking examples of suburban, single-family, residential expansion are the Table Mesa subdivision south of Boulder and the Gunbarrel Hill subdivisions northeast of the present city limits. The continued growth of these and similar subdivisions underlines the demand for saving open space.

The awareness of space conservation was not an unheard of idea in Boulder, even years ago. Frederick Law Olstead, Jr. (1910) prepared a report on density and zoning for the City of Boulder, which mentioned the setting aside of publicly-owned land for large parks. However farsighted these concepts might have been, their general idea was virtually ignored until a few years ago. In September, 1964, a City of Boulder publication, "Boulder's Fringe Area Objectives," presented a scheme for preserving Boulder's natural beauty by protecting it from urban encroachment. Suggested as the protective measure was an open-area reserve (greenbelt) to tie together the endangered tracts.

Certainly outdoor laboratories and study sites for the natural sciences would be one type of utilization for the open spaces around Boulder. One function of protected sites, according to Boulder planners, is for scientific use. With the University of Colorado located in Boulder, a need for such areas is critical. The natural sciences, biology, geography, and geology, for example, greatly benefit from the accessibility of suitable study sites, and such sites add to the national stature of these natural sciences. Fortunately, the University has had, and continues to have, an abundance of valuable study area. The continued accessibility to natural study areas cannot be assured, however, unless adequate measures are taken to protect these functional open spaces from the advance of urban sprawl. City and county planners and the University must work as a unit to save and acquire these additional tracts by means of thorough studies of the endangered sites and their problems. The White Rocks is such a study area and is presently used by several departments of the University of Colorado. It is an area facing problems from urban encroachment.

White Rocks, a 60-acre land area of outcropping sandstones, is located approximately 8 miles northeast of Boulder within the Denver-Boulder-Longmont urban triangle (Figure 1). Accessible by four- and two-lane roads from any point on the Colorado Piedmont, the physical environment of White Rocks is unique, is a scientifically valuable area, and is aesthetically attractive. The proximity of White Rocks to population centers makes it vulnerable to urban and highway encroachment, industry, trespassers, vandals, improper use by the scientific community, overgrazing, water and air pollution, all of which threaten its natural state. Increasing the public's awareness of the need for protecting remaining natural areas is essential to the preservation of White Rocks.

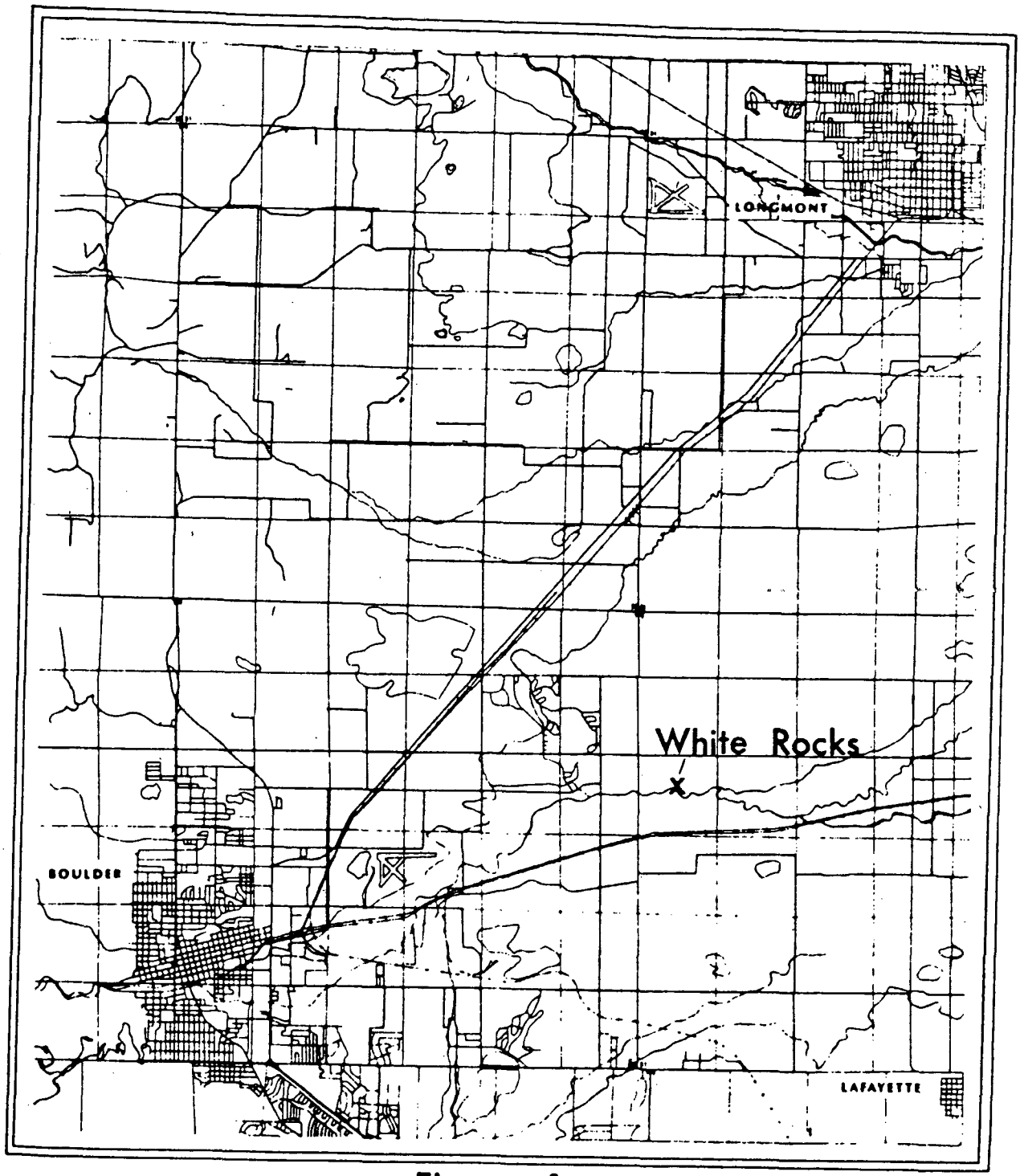

Figure 1

CHAPTER II. THE ENVIRONMENT

Dennis I. Netoff and Helen Louise Young

The area chosen for analysis lies in the semi-arid section of the Colorado Piedmont near Boulder, Colorado, where several surface outcrops of polygonal jointing occur (Figure 2). Special attention was given to the area known locally as the "White Rocks" (Figure 3), where the polygonal pattern is especially well manifested, and where easy access permitted detailed study.

The conspicuous and somewhat exotic feature that distinguishes many outcrops of the Laramie and Fox Hills sandstones near Boulder results from jointing of a type not usually found in sandstone. The joints intersect to form polygons[1] that differ from those typically developed in sandstone in geometric form and related topographic manifestation.

Two basic polygonal patterns occur. The first is characterized by a preponderance of right-angle intersections and bears close similarity to mud cracks and ice-wedge polygons in plain view (Figure 6). The second, occurring within the first, is composed of hexagonal and pentagonal figures that resemble columnar jointing in horizontal perspective (Figure 6). A hummocky topography that is closely related to joint occurrence gives a unique characteristic to the surface relief and influences the distribution of a variety of local flora and fauna.

General Geologic Structures

The major structural patterns of the Boulder area are controlled by two regional structural features, the Front Range anticline and the Denver Basin (Hunter, 1947), both formed during the Laramide orogeny. The Front Range anticline has a north-south axis and extends from Canon City, Colorado, north to Laramie, Wyoming. The Denver Basin, along the east flank of the Front Range, is an asymmetric trough and generally parallels the anticlinal axis.

The east-dipping, western limb of the basin is the principal structural feature. The sedimentary beds are steeply dipping near Boulder, then flatten rapidly a few miles to the east. It is within these gently dipping beds that the Upper Cretaceous sandstones under consideration here are found.

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[1] "Polygon" is used here to refer to a closed figure bounded on several sides, some or all of which may be curved.

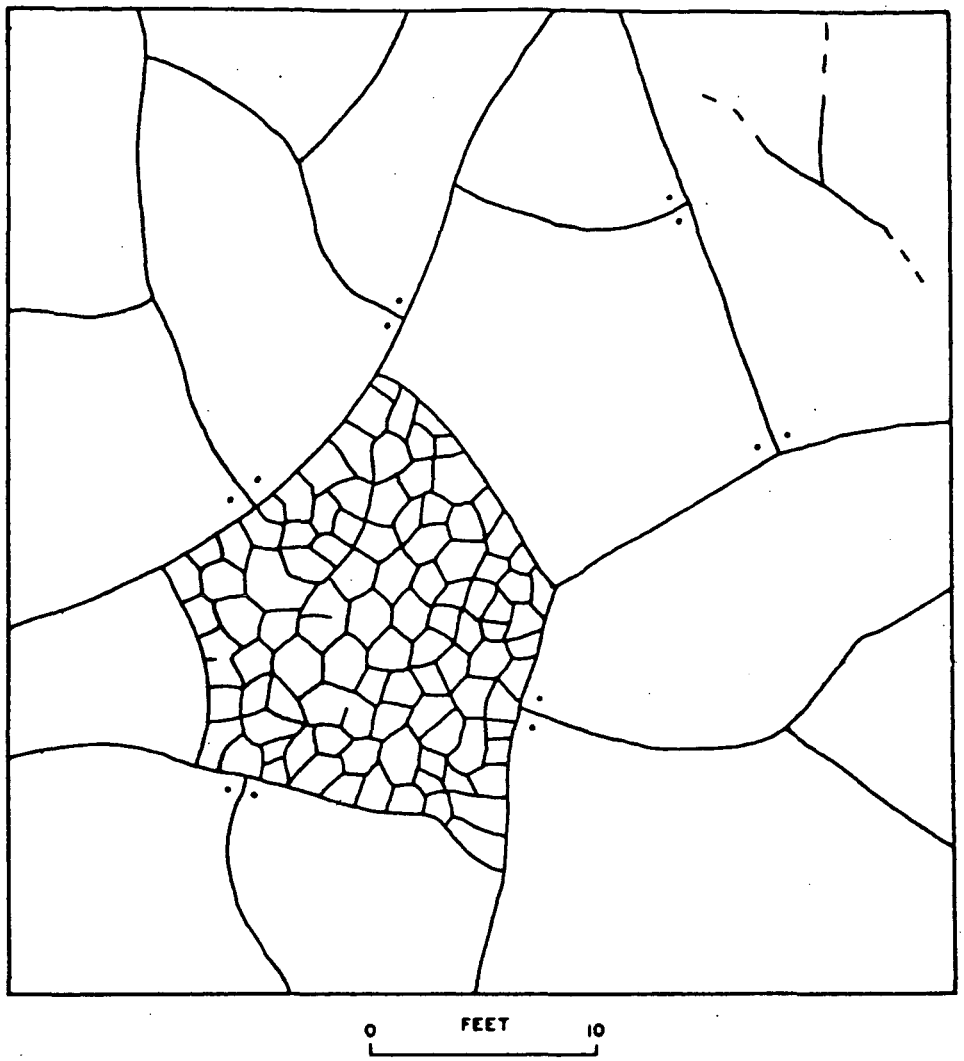
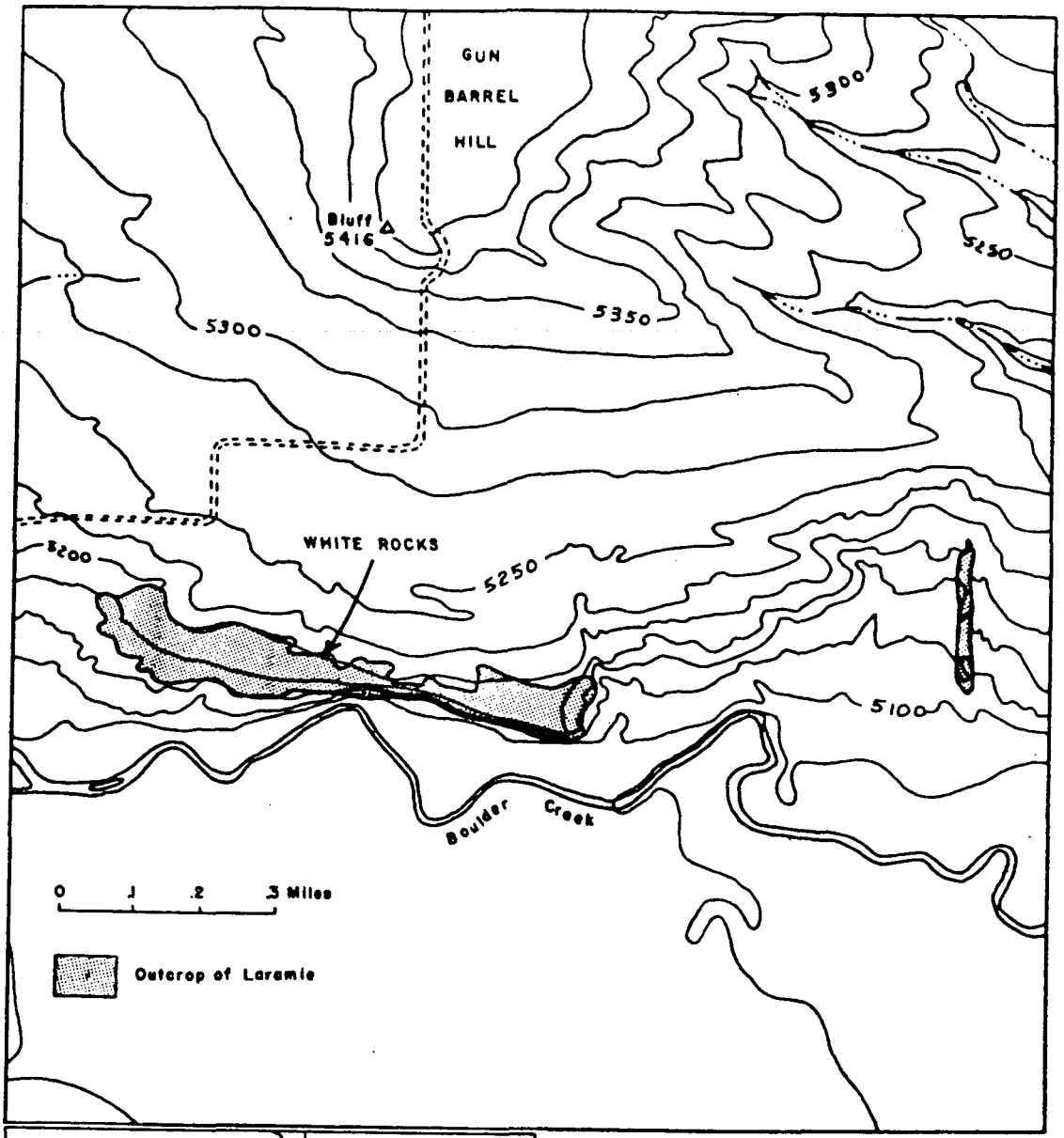


Figure 2. Idealized plan view map of joint systems. A high percentage of right angle intersections occur in the large joint system, while the smaller joints characteristically form hexagons and pentagons (dots denote right-angle intersections).



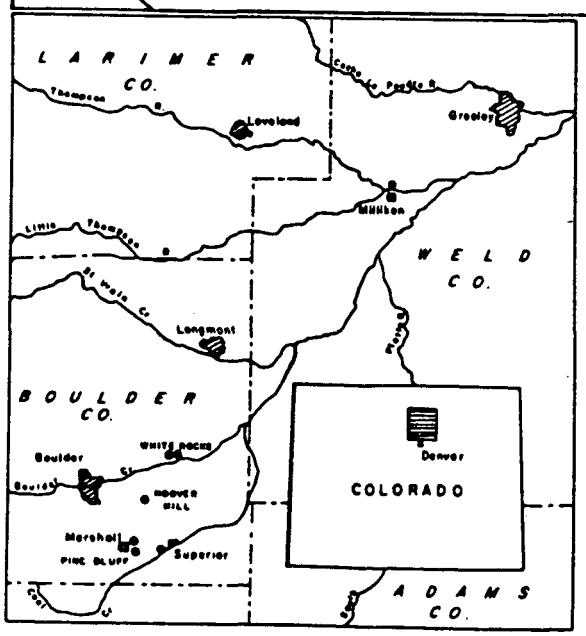


Figure 3. The White Rocks area. Polygonal joint patterns occur in nearly all surface outcrops of the Laramie Sandstone here. The contour interval in the map above is 25 feet.

The distribution of sandstone outcrops with polygonal jointing is shown on the small map at the left. Here the dots indicate the location of such occurrences.

● Sandstone outcrops with polygonal jointing

MILES

Figure 4. South-facing cliff exposes highly pitted Laramie sandstone. Beneath the lower, undercut part of the Laramie, a thin coal seam separates this formation from the Fox Hills which extends outward toward the floodplain as a bench. (Photo by Dennis Netoff)

Figure 5. Tall grass and scrubby brush vegetation grow at the base of the outcrops along North Boulder Creek. This vegetation cover and the caves created by the wind and solution hollows provide a variety of habitats for small mammals within a short horizontal distance. (Photo by Helen Louise Young)

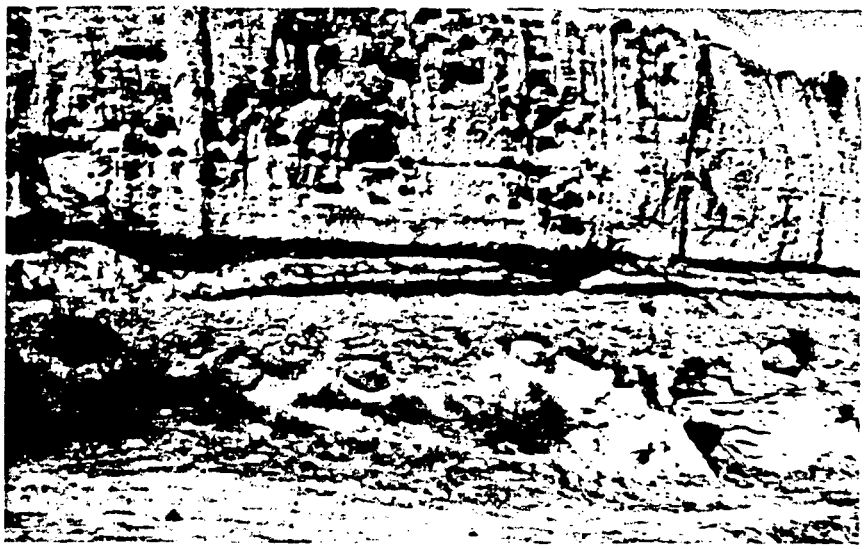


Figure 4

Figure 5

Local structural features are superposed on the regional structure, and are probably of Laramide origin. These include various types of folds and faults that tend to follow one or another of several basic patterns whose trends are predominantly north or northwest (Hunter, 1947). Many of the folds in the area between Marshall and White Rocks are subordinate to faults and are attributed to drag on faults (Parkinson, 1956).

Upper Cretaceous Stratigraphy

The uppermost Cretaceous sedimentary sequence in the Denver Basin is represented by a series of alternating sandstones, shales, and thin coal beds, all of which were deposited during a general regression of the Cretaceous sea. In this sea, subsidence and sedimentation were generally contemporaneous, but proceeded at different rates, resulting in regression when sedimentation exceeded subsidence and transgression when subsidence exceeded sedimentation (Fenske, 1963, p. 41). The polygonal joint patterns are found in the Fox Hills and Laramie formations, which were deposited during the last major regression of the sea.

The Fox Hills Formation

The Fox Hills formation is generally a light tan to brown colored, massive, cross-bedded and ripple-marked sandstone that is conformable with the underlying Pierre shale (Spencer, 1961). Grain size varies from coarse to fine, and numerous iron-stained, dark brown, hard, calcareous sandstone concretions are found in many places. Thickness varies from about 90 feet at White Rocks to 131 feet at Marshall (Parkinson, 1956, p. 11).

The upper and lower formation boundaries of the Fox Hills sandstone are difficult to locate exactly because of their transitional nature with the underlying Pierre shale and overlying Laramie formations. The lower boundary is usually accepted as the horizon below which the section is predominantly marine clay shales and sandy shales of Pierre age, and above which the section is buff to brown sandstone containing concretions (Lovering, 1932, p. 702). The upper boundary of the Fox Hills has been described by the same author as the horizon above which the section is composed predominantly of fresh and brackish-water deposits accompanied by coals and lignitic shales and below which it is predominantly marine. The location of this boundary, however, is controversial and several attempts have been made to change it (Gude, 1950; Goldstein, 1950; Horner, 1954). It is noteworthy, however, to recognize that many vertical as well as lateral facies changes exist in the formations and that marine sandstones may be present between the clays and lignites in the "non-marine part of the section."

The Laramie Formation

The Laramie Formation is a thick series of sandstones and shales, generally considered of fresh and brackish-water origin. The Laramie formation in the Denver Basin can be divided into two parts, a lower one of primarily sandstones and an upper composed mostly of clays. Sandstones of the lower part of the section tend to be white to buff in color, even-bedded, speckled,

and medium to fine-grained. Beds are usually soft and easily weathered and exposures are therefore scarce. Sandstone units may be separated by bands of sandy shale, lignitic shale, and intercalated coal seams. The upper part of the section consists mainly of clays, with some small lenticular bodies of sandstone (Horner, 1954, p. 14).

The Laramie overlies the Fox Hills conformably and in most places transitionally. The Laramie is unconformably overlain by the Denver and Arapahoe formations of early Tertiary age according to some authors, but others (Spencer, 1961) assign a late Cretaceous age to the Arapahoe and include it within the Laramie.

Polygonal joint patterns in the White Rocks area are restricted to the Laramie sandstones, and hence a brief discussion of the stratigraphy there seems pertinent. The exposed section consists of 250 feet of sediments which are predominantly sandstone (Fenske, 1963, p. 52). Here the Laramie and Fox Hills can be differentiated on the basis of color and lithology, and are separated by a conspicuous bed of lignitic shale, capped by a thin coal seam. The Laramie is a white, massive, even-bedded sandstone with a "salt and pepper" appearance due to the presence of black chert grains (Horner, 1954, p. 14), and forms a massive vertical cliff that overlooks the floodplain to the south. The Fox Hills is a light tan to brown, strongly cross-bedded sandstone with numerous brown concretions, and makes a step-like bench below the vertical face of the Laramie (Figure 4).

Occurrence of Polygonal Patterns

Polygonal jointing in sandstone in the Boulder area occurs in only a few places. Outcrops of both the Laramie and Fox Hills formations may display this pattern, but it is better known and commonly better developed on the Laramie, especially at White Rocks. The most extensive outcrop areas of polygonal jointing occur on river bluffs where undercutting by streams has exposed the massive sandstones. Other natural exposures are of minor areal extent and usually occur along the steeper side slopes of terraces or pediments. Sandstone outcrops recently exposed by man are not known to display polygonal jointing.

The presence of polygonal joint patterns appears to be closely related to present-day topography and unrelated to exposure to insolation and wind. Polygonal development is not restricted to any one plane and may be found on slopes varying from horizontal to almost vertical. Exposure to wind and sun does not seem to be an important factor in their distribution, as they have been observed on north-, south-, east-, and west-facing outcrops.

The evidence for polygonal patterns occurring beneath a soil or alluvial cover is inconsistent and inconclusive. Some recently exposed surfaces at White Rocks lack polygonal patterns. Two excavations were made into the overlying soil at White Rocks. Both excavations were marginal to exposed Laramie sandstone that was polygonal jointed. Faint joint patterns persisted over 4 feet back into the soil cover at the first area. The second excavation exposed only a mottled, irregular surface devoid of joints. The

explanation of this apparent discrepancy may be that all the joint patterns originated in a subaerial environment, but very recent eolian deposits have covered portions of formerly exposed sandstones. Additional escavations are needed before definite conclusions can be made.

Types of Polygonal Jointing

Two unique, but distinctively different types of polygonal joint patterns are apparent on almost all areas studied (Figure 6). The patterns can be classified according to whether or not the intersections of the joint are predominantly orthogonal, a classification that was used by Lachenbruch (1962, p. 44-55) to describe ice-wedge polygons in permafrost.

The two systems of jointing are different not only in pattern, but in scale. Orthogonal systems are much larger, and the joints that bound them will be referred to as megajoints. Nonorthogonal systems are smaller in size and give the appearance of being superimposed on the orthogonal systems, and are somewhat controlled in their pattern where they are adjacent to the megajoints. These will be referred to as microjoints.

The "Turtleback" Form

A unique topographic characteristic related to the combined effects of the orthogonal and nonorthogonal polygonal patterns has given the name "turtlebacks" to many exposed surfaces. Exposures at White Rocks reveal a gently undulating terrain with local relief of up to a few feet. Topographic highs are associated with the centers of polygons, while lows are coincident with joints, the larger joints occupying significant troughs and the microjoints creating a hummocky surface. Thus, the orthogonal polygons, when bounded on all sides by troughs, take on the appearance of a low dome with a hummocky surface created by microjoints, resembling a turtle's back (Figure 7 and Figure 8).

Origin of Stress

Much of the following discussion is speculative. The proposed theories regarding the origin of stresses that produced the polygonal joint patterns are yet to be proved and await further tests and experimentation.

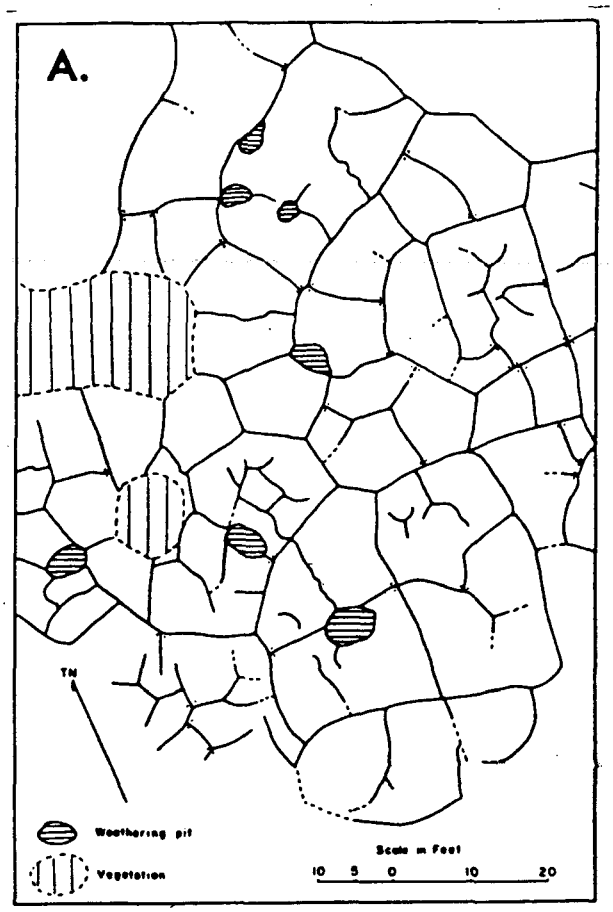
Thermal Hypothesis

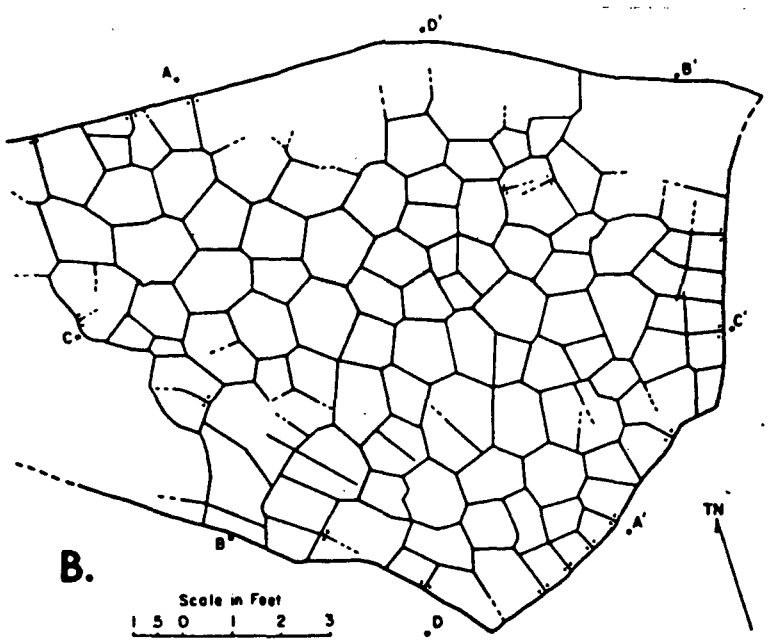
The theory of thermally induced breakage of rock is based on the fact that most materials expand when heated and contract when cooled. Fracture upon heating may occur when heat is rapidly applied to one part of the mass, causing differential expansion and creating shearing stresses that will result in rupture if the elastic strength of the rock is exceeded.

Desiccation Hypothesis

Volume changes related to clay mineral expansion and contraction are known to cause heaving and cracking in clayey material. Mud cracks and

A. (Right) Orthogonal system of polygons at White Rocks, with dots indicating right-angle intersections.





B. (Left) Nonorthogonal joint patterns in sandstone at White Rocks. Megajoints bound the smaller microjoints except on the eastern side where joints gradually fade. Dots denote right-angle intersections.

Figure 6

Figure 7. The "turtleback" form. The hummocky surface is associated with joint patterns. The diameter of the small polygons is about a foot. (Photo by Dennis Netoff)

Figure 8. Rolling, rocky exposure of the Laramie sandstone at White Rocks. Trees, shrubs, and grasses struggle for a foothold in the depressions where there is a thin veneer of soil and some moisture. (Photo by Helen Louise Young)

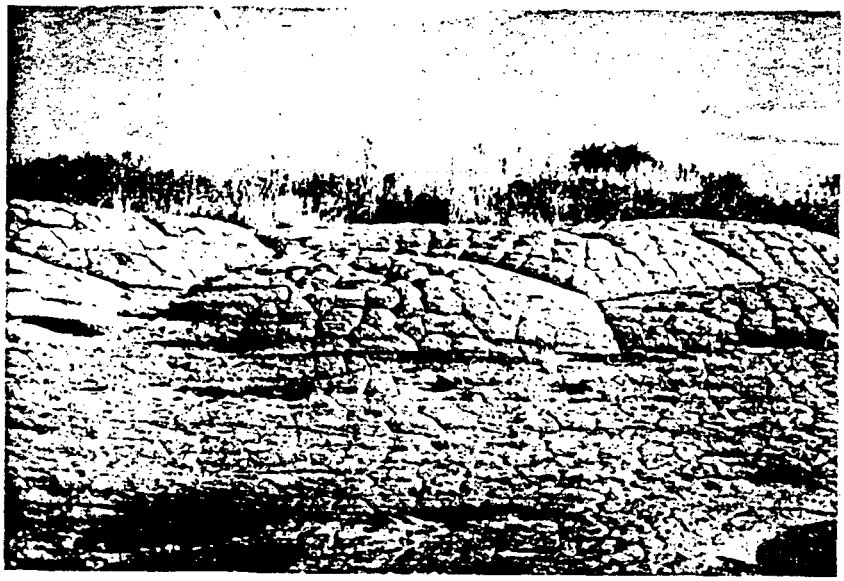


Figure 7

Figure 8

soil cracks, often forming well-developed polygonal patterns, are a common geologic phenomenon and are attributed to desiccation. Voluminous literature in soil mechanics has been dedicated to the effects of expansive clays on road and building construction.

Moisture Content of Polygons

The moisture content of the jointed sandstone varies vertically, horizontally, and temporally. Moisture characteristics are based primarily on field observation and some quantitative measurements.

The time factor is perhaps of greatest significance in producing local variations in moisture content. Sporadic rainfall is a typical characteristic of the climate, and hence during the course of a year the sandstone is subject to many wet and dry cycles. Following periods of rain or snow, the moisture content of the sandstone is at a maxiuum and may approach saturation, while extended periods of drought result in evaporation and maximum water loss.

Horizontal variations in moisture are especially evident as drying proceeds subsequent to periods of precipitation. While the centers of the polygons take on a dry appearance almost immediately, moisture may linger on for many hours in the troughs near the polygon borders. Moisture content at depth may also reflect this surface pattern. Although no ~~empirical~~ evidence was obtained to verify this, it seems logical for two reasons: first, the joints occupy the lowest point topographically, concentrating surface and subsurface water here by gravity; and second, the joint plane represents a zone of discontinuity and may act as a barrier to moisture migration.

Observation on the vertical distribution of moisture yielded interesting, and somewhat surprising results. Although the surface nearly always appears dry, the sandstone at a very shallow depth is constantly moist to sight and touch. Even after a month without precipitation, damp sandstone was found within 2 inches of the surface. Several samples of sandstone were selected from a vertical section up to a depth of 10 inches and were analyzed for moisture content. Samples were heated to 110 degrees Centigrade for 12 hours and moisture percentages were then calculated on a weight basis. It is interesting to note that a significant change in the slope of the moisture curve occurs at the average depth of microjoints.

A case-hardened surface is typical of most polygonally jointed areas, and is believed to have some influence on moisture characteristics. The thickness of the casehardening is rarely greater than a quarter of an inch and may only be represented by a paper-thin layer in some instances. The composition and origin of the material is unknown, but is probably derived from soluble minerals within the sandstone that have migrated upward by capillarity during dry periods and have been left behind and concentrated as the water evaporates. When wet, the surface may become slightly sticky and behaves similar to clayey material. The presence of the case-hardened surface reduces the infiltration capacity of the sandstone and may also act to retard the upward loss of moisture from the sandstone, acting as an

insulating blanket. A possible example of how the material affects the infiltration of water is illustrated by the behavior of water in weathering pits, which are widespread at White Rocks. Following heavy rainfall or snowmelt, the weathering pits fill with water, and the small ponds created may persist for weeks without further precipitation (Figure 9). The permeable sandstone should allow the water to be quickly absorbed, but apparently the case-hardened surface, possibly with the help of swelling clays in the matrix, prevent infiltration.

Once a small depression develops, it becomes a cachement for water, increasing the chemical weathering. In addition, sometimes small rocks are washed down into the solution pits by a heavy runoff. After the water in the solution pit evaporates, the rocks may be moved about in the pits by the wind. Eolian erosion affects both the pits and the rock fragments and continued scouring may polish the faces of the rock fragments until they are quite smooth. These angular, polished rocks are ventifacts called "dreikanters."

Origin of the "Turtleback" Form

The hummocky topography associated with the polygonal joint patterns is somewhat unique and warrants some discussion (Figures 7 and 8). The troughs that develop along the joints are believed to be a product of more active chemical and physical weathering, initiated by the greater moisture retention capacity in the joint zone. Once an initial ~~depression is created~~, weathering processes are intensified, and conditions become favorable for the maintenance and further deepening of the grough. The removal of the case-hardened surface may be the initial phase of trough development, allowing granular disintegration of the sandstone and subsequent removal by water or wind.

Local Anomalies

Tectonic forces have affected the visible statigraphy at White Rocks. A fault has altered the stratigraphic arrangement of the east end of the rocks. Here, a high-angle, reverse fault breaches the sandstone strata. The displaced stratigraphy adds to the aesthetic value of the outcrop by changing the visual relief. West of the fault line, the stratigraphy is not disturbed, but east of the fault line the Fox Hills formation is pushed up to the level of the Laramie. The Pierre shale which underlies the Fox Hills is exposed and, near the fault zone, some of the Pierre beds have been deformed. East of the fault zone, the Laramie, having been uplifted and exposed to weathering and erosion, is not visible (Figure 10).

Concretions[1] are found in varied shapes and sizes in the Fox Hills and Laramie formations at White Rocks. The origin of these concretions begins

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[1]Term refers to an irregular concentration of certain mineral constituents of sedimentary rock.

Figure 9. Weathering pits at White Rocks. Water may linger in these depressions for weeks subsequent to heavy rains. The weathering pit includes the area occupied by water and the adjacent area of unjointed sandstone. The varied topography, created by these and by the turtlebacks, provides a protective habitat for native grasses (note rock hammer for scale on far side of weathering pit. (Photo by Helen Louise Young)

Figure 10. Aerial view of the White Rocks. A high-angle reverse fault line forms a valley at the eastern end of the rock outcrop seen in the upper right part of the photo. Here, the Fox Hills ("F", right of valley) has been pushed to the level of the light-toned Laramie ("L" left of valley). East of the fault, the Laramie outcrop disappears. Note south-facing, pitted cliff face. (Photo by Dennis Netoff)

Figure 9

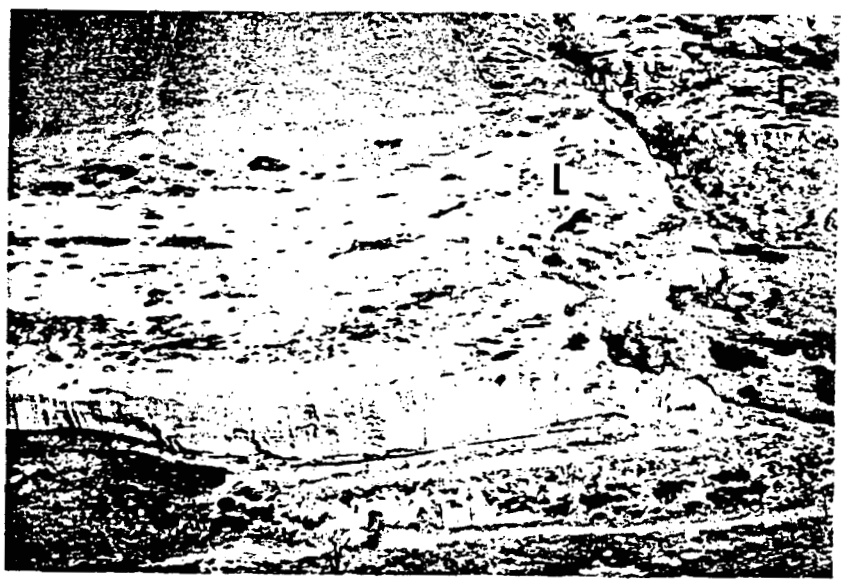

Figure 10

with the dissolving of certain minerals in the sandstone and their suspension in the rock pores. With supersaturation of the pore fluid, precipitation of the mineral occurs around some small nucleus - a fossil or rock fragment. Concretions at White Rocks are of different types depending upon the predominant mineral composition. Size and shape of concretions is determined by the moving groundwater, the alignment of pores in the host sediment and the shape of the nucleus. Fenske (1963, p. 38) listed three major types of concretions at White Rocks: calcareous, sand calcite, and ferruginous.

Other Geomorphic Features

The genesis of the long, linear, east-west hollow at the base of the cliff is indefinite. The hollow, approximately 5 feet wide, 3 to 4 feet in depth and several hundred feet long is at the base of the Laramie formation on the south-facing cliff (Figures 4 and 10). Because of its prominence, it is not only scientifically interesting, but aesthetically attractive. It is suggested that this linear depression might have been formed by downward percolation of groundwater. An impermeable rock layer just below the present hollow may have forced the water to flow laterally - eroding the hollow as it flowed out of the cliff. Various salt deposits inside and below the long, linear hollow provide further evidence for the role of groundwater. Precipitation of these minerals most likely occurred as evaporites. Disintegration of the sandstone and further accentuation of the hollow may have been facilitated by the growth force of the salt crystals.

Larger, more bowl-shaped depressions into the south-facing bluff were probably carved out by North Boulder Creek when it flowed at a higher level than at present. The creek meandered against the bluff at one spot leaving a depression in the cliff almost a hundred feet long and 50 or 60 feet high.

Other features related to the erosive action of water are the small honeycomb hollows (Figure 4) found on the steep cliff face of the Laramie along with a natural bridge. The hollows may have started as small depressions in the cliff which filled with water dissolving the rock and causing it to crumble after evaporation took place. The natural bridge, about 5 feet high and 15 feet wide at the base, is separated from the cliff by approximately 10 feet.

Vegetation

Patterns of vegetation vary with altitude, exposure to sun and wind, angle and steepness of slope, available water, soil and influence of man. The varied topography of White Rocks, as determined by chemical composition, structural conditions, and erosional processes, provides a variety of different vegetation habitats within a limited horizontal distance (Figure 5). The steep, 70- to 80-foot drop from the top of the bluff to the floodplain at the southern edge of the outcrop offers a rapid transition from the dry piedmont to the floodplain of North Boulder Creek (Figure 13). Constantly exposed to sunlight, the south-facing, light-colored sandstone provides the warmest and most protected habitat in the immediate area. Local topog-

graphic irregularities, such as the "honeycombs" in the cliff, the joints in the sandstone, the weathering pits, and the gulley carved out by the fault provide additional varied habitats for plant life.

White Rocks is a part of the plains grassland region (Rodeck, 1964, p. 36). Typical vegetation on the floodplain is a mixture of blue gramma (Bouteloua gracilis (HBK) Lag.), buffalo grass (Buchloe dactyloides (Nutt.) Engelm.) and yucca (Yucca glauca). Big bluestem (Andropogon geradi Vitm.), needle grass (Stipa comata Trin. and Rupr.) are common on rocky, eroding slopes at White Rocks. Shrubs such as skunkbrush (Rhus trilobata Nutt.) and other scrubby bushes may cling tenaciously to rocks or grow in gullies. Only two or three ponderosa pine (Pinus ponderosa Dougl. ex Laws) grow on the Laramie outcrop (Rodeck, 1964, pp. 36-38).

White Rocks is recognized by biologists in America and abroad as a haven for several species of rare plants. The cliffs support one of only three known colonies in North America of the fern, Asplenium adiantum-nigrum. Extremely rare, this fern has been collected in only three other places in the Western Hemisphere: Zion National Park, Utah; Flagstaff, Arizona; and Marion County, Florida (Weber, 1949). The grass Aristida basiramea and the legume Apios americana, commonly called the ground nut, have been found at White Rocks and are the only recorded Colorado specimens for these species (Weber, 1970). Plants representing 32 different families and over 90 different species have been collected at White Rocks in the past 60 years and are included in the University of Colorado's herbarium (Appendix A).

Fauna

The varied topography and exposure of White Rocks provide diverse animal habitats. Because of the intimate link between topography, climate, vegetation and animal life, the typical animals found at White Rocks are those associated with the plains grassland vegetation zone. Studies of animal life at White Rocks have been carried on by both the biological scientists and interested residents of the area.

Small rodents, such as mice, squirrels and rabbits are common. These mammals make their homes in the rock hollows at the base of the cliff and in the brush and fallen trees along the floodplain. The predatory mammals, the coyote and red fox, are less common and tend to be more easily frightened by man's presence in the vicinity than the rodents. Landowners fear an overpopulation of herbivores might result if the predators were forced to flee.

The only extensive field inventory of mammals and birds of the area was conducted in 1948 in a cottonwood grove along North Boulder Creek about a mile upstream from White Rocks. Among the observations in this study (Beidleman, 1948) which can be considered typical of the floodplain at the base of White Rocks are: three different genera of snakes and of turtles; 88 different species of birds and 10 different species of mammals.

Many observations by residents of the area have added to Beidleman's list. A composite from Beidleman's thesis and personal interviews lists the most common birds and mammals (Appendix B).[1]

White Rocks is used as a study area by the animal ecologists. Twice yearly, local bird-watchers conduct a bird count along the floodplain near the rocks. Biologists have observed birds at White Rocks and a local resident, Mrs. W. C. Sullivan, banded birds in an effort to check on permanent residents and their migratory patterns.

Several unusual and rare animals have been found at White Rocks. Dr. Robert Gregg, entomologist at the University of Colorado, has collected rare species of ants at White Rocks. Aphaenogaster fulva is common to eastern United States but is rarely found west of the Mississippi River. Three other rare western species have been found at White Rocks (A. huachucana, Formica criniventris and Lasius occidentalis). A mining bee (Perdita opuntiae Cockerell) drills burrows in the sandstone cliff and is unique to the site (Byars, 1936).

The measure of an area's scientific value is in its number, variety and quality of specimens and examples. For a geologist or physical geographer, White Rocks is valuable because of its exposed stratigraphy and its textbook examples of secondary sedimentary structures. As a haven for rare plant and animal life and a variety of ecological habitats, White Rocks has a strong attraction for those interested in biological landscape - topography, climate, vegetation and animal life combine in ecological harmony creating a unique, scientifically valuable and aesthetically attractive study area.

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[1]Only birds and mammals are considered here due to more field observations having been done on these members of the animal kingdom.

CHAPTER III. EFFECTS OF CHANGING LAND USE

Helen Louise Young

Physical, economic and social factors within a given area determine the land utilization. All must be considered, for each forms an integral component of evolving land use. Man is not entirely at the mercy of nature, yet a certain degree of influence is exerted by the climate, topography and biota in controlling his activities.

The varied topography of White Rocks forms a natural barrier to the plow. Farming the rock outcrop is virtually impossible. Climate also limits agricultural use through the deficiency and unreliability of the rainfall. Adding to the agricultural limitation is a very low groundwater table. Wells permitting large-scale irrigation are not feasible (Longley, 1970). Just as topography and climate are important controls in land use, soil capability may be the major factor in determining land use in the White Rocks area.

The Soil and Agricultural Potential

Most soil in a semi-arid climate is potentially fertile; however, lack of rainfall limits the productivity considerably. Sweet and Dodson (1935) and Moreland (1968) have named, described and analyzed the soils in the White Rocks area. Though the reports were compiled more than 30 years apart, the results were quite similar. Different nomenclature was utilized in each report; however, the important consideration is the soil capability rather than the soil name. Only textural description (sand, clay, loam, for example) and land capability classification[1] are used to show the relationship between different soil textures, slope and drainage and different types of land utilization.

The land under dry farming north of the rock outcrop is a sandy loam. These soils are moderately light textured at the surface. The water intake is rapid and the water-holding capacity is medium to moderately low (Moreland, 1966). The lands on the southern fringe of Gunbarrel Hill have a capability classification of Class III and Class IV, depending on the degree of slope (Figure 11). Soils west of 75th Street in the area of highest suburban density are mostly poorly drained clays with a few fine sandy loams. These soils have a capability classification of Class IV and

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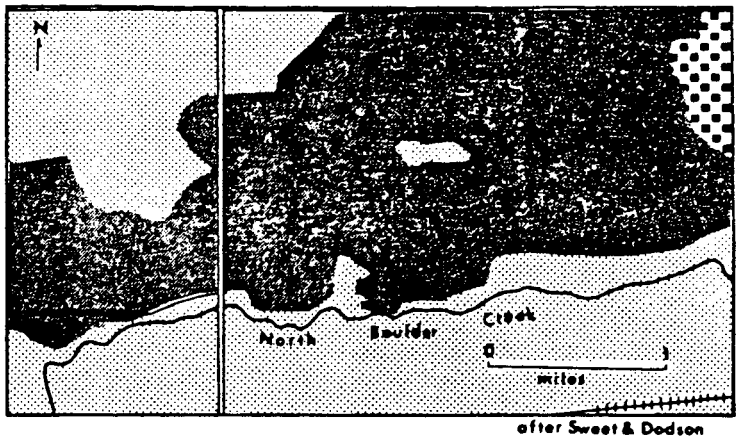
[1]Classification of lands according to their capability is based on the Land Capability Classification of the Soil Conservation Service, U.S. Department of Agriculture. For definition of classes see Figure 11.

LAND CAPABILITY

WHITE ROCKS AND VICINITY



CAPABILITY CLASSIFICATION EXPLANATION

Loams. Class II. Some limitations that reduce the choice of crops or require some conservation measures.

Clay loams. Class III. Severe limitations that reduce the choice of crops or require special conservation practices or both.

Clays and fine sandy loams. Class IV. Very Severe limitations that restrict choice of crops, require very careful management or both.

White Rocks Outcrop. Class VIII. Not suited for cultivation, range, pasture or woodland. Suited only for recreation, wildlife, water supply or aesthetic purposes.

[1]Based on U.S. Department of Agriculture Land Capability Classification.

Figure 11

Figure 12 Aerial view of the White Rocks area looking northwest toward the Continental Divide.
The floodplain and meanders of Boulder Creek appear at the left (south) of the sandstone cliffs. In the distance, residences encroach upon agricultural land adjacent to the White Rocks. (Photo by Dennis Netoff)

Figure 13 The vertical cliff at White Rocks presents a striking stratigraphic difference between two sedimentary formations - the white, uppermost Laramie and the Fox Hills below (appears here as the lower, shrub-covered slope). Several different depositional environments are illustrated by the Laramie, the Fox Hills, and the transition zone between them. (Photo by Helen Louise Young)

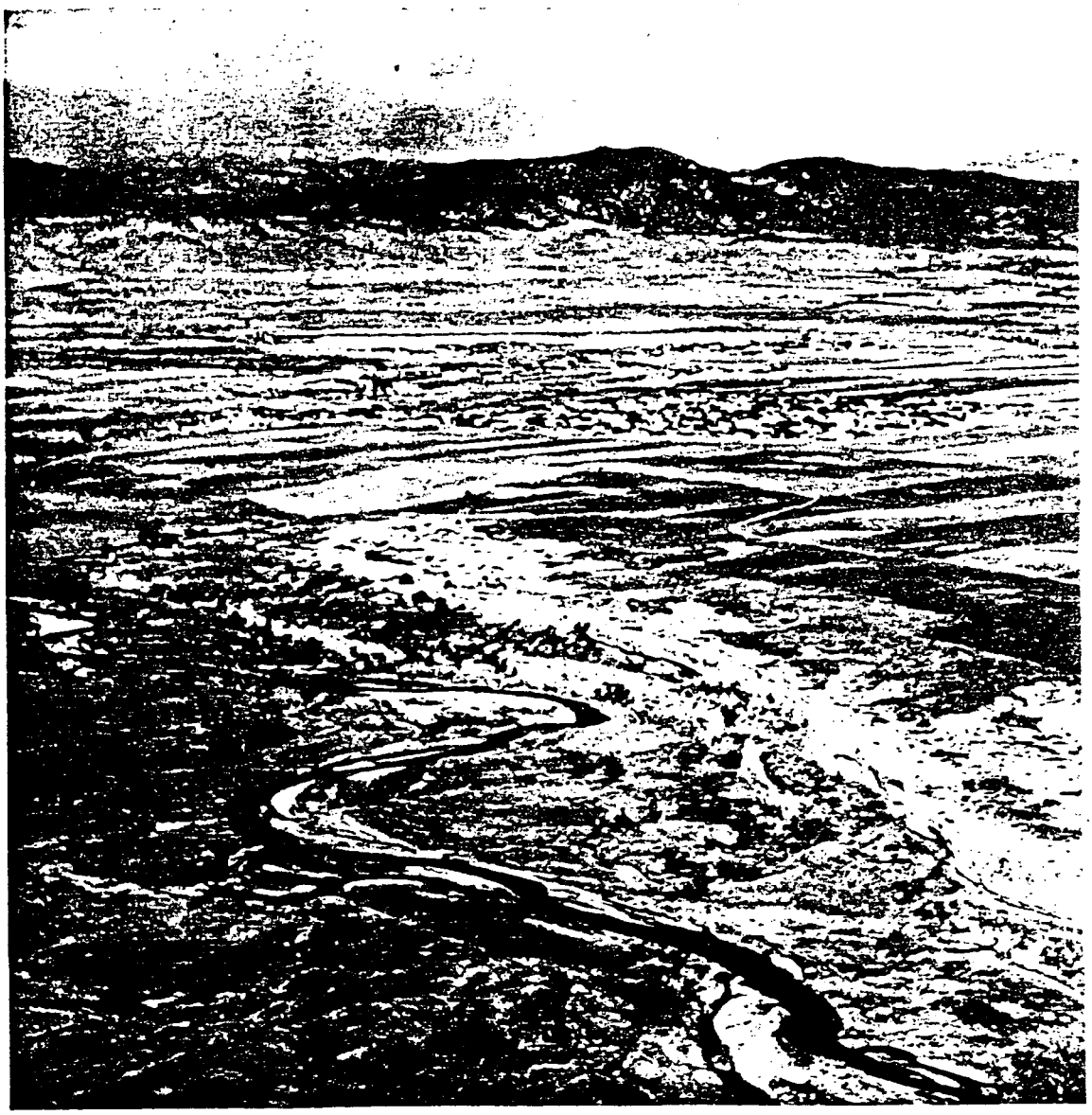


Figure 12

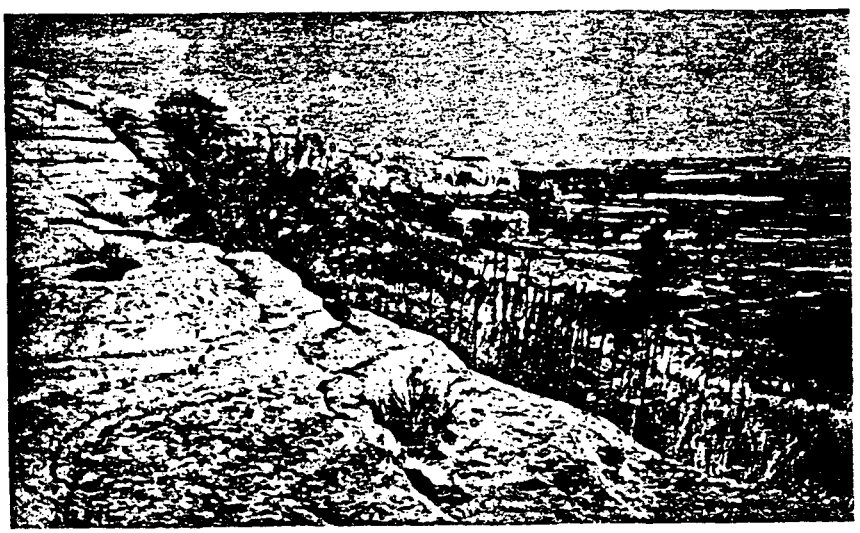


Figure 13

and are less suited for agricultural use than those on Gunbarrel Hill (Sweet and Dodson, 1939, pp. 20-21).

The land on the North Boulder Creek floodplain is a moderately deep, loamy, poorly drained, alluvial soil. The surface has a heavy texture and has a capability of Class IV (Moreland, 1966). In short, all the lands surrounding White Rocks could not be classified as highly agriculturally productive. Care must be taken continually to prevent wind and water erosion. The agricultural land north of White Rocks is utilized for farm-and-fallow wheat, while grazing takes place on the floodplain. The White Rocks outcrop has a capability of Class VIII due to the extremely rugged terrain.

Soil drainage, fertility and slope have a significant effect on agricultural productivity and low agricultural productivity has opened the way for other types of land use in the study area. The first lots to be sold for subdivisions are located west of 75th Street on the flat, poorly drained Class IV land (Figure 11). This land was flat enough to permit houses to be built, yet not agriculturally productive. The land east of 75th Street on Gunbarrel Hill (Class II and Class III) remains under dry farming, but since there is no source of irrigation water on Gunbarrel Hill, the owners of the land might not find it feasible to farm in the near future. Two logical possibilities for the land if it were taken out of farming are: 1) the land becoming part of a greenbelt or 2) it becoming sites for subdivision (Campbell, 1969).

Urban Growth and Expansion

Presently most of the land east of 75th Street and north of White Rocks on Gunbarrel Hill is zoned for agriculture (Boulder County, 1965). An important exception to agricultural zoning is the Heatherwood Estates subdivision which has been developed within the last 3 years by Wood Brothers Homes, a large building firm based in Denver, The first home in Heatherwood was built in 1967 (O'Laughlin, 1970). Heatherwood subdivision is emphasized to a greater extent than the other suburban developments west of 75th Street (Gunbarrel Greens, Island Greens, Flintlock Estates, for example) because it poses the greatest encroachment threat to White Rocks. Heatherwood is now building houses on most of the Southeast ¼ Section 12, Township 1 North - Range 70 West. This urban expansion may extend to less than one-third of a mile northwest of White Rocks within the next 5 years, for the land (NW¼, NE¼, Section 13) has already been purchased by Wood Brothers Homes. Land so close to White Rocks may be occupied by single-family residences or multi-family apartments (O'Laughlin,1970).

Realistically, within 5 to 10 years, Heatherwood may extend a mile or more to the north and east and, more crucially, south to the very edge of White Rocks. Such a projection may be substantiated inasmuch as the land presently occupied by Heatherwood was farmed as recently as 3 years ago. Subdivisions have expanded over 1 mile eastward toward White Rocks in the past 6 years.[1] The change from dry farming to suburban development

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[1]Measurements compiled from U.S. Department of Agriculture aerial photography of the area, 1963 and 1969.

is still occurring. The indication is that a farmer will continue to farm a parcel of land while it is profitable; however, if for some reason (lowering of wheat prices, for example) the farmer can no longer farm, he must seek the best economical use of the land. If a real estate developer offers a handsome price for the land, it is possible that the farmer will sell (Musser, 1970). An additional incentive to sell would be the psychological effect of the suburbs. The encroachment of suburban development near a farm might lead to the leaving of the farm, because of constant disruption of normal farm activities.

Past patterns of land use are significant in understanding present patterns and being able to make future projections. Farming was once the only activity north and south of White Rocks. Industrial growth (IBM, for example) in the proximity and the desire of a person to live away from the city proper have led to the urban expansion near White Rocks today. Essential to the interpretation and the understanding of these rapid and profound changes is the consideration of the expansion and growth of Boulder during the past three decades.

Continued growth and expansion of Boulder is best understood by recognizing its potential as an industrial, research and educational center. An ever-expanding Boulder employer, the University of Colorado, attracts and continues to attract numerous research firms. Examples of the quality of research growth are the following firms: The National Center for Atmospheric Research, the Environmental Science Services Administration, the National Bureau of Standards, Ball Brothers Research Corporation, International Business Machines (IBM), and others.

Industrial and commercial growth is mirrored in population growth. The Boulder Chamber of Commerce publishes population figures from the United States Bureau of the Census in addition to their own population projections. Boulder population changes in the last 30 years are noted in Table 1.

TABLE 1. POPULATION GROWTH, CITY OF BOULDER

Year	Population
1940	12,958
1950	19,999
1960	37,718
1970	65,977*

* Preliminary figure, U.S. Bureau of the Census

Source: Boulder Chamber of Commerce

TABLE 2. CHANGING LAND USE IN THE WHITE ROCKS AREA, 1941-1969

Category	1941	1955	1963	1969
Dryland Farming	51.01	50.51	46.14	32.71
Pasture	26.09	26.88	31.76	29.40
Developed Cropland	16.77	12.95	7.31	4.54
Undeveloped Land	3.43	4.73	2.25	10.10
Urban	---	---	2.19	11.82
Recreation	---	---	4.23	4.23
Industry	---	---	1.40	1.40
White Rocks	1.84	1.84	1.84	1.84
Percentage subtotal	99.14	98.13	97.12	96.16
Miscellaneous Uses*	.86	1.69	2.88	3.84
Total	100.00	100.00	100.00	100.00

Note: Percentages of each categorical use are shown for the White Rocks study area of some 3,200 acres surrounding the rock outcrop. Based on information from U.S.D.A. and A.S.C.S. aerial photography.

* Miscellaneous categories include area occupied by roads, railroads, houses and public utility stations.

Although Boulder has undergone tremendous growth in the past 30 years, this growth is not as critical to this study as the suburban expansion east of Boulder in proximity to White Rocks.

Industrial growth east and northeast of Boulder has given impetus to residential expansion in those directions. IBM is the largest employer northeast of Boulder and the growth of IBM has had the greatest single effect on other industrial and rapid suburban expansion northeast of Boulder.

When plans for IBM's construction began in March, 1965 (Town and Country Review, 1970), the land now occupied by IBM was predominately agricultural. In the early 1960s some small-scale platting of subdivisions in the Gunbarrel Hill area had occurred, but there was no substantial urban development until after the location of the IBM plant along the Boulder-Longmont Diagonal Highway (State Highway No. 119). By January, 1969, the number of employees increased by over 2,000 to 4,350 (Town and Country Review, 1970).

In the eastward expansion of Boulder, a sizeable land area zoned for industry under the name of Boulder Industrial Park, is located approximately one and one-half miles east of Boulder. All industries in the industrial park (including Ball Brothers Research Corporation) are accessible from the subdivisions northeast of Boulder via 75th Street. It is clearly obvious not all employees of these industrial areas will eventually move into subdivisions northeast of Boulder; nonetheless, these growing industrial complexes set the stage for further suburban expansion.

Site and situation determine the public's choice to move into subdivisions as Gunbarrel Greens and Heatherwood. For most homeowners, a major consideration is time and distance to work. Additional impetus to suburban expansion northeast of Boulder lies in the aesthetic appeal of the area. The subdivisions are far enough away from Boulder to escape the noise and the traffic problems, in addition to having a spectacular view of the Front Range of the Rockies and the Continental Divide. Thus, a tremendous growth in urban development continues northeast of Boulder.

The most valuable portrayal of changing land use patterns in the past three decades is illustrated by maps of land use changes at selected intervals for historical and geographic perspective (Figures 14, 15, 16, and 17). Data for changing land use is from two sources: aerial photography (1941, 1955, 1963, and 1969)[1] and field reconnaissance.

To understand changing land use patterns, percentages of different uses were determined from each of the four maps based on the air photos for the same years by imposing a grid over each. This method results in acceptable percentages of changing land patterns (Table 2).

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[1]Photographs used were provided by the Boulder County Soil Conservation Service and the Longmont office of the U.S. Agricultural Stabilization Conservation Service.

By comparing land use changes using the four maps and the percentage change table, two particular patterns of change emerge. Most noticeable is the growth of urban areas which occupy former agricultural land. Less striking is the gradual change in agricultural use from less developed agriculture to more grazing. This change may be the result of declining need for agricultural products to be grown in this particular area.

Land used for agricultural purposes and for single-family residences constitutes the main utilization within the study area at the present time. The White Rocks outcrop is neither used for agriculture nor for housing, yet from the scientific and aesthetic viewpoint, White Rocks' most significant utility is as a natural, isolated study area.

Present Utilization of White Rocks

In keeping with the theme of land use, an inventory of the degree of utility White Rocks provides the scientific and academic communities becomes critical in evaluating the worth of White Rocks as a study area.

Appendix C, an annotated bibliography, lists theses and other scholarly articles written about some interesting geologic feature or biota of White Rocks. Interviews with University of Colorado faculty members having utilized White Rocks or having some special interest in the area were conducted. The interviews provided a measure of the past and present utilization of White Rocks by the University. Undoubtedly, a few interested parties may not have been contacted, but as complete a list of interviews as possible is found in Appendix D. In addition, letters written by scientists and other knowledgeable individuals concerning White Rocks were generously provided (Weiser, 1969, 1970). (See Appendix D for a list of those submitting letters.) These letters were written on request by Mrs. Weiser, who organized efforts to bring the problem of highway encroachment to the attention of the Boulder County Long-Range Planning Commission.

The letters express each individual's estimation of White Rocks' value as a scientific study site. Those in the field of biology emphasized White Rocks as being an isolated habitat for numerous plants and animals, some very rare. Each letter also described White Rocks as a unique study site accessible to the University. Letters dealing more with the geological formations praised the area for its exposed stratigraphy and other interesting geologic features. All the letters stressed the need for preservation of White Rocks. Even though they represent one point of view, they should be noted as knowledgeable opinions of the worth of White Rocks.

Numerous field trips and research projects are conducted at White Rocks. From the Biology Department, a class in insect taxonomy makes an excursion to White Rocks each fall for collection purposes. These trips have been regularly conducted since 1956 (Gregg, 1969). In the spring of 1969, undergraduate classes in physical geography began field trips to White Rocks. The White Rocks field trip, taken by some 500 students since last spring, hopefully will become a permanent part of the class field trip schedule. Prior to spring, 1969, the geography field trips did not involve climbing onto the rocks, but viewed the south-facing cliff from 75th Street.

Until 1964, all undergraduate geology students took a field trip to White Rocks. About 1,000 students per year make this trip. On several occasions, advanced geomorphology classes have visited White Rocks (Bradley, 1969).

Additional activities, whether they be the surrounding land use or the scientific studies at White Rocks, affect the ecological balance of a relatively isolated natural area. Because natural study sites are indeed rare, an analysis of some of the major threats to White Rocks must be investigated.

Adverse Effects of Encroachment

The analysis of urban encroachment in the White Rocks area has already been discussed. Some additional adverse effects of encroachment are the following: 1) water and air pollution associated with urban and highway expansion; 2) trespassers and casual recreationists; 3) vandals and poachers; 4) overgrazing of the floodplain; 5) increased runoff erosion above the rock outcrop; and 6) negligent use by members of the scientific community.

As additional people come to live in the vicinity of White Rocks, the frequency of unconcerned individuals straying onto the rocks increases. These well-meaning but inconsiderate recreationists leave their ~~marks on~~ the vertical and horizontal rock outcrops by carving their names on and otherwise defacing the rocks. Beer cans, empty gun shells, and other debris are depressing evidence of human carelessness and land pollution. Such trespassing is common and only careful supervision of the rocks prevents major damage. Instances of vandalism include the setting of grass fires, draining an artificial reservoir, cutting of trees and killing wildlife (Weiser, 1969, 1970 and Ertl, 1970).

Explosive growth east of Boulder is accompanied by more intensive use of present transportation facilities and the building of new roads. The most recent threat to White Rocks is McCaslin Boulevard, a proposed high-speed, limited-access, north-south highway. No specific route has been designed as of present; however, two proposed routes actually touch the western (one proposed route) or the eastern (another proposed route) extremity of the rock outcrop. The immediate and long-term effects of this expressway are the following: 1) disturbing the animal life by noise, causing some animals to leave the area thereby changing the ecological balance; 2) filling the air with harmful exhaust (especially if the highway were built west of the rocks due to prevailing winds) with the possible loss of some species of vegetation; and 3) encouraging carelessness, vandalism and demand for public access by making White Rocks more visible from the highway. The impending threat to White Rocks posed by McCaslin Boulevard has been alleviated by a recent decision made by the Boulder County Long-Range Planning Commission on February 27, 1970. The Commission decided that "if and when the boulevard is constructed, the route will by-pass the scenic and valuable natural area known as the White Rocks" (Boulder Daily Camera, 1970).

Soil erosion north of the rock outcrop might ultimately destroy the aesthetically and scientifically valuable topography by greatly speeding up the erosional processes on the rocks. If the natural grass cover above

the rocks were to be eliminated by fire, trampling, or suburban development. the Laramie outcrop would be vastly altered from increased erosion. Overgrazing on the floodplain has caused damage to the vegetational habitats along the floodplain by increasing erosion. Through the efforts of landowners who graze their cattle on the floodplain, this overgrazing is being controlled.

Any presence of man on White Rocks alters its natural state: therefore, even those who appreciate the scientific and aesthetic values of the rock outcrop and make field investigations violate its isolated state. The utilization of White Rocks by one scientific discipline may lessen the study potential of the area by another discipline. Those investigating the topography, for example, might inadvertently trample the vegetation or frighten animals. Such incompatable field studies should be carefully avoided. Compared to the other threats facing White Rocks, and considering the utilitarian purpose of such excursions onto White Rocks, damage from the scientific community is the least of the threats. Concerned and knowledgeable individuals are most likely to respect the value of this natural area.

White Rocks is definitely affected by the surrounding land use changes. These changes from agriculture to urbanization pose a threat to its isolated state, its importance as a study area and its scientific and aesthetic value. Scientists, because of the increasing use of White Rocks ~~in recent years~~, are becoming more aware of its importance - thereby gaining more of an appreciation of the area. Concerned individuals, through an historical perspective of land use change must attempt to formulate steps to preserve White Rocks for future scientific use.

CHPPTER IV. CONCLUSIONS AND RECOMMENDATIONS

Helen Louise Young

Expansion of urbanization into former agricultural land is not a unique situation, nor is the encroachment of man into isolated natural areas. The dilemma facing White Rocks is mirrored in thousands of other natural sites throughout the country.

The most important decision to be made is whether White Rocks should be preserved in its natural state. On the basis of investigation of pertinent literature, interviews with parties knowledgeable of its value, and field examinations, the answer to the query must be an unequivocal "Yes." White Rocks is unique geologically and biologically and its loss as an accessible study area would be a tragedy. Not only should White Rocks be preserved as a natural study site, but as an area of extremely limited access even for scientific purposes and aesthetic enjoyment. Ideally, upper-division-course university field laboratory trips and faculty and graduate students should have access to the area for scientific utilization.

The next problem is a geographic delimitation of an adequate buffer zone to protect White Rocks' isolation as it exists today. Bearing in mind the present land patterns (Figure 17), the following buffer zone is presented with its geographical boundaries:

1. Northern buffer zone - suburban development should remain at least one-quarter to one-half mile north or the rocks. A vegetation buffer should remain between housing and the rock outcrop to minimize erosion on the slopes north of White Rocks and the rock outcrop.

2. Southern buffer zone - the floodplain of North Boulder Creek provides an excellent natural buffer. No extensive urban development can be allowed on the floodplain according to county zoning regulations. Gravel pits along the floodplain near the bluffs should be prohibited because of aesthetic damage.

3. Eastern buffer zone - land east of the study area which stops at the prominent fault and the disappearance of the Laramie outcrop is rugged terrain presently used for grazing. No development should come closer than one-half mile to the eastern end of the rocks.

4. Western buffer zone - any residential development should be at least one-quarter mile to one-half mile west of the rocks. Development west of the rocks should be especially discouraged due to the prevailing winds blowing pollutants toward White Rock.

Precise limitation of a buffer zone that protects White Rocks is difficult, for an intimate understanding of the area's delicate ecological balance is necessary. Interwoven with the ecological balance are the social problems and the legalities of changing land use, zoning, and industrial expansion. Realistically, a future projection of what happens to the land surrounding White Rocks and what feasible steps to save it (working within given possibilities) must be considered.

Recommendations

To provide the most feasible, yet assured method of preserving White Rocks for future generations, the following recommendations should be considered:

1. Continuation of present agricultural zoning for lands immediately north of White Rocks; therefore, the County Commissioner's Zoning Board should not allow residential zoning to the edge of the rock outcrop.

2. Cooperation from real estate developers such as Wood Brothers (developers of Heatherwood) must be sought to prevent extremely close encroachment and to aid in preservation of a buffer between Heatherwood and White Rocks.

3. Industrial development along the floodplain at the base of the cliff must be prohibited if White Rocks is to have its greatest utility. Gravel pits could be restricted by the County's not granting use permits for their location at White Rocks.

4. Close and continuous supervision of White Rocks should be provided to reduce the threat of vandalism. Mrs. Weiser's living near the outcrop presently contributes to the supervision.

5. The wills of the property owners of White Rocks should provide for transfer of their property (after their or their heirs death) to a conservation foundation which could preserve White Rocks in perpetuity. Mrs. Weiser plans to arrange such a provision.

6. Encouraging legislation to deal with legal problems of preserving natural areas. If White Rocks were obtained as part of a green belt program, by an educational institution or a conservation organization, there should be legal means to restrict public access in perpetuity. At present, if White Rocks were in public ownership, there is no legal way to restrict public accessibility.

7. Conservation tax easement, preferential assessment (the valuation of property on the basis of present, instead of potential land use), or other tax advantages should be offered the owners of White Rocks to encourage its preservation as a natural area.

8. Consideration and respect must be given the area by those utilizing White Rocks for any purpose. The value, uniqueness and delicacy of the area should be made known to those entering White Rocks.

An assessment and analysis of the quality of White Rocks as a study area - what it offers in aesthetics and scientific value - and an understanding of the land use changes over time enables a more valid projection of what may happen to White Rocks. White Rocks' physical uniqueness is irreplaceable. Its importance stems from its having been relatively isolated and its having become a haven for seldom-seen plants and animals. Adding to its importance are the geological structures, which merit observation and research. Hopefully, the foresight and cooperative efforts of individuals concerned with protecting the environment will assure the perpetuation of White Rocks as a truly unique natural area.

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APPENDIX A

FLORA FOUND AT WHITE ROCKS AS RECORDED BY THE UNIVERSITY OF COLORADO MUSEUM HERBARIUM

Listing is by family, genus and species.

Alismacaea
- Sagittaria latifolia Willd.

Anacardiaceae
- Rhus glabra L.
- R. trilobata Nutt. ex. T. & G.

Asclepiadaceae
- Asclepias viridiflora Raf.

Betulaceae
- Betula fontinalis Sarg.

Boraginaceae
- Cryptantha minima Rydberg
- C. jamesii (Torr.) Payson
- Lappula redowskii (Hornem.) Greene
- Lithospermum incisum Lehn.

Campanulaceae
- Triodanis leptocarpa (Nutt.) Nieuwl.
- T. perfoliata (L.) Nieuwl.

Chenopodiaceae
- Atriplex canescens (Pursh) Nutt.
- Eurotia lanata (Pursh) Moq.

Commelinaceae
- Tradescantia occidentalis (Britt.) Symth

Compositae
- Artemisia filifolia Torr.
- Erigeron pumulus Nutt.
- Gnaphalium chilense Spreng.
- G. wrightii A. Gray'
- Helianthus petiolaris Nutt.
- Hetherotheca villosa (Pursh) Shinners
- Hymenopappus filifolius Hook.
- Kuhnia eupatorioides L.
- Lactuca tatarica (L.) C.A.Mey
- Machaeranthera tanacetifolia (H.B.K.) Ness
- Solidago missouriensis Nutt.

Cruciferae
- Chorispora tenella DC.
- Thlaspi arvense L.

Cyperaceae
- Carex heliophila Mack
- Cyperus acuminatus Torr.&Hook
- C. inflexus Muchl.
- Eleocharis macrostachya Britt.
- Scirpus microcarpus Presl.

Euphorbiaceae
- Chameasyce fendleri (T&G) Small
- C. missurica (Raf.) Shinners
- Euphorbia marginata Pursh

Fumariaceae
- Corydalis aurea Willd.

Gramineae
- Agropyron dasystachum (Hooker) Scribner
- A. gerardii Vitman
- Aristida basiramea Engelmann
- A. fendleriana Steud.
- Buchloe dactyloides (Nutt.) Engelmann
- Calamovilfa longifolia (Hook.) Scribn. in Hack.
- Oryzopsis hymenoides (R.&S.) Ricker
- Poa sandbergii Vassey
- Puccinellia nuttalliana (Schult.) Hitchc.
- Stipa comata Trin. & Rupr.
- Vulpia octoflora (Walt.) Rydb.

Hydrocharitaceae
- Elodea canadensis Michx.

Labiatae
- Monarda pectinata Nutt.

Leguminosae
- Apios americana Medic.
- Astragalus drummondii Dougl. in Hook.

Leguminosae (continued)
- A. sericoleucus A. Gray
- Lathyrus polymorphus Nutt.
- Lupinus pusillus Pursh
- Oxytropis sericea Nutt.
- Sophora nuttalliana B. L. Turner
- Thermopsis rhombifolia Nutt. ex Rich.

Lemnaceae
- Lemna minor L.

Loasaceae
- Mentzelia albicaulis Dougl. ex. Hook.
- M. nuda (Pursh) T.&G.

Onagraceae
- Gaura coccinea Nutt. ex Pursh
- Oenothera albicaulis Pursh
- O. brachycarpa A. Gray

Orobanchaceae
- Orobanche fasciculata Nutt.

Oxalidaceae
- Oxalis stricta L.

Pinaceae
- Pinus ponderosa Dougl. ex Laws.

Polemoniaceae
- Ipomopsis laxiflora (Coulter) V. Grant

Polygonaceae
- Eriqonum annuum Nutt.
- Polygonum ramosissimum Michx.

Polypodiaceae
- Asplenium trichomanes L.
- Asplenium adiantum-nigrum L.
- Cheilanthes feei Moore

Nyctaginaceae
- Abronia fragrans Nutt. ex Hook.
- Oxybaphus linearis (Pursh) Robinson

Ranunculaceae
- Ranunculus cymbalaria Pursh

Rosaceae
- Amelanchier utahensis Koehna
- Potentilla anglica Leacharding
- Prunus virginiana L.
- Rosa arkansana Porter

Scrophulariaceae
- Linaria texana Scheele
- Penstemon angustifolius Nutt.
- P. secundiflorus Bentham

Solanaceae
- Physalis virginiana Mill.
- Solanum americanum Mill.
- S. sarachoides Sendt. ex Mart

Ulmaceae
- Celtis occidentalis L.

Umbelliferae
- Cymopterus acaulis (Pirsh) Raf.

Violaceae
- Viola papilionacea Pursh

Urticaceae
- Parietaria pennsylvanica Muhl. ex Willd.

APPENDIX B

FAUNA FREQUENTLY SIGHTED AT WHITE ROCKS

Birds

Scientific Name	Common Name
Ardeidae	
Ardea herodias	Great blue heron
Nycticorax nycticorax	Black-crowned night heron
Charadriinae	
Oxyechus vociferus	Killdeer
Columbidae	
Columbia livia	Rock dove
Zenaidura macroura	Western mourning dove
Corvidae	
Pica pica	American magpie
Falconinae	
Falco sparverius	Sparrow hawk
Fringillidae	
Melospiza melodia	Mountain song sparrow
Passerina amoena	Lazuli bunting
Icteridae	
Agelaius phoeniceus	Thick-billed redwing
Icterus bullocki	Bullock's oriole
Sturnella neglecta	Western meadowlark
Xanthocephalus xanthocephalus	Yellow-headed blackbird
Phasianidae	
Phasianus colchicus	Ring-necked pheasant
Picidae	
Asyndesmus lewis	Lewis' woodpecker
Colaptes cafer	Red-shafted flicker
Strigidae	
Bulbo virginianus	Great horned owl
Tytonidae	
Tyto alba	Barn owl

Animals

Scientific Name	Common Name
Canidae	
Canis latrans	Coyote
Vulpes fulva	Red fox
Castoridae	
Castor canadensis	Beaver
Cervidae	
Odocoileus hemionus	Mule deer
Cricetidae	
Ondatra zibethica	Great Plains muskrat
Peromyscus boylei	Brush mouse
P. leucopus	White-footed mouse
P. maniculatus	Deer mouse
Geomyidae	
Geomys bursarius	Plains pocket gopher
Leporidae	
Lepus californicus	Blacktail jackrabbit
Sylvilagus nuttalli	Mountain cottontail
Sciuridae	
Citellus variegatus	Rock squirrel
C. tridemlineatus	Thirteen-lined ground squirrel
Eutamias quadrivittatus	Colorado chipmunk
Marmota flaviventris	Rockchuck (Yellow-belly marmot)

APPENDIX C

SELECTED BIBLIOGRAPHY OF WORKS RELATING TO WHITE ROCKS

Biology

Beidleman, Richard G. "The Vertebrate Ecology of a Colorado Plains Cottonwood River Bottom." Unpublished MA thesis, University of Colorado, 1948.

A field study of a cottonwood river bottom vertebrate habitat along Boulder Creek about two miles upstream from White Rocks. A list of the observed fauna was compiled and the same species are likely to be found along Boulder Creek at the base of White Rocks.

Byars, Loren F. "An Ecological Study of the Ants of the Plains Region of Boulder County, Colorado." Unpublished MA thesis, University of Colorado, 1936.

A description of the correlations between the ant fauna of a compact but ecologically varied area and its topography. White Rocks was one of five study sites for collection of specimens.

Weber, William A. "The Flora of Boulder County Colorado." Unpublished two volume work sponsored by Biology Department and the University of Colorado Museum, 1949.

A two-volume work which includes a key to the flora of Boulder County and a list of all plants collected as part of the University of Colorado Museum collection. White Rocks was a favorite collection site and about 90 different species of plants were found there.

Geology

Emmons, Samuel F., Whitman Cross and George H. Eldridge. "Geology of the Denver Basin in Colorado," United States Geological Survey Monogram 27, 1896.

An early study of geology in the Denver Basin. Mention is made of the stratigraphy and the coal seam at White Rocks.

Fenneman, N.M. "Geology of the Boulder District, Colorado," United States Geological Survey Bulletin 265, 1905.

A geological study of about a 15-mile radius of Boulder, Colorado. The original purpose of this report was to find petroleum in paying quantities. White Rocks was mentioned as having excellent exposures Fox Hills and Laramie.

Fenske, Paul Roderick. "The Origin and Significance of Concretions." Unpublished PhD dissertation, University of Colorado, 1963.

A description of the Fox Hills and Laramie stratigraphy in the vicinity of Boulder and an investigation of the concretions found in these formations. Special reference is made to concretions found in the White Rocks area.

Hayes, John R. "Cretaceous Stratigraphy of Eastern Colorado." Unpublished PhD dissertation, University of Colorado, 1950.

A report of the Cretacous stratigraphy of part of northeastern Colorado, southeastern Wyoming and the southwestern corner of Nebraska. As part of the overall stratigraphic study, the Fox Hills and Laramie formations were examined at outcrops. White Rocks was one of the sites for study of these formations.

Henderson, Junius. "Cretaceous Formations of the Northeastern Colorado Plains," Colorado Geological Survey Bulletin, XIX, 1920.

Purpose is determination of the stratigraphic position of northeastern Colorado coal beds. A list of fossils found near a fault at White Rocks is included in the work.

Horner, Wesley Pate. "The Fox Hills - Laramie Contact in the Denver Basin." Unpublished MA thesis, University of Colorado, 1954.

A study of the Fox Hills - Laramie contact in six major outcrops in the area east of the Front Range foothills, including White Rocks. This thesis proposes a change in the previously defined contact between the two formations. The study was based on evidence from thin sections, size analysis, measured sections and field observation.

Parkinson, Lucius James Jr. "Geology of an Area East of Boulder, Boulder County, Colorado." Unpublished MA thesis, University of Colorado, 1956.

This thesis maps the structural and areal geology of an area east of Boulder and relates the local structures to regional structure. Special attention was given to faults. Four north-trending faults in the White Rocks area were mapped.

Geography

Netoff, Dennis Ivan. "Polygonal Jointing in Sandstone Near Boulder, Colorado." Unpublished MA thesis, University of Colorado, 1970.

Master's thesis describing the nature of the polygonal joint patterns found in the upper Laramie sandstone. Through field work done on the turtlebacks,a hypothesis was formulated as to their origin.

Young, Helen Louise, "White Rocks: Social, Cultural, and Land Use Changes Affecting a Natural Area," Unpublished MA thesis, University of Colorado, 1970.

MA thesis describing effect of urban growth on this natural area. Evaluates the potential uses of the area and recommends steps to be taken to preserve its unique quality.

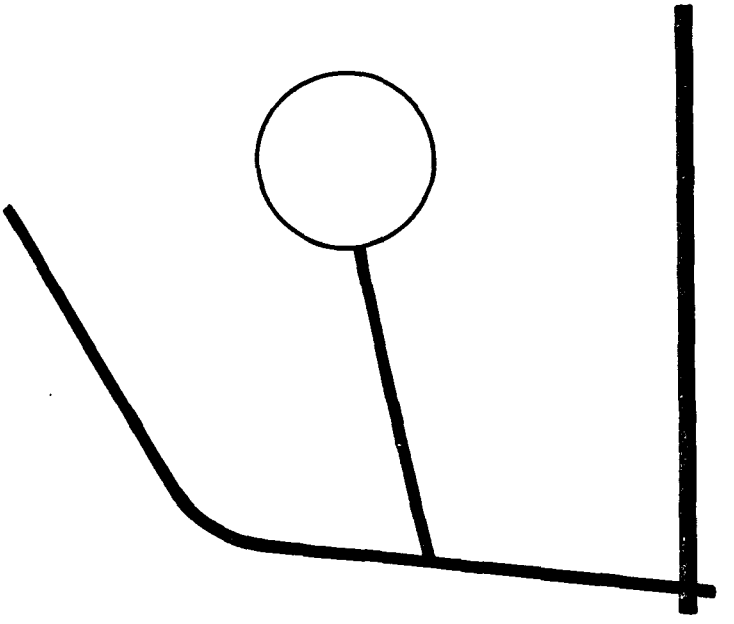
APPENDIX D.

LIST OF INDIVIDUALS CONTACTED THROUGH INTERVIEWS AND SUBMITTING LETTERS AS TO THE VALUE OF WHITE ROCKS*

Individual	Position or Interest
Bock, Carl E. (interview)	Assistant Professor of Biology, University of Colorado
Bradley, William C. (interview)	Professor of Geology, University of Colorado
Crowley, Lawrence D. (letter)	Science Teacher, Boulder Public Schools
Gregg, Robert E. (letter and interview)	Professor of Biology, University of Colorado
Kroeck, William F. (letter)	Graduate Student, Department of Geography, University of Colorado
Longley, Warren W. (letter)	Professor of Geology, University of Colorado
MacPhail, Donald D. (letter)	Professor of Geography, University of Colorado
Netoff, Dennis I. (letter)	Graduate Student, Department of Geography, University of Colorado
Rodeck, Hugo G. (letter)	Professor of Natural History and Director of the Museum, University of Colorado
Shushan, Sam (letter)	Associate Professor of Biology, University of Colorado
Thorne, Oakleigh II (letter)	President and Director, Thorne Ecological Foundation
Weber, William A. (letter and interview)	Professor of Natural History and Curator of Museum Herbarium, University of Colorado
Weiser, Martha R. (interview)	Landowner and Resident of White Rocks
Willard, Beatrice E. (letter)	Vice-President, Thorne Ecological Foundation
Williams, Olwen (letter)	Professor of Biology, University of Colorado

* Letters are in possession of Mrs. Martha K. Weiser, Boulder, Colorado.

WONDERLAND LAKE AREA STUDY



Department of Geography

University of Colorado

WONDERLAND LAKE

AREA STUDY

DEPARTMENT OF GEOGRAPHY

UNIVERSITY OF COLORADO

Boulder, Colorado

1972

TABLE OF CONTENTS

	Page
CONTRIBUTORS	i
FOREWORD	ii
PART I ENVIRONMENTAL SURVEY	1
General Geology	2
Soils	3
Biologic Evaluation	6
Surrounding Upland	7
Eastern Drainage	7
The Lake Dam	7
Lake Perimeter Lowland	8
The Lake	8
Fauna	9
Summary	10
PART II LAND USE	11
PART III LAND EVALUATION AND TENURE	15
PART IV ALTERNATIVES, IMPACTS AND RECOMMENDATIONS	21
Alternative I	21
Alternative II	21
Alternative III	22
Recommendations	23
FOOTNOTE	25
ADDITIONAL REFERENCES	25
APPENDIX I	26

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Part IV Alternatives, Impacts and Recommendations

Webster H. Sill
Craig Hafner
Mark L. Swanson
K-Lynn Keith

FOREWORD

This report on the Wonderland Lake area is one of three undertaken by the Department of Geography at the University of Colorado for the City of Boulder. The project was initiated by the students and faculty of Geography 540, Land Use Seminar, as a research study. Its purpose is to provide information for city and county officials and concerned citizens to assist them in planning the future development of the City and County of Boulder.

Payments of expenses and for materials for this report were made possible by a grant from the City of Boulder. The project was carried out through field investigation and library research by the students.

The study group would like to thank the following people who provided very helpful assistance and comments for our study:

Sanford Gladden, Boulder Historian

Paul Skwiot, City Land Officer, Advisory Committee on Open Space

Tom Powell, Assistant Wildlife Researcher, Colorado Division of Wildlife

Libby Goodwin, Boulder County Park Planner

Doug Tiefel, Boulder County Planning Office, Seminar Participant

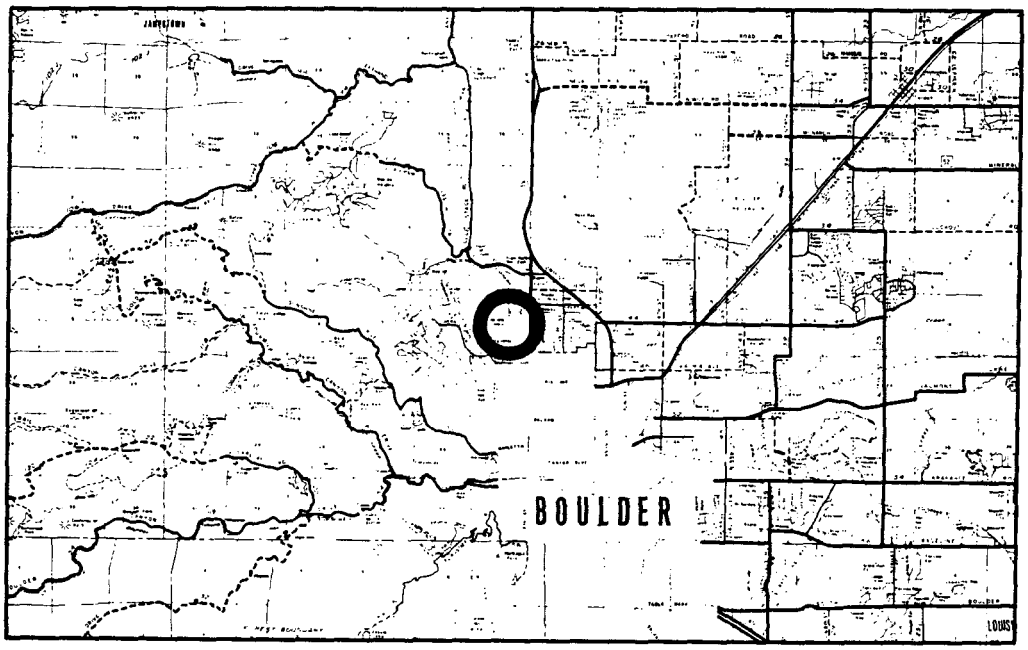
Special thanks to the personnel in the County Assessor's and Records Department for their patience and help during our long hours researching. Thanks also to Mary Axe for typing this report. A final note of thanks to Professor Donald D. MacPhail for his direction and encouragement in the research and preparation of this report.

The opinions expressed herein represent solely the conclusions of

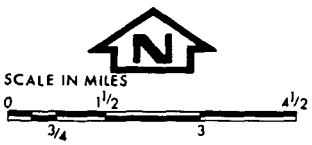
the students in the seminar. Their viewpoints do not necessarily reflect those of the University of Colorado, of the Geography Department, or of the City of Boulder.

LOCATION MAP

MAP NO. 1



WONDERLAND LAKE



Map No. 2 (photomap)

PART I

ENVIRONMENTAL SURVEY

Wonderland Lake is located in Section 13, Township 1 North, Range 71 West of the 6th P.M. The Boulder area is classified climatically as a semi-arid interior continental type. Geographically, the subject property is located immediately east of the Boulder Hogback, where the terrain rises dramatically. The lower half of this steep slope is generally treeless. The vegetation is described in the biological report of the area. Near the top of the hogback are a few single-family residences. The relief of the eastern slope of the hogback is comprised of small parallel ridges and valleys. This is due to erosion, weathering and runoff down the slope.

South of Wonderland Lake, open space separates Leach and Arnold's Linden Park Subdivision from the lake by approximately 1300 feet. Residence development appears to be near completion, and Leach and Arnold are planning no more new sites in the immediate area. Their plan is to leave the area surrounding the lake natural. This open space, with the exception of a few trees, is generally rocky, hilly grassland.

On the east end of the lake there is an earthen dyke which was built to increase the depth of the lake. The east side drops rather steeply into a gully that continues to drop in elevation until it runs into Broadway. The present land use of this valley is grazing for horses. To the south of this valley are seven residences along Quince Avenue.

North of the valley are single-family residences on Utica and Union Avenues. These areas very gently slope eastward toward Broadway. Immediately to the north of the lake around the shoreline are two single-family residences. According to one of the residents near the lake, the water

level of Wonderland is presently at an all-time low. Contributing factors to this situation are a high evaporation rate and very little run-in. Besides the natural water level in the area the only method of gaining water appears to be through Silver Lake Ditch, seepage, and precipitation. It is safe to assume that there is not enough runoff from snow and rain from the mountains to sustain an adequate water level. Apparently Silver Lake Ditch Company holds water rights to Silver Lake Ditch. In the past, water has been deterred before crossing into the subject property (at point A on drainage map).

Presently, there are only a few inches of water in the ditch and its flow is light. Point C of the drainage map shows the only present source of water intake by the lake. This intake is due to the efforts of Rex A. Scott who lives near the lake. He is diverting some of the ditch water through a small three-inch pipe. So it is evident that there is not enough water to sustain a high, normal water level, since at the present time there is no water running out of the lake.

Present access to Wonderland is very poor. Other than through private property to the north, the only other true access points are located at the intersection of Quince Avenue and a private north-south road from the Leach and Arnold Subdivision.

GENERAL GEOLOGY

Geology of the Boulder area can be considered the result of three major stages of development. First, the area was a broad, nearly flat surface composed of Boulder Creek granodiorite. On this surface the sedimentary rocks were deposited to a depth of several thousand feet. Second,

the present front range was formed by a broad uplift of the sedimentary units. Third, the sedimentary rocks forming this arch were stripped away by erosion, exposing the granite core and leaving steeply dipping sediment on each flank of the upward area. Bedrock in the Wonderland Lake area consists entirely of these sedimentary rocks.

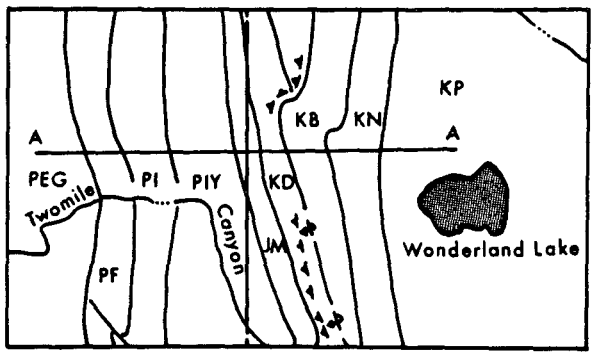
Wonderland Lake is located in Section 13, Township 1 North, Range 71 West of the 6th P.M. The area is geographically located immediately east of the Boulder Hogback and varies in a short distance from an elevation of 5,560 feet to an elevation of approximately 6,120 feet. This sharp rise is an expression of the eastern side of the Dakota Hogback which is composed of erosion resistant inter-bedded units of sandstones and shales dipping steeply east. The extreme western portion of the area lying between Wonderland Lake and the Dakota Hogback is underlain by the Benton formation while the remainder of the property is underlain by the Niobrara and the lower portion of the Pierre formations. These geologic units are composed predominantly of a dark grade fissile shale containing a considerable amount of expansive clays. Due to the incompetency of the shale units and the dip slope to the west of Wonderland Lake, several land slumps have occurred in the past. One of the major slumps in the area is immediately west of Wonderland Lake and encroaches almost on the lake itself. The area has a thin mantle of alluvial debris and weathered material.

Soils

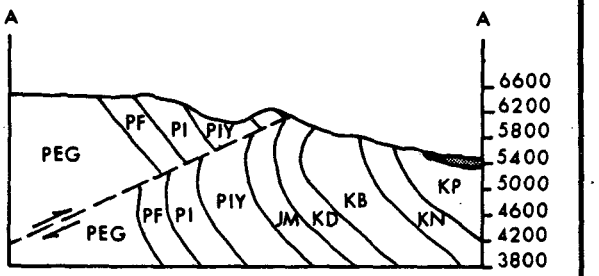
There is no well developed soil profile in the Wonderland Lake area. Such soil as does exist is composed of:

GEOLOGICAL MAP

MAP NO. 3

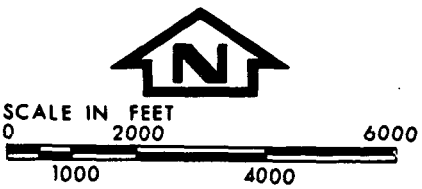


PLANIMETRIC VIEW



CROSS SECTIONAL VIEW

KP	Pierre Formation
KN	Niobrara Formation
KB	Benton Formation
KD	Dakota Group
JM	Morrison
PIY	Lykins Formation
PI	Lyons Formation
PF	Fountain Formation
PEG	Granite



1. A thin mantle of upland terrace gravels;
2. A poorly stored assemblage of Detritus which has originated from the dip slopes to the west; and,
3. Partially wetted and decomposed Pierre shale.

The Pierre shale contains modest amounts of expansive clays. However, the Benton formation which comprises the dip slope to the west of the Wonderland Lake contains a high percentage of swelling clays. In addition to the swelling problems associated with these expansive clays, the soil of Wonderland Lake area is highly alkaline. White deposits of alkali can be seen in almost all surficial depressions.

On the basis of information presented here, the major consideration at this site will be the slope stability. At the present time, in their natural state the slopes may be considered entirely safe and stable. However, extreme care will be necessary in all cuts, fills, slope angles, and drainage associated with developing potentials in the area. Special consideration should be given to foundation design for all structures.

The presence of highly alkaline material should be considered before irrigated landscaping of the area surrounding, as irrigation tends to concentrate the alkali at the surface with the net result that the lawns and shrubs would be destroyed. Sheet waste and local drainage of the area surrounding the lake may concentrate mineral contaminants in the lake itself which may be detrimental to life.

BIOLOGIC EVALUATION

Wonderland Lake is located within the Plains Grassland regional ecosystem just below the Grassland-Lower Montane ecotone. The vegetative

units which occur are basic structural responses to climatic control. This area has been actively influenced by man in the form of grazing, building, et cetera, which produces a definite sociological response of the vegetation, but always within the range of regional climatic control. Because the study area encompasses more than the lake itself, a separation into physiographic units should be helpful.

Surrounding Upland

This area is found mainly to the south and west of the lake. Mixed grasses and herbs prevail including grama grass (Bouteloua spp.) and buffalo grass (Buchloe spp.). Moderate to occasional occurrence of yucca (Yucca glauca Nutt.) and prickly pear cactus (Opuntia rafinesquei Engelm.) was noted. No attempt was made to identify the herbs as most were in the post-flowering condition. A high percentage, however, were within the family Compositae. Prickly lettuce (Lactuca scariola L.) was in profusion west of the lake. This is an introduced weed associated with soil disturbance. No unusual associations were noted in this area.

Eastern Drainage

This area exists below and east of the lake dam and extends to Broadway. The sides of the drainage have been very heavily grazed and offer no particularly interesting features. At the base of the dam, a substantial growth of sandbar willow (Salix spp.) is evident. Left alone, it should continue to spread easterly along the drainage.

The Lake Dam

This narrow band which forms the eastern edge of the lake is dominated by fairly mature willows (Salix spp.). In addition, a mixture of

forms of mosses and crustose lichens were found scattered throughout the area. The aquatic vegetation, owing to the shallow condition of the lake and resultant high degree of photosynthesis, is rather profuse. These particular flora should be given greater study in the near future, but at present the expertise of the study group does not allow for this.

Fauna

The animal life of the area is quite diversified and relates to the varied micro-environment and the creation of many niches. Mammals such as the mule deer (*Odocoileus hemionus*), red fox (*Vulpes fulva*), blacktail prairie dog (*Cynomys ludovicianus*), and muskrat (*Ondatra zibethica*) have been noted in the study area after only a few days of observation. It is very likely that an in-depth study will indicate more.

The avian life of the area is as abundant as it is diversified. The aquatic setting of the area provides a magnet in the semi-arid Boulder region for many species of waterfowl and assorted shore-birds. One member of the study team reported spotting over 200 waterfowl at the lake in one day. Of the more common species noted were the widgeons, teal, and mallards. Additionally, more extensive sightings have occurred by local bird clubs and individuals, and residents report up to 500 waterfowl have frequented the lake when the water level was normal.

Turtles and crayfish have been spotted at the lake; however, no attempt has been made to determine their actual populations. The Colorado Division of Wildlife and Fisheries Research Center plans to make a complete aquatic survey of the lake in the spring of 1973. No study has been made as to the presence of insects in the area, although interesting finds may

await the aquatic survey.

Summary

The Wonderland Lake area is biologically diversified and educationally stimulating. As a result of this diversification, a rich variety of wildlife within a relatively small area awaits the occasional visitor as well as the serious student.

Although the area has been substantially influenced by man, it is felt that through critical analysis of the biota and careful management practices, the area can maintain its unique character and provide exceptional aesthetic and educational experiences. In many cases species that once occurred naturally can be reintroduced or encouraged. The areas of predicted concentrated usage should be directed away from nesting and other fragile areas for obvious reasons. Boating of any type should not be allowed due to the impact of such activity upon the flora and fauna coupled directly with a relatively small area.

It is hoped that the above factors will be considered if the area is to be preserved for future generations.

PART II

LAND USE

When considering the present land use of the Wonderland Lake area, it is appropriate to consider briefly past land use of the area as seen through aerial photographic maps taken in 1938, 1956, and 1972. The 1938 photo map shows the area in a relatively undeveloped stage when compared to the one taken in 1972. Basically, the land appears to have been committed to agricultural pursuits; that is, there were three orchard plots just west of Broadway in the southeast part of the Wonderland Lake area. An unimproved road connected Wonderland Lake and Broadway. The rest of the surrounding area was used as open pasture land.

In 1956, definite trends toward development appear to have started. Originally, in the southwest end of the property, a small rectangular reservoir was developed. Secondly, several homes were built in the area just west of Broadway and east of the dam bank of Wonderland Lake. In addition, two new improved streets were constructed, running east to west from the lake area to Broadway. Finally, development around Wonderland Lake itself was started by a home being built on the north shore of the lake.

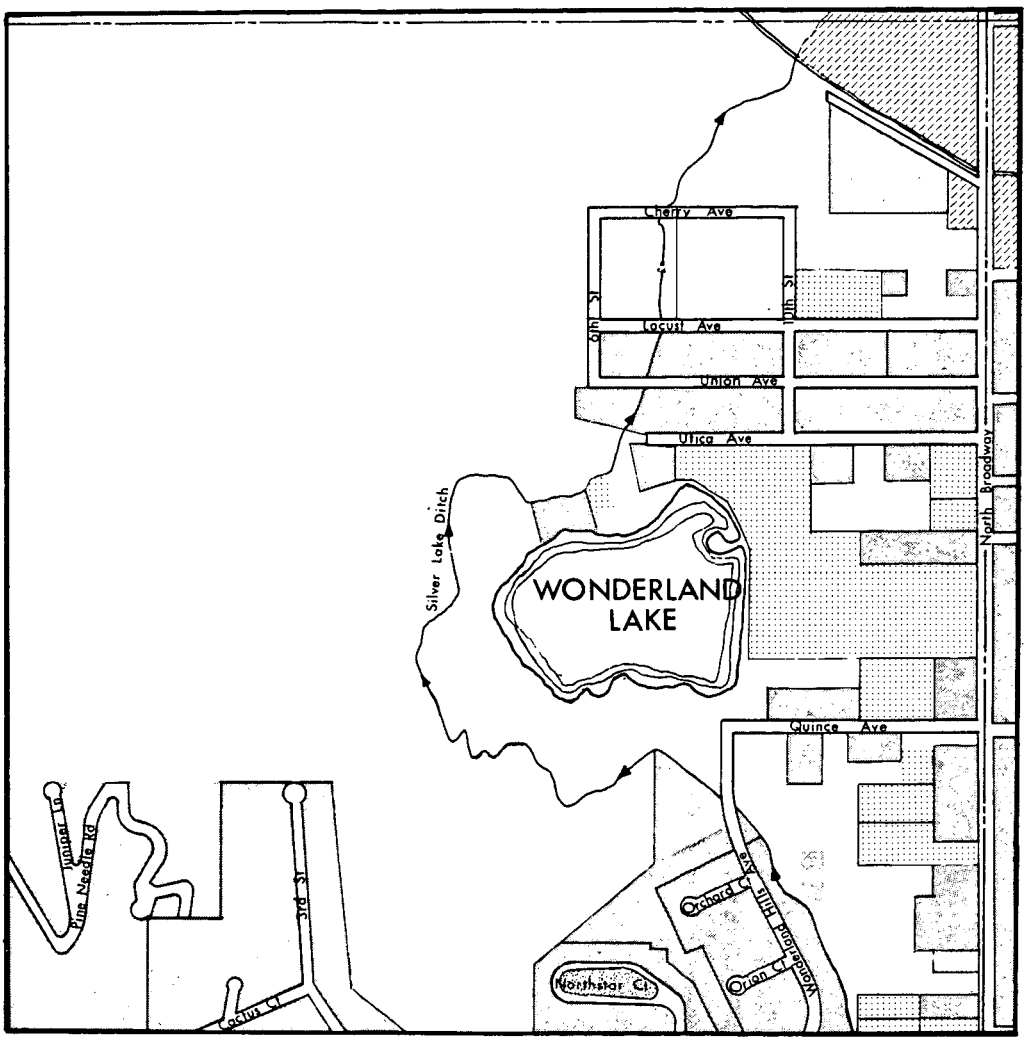
By 1972, the face of the area had changed dramatically as a result of the increased pressure of urbanization and subdivision development. First, the small rectangular reservoir was completely enclosed and covered. Two more east-west streets were developed west of Broadway and northeast of the lake area. These streets were built specifically to support a small subdivision development. In the very northeast section of the area, just west of Broadway, a mobile home development was placed, capable of support-

ing sixty-eight mobile homes. On the northwest side of the lake shore another residence, the Rex A. Scott home, was completed.

The most dramatic change in the area, however, was the subdivision development begun by the Leach and Arnold Company located on the south end of the property and also along the Hogback. The development has grown to such an extent that the subdivision is now within 1300 feet of the south shore of Wonderland Lake. The current land use of the Wonderland Lake area is shown by Map No. 4. The land use survey shows the encompassing nature of subdivision development.

PRESENT LAND USE

MAP NO. 4



LEGEND

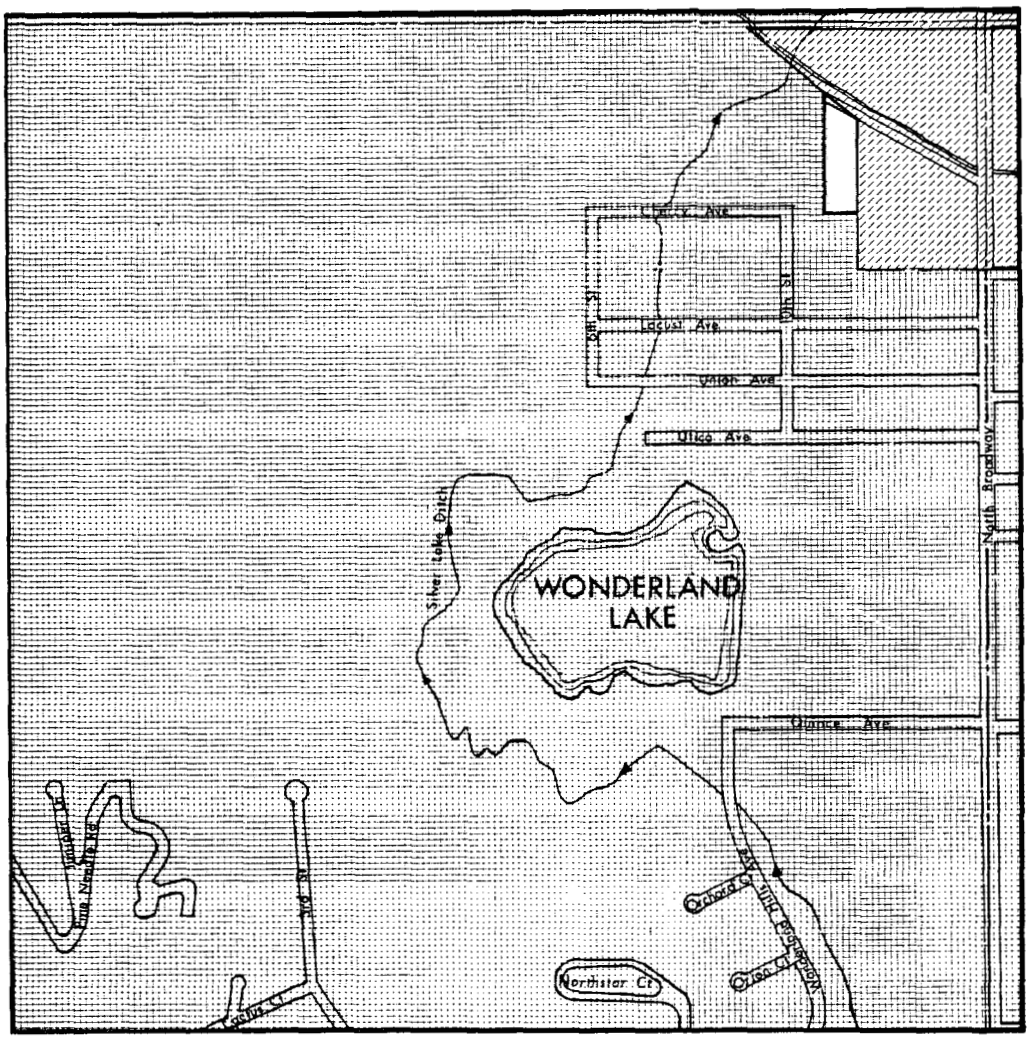
- Vacant
- Agriculture
- Commercial
- Residential
- Education Fac
- Recreation

N

SCALE IN FEET
0 500 1500
250 1000

ZONING

MAP NO. 5



LEGEND

- Rural Residential
- Commercial
- Multiple Family

N

SCALE IN FEET

0 500 1500

250 1000

ZONING MAP

PART III

LAND EVALUATION AND TENURE

The area of this study is generally Section 13, Township 1 North, Range 71 West, although the entire section is not covered. The following pages probably contain more information on land and tenure than is necessary to determine a bidding price. However, this information may lead to an understanding of the extensive and recent growth in the area, and the possibility of future trends.

The section can be divided into two parts: residential lots, generally small in area, can be found in the eastern and southern portions of the section, and land in the northern and western portions, much of which is owned by the City of Boulder. Property values vary widely within the section. The price per acre reflects the desirability of land for building sites. Generally, undeveloped land is more valuable than comparable agricultural land farther from the city.

Though the City of Boulder owns a significant portion of the section, three remaining areas may yet interest the city. These are: 1) Wonderland Lake; 2) the Dunn property (see attached, 21 and 22) east of the lake; and 3) the 28 acres due west of the lake (see attached, 52).

The city presently holds an option on the Wonderland Lake property. Since lake property is not assessed by the county, it is hard to judge its value prior to buyer/seller contact. The Dunn property is flanked by residential areas, and therefore will be expensive. Though expensive, this small valley seems a natural extension of the open space idea. Without city purchase, further development of this property can be expected. ALA

Partnership holds the land due west of the lake. If the city were to purchase this land, the price per acre would be much higher than the land immediately west of it which was recently purchased by the city. The prime residential character of this land will make it expensive and difficult to obtain. The following table and map (Map No. 6) illustrate the land ownership and values in Section 13.

TABLE 1

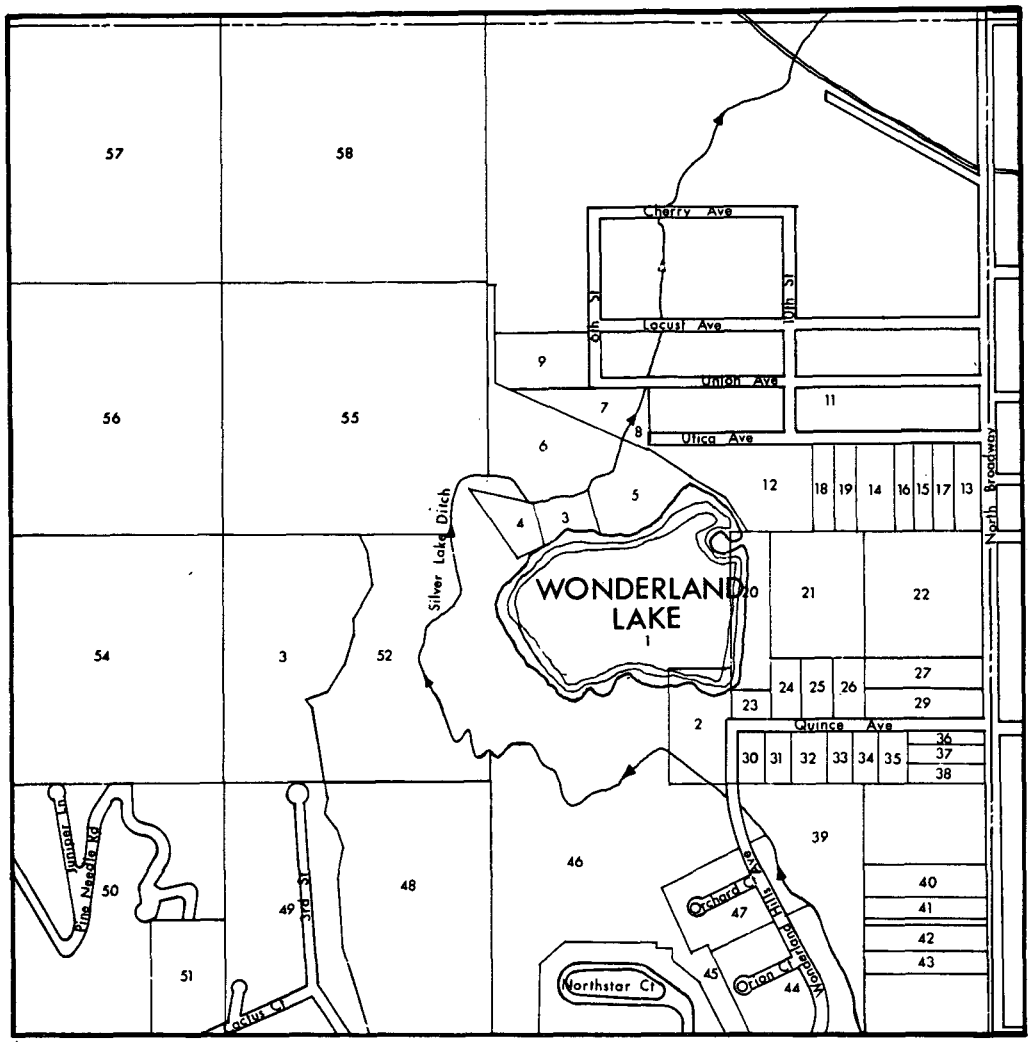
Land Ownership and Value in Section 13, T1N, R71W

Section Designation	Boulder County and City Designation	Owner	Acres	Real Value per Acre
NW^4SE^4	1) Wonderland Lake	Leach & Arnold	56.37	
	2) 2025	ALA Partnership	4.2	1050.
	3) 2296 less A	"	.67	1340.
SW^4NE^4	4) 2296A & 3085	Rex H. Scott	2.2	9950.
	5) 2070	ALA Partnership	3.6	3150.
	6) 1762	"	3.6	210.
	7) 1754N	Beverly Ann Short(1/8) Glen Short (3/4) Robert F. Short (1/8)	1.0	22800.
	8) 1754N1	Philip W. Raveling	1.0	17600.
	9) 1754R	Boulder County	3.5	
	10) 1754	Carrie P. Sheets	4.0	9530.
	11) 1754	Sheet Subdivision	9.29	41700.
	12) 1764	ALA Partnership	4.6	952.
SE^4NE^4	13) 1764A	Allen T. & Velma J. Parrish	1.89	13880.
	14) 1764B	Dean R. & D. A. Lauer	2.0	3610.
	15) 1764C	E. R. & D. Long	1.0	11420.
	16) 1764C1	"	1.0	9300.
	17) 1764C2	B. E. & Pearl Barr	1.0	14590.
	18) 1764D	G. F. & Wilma Smysor	1.12	13740.
	19) 1764E	"	.82	2680.
NE^4SE^4	20) 1760 1761	ALA Partnership	3.0	1245.
	21) 1755	Anna Lee Dunn	8.75	830.
	22) $NE^4NE^4SE^4$	"	10.0	
	23) 1761	Joseph C. Young	.69	2130.
	24) 1758A	Frances H. Snyder	1.06	25320.
	25) 1758	Charles D. & B. Roberts	1.46	14740.
	26) 1758B	James T. Sacamamo	1.06	16270.
	27) $N^2N^2SE^4NE^4SE^4$	John H. & C. Staphens	2.5	10950.
	28) 3299 (or) $S^2N^2SE^4NE^4SE^4$	National State Bank (Trustee)	2.5	5970.
	29) $S^2N^2SE^4NE^4SE^4$	ALA Partnership	2.5	3270.
	30) 1757C	A. A. & R. M. Ebel	1.0-	2670.
	31) 1757F	"	1.0-	2670.
	32) 1757D	C. Wayne & K. McDuffie	1.17	12470.
	33) 1757G	A. A. & R. M. Ebel	1.0-	2200.
	34) 1757E	Lois M. Bastrom	1.0-	19410.
	35) 1757B	E. L. & J. M. Sater	1.14	11710.
	36) 1757	F. C. &. L. L. Hendee	.7	3140.
	37) 1757A1	D. O. & Mary A. Miller	1.0	9760.
	38) 1757A	Kurt & Elizabeth Wolf	1.0	15850.

SE^4SE^4	39) 1756	A. A. & R. M. Ebel	40.0	250.
	40) $N^2S^2NE^4SE^4SE^4$	ALA Partnership	2.5	3260.
	41) 2947 & 1763	Jarrow School Inc.	2.98	
	42) 1768	Clarence W. & Florence E. Richman	2.0	9060.
	43) 1998	L. A. & A. L. Durward	2.4	8400.
	44) Wonderland Hills			
	45) West of Ditch,	City of Boulder	6.6	
SW^4SE^4	46) SW^4SE^4less Wonderland Hills	"	21.2	
	47) Wonderland Hills #2	Albireo Investment Co. (19 lots), Leach & Arnold (1 lot), A. & M. L. Sinyder (1 lot) R. & R. Pershbacker (1 lot), K. & F. & S. Smith (1 lot)--total	6.85	5930.
SE^4SW^4	48) SE^4SW^4	Albireo Investment Co.	24.51	
	49) SE^4SW^4 (west)	Spring Valley Est.	15.49	
SW^4SW^4	50) SW^4SW^4 less E400' of S600'	Pine Brook Hills #6	34.5	
	51) E400' of S600'	Spring Valley Est.	5.51	
NE^4SW^4	52) $E^2NE^4SW^4$	ALA Partnership	28.0	(not taxed sale 1972)
	53) $W^2NE^4SW^4$	City of Boulder	12.0	
NW^4SW^4	54) NW^4SW^4	"	40.0	
SE^4NW^4	55) SE^4NW^4	"	40.0	
SW^4NW^4	56) SW^4NW^4 less 4036 & 4036A	"	38.0	
NW^4NW^4	57) NW^4NW^4	"	40.0	
NE^4NW^4	58) NE^4NW^4	"	40.0	

OWNERSHIP – VALUATION *

MAP NO. 6



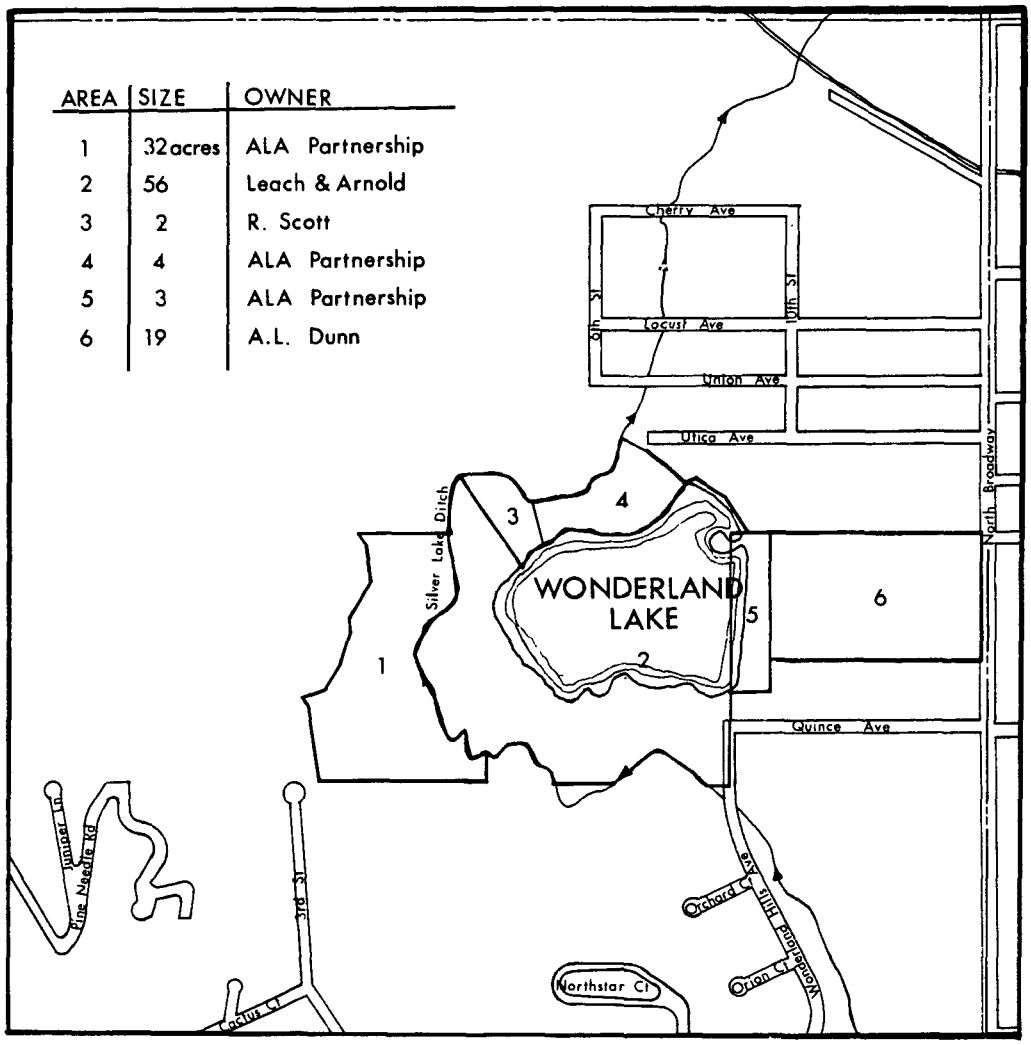
* Numbers correspond to Table 1

SCALE IN FEET
0 500 1500
250 1000

PROPOSED LAND USE

MAP NO. 7

AREA	SIZE	OWNER
1	32acres	ALA Partnership
2	56	Leach & Arnold
3	2	R. Scott
4	4	ALA Partnership
5	3	ALA Partnership
6	19	A.L. Dunn



N

SCALE IN FEET

0 500 1500

250 1000

PART IV

ALTERNATIVES, IMPACTS AND RECOMMENDATIONS

A study of the Wonderland Lake area leads to a number of possible alternatives. Much of the area's future has been determined by development. However, a limited and vital area remains open to land use options. In the following paragraphs three alternatives are advanced and examined. The recommendations of the Study Group follow the alternatives.

ALTERNATIVE I

The first alternative is a "hands off" policy, the city allowing private development to take its course. If this policy is followed, the Wonderland Lake area will be developed. Area #1 (see Map No. 7), due to its prime location, will be developed first. This area will contain expensive homes, overlooking the lake, within the near future. Areas #5 and #6 (see Map No. 7) will develop slowly. This area, below the dam, is a valley and somewhat marshy. However, area #6 borders Broadway and may in time become a commercial strip development. Areas #3 and #4 (see Map No. 7) already have residential units. Area #2, Wonderland Lake, will probably continue to exist as a lake. However, the possibility of filling and residential development sometime in the future cannot be overlooked.

A modified Alternative I would be city purchase of Wonderland Lake. If this course were followed, the lake would be maintained. Yet, with only this land purchase there would be no public access to the lake. In effect, it would become a private lake for the immediate residents, maintained at public expense.

ALTERNATIVE II

The second alternative is city acquisition of areas #2, #4, #5, and

#6. These areas will prove less expensive than the properties #1 and #3. Under this plan, areas #5 and #6 could serve several purposes. The city could develop a community center, public buildings, or an intensive recreational center. Areas #4 and #2, generally Wonderland Lake, would prove useful as a moderate use recreational site. Fishing and picnic grounds seem a natural use for this space. Purchase of the above properties also has the advantage of linking these areas with the large expanse of open space to the north and west, an area recently purchased by the City of Boulder. This would allow citizens to gain access, via city property, to the city-owned hogback.

A modification of Alternative II would be the purchase of only areas #5 and #6. Acquiring this land would allow the city an option in the North Boulder area for a future civic or recreational site.

ALTERNATIVE III

Alternative III is the acquisition of all lands surrounding Wonderland Lake. This alternative depends upon the ability to acquire property #1, then in turn properties #2, #5, #6, #4, and #3. Area #1 will be very expensive due to its prime nature as a site for residential development. Areas #3 and #4 will be somewhat difficult to obtain since each property has a residential unit on it. However, #3 and possibly #4 can be dropped from this alternative without too much damage until some future time when this property becomes more available.

This alternative is basically a progression of recreational lands. Area #1 would become a limited-use recreational area. This property is part of the hogback and complements that portion of the hogback presently

owned by the city. A limited number of bridle and hiking trails, in conjunction with other city-owned open space, would be excellent utilization of this land. Areas #2, #3, and #4 would serve as a moderate-use recreational area, possibly for fishing and picnicking. Areas #5 and #6 would again be useful as places of intensive use for recreation. Use of this land may develop along several lines.

RECOMMENDATIONS

The Study Group recommends Alternative III, the purchase of all lands around Wonderland Lake (Map No. 7). Area #1 is of prime importance. This land constitutes part of the hogback. If it were allowed to develop, this area would be extremely visible from any direction. Residential development on this property would scar the natural beauty of the hogback. Anything that detracts from the aesthetic value of the foothills would also detract from the aesthetic value of Boulder. When this land is acquired by the city, it will have been put to its most beneficial use--visual aesthetic satisfaction.

In the event that Alternative III is rejected by the city, the Study Group lists the following specific recommendations:

1) That the city reject purchase of Wonderland Lake unless able to acquire either property #1 or properties #5 and #6;
2) That if Wonderland Lake is purchased, it not be deepened in the immediate future. Money, at present, is better spent on land acquisition;
3) That if Wonderland Lake is purchased, an inflow/outflow drainage be immediately established via Silver Lake Ditch;
4) That if development takes place on the hogback (property #1), the city

move to increase the minimum lot size, and enforce height limits;

5) That if development takes place on the hogback, and the city buys Wonderland Lake, the city enforce some type of runnff controls on the developers and lot owners, thus maintaining water quality in Wonderland Lake.

If any of the above alternatives is accepted which allows for public fishing, the Colorado Division of Wildlife, under agreement with the City of Boulder, could manage the lake for a warm water fishery. This would include largemouth bass, sunfish, and channel catfish. Depending upon ice safety conditions, a winter fishery utilizing rainbow trout could also be established and maintained. Furthermore, the Division states that "this type of management on similar lakes currently supports approximately 1,000 to 1,500 fishing trips per acre per year."[1]

APPENDIX I

A PARTIAL LIST OF BIRDS SPOTTED AT WONDERLAND LAKE OVER A PERIOD OF TWO DAYS

Mallard (*Anas platyrhynchos*)

American Widgeon (*Mareca americana*)

Canvasback (*Aythya valisineria*)

Shoveler (*Spatula clypeata*)

Pintail (*Anas acuta*)

Redhead (*Aythya americana*)

Green-winged Teal (*Anas carolinensis*)

Blue-winged Teal (*Anas discors*)

Water Pipit (*Anthus spinoletta*)

Great Blue Heron (*Ardea herodias*)

Killdeer (*Charadrius vociferus*)

Wilson's Phalarope (*Steganopus tricolor*)

Ring-billed Gull (*Larus delawarensis*)

Franklin's Gull (*Larus pipixcan*)

FOOTNOTE

1 Letter from Colorado Division of Wildlife, Fisheries Research Center

ADDITIONAL REFERENCES

William A. Weber of the University of Colorado Museum

Robbie Elliot of the Boulder Bird Club

Tom Powell, Fisheries Research Center, Colorado Division of Wildlife

Jane Bock, Department of Biology, University of Colorado

Map sources

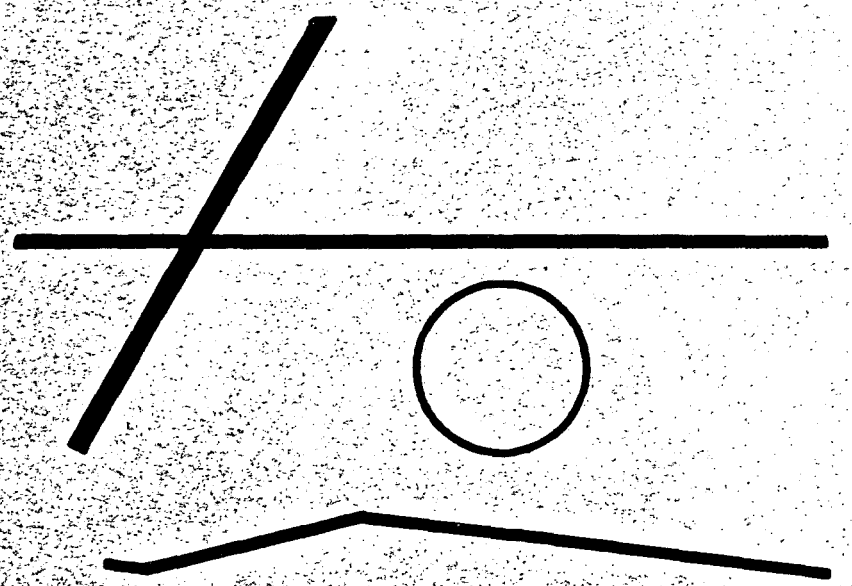
United States Geological Survey--Boulder Topographic Quadrangle, 1957

Boulder County Road Map, 1971

Boulder County Base Map, 1965

APPENDIX

HAYDEN LAKE AREA STUDY



Department of Geography

University of Colorado

HAYDEN LAKE

AREA STUDY

DEPARTMENT OF GEOGRAPHY

UNIVERSITY OF COLORADO

Boulder, Colorado

1972

TABLE OF CONTENTS

	Page
CONTRIBUTORS	i
FOREWORD	ii
PART I ENVIRONMENT	2
Location	2
Climate	2
Geology	3
Drainage	3
Soils	4
Vegetation	6
Fauna	10
PART II LAND USE	12
Past	12
Present	16
PART III LAND TENURE AND EVALUATION	18
Tenure	18
Evaluation	18
PART IV ALTERNATIVES, IMPACTS, AND RECOMMENDATIONS	22
Alternatives, Impacts	22
Recommendation	24
FOOTNOTES	26
ADDITIONAL REFERENCES	26

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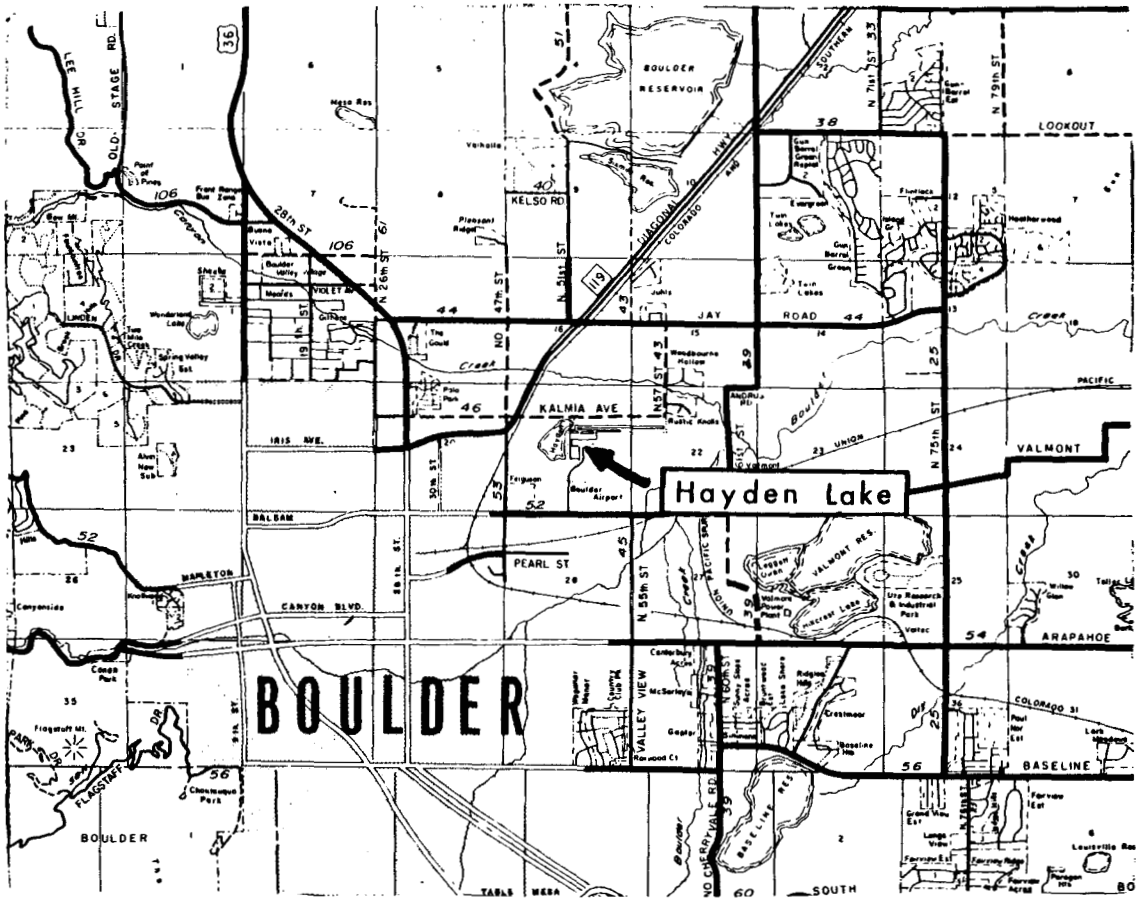

Hayden Lake
BOULDER
BOULDER RESERVOIR
LOOKOUT
KELSO RD
JAY ROAD
KALMIA AVE
IRIS AVE.
BALSAM
PEARL ST
CANYON BLVD.
VALMONT
ARAPAHOE
BASELINE
VALMONT RES.
LEE HILL RD
OLD STAGE RD.
28th ST
N 26th ST
N 47th ST
N 55th ST
N 71st ST
N 75th ST
N 79th ST
PACIFIC
UNION
COLORADO
SOUTH
TABLE MESA
FLAGSTAFF

Airport
Longmont Diagonal
Valmont Rd

FOREWORD

This report on the Hayden Lake area is one of three undertaken by the Department of Geography at the University of Colorado for the City of Boulder. The project was initiated by the students and faculty of Geography 540, Land Use Seminar, as a research study. Its purpose is to provide information for city and county officials and concerned citizens to assist them in planning the future development of the City and County of Boulder.

Payments of expenses and for materials for this report were made possible by a grant from the City of Boulder. The project was carried out through field investigation and library research by the students.

The study group would like to thank the following people who provided very helpful assistance and comments for our study:

Sanford Gladden, Boulder Historian

Paul Skwiot, City Land Officer, Advisory Committee on Open Space

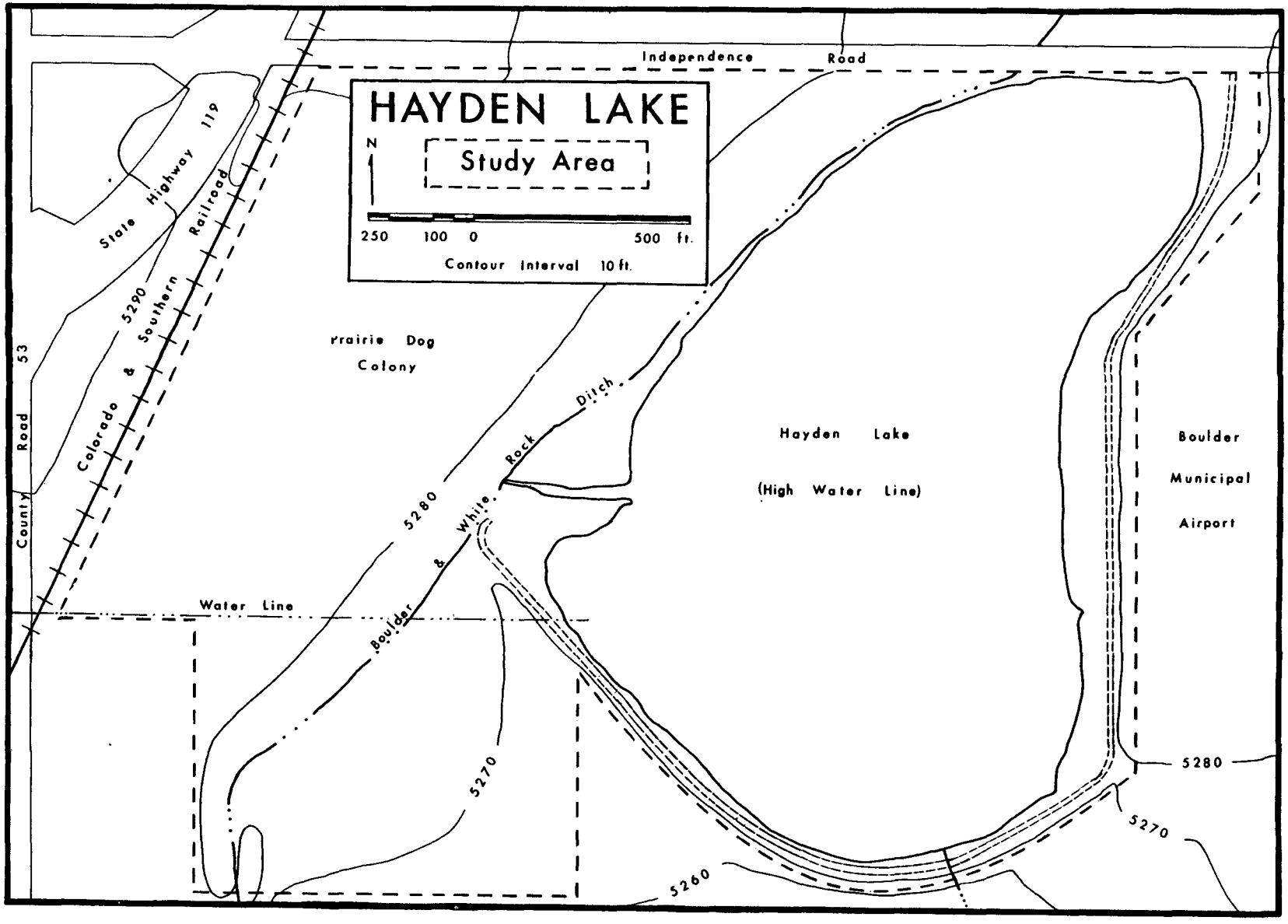
Tom Powell, Assistant Wildlife Researcher, Colorado Division of Wildlife

Libby Goodwin, Boulder County Park Planner

Doug Tiefel, Boulder County Planning Office, Seminar Participant

Special thanks to the personnel in the County Assessor's and Records Department for their patience and help during our long hours researching. Thanks also to Mary Axe for typing this report. A final note of thanks to Professor Donald D. MacPhail for his direction and encouragement in the research and preparation of this report.

The opinions expressed herein represent solely the conclusions of the students in the seminar. Their viewpoints do not necessarily reflect those of the University of Colorado, of the Geography Department, or of the City of Boulder.


HAYDEN LAKE
Study Area
N
250 100 0 500 ft.
Contour Interval 10 ft.
Independence Road
State Highway 119
Colorado & Southern Railroad
County Road 53
5290
rrairie Dog
Colony
Rock Ditch
Boulder & White
5280
Hayden Lake
(High Water Line)
Boulder
Municipal
Airport
Water Line
5270
5260
5280
5270

PART I

ENVIRONMENT

LOCATION

The study area under consideration is approximately eighty acres of land located two miles northeast of downtown Boulder. It includes Hayden Lake and 44 acres of agricultural land between the lake and the Colorado & Southern Railroad right-of-way. Its formal location is described as the center of the western one-half of Section 21, Township 1 North, Range 70 West. It is bounded on the north by Independence Road, an east-west county road, on the east by the Boulder Municipal Airport, and on the south by the Vista Village Trailer Park for mobile homes.

The study area, referred to as the Hayden Lake area in this report, is on a gentle sloping alluvial terrace. Elevation ranges from 5,290 feet above sea level at the northwest corner to 5,260 feet at the southeast corner. Its slope is ten degrees to the south and east.

Hayden Lake is an irrigation reservoir with an earth-filled dam on the southeast side. The Boulder and White Rock Ditch, flowing from the southwest to the northeast, feeds the reservoir through a small side ditch.

CLIMATE

Being located virtually in Boulder, the study area's climatic conditions are identical with Boulder's. The average monthly temperature ranges from a high of 71.8 degrees F. in August to a low of 37.5 degrees F. in January. The annual mean temperature is 51.6 degrees F. The frost-free season is usually 140-155 days per year. The annual precipitation is

18.57 inches, much of which is produced by numerous summer thunderstorms. Included in this is an average annual snowfall of 81.0 inches. Humidity, as would be expected in a semi-arid region, is low. The most dramatic climatic characteristic of the Boulder area is the frequent "high wind." The winds are generally from the west and heaviest during the winter months.[1]

GEOLOGY

The geology of the Hayden Lake area is relatively simple with the subsurface being made up of mainly alluvial which forms a gentle sloping terrace. The alluvium attains a maximum depth of approximately thirty feet and is totally underlain by Pierre Shale. This formation which can be more than 5,000 feet thick is composed of dark gray to black clay shales and arenaceous shales which are homogeneous over large areas.[2]

DRAINAGE

Hayden Lake was built by the Boulder & Lefthand Irrigation Company of Longmont, Colorado, as a water storage reservoir. The original filing of the lake was for 190.1 acre feet of water on July 21, 1905. In 1931 the reservoir was enlarged to a depth of 21 feet which allowed for an additional 311.7 acre feet of water.[3] The water is used to irrigate 2,800 acres of land owned by approximately forty separate users living to the south and east of the lake. Its 501.8 acre foot capacity (21,860,954 cubic feet) of water is attained in the spring and frequently later in the season during particularly wet years. At the time of this writing (mid-September), the water level was down approximately seven feet, with no attributable inflow from its feeder ditch, the Boulder and Whiterock Ditch,

called the Beasley Ditch by some local people.

The lake lies on a north-south axis and fills an erosion depression cut into the surrounding alluvial terrace. Its 5,600 foot perimeter (41.36 acres) at high water is tightly bounded on three sides by the Boulder County Airport to the east, the dam to the south, and Independence Road to the north. Boulder & Whiterock Ditch runs roughly parallel to the lake's western frontage and varies in distance from thirty to 250 feet from the shoreline. Beyond the ditch lie 44 acres of land also owned by the Boulder & Lefthand Irrigation Company, but under the reign of a substantial prairie dog colony.

Hayden Lake's water is appropriated and conveyed from Boulder Creek via the Boulder & Whiterock Ditch, which commences at Broadway Street in downtown Boulder. The water is removed when needed by means of an underground pipe beneath the dam which extends southward to the Boulder & Lefthand Irrigation Ditch. Complimentary rain water captured through drainage is probably minimal, due to the negligible relief of the surrounding land and the subsequent lack of any natural drainage channels into the lake.[4]

SOILS

All of the soil of this area is classified by the Soil Conservation Service, SCS, as type 28B, Nederland very cobbly sandy loam.[5] This is a moderately deep, well drained, poorly developed soil. The surface soil is moderately light textured. The subsoil is medium textured. This soil is underlain by rock and cobble at twenty to forty inches and has enough cobble and rock throughout to prevent cultivation. Water intake and water holding capacity are medium. Further classification by the SCS shows this soil ranging in slope from one to 12 per cent. It is not suited for cultivation,

having very severe limitations. It is suited for range, woodland, or wildlife uses if carefully managed. Usually the soil will not take physical practices such as pitting, furrowing or seeding. It can be shallow, heavy, stony, low in fertility, salty, alkaline or have low moisture capacity.

Examination of the Nederland series, as detailed by the SCS, may provide further insight. The Nederland series consists of deep, well drained, loamy soils. They develop on old high terraces and alluvial fans in loamy alluvium with much cobble and stone. Vegetation is mainly tall grasses and mid grasses. The surface layer is brown, very cobbly, sandy loam about six inches thick and noncalcareous. The subsoil is dark, reddish brown, sandy clay loam about 11 inches thick, noncalcareous, with much cobble. Underlying the subsoil to sixty inches or more is reddish brown, sandy loam, noncalcareous and containing much cobble and stone. The soil is neutral or slightly acidic in reaction. It is moderately permeable with a water holding capacity for the profile of 4.5 to 6.5 inches. Effective rooting is sixty inches or more. Most of these soils are used for range, but some areas near larger towns have homesites on them.

The thickness of the A horizon of the Nederland series ranges from three to eight inches. The texture is typically cobbly, sandy loam with the cobbles ranging from thirty to forty per cent. The B horizon is sandy, clay loam with weak prismatic and blocky structure. Content of the coarse fragments ranges from fifty to seventy per cent, with the thickness of the B horizon ranging from 22 to 27 inches. The C horizon ranges from light sandy clay loam to sandy loam with more than fifty per cent coarse fragments.

To summarize, the Nederland very cobbly sandy loam is a difficult

soil. Stones and cobbles prevent efficient plow agriculture. Though the erosion hazard is slight, if it occurs, reseeding is very difficult. With good range management this soil can produce excellent forage.

VEGETATION

It is apparent from the vegetation growing in the vicinity of Hayden Lake that the soil has been greatly disturbed, the eastern side much more so than the western. All but two of the species are considered to be weed (sand lily and black-eyed Susan). These weedy plants establish themselves on ground where the soil profile and water retention ability have been destroyed. The eastern side appears to have been overturned, possibly when the lake was deepened in 1931. The entire area is heavily overgrazed, particularly the pasture to the west. The overgrazing, by both horses and an overabundance of prairie dogs, results in a destruction of ground cover, which opens the trampled soil to weed invasions. The grasses present were impossible to identify in such a grazed state.

The vegetation can be separated into two broad areas, the area directly surrounding the lake and the adjoining pasture. The plants surrounding the lake grow in roughly concentric rings according to their water requirements and tolerances. Closest to the water on the fine clays are the cockleburs. This area might be submerged early in the spring or summer, but this annual can endure the flooding and waits until the drier August-October to flower. Surrounding the cockleburs on the outer, less-frequently submerged margins is a ring of cottonwood seedlings less than a foot high.

At this point, the rings break continuity because of the difference in soil disturbance on the two sides of the lake. The western side has a

less disturbed soil which is illustrated by the continuation of the ring pattern. On the outer edge of the cottonwood seedlings is an area of poor drainage with sedges, cattails, and bulrushes. Still further west of the lake but along the irrigation ditch are the large peachleaf willows, plains cottonwoods, and shrubby sand bar willows. The eastern side of the lake has a few small cottonwoods and willows at its outer margin, but the disturbed, drier ground is covered with weedy composites (asters) and a tall, weedy mustard (Lepidium latifolium). The dam at the south end also has a few trees, primarily willows and box elders.

The pasture to the west of the ditch has a very sparse ground cover, little grass, and many weedy composites adapted to drier conditions. These include asters, ragweed, sage, and some small Russian thistle.

Ten of the species listed have spiny parts, usually on the leaves of the fruit. These plants are abundant, and at the least can be very annoying. The yucca or prickly pear can inflict serious injury if not treated with caution.

There is an overwhelming number of species in the Composite family. This could be due to one or both of two reasons: 1) This study was undertaken in early fall after most other plants have bloomed and died. Composites such as asters bloom primarily in late summer and autumn and dominate the landscape at that time. 2) Many composites, the goldenrods and ragweeds, for example, are invaders of disturbed ground, and would be present in high numbers in spring and summer as well as in fall.

Few of the plants are attractive, and the general impression is that of a disturbed, weedy roadside.

LIST OF SPECIES

Trees & Shrubs: Populus sargentii (plains cottonwood)
Salix amygdaloides (peachleaf willow)
Salix interior (sandbar willow)
also: Salix bebbiana (bebb willow)
Acer negundo (box elder)
Crataegus erythropoda (hawthorn)

Herbs:

Allergy Pollen: Solidago rigida (Compositae) (stiff goldenrod)
Solidago speciosa (") (showy goldenrod)
Ambrosia psilostachya (Compositae) (western ragweed)
Ambrosia artemisiifolia (") (common ragweed)
Ambrosia trifida (") (giant ragweed)

Spiny: Bidens frondosa (Compositae) (beggars ticks)
Xanthium pensylvanicum (") (cocklebur)
Cirsium arvense (") (Canada thistle)
Lactuca scariola (") (prickly lettuce)
Glycyrrhiza lepidota (Leguminosae) (wild licorice)
Dipsacus sylvestris (Dipsacaceae) (teasel)
Opuntia spp (Cactaceae) (prickly pear)
Yucca glauca (Liliaceae) (narrowleaf yucca)
Salsola kali (Russian thistle) (Chenopodiaceae)
Kochia scoparia (Chenopodiaceae) (Mexican fireweed)

Composites: (in addition to the above)
Aster falcatus
Aster porteri
Aster laevis
Senecio spartioides (grass-leaved senecio)
Cichorium intybus (chicory)
Grindelia squarrosa (gumweed)
Chrysothamnus nauseosus (rabbit brush)
Liatris punctata (blazing star)
Gutierrezia sarothrae (snakeweed)
Artemisia frigida (pasture sagebrush)

Others: Verbascum thapsus (Scrophulariaceae) (mullein)
Euphorbia marginata (Euphorbiaceae) (snow-on-the-mountain)
Asclepias speciosa (Asclepiadaceae) (milkweed)
Rumex crispus (Polygonaceae) (curly dock)
Chenopodium album (Chenopodiaceae) (lambsquarters)
Portulaca oleraceae (Portulacaceae) (purslane)
Lepidium latifolium (Cruciferae) (tall whitetop)

Grasses: Aristada longiseta var. robusta (Agrostidea) (three-awn)
species of the tribe Chloridea (weedy)

Marshy: Typha latifolia (Typhaceae) (cattail)
Scirpus spp (Cyperaceae) (bulrush)
Carex spp (Cyperaceae) (sedges)

Non-Weeds: Rudbeckia hirta (Compositae) (black-eyed Susan)
Leucocrinum montanum (Liliaceae) (sand lily)

FAUNA

As in any natural area we may expect to find a biotic community consisting of many diverse forms of life. The territory surrounding Hayden Lake is populated by fauna common to the dry Great Plains environmental habitat.

At the ground level may be found mice, gophers, skunks, rabbits, snakes, ants, beetles, crickets, grasshoppers, caterpillars, worms, and other animals. Above the ground and in the trees we may observe owls, hawks, meadowlarks, killdeer, gulls, woodpeckers, flickers, crows, magpies, squirrels, butterflies, bees, flies, moths, and other birds and insects.

While it is interesting to note these animals which are common to the complex ecological web of the plains, perhaps the most distinctive animals living in the Hayden Lake area are the prairie dogs in the 44 acre field west of the lake. Although the prairie dog is native to the plains, and at one time large numbers of prairie dogs lived in the western part of the United States, its population has been greatly diminished in recent times. Millions of the animals are killed by poisoned food and poison gases because they are a serious pest to farmers and cattle raisers in the West.

The black-tailed prairie dog (cynomys ludovicianus) of the kind living at Hayden Lake, lives socially in colonies or towns of crowded burrows with populations of between five and 35 per acre.[6] Each burrow has a little mound at its entrance forming a curb about the shaft which leads steeply to a series of chambers 12 feet or more underground. The animal is secure from predators and spends the winter in comfort in these chambers

sustained by a store of food gathered from the surrounding area.

The prairie dog has primarily a vegetarian diet and for this reason is often in competition with cattle and other livestock for range forage. Also, their open burrows occasionally cause injury to horses and farm equipment, thus lending credence to their status as a pest. In some places, however, prairie dogs have been found to destroy weeds with resulting benefit to range grasses, especially grama grass. Also they return underground nutrients to the surface where they may be utilized by plants, and their tunnels permit oxygen to stimulate the growth of microbial life beneath the surface. The study team estimated that there are between 200 and 300 prairie dogs presently living within the Hayden Lake area. With no natural predator evident, future control of the population might be necessary.

An anticipated water life survey of Hayden Lake by the State of Colorado, Division of Wildlife, was postponed until spring of 1973. Mr. Tom Powell, Assistant Wildlife Researcher, has assured us that Hayden Lake has fishery potential and will be included under the State's urban fishing program. He also stated that lakes of similar size usually support 1000-1500 fishing trips per acre per year.

PART II

LAND USE

PAST

The history of the Boulder area is illustrated on a small scale by some of the past land uses of the study area. The early gold strikes which brought miners to the area required agricultural support from the plains. In order to grow productive crops on the Colorado Piedmont a farmer needed to irrigate his land. For him to be assured of water when he needed it, reservoirs were built, and farmers and ranchers joined together to form ditch companies. Hayden Lake was just such a reservoir, being constructed in 1875 but not "officially" completed until 1905.

The railroads also played a significant part in the early history of the area. In 1870 the Colorado Central Railroad, later changed to the Colorado and Southern Railroad, was built between Boulder and Longmont. The track forms the western border for the study area.

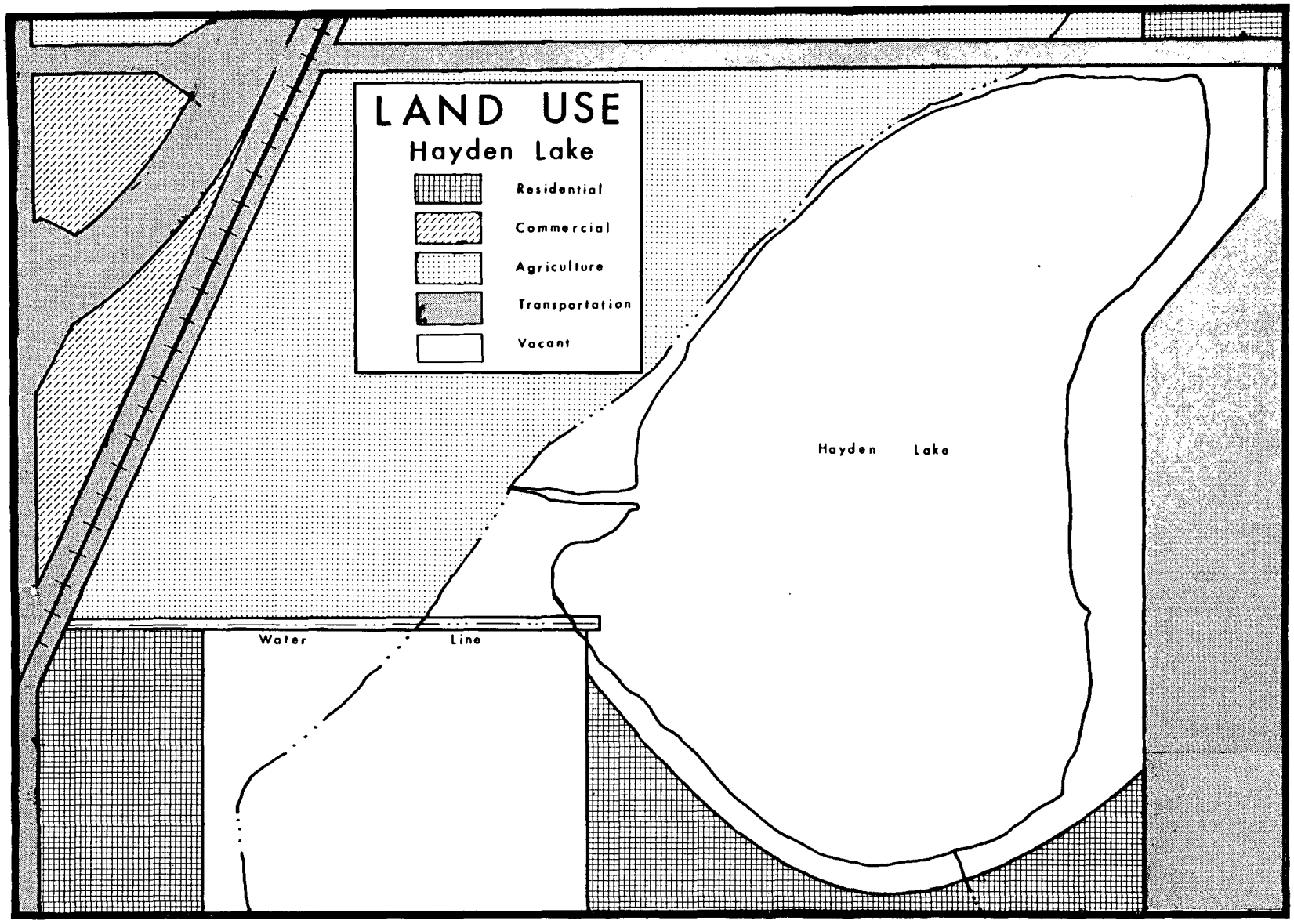
Up through 1900, the typical scene of the Boulder area was one of successful agricultural growth. Many farms dotted the area and homes were being built to accommodate further growth. Activities still had a mutual concern with the mining in the region. In 1901, some of that was changed when oil was discovered northeast of Boulder. In less than five years, over one hundred wells had been drilled of which 28 were producers. Land came under the ownership of various oil companies as the result of outright purchase and speculation. Oil production from the area soon became sufficient to qualify it as the second largest in the state. There were three wells drilled in the Hayden Lake area: the Alamo, the Blue Jacket, and the Interstate. It does not appear from the

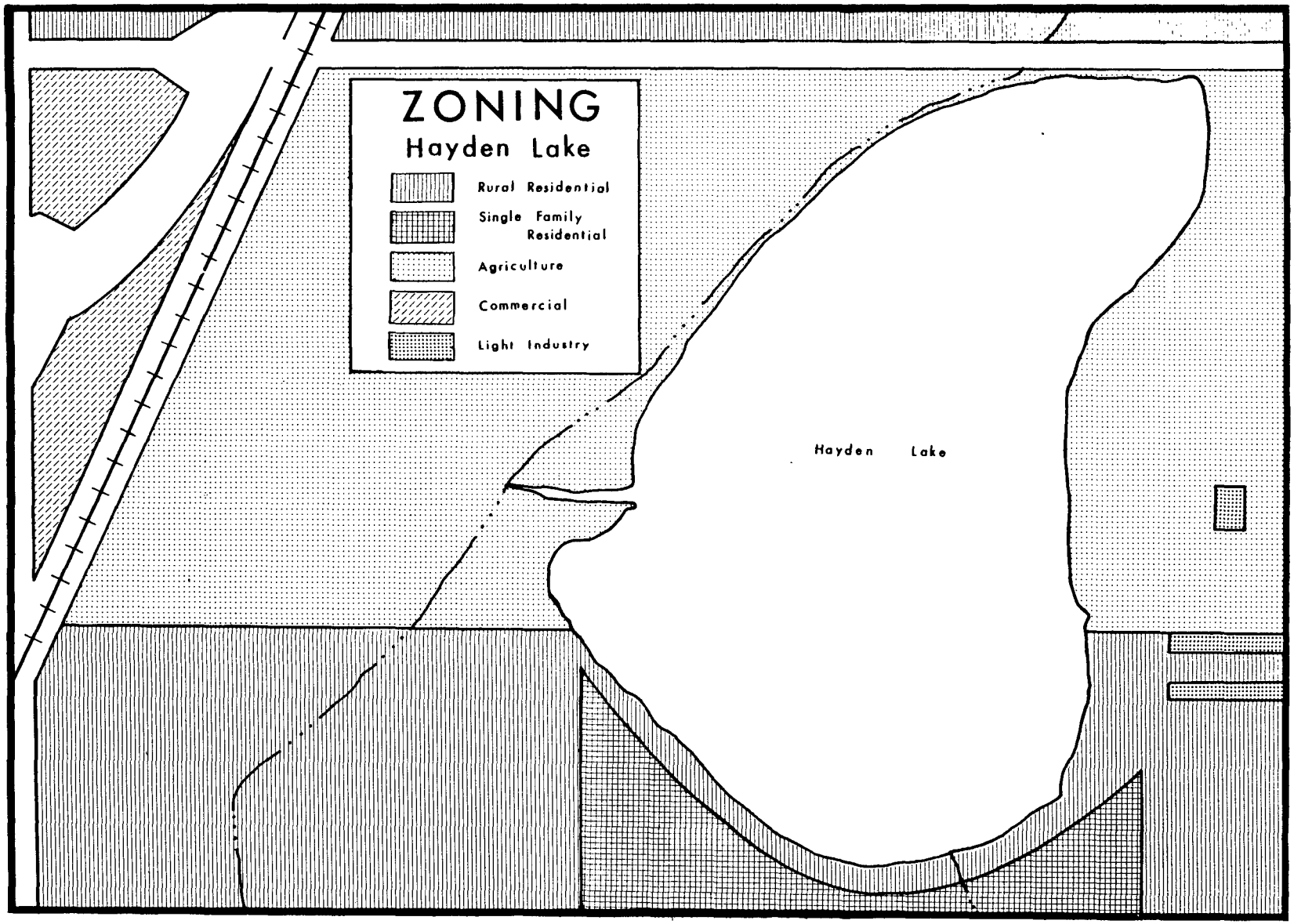
record that any of them became producers.

In 1920, the area saw its first airplane landing on the flat land to the east. The Silverwing Aircraft Company established a small operation near the present Boulder Municipal Airport. Though the company moved in 1928, the airport's presence had been established in the area.

In 1931, the members of the Boulder & Lefthand Irrigation Company decided they needed more water. By March of that year they made a filing for an additional 311.7 acre feet of water, which was acquired by raising the dam 16 feet and excavating the lake bottom an additional five feet. This brought the total water in the reservoir to 501.8 acre feet which is its present capacity.

The area west of the lake was primarily used for grazing with no significant crops attempted due to the poor quality of the soil. In recent years the airport has been enlarged to accommodate increased air traffic, the railroad has decreased in use, and there has been considerable residential development to the south and west of the study area. The rate of converting agricultural land to fairly intensive residential has increased during the past few years.


LAND USE
Hayden Lake
Residential
Commercial
Agriculture
Transportation
Vacant
Hayden Lake
Water Line


ZONING
Hayden Lake
Rural Residential
Single Family Residential
Agriculture
Commercial
Light Industry
Hayden Lake

PRESENT

The land in the immediate vicinity of Hayden Lake appears to be in a transitional stage from a predominantly open, agricultural type of use to one of increasingly urbanized development. In our examination of the area we find that present land uses are representative of these changing conditions. The categories of land uses which are of significance in our analysis are residential, agricultural, commercial, transportation, and vacant.

The most notable residential use of the land is the Vista Village Trailer Park adjacent to the southern edge of the Hayden Lake dam. This trailer court, with spaces developed for approximately three hundred trailers, extends southward to Valmont Road and is bounded on the east by the Airport Road. Other homes in the area are individual single-family dwelling units with about ten residences located north of Independence Road, 15 on either side of County Road 53, and five scattered to the south of the lake.

Agricultural use of the land seems to be restricted mainly to relatively unimproved pastures for grazing except in isolated areas. Approximately ten horses share the field west of the lake with prairie dogs, while the area of open field to the north, across Independence Road, appears unused at this time. Other pasture lands, broken by residential developments, are considerably smaller and are interspersed throughout the vicinity.

Commercial activity in the study area is limited to the intersection of the Longmont Diagonal and County Road 53. A service station, mobile home dealer, car wash, and restaurant-bar are now located at this intersection.

Land use connected with transportation has a large influence upon the Hayden Lake area. The Boulder Municipal Airport borders the eastern edge of the

lake and extends eastward for over half a mile. The airport is used primarily by small private aircraft and a few gliders. The Longmont Diagonal Highway provides a major automobile artery for the City of Boulder, and the Colorado and Southern Railroad tracks parallel the Diagonal. County Road 53 on the west, though handling comparatively minimal traffic, has the potential, if the proposed 47th Street By-pass is adopted, of becoming a thoroughfare.

PART III

LAND TENURE AND EVALUATION

TENURE

Table 1 lists the present owners of land in the Hayden Lake area. The letters refer to the location on the accompanying map. The significant property holders of the land surrounding the lake, which is owned by the Boulder & Lefthand Irrigation Company, are the City of Boulder with the airport to the east, the Boulder & Lefthand Irrigation Company to the west, and the Vista Village Trailer Park to the south. The latter is owned jointly by Doris L. Baisirger, Vaugn Leggett, and Inez L. and Ledra L. Snyder. Neil D. McKenzie, et al., own the major portion of the land north of Independence Road.[7]

EVALUATION

The examination of land values in the Hayden Lake area involves a study of the assessed land values recorded at the County Assessor's Office, Boulder, Colorado. The assessed land value is thirty per cent of the actual appraised value. The property tax is determined by multiplying the assessed value by the appropriate mill levy.

The information concerning the land values of the Hayden Lake study area are presented on Table 1. The chart in this survey lists tract number, the acreage involved, and its accompanying assessed value. From this value was computed the actual appraised value and the value per acre. The appraised value is determined by the County Assessor from his appraisal of present land use value and not in consideration of any potential value of a future use. The fair market value of property is generally between ten and twenty per cent greater than the assessor's appraised value.

Because the Hayden Lake area is presently used for mainly agricultural and rural residential purposes, the assessed value reflects the value of these usages. However, the location of this area might place the fair market value of its potential use in a different category. The pressure of an expanding Boulder for development and the potential commercial, industrial, or more intensive residential usages of this land may possibly make the fair market value considerably greater than what might be expected of the land if it remained agricultural. The future land values will depend directly upon the types of land use selected or permitted for the area.

We may already observe how the values have risen in the case of the Vista Village Trailer Park adjoining Hayden Lake to the south. This residential development is valued five to ten times greater per acre than the former agricultural area. To the west, near the Longmont Diagonal, commercial businesses established have values per acre which have increased five times that of open agricultural lands.

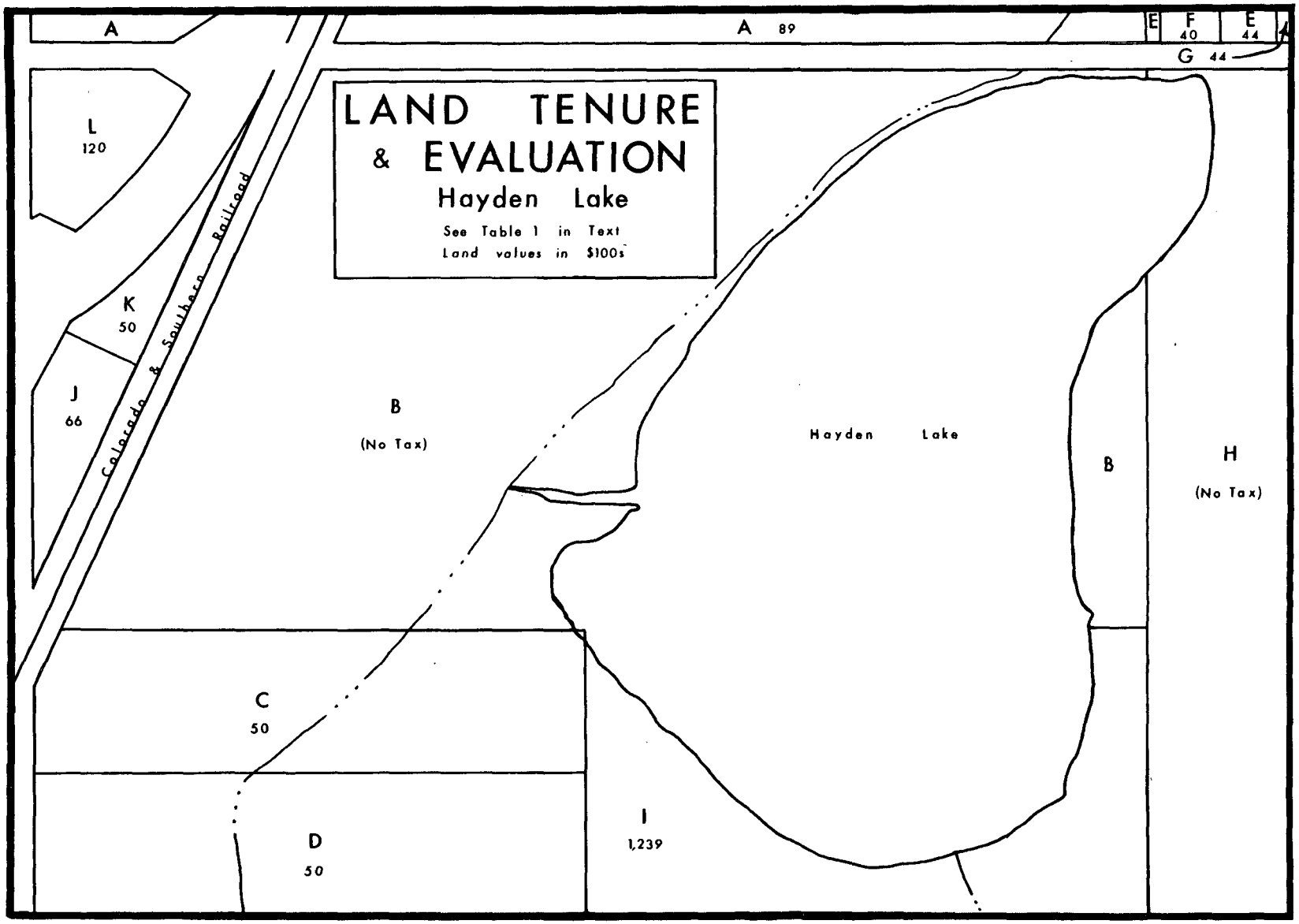

LAND TENURE
& EVALUATION
Hayden Lake
See Table 1 in Text
Land values in $100s
A
A 89
E
F
40
E
44
G 44
L
120
K
50
J
66
Colorado & Southern Railroad
B
(No Tax)
Hayden Lake
B
H
(No Tax)
C
50
D
50
I
1,239

TABLE I

Land Ownership and Assessed Values in the Hayden Lake Area*

Use	Map Identification Letter	Present Owner	Tract Number	Acreage	Assessed Value	Appraised Value	Appraised Value/Acre
Agricultural	A	Neil D. McKenzie, et al.	897899	39.1	$2670	$ 8891	$ 227.39
					Improvements: 50	167	
	B	Boulder-Lefthand Irrigation Co.	988992	44	NO TAX		
Rural Residential	C	W. William & Gertrude Anderson	14295	10	1500	4995	499.50
					Improvements: 1680	5594	
	D	Keith Enterprises, Inc.	00092	10	1500	4995	499.50
					Improvements: 5220	17383	
	E	George & Zelma Carter	811733	5	1320	4396	879.20
					Improvements: 6390	21279	
	F	C. B. & Lucille R. Bennett	632534	1	1200	3996	3996.00
					Improvements: 2100	6993	
					Improvements: 4140	13786	
	G	Earl & Lillian Juhl	645570	5	1320	4396	879.20
					Improvements: 2290	7626	
Airport Trailer Park	H	City of Boulder	99876	97	NO TAX		
	I	Doris L. Baisirger, Vaugn Leggett, & Inez L. & Ledra L. Snyder (each 1/3 interest)	867970	18.5	12400	41292	2752.80
					Improvements: 10370	34532	
			867971	20	12400	41292	2064.60
					Improvements: 10370	34532	
			377820	20	12400	41292	2064.60
					Improvements: 10370	34532	
Commercial Business	J	Mark One	831142	1.5	1980	6593	4395.33
					Improvements: 12890	42924	
	K	L. F. & Ira M. Wellborn	684232	1.5	1500	4995	3330.00
					Improvements: 10300	34299	
	L	J. D. & J. B. Parker	629957	2	3600	11988	5[illegible]00

*[illegible] 8

PART IV

ALTERNATIVES, IMPACTS, AND RECOMMENDATIONS

Consideration of the future of the Hayden Lake study area yields five alternatives. Each alternative and its impact on the Hayden Lake area is discussed below. This discussion is followed by the specific recommendation of the study group.

The first alternative is light industrial development. It has been suggested that a light industrial park might be beneficial in the Hayden Lake area. Certainly the proximate access to transportation routes of major highways, railroads, and possibly aircraft exists in the area. Several benefits would be derived from this alternative. Warehousing activities would be transferred to the outskirts of the city which would reduce some industrial and heavy truck traffic to the central business district. An additional benefit of an industrial park would be an increase in the Boulder tax base. This added revenue might be used to acquire greenbelt or open space land. The location just off the Longmont Diagonal and the proposed 47th Street By-pass would facilitate easy dispersal to the north, northeast, and south.

Several restrictions to this industrial alternative are apparent. The proposed area is directly in line with the existing east-west runway of the Boulder Municipal Airport. The Federal Aviation Agency has fairly specific height regulations on buildings in or near the flight path of a runway. This plan also runs counter to the proposals in the 1970 Boulder Valley Comprehensive Plan and may tend to produce unwanted high density growth in the Hayden Lake area.

The second alternative is residential development. To the south and

west of the study area, this alternative is already a reality. The rapid residential encroachment into the vicinity is evident from studying past aerial photographs. If this trend is followed, a prediction can be made that this area will develop into low income, high density housing. Several factors would make the Hayden Lake area unattractive for residential development. The previously mentioned restrictions on the height of buildings in light industry would be secondary to the potential danger of aircraft flying low over high density apartment type structures. In fact, due to Federal Aviation regulations, residential development would be restricted to the southwest corner of the study area. An additional factor worth anticipating would be the noise volume of the various aircraft, trains, and heavy automobile and truck traffic.

A strip of business development along the Diagonal and Independence Road is the third possibility. Commercial development has already been proposed in the Boulder Valley Comprehensive Plan, but for the area directly north and west of the study area across the Longmont Diagonal. Besides being close to growing population centers, there are easy access routes into the area. The city would also derive a healthy tax base from this development. This alternative possesses several problems. Federal Aviation Agency safety regulations may limit building height and location directly west of the flight path of the airport. The numerous transportation routes in the area, producing ever increasing traffic noise may prove annoying to customers, offsetting the commercial value of easy access. And finally, strip development seems contrary to recent concern shown by citizens for concentrating business areas.

The fourth alternative is basically the one set forth in the Boulder Valley Comprehensive Plan which is city purchase of Hayden Lake and the property

west to the Diagonal. Coming under potential greenbelt, the area would become a recreational location. A city park will definitely be needed in the future if the proposed development south and west continues. However, the numerous transportation facilities operating near this area might present serious safety limitations for any intensive recreational use. A more feasible solution within this alternative would be a limited-use recreational area. This option could include fishing on the lake, picnic areas around the lake, and a nature walk circling the prairie dog colony. Besides providing an unusual visitors' stop, the location could be used by various school groups for educational field trips. In the southwest corner of the area, considerably south of the airport flight path, a small children's park could be developed for the citizens of the mobile home park. There is no usable park in the vicinity. An additional possibility within this alternative might be the development of a city-owned camp ground west of Hayden Lake.

The final alternative is simply no development. The property would remain as it presently is zoned for agriculture. The public would continue to be restricted from the area, and the lake would remain a rather unattractive, litter-gathering reservoir.

RECOMMENDATION

It is the opinion of the study group that a limited use recreational site is the most suitable alternative for the Hayden Lake study area. If in the future the airport is moved, the alternatives listed above can all be reconsidered. None of them would be limited by any Federal Aviation regulations regarding height of structures or location in the flight path.

Light industry could possibly move to the east and encompass a much

larger area, assuming the 97 acres of the City's airport land were made available for private development. Residential opportunities would also be opened up, as well as strip development. The specific study area of a little over eighty acres, including the lake, would continue to have an appeal as a recreation or open space location regardless of the surrounding development.

FOOTNOTES

1 Details of Boulder's Climate. Boulder, Colorado: Chamber of Commerce, 1972.

2 Zena M. Hunter, Geology of the Foothills of the Front Range in Northern Colorado (map, sheet 2 of 2). Denver, Colorado: Rocky Mountain Association of Geologists, 1955.

3 Record of Water Decrees, District #6, Book 8. Boulder, Colorado: Boulder County Clerk's Office, pp. 263-264.

4 Alex Laber, President, Boulder & Lefthand Irrigation Company, Longmont, Colorado. Telephone interview.

5 Donald C. Moreland, Soils Handbook for the Boulder Survey Area, Colorado: Report for the U.S. Department of Agriculture. Boulder, Colorado: Soil Conservation Service, 1966.

6 Alexander C. Martin, American Wildlife and Plants. New York: McGraw-Hill Book Co., 1951.

7 Land Description Book. Boulder, Colorado: Boulder County Assessor's Office, 1972.

8 Ibid., 1970.

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Hidden Valley Ranch-

Boulder Reservoir Recreation Complex:

Community & Environmental Impact

HIDDEN VALLEY RANCH--BOULDER RESERVOIR RECREATION COMPLEX:

COMMUNITY AND ENVIRONMENTAL IMPACT

Kathleen B. Krohn

Editor

Prepared by

The Land Use Seminar
Department of Geography
University of Colorado

In cooperation with

The Department of Parks and Recreation
City of Boulder
Boulder, Colorado

1977

TABLE OF CONTENTS

Chapter		Page
	FOREWARD Donald D. MacPhail	v

PART I--THE COMMUNITY

1.	FUTURE DEMAND FOR RECREATION USE AT HVR/BR Arthur W. Leon	2
2.	USER TYPES Thomas A. Barrett	5
3.	COMPREHENSIVE PLAN FOR THE CITY AND COUNTY OF BOULDER Sybil M. Downing	9
4.	LAND OWNERSHIP AND VALUATION Emily O. Robbie	12
5.	ZONING Emily O. Robbie	14
6.	SEWER AND WATER SERVICE Emily O. Robbie	18
7.	LEGAL CONSIDERATIONS Emily O. Robbie	20

PART II--THE ENVIRONMENT

8.	CLIMATE David F. Cusack	23
9.	HYDROLOGY, GROUND WATER AND FLOODING POTENTIAL Susan Rogers	29
10.	VEGETATION John L. Koehler	31
11.	WILDLIFE John L. Koehler	33

Chapter Page

12. LIMITATIONS IMPOSED BY SOILS ON LANDFORMS, TREES, GRASSES, SANITATION AND CROPS..... 37
James E. Donohue

13. SOIL LIMITATIONS--RECREATIONAL AND URBAN ENGINEERING USES..... 48
Donald H. Rosenthal

PART III--SUMMARY AND ALTERNATIVES

14. SUMMARY..... 62
Kathleen B. Krohn

15. ALTERNATIVES FOR DEVELOPMENT..... 64
Kathleen B. Krohn

BIBLIOGRAPHY..... 71
(By Chapter)

LIST OF TABLES

Number Page

I. Number of Days Per Year Spent in Sports Activities..... 6

II. Temperature-Based Seasons..... 24

III. Average Number of Hot and Cold Days Per Month..... 25

IV. Mean Precipitation..... 26

V. Significant Precipitation..... 26

VI. Months of Snow..... 26

VII. Area Soil Capabilities and Character..... 39

VIII. Suitability of Grasses by Soil Characteristics..... 45

IX. Economics and Vulnerability of Recreation Alternatives..... 65

X. Limitations on Recreation Alternatives..... 66

LIST OF FIGURES

Number		Page
	COVER DESIGN Lin M. Takeuchi and Jeffrey R. Sykes	
1.	CURRENT ZONING STATUS George L. Salvador and James A. Shaner	15
2.	VEGETATIVE SUITABILITY Michael J. Keables and Amy L. Mills	42
3.	SOIL LIMITATIONS FOR WASTE DISPOSAL Michael J. Keables	47
4.	GEOLOGICAL MAP Lisa A. Coen	49
5.	LIMITATIONS FOR RECREATIONAL USES--I Christopher L. Curtis	52
6.	LIMITATIONS FOR RECREATIONAL USES--II Scott A. Shiigi	53
7.	LIMITATIONS OF URBAN USES Lisa A. Coen	57
8.	DRILLED PIER AND GRADE BEAM FOUNDATION	58

Faculty Advisor, Cartography --- Albert W. Smith, Ph.D.

FOREWORD

This report is the eighteenth in a series that began in 1965. It has become a tradition for the graduate seminar in land use of the University of Colorado on the Boulder Campus to initiate an environmentally oriented project in the local area in cooperation with an agency of the Boulder community on either the municipal or county level, sometimes both.

The studies achieve a number of objectives. The participating graduate students undertake a realistic project which they are able to plan, execute, and publish within the brief period of one semester. In this instance, senior geography students aided in the preparation of the maps which appear in this report as projects in their cartographic training. These studies provide new information and compile existing data for new perspectives in such a way that they become useful documents for municipal and county officials and citizen groups concerned with the growth and development of the City of Boulder and Boulder County. These are professional training exercises mainly for graduate students from a number of related academic disciplines. Each of these individuals possess at least one professional degree. Contributing to this study were people with professional experience in geography, planning, forestry, geology, public administration, political science and wilderness education.

In response to a suggestion by the Parks and Recreation Department of the City of Boulder, the land use seminar elected to study and analyze the recently acquired area of Hidden Valley Ranch and the Boulder Reservoir area which lies adjacent to it. These are contiguous and form part of Boulder's green corridor to the north of the City. Treating these adjacent properties as a total recreational complex was a particularly challenging experience since each of the two units has unique environmental, political and legal qualities.

Dr. Albert Smith's supervision of the cartographic work and his advice has been most helpful. All of us at the University are grateful to the professional staffs of many departments of the City of Boulder and of Boulder County for their time and expertise in assisting us in our efforts

and objectives. In particular, we wish to thank J. Leonard Ehrler, Jr., Director of the Parks and Recreation Department of the City of Boulder. For their contributions, we wish also to recognize Don Walker, Walter L. Wagenhals, William Light, Jim Pendleton, Chuck Lehneis, Jody Fitzgerald, Ann Forbes, Cathey Womble, Nolan Rosall, Richard Marlowe of the city government; and Edward A. Tepe, Jason Brouillette, Doug Tiefel, and Peter Fogg of the Land Use Department of Boulder County; also Linda Light Bump of the Department of Parks and Open Space of the county government.

Some of the graduate researchers would like to have had more time to pursue certain themes in greater depth but it was not available. Nonetheless, they join me in expressing the hope that this report provides informative insights on some complex recreational issues that affect both the City and the County.

This study addresses three basic elements which relate to the Hidden Valley Ranch/Boulder Reservoir (HVR/BR) recreation complex: 1) community needs and their impact on the HVR/BR area; 2) the environmental quality and constraints existing there; and 3) social, economic and environmental costs related to limited, moderate and intensive recreational alternatives in this approximately four square-mile area north of the City.

The chapters and illustrations of this report represent the endeavors and views of individual participants and in no way should be interpreted as the official views of the Department of Geography of the University of Colorado in Boulder nor any other cooperating agency of local government. All of us welcome the opportunity of working cooperatively with the Department of Parks and Recreation of the City of Boulder. We are very grateful for the assistance and patience of those who shared this effort with us. We much appreciate the work of Susan Rogers for her initial editorial assistance.

This is a collective and individual effort of a group of dedicated persons concerned about the quality of the local environment and its attendant stresses. Boulder County residents, students, and local officials may gain understanding from this report that will assist them in their efforts to perpetuate the Boulder area as a pleasant and attractive place in which to live.

Donald D. MacPhail, Ph.D.
Faculty Advisor, Land Use

Boulder, Colorado
June, 1977

PART I

THE COMMUNITY

CHAPTER 1

FUTURE DEMAND FOR RECREATIONAL USE OF HIDDEN VALLEY RANCH AND BOULDER RESERVOIR (HVR/BR)

The recreational needs of the Boulder population are largely satisfied by the mountain environment, but enough people desire the use of ranch and water recreation facilities to keep HVR/BR at near capacity use during the summer and much of the spring and fall (Landon, 1974, p.7). Although there is evidence that there will be a decline in the rate of population growth in and around Boulder in the near future, the demand for the use of these two facilities will likely increase beyond their capacities. With these trends in mind, some difficult decisions concerning the use of these facilities must be made.

The City of Boulder was one of the fastest growing cities in the state between 1960 and 1970. During this period, Boulder's population increased 77.3 per cent from 37,718 to 66,870 (Census, 1973, p. 66,654). This increase was almost entirely through in-migration, growth of the University of Colorado and the establishment of several government agencies and research organizations within Boulder County. Between 1970 and 1975, the City added 5,630 people at an average annual growth rate of 3.5 per cent for the past five years (Bldr. Area Study Comm., 1973, p. 45).

In 1973, the Boulder Area Growth Study Commission made some economic and demographic projections for Boulder County. Using a cohort-survival method of population forecasting and an econometric approach to employment forecasting, the Commission postulated four possible growth scenerios and estimated the 1975, 1980, 1985 and 1990 populations for the City and County for each set of assumptions. The "alternative futures" were based on 1) "the continuation of all current (1973) policies and trends" (Bldr. Aux. Growth Study, 1973, p. 45), 2) severe limitations on growth, 3) an increased emphasis on environmental quality or 4) an increased emphasis on socio-economic and cultural diversity.

The passage of the "Danish Plan" in 1976 by the voters of Boulder, in addition to the leveling off of university enrollment, and the decrease in industry, indicate that the trend in Boulder County will approximate alternative 2 in the Growth Commission Study. Of the four alternatives, alternative 2 predicts the lowest rates of growth for both the City and County. For the City, it predicts a 67 per cent increase in population between 1970 and 1990. This would give Boulder a population of roughly 112,000 in 1990. For Boulder County, alternative 2 predicts a 195 per cent increase to 389,229 by the same year.

The Danish Plan, which has a statutory limitation of five years, will legally limit the rate of population growth in the City to roughly 3 per cent per year. The ordinance stipulates that no more than 450 building permits for houses may be issued in any single year and that approximately one-half of those issued must be within the central portion of the City. However, the statute has no effect on the issuance of building permits in the remainder of the County.

Comparing the legal restraints established by the Danish Plan with the predictions in alternative 2, a population of 112,000 for Boulder in 1990 does not seem unreasonable. It is doubtful, however, that the County can sustain such a high rate of growth for the next 14 years. If the predicted economic trends of alternative 2 are accurate, a sharp decline in the number of new basic industries (those industries which sell their products outside of the community) locating in Boulder County will lower the demand for new housing. If the demand remains constant, it is likely that the County will follow the lead of the City and establish its own limits on the rate of growth. County limitations would be especially likely, should the City continue to annex adjacent areas.

Thus, if the growth rate for the County approximates that of the City (as it did during the period 1960-1970), the County population will not exceed 300,000 in 1990. Still, it must be recognized that this figure represents an almost 75 per cent increase over the present population.

The effects of population growth in Boulder County on HVR/BR will likely be to increase demand for use of these facilities to the maximum limit in the near future. This prediction is supported by the fact that

the areas immediately south and southeast of Boulder Reservoir are currently experiencing a housing boom that is likely to continue. This growth will place a substantial number of persons within walking distance of the already heavily used facilities.

Demand for facilities, such as HVR/BR, is already high among Boulder residents. A 1974 survey of leisure behavior patterns in Boulder found that swimming was the most popular non-mountain recreational activity (Landon, 1974). Other activities that could make use of the area were also listed by the respondents. Thus, the number of potential users of the area is likely to increase significantly due to three factors: 1) an increase in the number of people living in the county; 2) an increase in the number of people living close to HVR/BR; and 3) a high demand among present and future residents for facilities that are or could be made available at HVR/BR.

CHAPTER 2

USER TYPES

In planning for the development of HVR/BR, the needs and desires of Boulder's recreational user types should be of prime importance. In a study commissioned by the Boulder Department of Parks and Recreation, various aspects of the recreational activities which are most popular among Boulder residents were determined. This survey not only provides information as to which activities are most popular, but also the average number of days per year spent in such activities, with whom the activity is indulged in, and whether or not the activity is organized. (See Table I.)

Caution should be used in interpreting the results of this study because some respondents may have overstated their participation in those activities which are considered socially desirable. At the same time, however, it may be inferred that since certain activities are considered socially desirable, the provision of facilities for such activities is also desirable.

Facilities for the above-mentioned activities, excepting those requiring mountainous terrain, deep snow, or vast areas could be provided for in the development of the HVR/BR complex. Facilities for a number of these activities are, in fact, already in existence.

In conclusion, the HVR/BR complex will largely be used by Boulder's young and relatively affluent families, many of whom are moving into the adjacent Gunbarrel area. In addition, Boulder Reservoir, being the largest outdoor swimming facility in the region, will continue to draw users from a wider area than any other facility that may be provided. Hence, those activities that are most favored for development in the HVR/BR are swimming, sailing, horseback riding, tennis, picnicking, fishing and nature study along marked trails.

Table I

Number of Days Per Year Spent In Sports Activities*

Activities	Average Number of Days Per Year	Standard Deviation	Per Cent With Whom		Per Cent Is It Organized	
Tennis	14.58	26.42	Family	22	Yes	6
			Friend	78	No	94
			Alone	0		
Golf	4.31	15.49	Family	27	Yes	3
			Friend	73	No	97
			Alone	0		
Bowling	5.91	16.46	Family	21	Yes	20
			Friend	79	No	80
			Alone	1		
Handball-Squash	6.32	19.39	Family	5	Yes	11
			Friend	92	No	89
			Alone	3		
Swimming-indoor	13.27	25.55	Family	27	Yes	4
			Friend	50	No	96
			Alone	23		
Swimming-outdoor	19.96	27.42	Family	38	Yes	3
			Friend	54	No	97
			Alone	8		
Softball-baseball	5.91	15.04	Family	8	Yes	26
			Friend	92	No	74
			Alone	0		
Basketball	6.75	18.32	Family	6	Yes	19
			Friend	91	No	81
			Alone	3		
Volleyball	4.06	11.37	Family	7	Yes	18
			Friend	93	No	82
			Alone	0		
Football	5.38	14.11	Family	1	Yes	15
			Friend	99	No	85
			Alone	0		

Table I (cont.)

Activities	Average Number of Days Per Year	Standard Deviation	Per Cent With Whom		Per Cent Is It Organized	
Skeet-trap shooting	1.07	6.98	Family	21	Yes	7
			Friend	61	No	93
			Alone	18		
Archery	.91	7.41	Family	10	Yes	20
			Friend	70	No	80
			Alone	20		
Horseback Riding	4.00	14.22	Family	26	Yes	11
			Friend	65	No	89
			Alone	9		
Ice Skating	5.18	14.85	Family	34	Yes	7
			Friend	63	No	93
			Alone	3		
Hiking-Climbing	22.75	27.89	Family	40	Yes	2
			Friend	54	No	98
			Alone	6		
Sledding	3.03	7.85	Family	39	Yes	2
			Friend	60	No	98
			Alone	1		
Backpacking	6.31	14.92	Family	28	Yes	2
			Friend	67	No	98
			Alone	5		
Downhill Skiing	8.11	16.15	Family	31	Yes	4
			Friend	69	No	96
			Alone	1		
Cross-Country Skiing	2.83	9.56	Family	30	Yes	2
			Friend	70	No	98
			Alone	3		
Water Skiing	2.39	9.53	Family	25	Yes	1
			Friend	74	No	99
			Alone	1		
Bicycling	24.31	34.06	Family	27	Yes	1
			Friend	33	No	99
			Alone	40		

Table I (cont.)

Activities	Average Number of Days Per Year	Standard Deviation	Per Cent With Whom		Per Cent Is It Organized	
Camping	9.81	17.06	Family	43	Yes	3
			Friend	54	No	97
			Alone	3		
Hunting	1.32	7.83	Family	21	Yes	6
			Friend	68	No	94
			Alone	11		
Fishing	7.08	17.81	Family	52	Yes	5
			Friend	41	No	95
			Alone	7		
Boating-Sailing	3.22	9.81	Family	38	Yes	1
			Friend	59	No	99
			Alone	3		

*Source: Landon, E. Laird, Jr. Leisure Behavior Patterns and Opinions of Boulder Residents, Bureau of Business Research, University of Colorado, Boulder, 1974, pp. 7-9.

CHAPTER 3

COMPREHENSIVE PLANS FOR THE CITY AND COUNTY OF BOULDER, COLORADO

The Comprehensive Plan for the City and County of Boulder provides a guideline for future land use within both governmental units. Included in the plan is a general statement of the policy along with rules and regulations for their implementation. Within this plan for land use, fall decisions regarding density of population which in turn have economic, environmental, transportation, and recreational implications.

The present Boulder Valley Comprehensive Plan was devised as a joint effort of the City, the County, the University of Colorado and the Boulder Valley School District. It was published in 1973 and is currently being updated with completion due by late 1977. In addition, the County of Boulder is working to finish a Comprehensive Plan by the same date. As part of its planning, the County is encouraging all Boulder County municipalities to draw future land use plans of their own.

The present Boulder Valley Comprehensive Plan was developed with the assumption that the extremely desirable setting of the area will attract development. The intention was to make it possible to continue to have a diversified community meanwhile preserving the beauty of the natural setting and the quality of the environment.

The planning area was approximately 58 square miles or 4 1/2 times the existing City of Boulder. The geographic limits were: the mountains to the west, Davidson Mesa to the south, Gunbarrel Hill to the northeast and the ridge between Mesa Reservoir and Boulder Reservoir to the north. Included in the Plan is the greenbelt and greenway area. At the present, Boulder Valley had dedicated 28 per cent of its land to either greenbelt or greenway. Greenbelt is defined as an expanse of open space on the perimeter of developed or yet-to-be developed areas. Greenway is a smaller area of linear open space to be used as pathways for walking, bicycling, and horseback riding.

In addition to greenbelt, the Plan also encompasses the future of residential density. The basic philosophy toward residential density was to increase the overall density of new and redeveloping family areas in order to:

(1) lower land and development costs,

(2) lower utility service and maintenance costs,

(3) provide greater variety in housing style and costs.

Density is clarified as:

very low - single-family, detached houses

low - possibility of detached or cluster of single-family houses or duplexes

medium - possibility of row or townhouses or two-story apartments

high - three-story walk-up or five-story elevator apartments.

Updating the 1970 Comprehensive Plan has involved the development of basic land use data which includes population, hydrology, health and sanitation, transportation, environment, and open space. Within the proposed Plan, a conceptual approach using three delimited areas for future planning has been agreed upon by both the City and County of Boulder. The zones have been determined by the availability of urban services. They are:

Area I - developed or redeveloped areas.

Area II - developing and to-be developed with utilities already in existence.

Area III - regarded by the County as open space, regarded by the City as open space until Area II is filled.

Although the concept is agreed upon by both governmental units, the rankings of the zones and the specific criteria for classification are currently under review and as yet undecided. Furthermore, the passage of both the "Danish" amendment and the decision on the Robinson case by the Colorado Supreme Court in 1976 have thrown considerable doubt on the impact of growth within the County. Educated guesses indicate that growth of the City will occur to the north and along a southeast corridor toward the Denver-Metropolitan area.

The proposed Comprehensive Plan of the County of Boulder will encourage each municipality to define and limit growth in its own urban service area. In Erie and Lafayette, this service area is considerably smaller than their existing plans indicate. The Plan specifically recommends that Niwot restrict its expansion to east of the Diagonal Highway. In the area immediately east of the Boulder Reservoir, it is anticipated that full development will occur. Outside the urban service areas, the County intends to restrict land use to very low density--one residence per 35 acres--to allow some growth while at the same time preserving some of the rural character of the County. Furthermore, it is estimated that approximately 40 per cent of the already-platted lots in the mountain area of the County and 25 per cent on the plains are yet to be developed. Through a control of residential growth areas, the City and County of Boulder hope to implement the Comprehensive Plan. Presently the Plan allows for growth along the Northeast Corridor and thus the County can expect a higher density level in the area near the HVR/BR.

CHAPTER 4

LAND OWNERSHIP AND VALUATION

The largest owner of property in the project area is the City of Boulder. The land on which Hidden Valley Ranch is located, consisting of 638 acres, was bought in April 1973 for a total purchase price of $900,000. This figure includes $50,000 as consideration for water, therefore the City paid $850,000 for the land, or $1,332.29 per acre. The purchase was made wholly with monies from the Open Space Fund for the express purpose of preserving the land as open space. The City Parks and Recreation Department is responsible for maintaining the land.

Boulder Reservoir, constructed in 1956, is jointly owned and operated by the City of Boulder and the Northern Colorado Water Conservancy District (Black, 1966, p. 16). The water district brings water from the Western Slope of Colorado via the Colorado-Big Thompson Project, and some of these waters are deposited in Boulder Reservoir (Black, 1975, p. 2). The land surrounding Boulder Reservoir is designated as "Boulder Parks Open Space," and it is also maintained by the Parks and Recreation Department.

While most of the land in the project area is owned by the City and is designated as open space land, there are some private owners who have interests in the project area. Most noticeable are the three relatively large parcels of privately owned lands in Sections 4 and 5, (T.1N.,R.70W.). These private holdings have modest homes and improvements on them, according to the tax records of Boulder County. Along the north Foothills Highway (U.S. Route 36) at the western boundary of the project area (Section 6), there is some light industrial development on privately owned land.

A third area of land which is not owned by the City is found around Mesa Reservoir, where there is a large parcel of "government/utility-operated open space," for radio telescopes.

The records at the Boulder County Assessor's Office indicate a number of reserved mineral rights under lands in the project area, most notably in Sections 5 and 6 around Mesa Reservoir and in Sections 3 and 4 around Boulder Reservoir. According to these records, the privately owned lands and mineral reserves found in the project area are not of great value. Greater valuation is placed on the lands located east of HVR/BR area and the Diagonal Highway in the vicinity of the Gunbarrel Subdivisions and IBM, rather than on lands immediately adjacent to the project area on the north, west and south and within the study area itself.

CHAPTER 5

ZONING

The HVR/BR area lies for the most part entirely within Township 1 North, Range 70 West, Sections 3, 4, 5 and 6 with some extension into Sections 9 and 10 along the southern shore of Boulder Reservoir (see Figure 1). This land is a portion of a large area zoned by Boulder County as an "agricultural district," indicating an area "where conservation of agricultural resources is of major economic value" (B.C. Zoning Resol., 1975, p. 15). Allowed in an agricultural district are one- and two-family dwellings, mobile homes, accessory buildings (structures incidental to the principal building), (B.C. Zoning Resol., 1975, p. 37), churches, schools, golf courses, and public parks or playfields which are used during the day. Agriculture, including grazing, is permissible, as are commercial feedlots. Specific reference is made to the allowable activities of oil drilling, mining, quarries and sand and gravel operations, with quarries and sand and gravel operations being subject to review by the Boulder County Commissioners, who may specify basic use and require a definite reclamation plan. Public utility mains, lines and underground facilities are allowed. Maximum building height in an agricultural district is 50 feet (B.C. Zoning Resol., 1975, p. 15).

Along the western boundary of the study area (Section 6), is a small amount of land adjacent to the north Foothills Highway (U.S. Route 36) which is zoned as a "light industrial district." The County Zoning Resolution specifies such districts as "areas for research, non-offensive manufacturing and distribution centers." Non-offensive uses would include assembling, processing and compounding. All activities must be within an enclosed structure, and irritations such as noise, odors and refuse must be confined to the premises; outdoor storage areas must be hidden from view from adjoining streets and residential districts. Maximum allowable building height in light industrial districts is 50 feet (B.C. Resol., 1975, p. 31).

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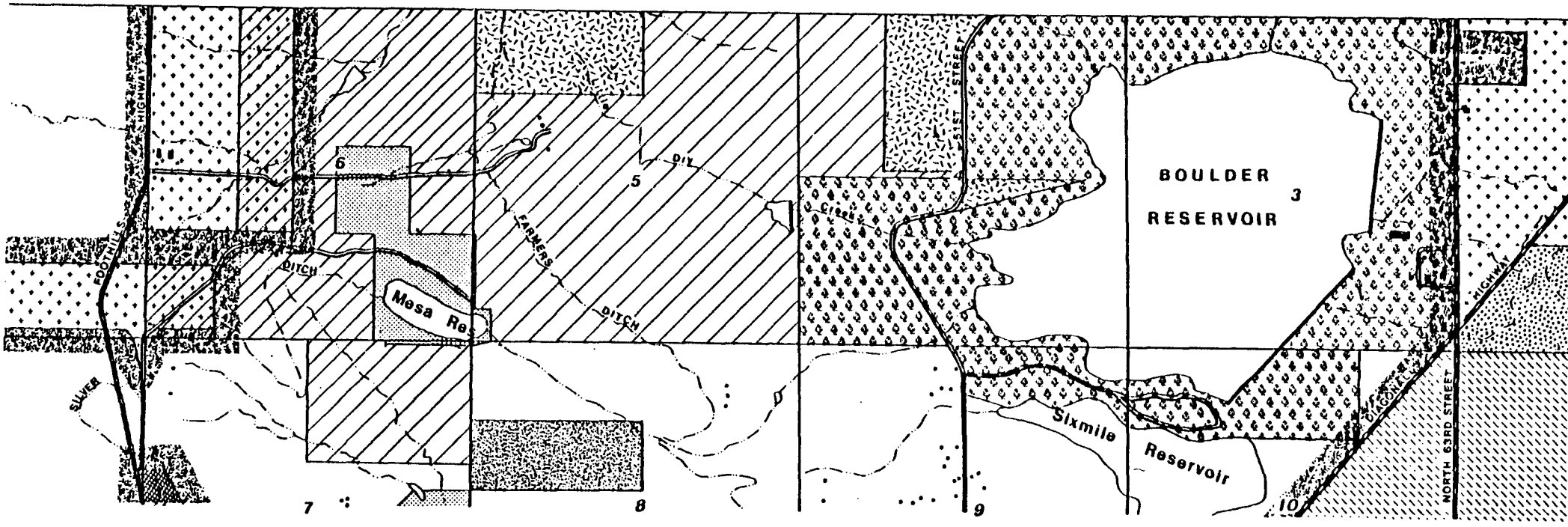
CURRENT ZONING STATUS



0 1mile

Legend

- Acquired Open Space
- Boulder Parks Open Space
- Development Rights Acquired
- Private Property
- Suburban Residential
- Agricultural
- General and Light Industrial
- Economic Development
- Transitional
- Government/Utility Operated Open Space

The land directly east of the project area, across 63rd Street and along the Diagonal Highway (Colorado Route 119), lies mainly within a "light industrial district" or a "suburban residential district," zones, with approximately one-third of Section 2 being zoned as an "economic development district." Suburban residential zoning indicates "low density residential areas located close to urban centers," and uses are more restricted. Allowed in suburban residential districts are one-family dwellings and accessory buildings only as places for habitation. Churches, schools, golf courses and daytime public parks, plus public utility facilities, are the only other allowable uses in such districts. The maximum building height is limited to 35 feet (B.C. Resol., 1975, p. 9). Land zoned as an economic development district indicates an area of "special uses which have economic value for Boulder County and which can be developed to be compatible with surrounding areas." Allowable uses of the land must harmonize with the surrounding developments and must be approved by the Boulder County Planning Commission following public hearings (B.C Resol., 1975, p. 23). Included in this general area, one finds such industries as International Business Machines (IBM) and Leanin'Tree Publishing Co., as well as subdivisions such as Gunbarrel Estates and Heatherwood.

The majority of land directly south lies within an agricultural district of which the study area is a part. Although Valhalla Subdivision is indicated on the county tax records as lying contiguous to the study area along 51st Street (Section 9), it is not, nor is it expected to be, heavily developed as a suburban residential area in the manner of the lands located east of the project area.

A "rural residential district" separates the agricultural zoning of the study area from the northern city limits of Boulder. This district contains "open areas for both agriculture and semi-urban purposes." Permissible uses in rural residential zones are the same as those in suburban residential districts, with the addition of agriculture; maximum building height is also 35 feet.

The lands immediately north of the study area are in the agricultural district. In general, zoning regulations at the present time indicate

only limited development of lands to the east of the project site as areas of anticipated and expected population growth. Expansion of county population and economic development is not anticipated nor expected in the area of Boulder Reservoir and Hidden Valley Ranch.

CHAPTER 6

SEWER AND WATER SERVICE

At the present time, there are no existing sewer and water lines of the City of Boulder into the HVR/BR area. Some mains run along the Diagonal Highway (Colorado Route 119) and 63rd Street, serving the subdivisions located east of the Diagonal Highway. While maps of proposed lines indicate some expansion of service to lands along the southern boundaries of the study area, there are no plans for expansion of city sewer and water service into the HVR/BR area.

There are two factors which decrease the probability that the project area will be served in the near future by city water and sewer. First, it is the policy of the Boulder City Public Facilities Department not to construct, at city expense, sewer and water mains nor provide sewer and water service to areas which are not currently being served by such facilities. When expansion of the service area does occur, it is usually because a developer builds the proper facilities to serve the subdivision, according to city specifications, and connects the facilities to existing city mains which are in the nearby area. The City of Boulder then credits the developer as each new unit hooks up to the system and begins to pay for the use of city water and sewer coming to the subdivision. In essence, Boulder does not construct water and sewer mains as a public good but rather provides the service of sewer and water supply to lines once others have provided them.

A second factor is, were Boulder forced to expand its service area, the Public Facilities Department feels that such expansion would occur along the northern edge of the city. The growth would follow an easterly direction toward the Diagonal Highway and then north toward the already existing residential developments of Gunbarrel and Heatherwood. That is, expansion would take place well to the south and east of the HVR/BR area and definitely not into the study area.

Unless there is good cause for the City to bring sewer and water mains directly to the HVR/BR area, sewer and water service will not be provided to the area within the near future.

CHAPTER 7

LEGAL CONSIDERATIONS

The land acquired by the City of Boulder in the Hidden Valley Ranch purchase in 1973 was paid for by the Open Space Fund. The monies in this fund come from three major sources: 1) 40 per cent of a 1 per cent sales tax voted by Boulder citizens in November 1967, specifically for the acquisition and maintenance of open space lands; 2) bonds allowable by amendment to the City Charter voted by the Boulder electorate in November 1971, which funds are also specifically allocated to the purchase of open space properties; and 3) income from any use of open space property, such as rental or user fees. Monies also may come from direct appropriations by the Boulder City Council, from private contributions and from the sale or lease of open space property (Open Space Plan, 1974).

In essence, the Open Space Fund is a trust fund for the citizens of Boulder, and land designated as open-space property, such as that of Hidden Valley Ranch, should be maintained according to the desires of Boulder residents. As interpreted by the City Real Estate Services Department, which is responsible for the purchase of open space lands, such areas are to be preserved and maintained in their natural state. Recreation activities allowed must be passive in nature; such as hiking, bicycling, horseback riding and picnicking. Restrictions on open space lands include such developments as tennis courts and ball fields; even the upgrading and improvement of existing recreational facilities is questionable, to the extent that it may be viewed as development rather than maintenance of existing facilities. These interpretations are supported by Boulder's Open Space Plan 1974, as developed by the Open Space Board of Trustees, a citizens' advisory board to the Boulder City Council.

The Open Space Plan does recognize the possibility of conflict between the Open Space Fund restrictions and desires by other city departments for other "appropriate" uses of open space land for city residents. The Open Space Plan suggests that such conflicts may be resolved through

the transfer of land from the jurisdiction of the Real Estate Services Department to the jurisdiction of the other department, with appropriate remuneration for the value of the land (Open Space Plan, 1974). However, there has never been an interdepartmental land transfer, and initial indications are that it may not be politically feasible, given the definition of open space land and the restrictions of the Open Space Fund.

Open space land is specifically intended to be preserved in a natural state rather than be developed for use. Given the trust-like nature of the Open Space Fund, it would be appropriate for the City Attorney's Office to recommend a strict and narrow interpretation of the appropriate city code restrictions (Revised Code of the City of Boulder, 1965, Section 40-16). In the event of conflicts between the code and any proposed use through departmental transfer, the Open Space Board also supports the dominance of such city code section (Open Space Plan, 1974).

In viewing the legal considerations and political ramifications, the transfer of open space lands to allow recreational development beyond the intent of the Open Space Fund would be a complex and involved matter, taking much time and involving many departments within the City's bureaucracy.

PART II

THE ENVIRONMENT

CHAPTER 8

CLIMATE

The purpose of this section is to present the effects of Colorado's variable weather on the HVR/BR area. The basic data for this section come from the NOAA weather reports for Boulder and Longmont and from several climate-related studies done on the semi-arid High Plains (Front Range Piedmont) on which the area in question is located. The tables which follow estimate the average temperatures and precipitation emphasizing the seasonality of the area. They are compiled from a compromise between the average for the Boulder and the Longmont weather stations during the period from 1968-75.

Weather Data

Before discussing the seasonal effects of climate on the area, a few general qualifying observations are in order. First, during the period studied (1968-1975), Longmont showed consistently greater extremes of temperature (less in precipitation) than did Boulder. Summer temperatures were hotter, winter temperatures lower, and daily highs and lows were more separated. Because of the nature of the terrain around the HVR/BR area, it seems that the averages more closely approach those of Longmont rather than those of the mountains and valleys near Boulder. Second, it should be noted that the period surveyed constitutes, along with the record of the last 30 years, a highly abnormal climatological period when viewed from the perspective of several centuries. This period has been warmer and wetter, and if climatological history tells us anything, future periods may not be quite so favorable (Bradley, 1974). Third, the great variations between individual years makes tenuous any concrete projections based on past averages. For instance, 1969 had a much wetter than usual spring with temperatures considerably above the average, while 1973 had a much wetter spring with temperatures below average. Again, 1969 had a much colder and drier than average summer, and a much hotter and wetter fall. The climate of the area is seasonal and is predictable only with a moderate degree of

probability. These extremes are more noticeable at the HVR/BR area than in the City of Boulder.

The following table represents a picture of temperature-based seasons in the area.

Table II

Temperature-Based Seasons

1.	Full Summer (2 months)	average high--85 & up average low --55 & up	July August	Warm Season (5 1/2 months)
2.	Marginal Summer (3 1/2 months)	average high--70 & up average low --40 & up	May, June September, 1/2 October	
3.	Transition (3 months)	average high--50 - 65 average low --25 & up	1/2 March, April 1/2 October, November	
4.	Full Winter (3 1/2 months)	average high--38 - 50 average low --10 - 25	December, January February, 1/2 March	

Table II shows that there are only two months a year that can be counted on for recreation requiring full summer conditions. In 1976, this would have even excluded half of July. Although there are many unseasonally warm days throughout the year, certain activities require a planned season for maximum beneficial use. The following table shows an average number of hot and cold days in the various months of the year. Table III gives a more accurate picture than Table II of the number of days that enjoy the full summer warmth (probably more attractive to mountain and water recreation than to other types), as well as the numerous days of the year which prohibit rigorous temperatures for many outdoor recreational activities.

Table III

Average Number of Hot and Cold Days per Month

Number of days with High over 90		Number of days with Low under 32	
10 - 20	July, August	25 - 30	January, February, March, December
2 - 10	June	20 - 25	November
		3 - 20	April, October
		0 - 3	May, September

Number of days with High under 32		Number of days with Low under 0	
4 - 12	January, February	2 - 15	January, February
1 - 5	December, March	0 - 5	March, April, October, November, & December
0 - 3	April, October, November		

A final observation on temperature, which also holds for precipitation, is the ranking of the most seasonal and undependable months of the year. Almost invariably these months are April and October (border months for the warm season), followed by June, September and May (all parts of the warm season). Three tables (IV, V, and VI) give the image of potentially wet and dry months from precipitation averages plus days with significant precipitation and the months of snow.

Table IV

Average Precipitation

Mean Precipitation	Months
Wet	
potentially over 4"	April, May, June, October
potentially 2" to 4"	March, July, September, November
potentially 1" to 2"	January, February, August, December
Dry	
potentially less than .2"	January, February, August
potentially less than .5"	March, June, July, September, October, November, December
potentially .5" to 1.0"	April, May

(note again the extreme variability of the months April, May, June and October)

Table V

Significant Precipitation

Number of days with precipitation over .5"	
up to 5 days	April, May, June, October
up to 3 days	September, November
one day or less	January, February, March July, August, December

Number of days with precipitation over .1"	
up to 10 days	June
up to 8 days	April, May, October
up to 6 days	March, September
up to 5 days	July, November, December
3 days or less	January, February, August

Table VI

Months of Snow

Average inches of snow per month	
5" - 20"	March, November, December
2" - 18"	January, February
0" - 20"	September
0" - 40"	April, October
0" - 6"	May

The weather in the HVR/BR area, as well as the rest of Colorado, is variable and not reliably predictable for specific seasons or years. Certain months emerge with greater regularity of weather patterns from year to year; others are extremely variable from year to year. The weather is most consistent in the full summer and full winter seasons, and least consistent in the marginal and transitional seasons (Table II).

Major implications for recreational activities based on temperature and precipitation are as follows: 1) activities requiring more or less predictable summer weather (i.e., tennis, swimming, sun bathing, organized summer sports, etc.) have a very limited season of potential use; 2) greater use during the year and thus full year enjoyment would be gotten by those sports and outdoor recreational activities that are more "resistant" to extreme and changeable weather; 3) activities identified with the winter season and not requiring a mountain environment could be developed.

Wind Effects

A final aspect of weather and climate in the area that needs attention is wind. Recent studies of the wind conditions in the Colorado Piedmont have led to insights not often considered in the past (MacPhail, 1972). Although there are not enough days during the year with moderate to high winds to drastically affect specific recreational activities, winds can bring winter-like conditions (cold from the mountains). More important is evaporation. Studies have shown that the actual evaporation potential in the area because of winds is significantly greater than the 16 - 18" annual precipitation rate (MacPhail, 1972, p. 27). Precipitation and winds are not always concurrent. Moreover, the amount of water absorbed by the soil at any period of precipitation is variable. The wind must be taken into account in planning for the development of the area. The depression of Hidden Valley offers light protection from the wind, considering the force and velocity of the winds across the area. Its location close to the mountain front assures continued buffeting (MacPhail, 1972).

Another effect of the wind is on water surface evaporation. Although there have been no studies done at Boulder Reservoir, recordings of surface evaporations on comparable water bodies near Fort Collins and in South Park

have shown a much greater rate of evaporation than imagined at the time these artificial lakes were constructed. Thus, it is assumed that a great deal of water is lost from the Boulder Reservoir each year producing an additional strain on an already scarce and valuable resource. Plans for construction of additional major reservoirs in other windy areas of the state have been altered as a result of the high rate of evaporation. The existence of Boulder Reservoir and the natural evaporation from it has already created a man-made microclimate that has modified the previous semi-aridity.

Evaporation, coupled with future projected growing demands on scarce water resources for Boulder and the Front Range Corridor, favor the development of recreational activities and facilities that take advantage of the natural terrain, vegetation and other environmental qualities rather than the introduction of more water-oriented development.

CHAPTER 9

HYDROLOGY, GROUND WATER, AND FLOODING POTENTIAL

The official annual rate of precipitation for the Boulder area foothills is 18 inches per annum. The precipitation for the Boulder Reservoir area, three miles east of the foothills is calculated to be lower--about 15 inches per annum. As with most semi-arid climates, somewhere between 5 per cent and 10 per cent of the precipitation is absorbed into the ground water tables. The figure 7 per cent is used as the recharge rate in the Boulder area. In other words, somewhere between 1.05 and 1.26 inches of precipitation goes directly into the aquifiers.

Aquifiers in the HVR/BR area are the alluvial gravel deposits and the intermittent stream beds, both of which show considerable seasonal fluctuation. Although the stream beds respond directly to precipitation, the gravel beds derive most of their water from the various irrigation ditches which traverse the area. Thus, the water table rises during irrigation season, April through July, and falls off for the rest of the year. In the dry season the water table is as deep as 7 feet below the surface. In the wet season, the table rises as high as 2 feet below the surface. The saturated layer of the acquifier is typically two to four feet thick. Wells in the alluvial sands have been found unreliable in all seasons except in late spring and early summer. The stream bed provides a more constant and reliable source of water.

The spillway for Boulder Reservoir is found to be unsafe for the 100-year flood. In order to compensate for this, the water level must be kept around 10 feet below the top of the spillway. The water in the reservoir has a high mineral content--sulfates and alkaline. Although a study of the 100-year flood in the Big Dry Creek is in preparation, the data was not available in time for inclusion in this report.

This cursory review of the availability of water at the HVR/BR area brings out several strong points. There is little precipitation and

even less of that is available as ground water. The ground water is not only limited, but is unreliable. Only the water in the stream beds can assure heavy usage, but it is of doubtful quality for human consumption. Although the impact of the 100-year flood is not yet available, the reservoir must be kept at a low level because of it. In conclusion, there is little local water available to serve a recreational facility in the area, other than that derived from transmountain diversion.

CHAPTER 10

VEGETATION

The HVR/BR area represents a small portion of the native grassland that once covered the Boulder area. The area is being diminished by the ever increasing demands for space by industry, developers, and recreationalists. Where there is an available water source, the grassland is often reclaimed for agricultural use by means of irrigation. The Hidden Valley Ranch and Boulder Reservoir properties are typical of the areas with these conditions.

The Ranch itself contains few concentrations of trees or shrubs. What large growth there is, is postclimax gallery forest vegetation located along the Farmer's Ditch in the southeast portion of the ranch (McNair, 1975, p. 96). Cottonwood and Willow are characteristic.

Although somewhat over-grazed, the range of the ranch supports approximately 50 per cent ground cover and has been rated as adequate.

Western Wheatgrass is perhaps the most predominant grass species, accompanied by Orchardgrass, Bromegrass, and Clover. In the southern portions of the Ranch stands of Switchgrass and Alkalai Sacaton may be observed in abundance (McNair, 1975, p. 97).

Other grasses present are:

Blue Grama
Cheatgrass
Sideoats
Kentucky Wheatgrass
Buffalograss

Sage and Hairy Goldaster are prevalent as low-lying brush species along with: (McNair, 1975, p. 97)

Wormwood
Salsify
Rabbitbrush

Yucca
Snakeweed

Because of its large body of water the Boulder Reservoir contains some plant species not found on the Hidden Valley Ranch. They include:
Sedges
Rushes
Cattails

Range Potential

The Hidden Valley Ranch is divided into eight principal pastures. There are five irrigated pastures and three dry.

In general, the ranch is now producing an average of 700 to 800 pounds per acre air dry. Improved irrigation practice and the application of nitrogen is capable of increasing the areas overall yield by 500-1500 pounds per acre.

Plans for improving the forage capacity are detailed in the Agricultural Management Plan of Boulder Open Space Lands. This report was compiled in 1975 for Boulder County by the Non-Trust Farm Management, Inc., of Denver, Colorado.

CHAPTER 11

WILDLIFE

Mammals

Before the turn of this century, the HVR/BR area may have seen vast herds of bison, deer, antelope, turkey, and bear. Now the area retains few of the larger animals (U.S.D.A., Soil Conservation Service, p. 52).

Smaller native mammals can readily be seen on the ranch and reservoir properties. They include:

Coyote	Shrew sp.
Black-tailed Prairie Dog	Muskrat
Long-tailed Weasel	13-lined Ground Squirrel
Cottontail Rabbit	North American Meadow Mouse
Skunk (common striped)	General species and genera of mice

Birds

Birdlife abounds in the area, with both seed-gathering, predatory, and water birds represented from time to time. The trees along the Farmer's Ditch serve as perch for many types of predatory birds. This category includes:

Sharp-skinned Hawk	Night Hawk
Cooper's Hawk	Kestrel
Red-tailed Hawk	Burrowing Owl
Rough-legged Hawk	Prairie Falcon
Swainson's Hawk	Marsh Hawk
Ferruginous Hawk	Golden Eagle

Further to the east, great numbers of waterfowl and water associated birds collect on or around Boulder Reservoir. Hunting is not monitored and is open to hunters with walk-in blinds during the season. Generally the season runs from the first week in October until the second week in January.

Along the western edge of the reservoir, among the rushes and sedges, a small breeding area for Mallards is in operation. Here there can also be seen great numbers of other water birds searching for food beneath the surface of the reservoir. They include:

Horned Grebe	Barids Sandpiper
Pied Billed Grebe	Least Sandpiper
Western Grebe	Dunlin*
Great Blue Heron	Semi-palmated Sandpiper
Cattle Egret*+	Western Sandpiper
Black Crowned Night Heron	American Avocet
White Faced Ibis	Herring Gull
Canadian Goose	Ring Billed Gull
Mallard	Franklin's Gull
Gadwall	Belted Kingfisher
Northern Pintail	Willet
Green Winged Teal	Greater Yellowlegs
Blue Winged Teal	Spotted Sandpiper
Cinnamon Teal	Common Snipe
Northern Shoveler	Kildeer
American Pigeon	Semi-palmated Plover
Redhead	American Coot
Ring-necked Duck	Common Merganser
Canvasback Duck	Ruddy Duck
Lesser Scamp	Bufflehead
Common Goldeneye	Bluebills

In the past, large concentrations of Ring-necked Pheasant have been located along the Farmer's Ditch of Hidden Valley Ranch. Other species of birds may be found either foraging in fields for grain or insects. They include:

Rock Dove	Pine Siskin
Mourning Dove	American Gold Finch
Red Shafted Flicker	Lesser Gold Finch
Western Kingbird	Green Tailed Towhee
Horned Lark	Rufous Sided Towhee
Barn Swallow	Savannah Sparrow

Cliff Swallow	Lark Bunting
Black Billed Magpie	Vesper Sparrow
Common Raven	Tree Sparrow
American Crow	Chipping Sparrow
Pinon Jay	Clay Colored Sparrow
Black Capped Chickadee	White Crowned Sparrow
Dipper	Song Sparrow
Robin	Dusky Grouse
Mountain Bluebird	House Finch
Water Pipit	Blue Grosbeak
Northern Shrike	Western Tanager
Loggerhead Shrike	Brown Headed Cowbird
Starling	Common Brackle
Virginia's Warbler	Brewer's Blackbird
Orange Crowned Warbler (Audubon)	Northern Oriole
Yellow Rumped Warbler	Red Winged Blackbird
Common Yellowthroat	Western Meadowlark
House Sparrow	

(Note: *Denotes birdlife not typically found in this area.
+Denotes birdlife sighted but pending verification by the Colorado Field Ornithologists Record Committee.)

Fish

Boulder Reservoir offers recreational fishing for many sportsmen. Because of its depth, the Reservoir can provide both warm-water and cold-water habitats for a variety of fish species. The Colorado State Fish and Game stocks a number of fish including:

Bass	Sunfish
Walleye	Crappie
Perch	Bluegill
Bullhead	Carp
Catfish	Suckers
Trout	

Additional knowledge on fauna of the HVR/BR area is being researched by the Boulder County Wildlife Survey in conjunction with the Audubon Society. Future references to the survey may provide fresh insight on an updated basis.

CHAPTER 12

LIMITATIONS IMPOSED BY SOILS ON LANDFORMS, TREES, GRASSES, SANITATION AND CROPS

Within the HVR/BR area the Soil Conservation Service (SCS) of the U.S. Department of Agriculture identifies thirteen different soil phases (types). Each of these thirteen soils (Table VII) has a different combination of physical and chemical properties. These edaphic characteristics have a profound influence on the type and location of future development that can take place in the area.

This section of the report discusses the types of soils present and their effect on the following types of land use: 1) suitability for planting trees, 2) crop production (irrigated and non-irrigated), 3) suitability for planting grasses, and 4) installation of sewage lagoons or septic tanks.

The thirteen soil phases previously mentioned belong to eight different series. The soils of the Heldt series are found in Sections 4 and 5 (T.IN.,R.70W.). The Heldt series is made up of deep, moderately well drained soils, formed on terraces and uplands in loamy alluvium weathered from sedimentary rock. The soils in the Heldt series are used for irrigated and dry cropland and for pasture.

The Kutch series consists of moderately deep, well drained soils. The slopes generally associated with these soils run from 3 to 9 per cent. The Kutch series originated on upland and valley sides in clayey residuum weathered from sedimentary rocks. The predominant use of these soils is for irrigated and dryland crops and pasture. The Kutch series is found in Section 4.

The Longmont series is found in Sections 3, 4 and 5 (T.1N.,R.70W.). These soils are deep, poorly drained, salty and alkaline. The Longmont soils formed on terraces and upland swales in clayey alluvium derived from shale. These soils are used for pasture, or urban purposes.

The Nunn series, like the Heldt series, is made up of deep, well-drained soil. These soils formed on terraces and valley side slopes in loamy alluvium. Nunn series soils are used for irrigated and dryland crops and for pasture. These soils are found predominantly in Section 5.

The Renohill series consists of moderately deep, well-drained soils. Sections 5 and 6 contain the major deposits of these soils. The Renohill series formed on upland hills and ridges in loamy parent material weathered from shale and sandstone. Soils of this series are found throughout the area. These soils are used for irrigated and dryland crops and pasture.

The Samsil-Shingle Complex is found in Sections 3, 4, and 5 (T.1N., R.70W.). These soils are well drained but shallow. The Samsil-Shingle Complex originated on upland hills and ridges in calcareous loamy residuum weathered from sandstone or shale. Soils of this complex are best suited to pasture.

The Terrace Escarpment (not a soil series) consists of undifferentiated shallow soils that have many cobbles and stones on the surface. The properties of the Terrace Escarpments are varied but they are not suited to cultivation. The most extensive occurrence of Terrace Escarpment is in Section 6 (T.1N.,R.70W.).

The Valmont series consists of deep, well-drained soils. Soils of the Valmont series are found throughout the HVR/BR area. These soils formed on old high terraces and benches in gravelly and cobbly loamy alluvium. Soils of the Valmont series are used for irrigated and dryland crops or pasture.

Table VII

Area Soil Capabilities and Character

Name of Soil	Symbol	Slope %	Tree Suitability	Capability Unit Irrigated	Capability Unit Non-Irrg.	Septic Tank Absorption Field	Sewage Lagoons
Heldt Clay	HeC	3-5	6	IVe-1	VIe-1	severe; slow permeability (sp)	moderate
Kutch Clay Loam	KuD	3-9	3	IVe-1	VIe-1	severe; bedrock(br) 20" to 40"; sp	severe: br 20" to 40"
Longmont Clay	LoB	0-3	6	----	VIw-1	severe; water table 1 to 2 feet; sp	severe: water table 1 to 2 feet
Nunn Clay Loam	NuB	1-3	3	IIe-1	IIIs-1	severe: sp	slight if slope is 1 to 2%; moderate 2 to 3%
Nunn Clay Loam	NuC	3-5	3	IIIe-2	IIIe-7	severe; sp	moderate 5 to 7% severe > 7%
Renohill Loam	ReD	3-9	6	----	VIe-3	severe; br ≤ 20"	severe: br ≤ 20"
Renohill Silty Clay Loam	RnB	1-3	3	IVs-1	IVe-4	severe: br 20" to 40"	severe: br 20" to 40"
Renohill Silty Clay Loam	RnD	3-9	3	IVe-1	VIe-1	severe: br 20" to 40"	severe: br 20" to 40"
Samsil-Shingle Complex	SeE	5-25	6	----	VIe-3	severe: br ≤ 20"	severe: br ≤ 20"
Terrace Escarpments	Te	-	6	----	VIIs-1	variable	variable
Valmont Clay Loam	VaB	1-3	3	IIIe-3	IIIs-1	slight	severe: rapid permeability
Valmont Clay Loam	VaC	3-5	3	IIIe-2	IIIe-7	slight	severe: rapid permeability
Valmont Cobbly Clay Loam	VcC	1-5	6	Vs-1	VIIs-1	slight	severe: rapid permeability

sp = slow permeability
br = bedrock

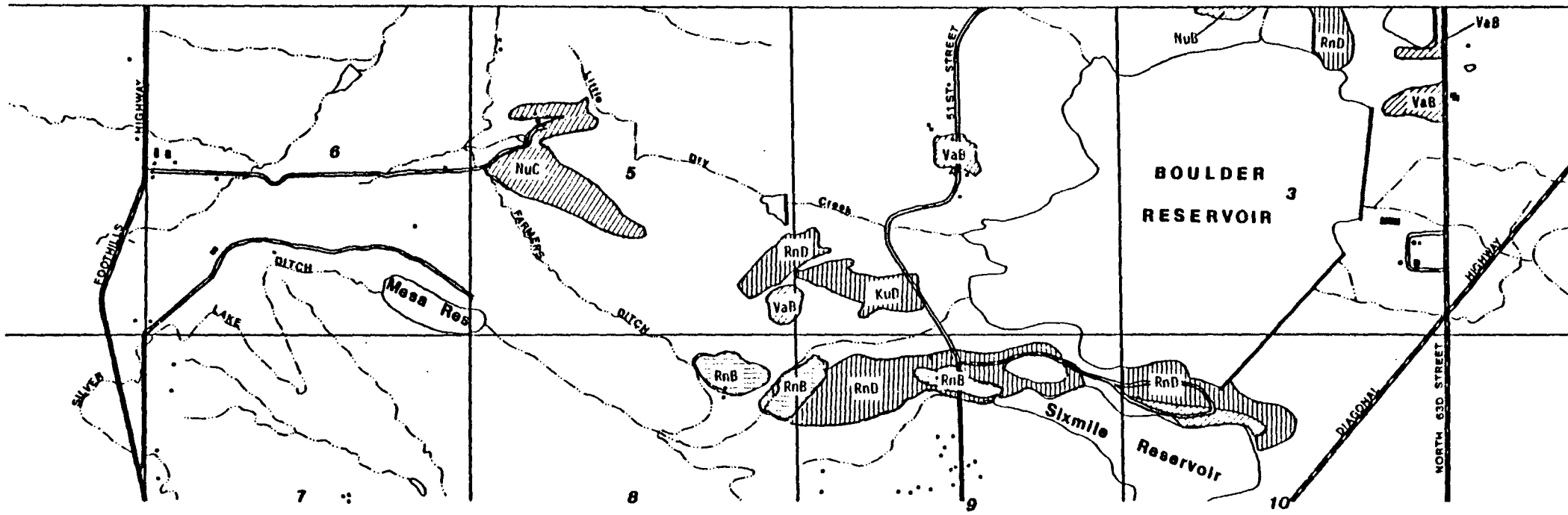
Trees

Planting trees in the HVR/BR area would help control soil blowing, lessen wind damage to crops, minimize evaporation, and provide a habitat for certain kinds of animals. In addition to this, many feel that trees would increase the aesthetic appeal of the area.

There are two major criteria that must be met before trees can be grown: proper soils and adequate moisture. According to the SCS, the soils of the HVR/BR area fall into two tree suitability groups: tree suitability "group three" and "group six" (see Table VII). In "group three," the following trees and shrubs are suitable for planting; Ponderosa Pine, Austrian Pine, Rocky Mountain Juniper, Concolor Fir, Colorado Blue Spruce, Siberian Elm, Green Ash, Honeylocust, Hackberry, Caragana, Choke-cherry, American Plum, Honeysuckle, Lilac, Spirea, Skunkbysh Sumac, and Russian Olive.

Soils classified "group six" (Table VII) are unsuited for tree planting because of one or more of the following reasons: they are shallow to bedrock; strongly sloping; poorly drained or aerated; excessively saline or alkaline; or they are cobbly, stony, gravelly, sandy, or very clayey (refer to Figure 2).

Much of this area is underlain with Pierre shale. Irrigated trees may be killed by iron sulfate leached from the shale by irrigation water. The Pierre shale swells and swales with an irregular pattern thereby making it hard to predict which areas will be affected. This same problem will affect the introduction of grasses which require irrigation.



VEGETATIVE SUITABILITY

0 1 mile

N

Legend

- Suitable for tree growth
- Suitable for tree growth and non-irrigated crops
- Suitable for tree growth, non-irrigated crops, and irrigated crops

A
MK

Grasses

Many different types of grasses can be introduced on an irrigated or non-irrigated basis. Grasses provide forage, reduce erosion by water, reduce soil blowing, and preserve moisture. Different types of grasses produce different amounts of forage and need different management practices. It is beyond the scope of this report to deal with the specifics of farm management. A report by the Non-Trust Farm Management Inc. covers the specifics (e.g., fertilizer rates) of range management in the HVR area.

All of the soils except Longmont Clay, Renohill Loam, Samsil-Shingle Complex, and Terrace Escarpment, are suitable for Orchard Grass or Smooth Bromegrass, if they are irrigated. For a list of which grasses are suitable on non-irrigated land see Table VIII.

Sanitation

If the HVR/BR area is developed into a recreation area, sanitation facilities will be needed. All of the soils in the area, except Heldt Clay and Nunn Clay Loam, have severe restrictions on building a sewage lagoon. The most common limitations on sewage lagoon development are bedrock or rapid permeability (see Table VII).

Restrictions upon the installation of a septic tank-absorption field are equally severe. In all of the soils, except the Valmont series, either bedrock or slow permeability seriously impair the installation of a septic tank (see Table VII). The restriction for a septic tank in the Valmont series is slight. (Figure 3)

Crops

In Table VII, all of the soil phases are given a capability unit rating. The lower the number the better the soil. By using the ratings, it is easy to compare one soil with another. If all other factors are equal, then one should cultivate the soil with the best capability rating.

The SCS defines class III and class IV soils as follows:

> Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
>
> Class IV soils have very severe limitations that restrict the choice of plants, require very careful management, or both (U.S.D.A., 1975, p. 32).

Class I, II, and III soils are, in general, suited for irrigated cultivation. If one uses class III soils as the cutoff point for irrigated crops then only the Nunn and Valmont series are suitable for cultivation.

For non-irrigated agriculture one might be apt to cultivate a lower class soil. If class IV soils are chosen as the cutoff point then the Nunn, Renohill, and Valmont series might be considered suitable for cultivation.

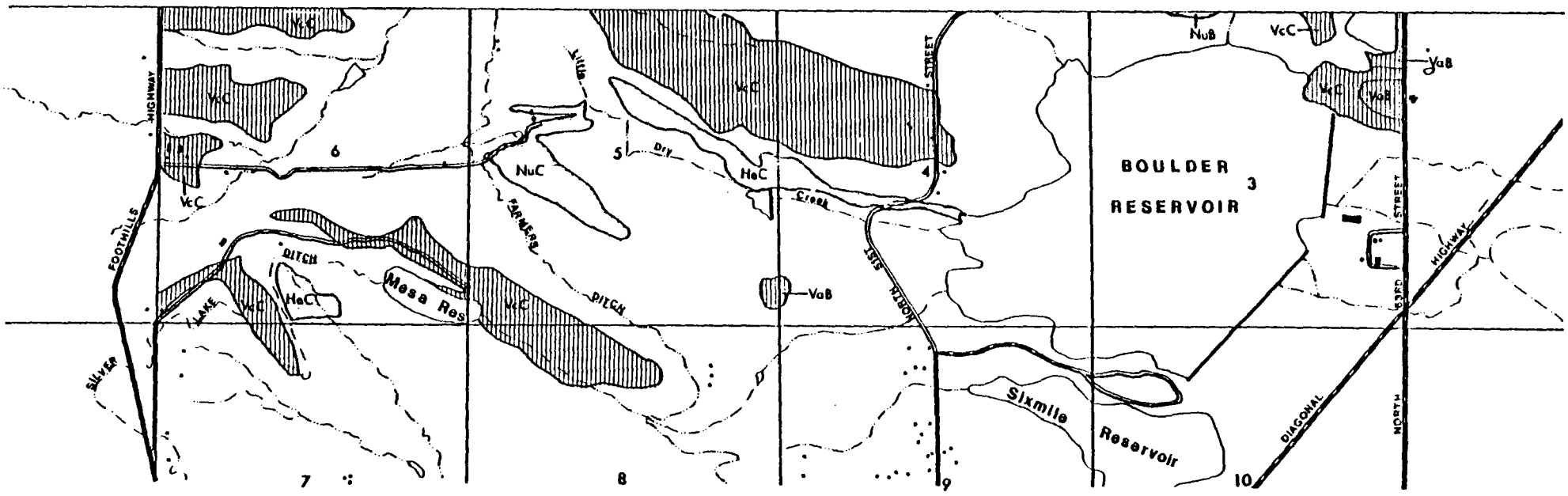
The cutoff points of class III for irrigated crops and class IV for non-irrigated crops are intended only to serve as a rough guide. Soils that can be profitably cultivated depend upon a great variety of constantly changing conditions.

Table VIII

✓ = soil well suited for grass type

Suitability of Grasses by Soil Characteristics

Name	Symbol	Blue Grama	Needle Grasses	Russian Wildrye	Crested Wheat-grass	Pubescent Wheatgrass	Inter-mediate Wheatgrass	Switch Grass	Alkali Sacton	Western Wheatgrass	Tall Wheat-grass	Tall Fescue	Needle & Thread	Big Blue Stem	Side & Oats Grama
Heldt Clay	HeC	✓	✓	✓	✓	✓	✓								
Kutch Clay Loam	KuD	✓	✓	✓	✓	✓	✓								
Longmont Clay	LoB							✓	✓	✓	✓	✓			
Nunn Clay Loam	NuB			✓	✓	✓	✓								
Nunn Clay Loam	NuC			✓	✓	✓	✓								
Renohill Loam	ReD		✓	✓	✓		✓			✓			✓		
Renohill Silty Clay Loam	RnB			✓	✓	✓	✓								
Renohill Silty Clay Loam	RnD	✓	✓	✓	✓	✓	✓								
Samsil-Shingle Complex	SeE		✓	✓	✓		✓			✓			✓		
Terrace Escarpments	Te		✓											✓	✓
Valmont Clay Loam	VaB			✓	✓	✓	✓								
Valmont Clay Loam	VaC			✓	✓	✓	✓								
Valmont Cobbly Clay Loam	VcC		✓											✓	✓



SOIL LIMITATIONS FOR WASTE DISPOSAL

N

0 1 mile

Legend

- Slight limitations on septic tanks
- Slight or moderate limitations on sewage lagoons

mjk

CHAPTER 13

SOIL LIMITATIONS--RECREATIONAL AND URBAN ENGINEERING USES

This chapter explores the capabilities and limitations of the soils and landforms of the HVR/BR study area for recreational and specific urban engineering uses.

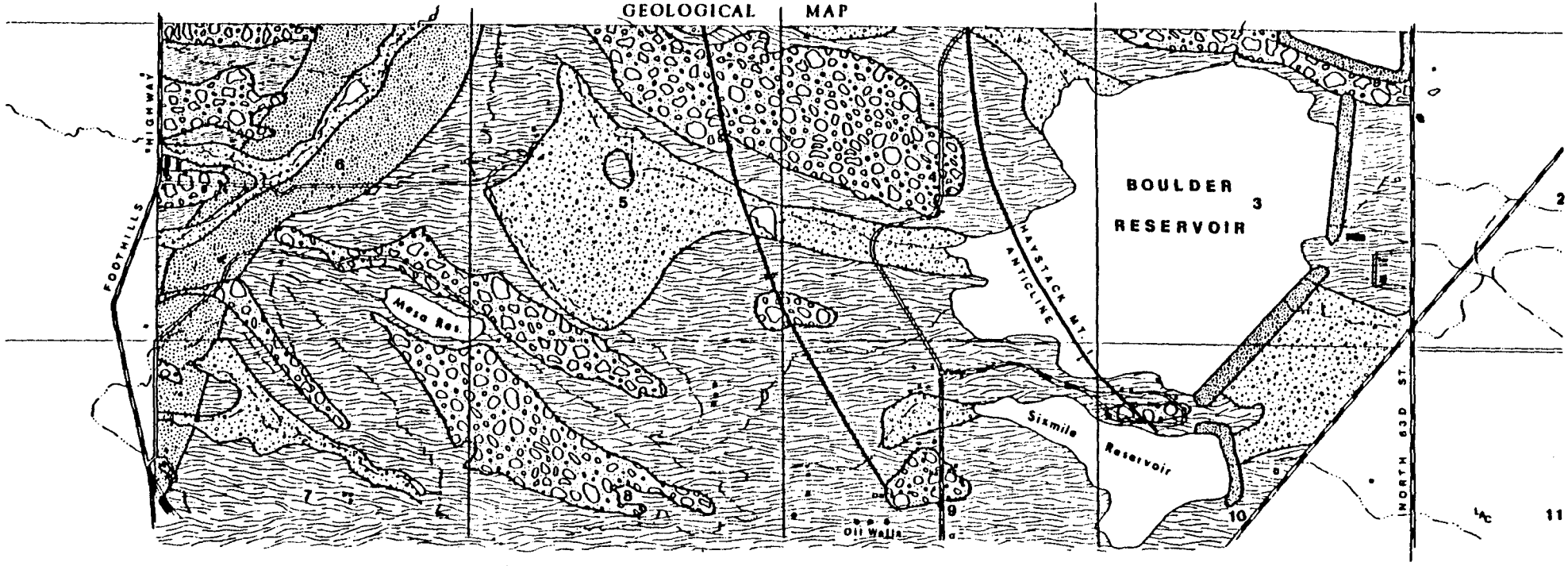
The Hidden Valley Ranch-Boulder Reservoir area is underlain by Pierre Shale of Cretaceous age (70-100 mybp.) on the north, east and south and by the Hygiene Sandstone on the west. The rolling topography characteristic of the area results from weathering of non-resistant Pierre Shale. Flat upland surfaces are Pleistocene alluvial terraces. Recent alluvium is present in intermittent stream channels.

Pierre Shale is an olive-gray shale interbedded with brown fine grained sandstone. The thickness of the Pierre Shale is 2,438 m (8,000 ft.) (Scott & Cobban, 1965). In the study area, the Pierre Shale dips 12-14 degrees southeastward. Pierre Shale has low permeability and high shrink-swell potential. Montmorillonitic clay soils (bentonitic soils) are expansive soils which developed from weathering of Pierre Shale under semi-arid conditions. These soils pose a potential hazard to structures built in the area without proper preconstruction site preparation (Hart, 1974).

The suitability of the various local soils for recreational uses, degree of limitation (slight, moderate, or severe), and subsequent recommendations are listed in the Soil Survey of Boulder County Area, Colorado. This chapter also deals with soil limitations for urban uses: specifically, local roads and streets, and dwellings without basements. Recommendations are made concerning these uses.

Recreational uses, according to the Soil Survey of Boulder County Area, Colorado include specific uses such as camp areas, picnic areas, playgrounds, paths and trails. For camp areas,

GEOLOGICAL MAP



Age		Explanation
Recent		Artificial Fill
Recent-Pleistocene Qal		Recent Alluvium
Pleistocene Qut		Pleistocene River Terrace Deposits
Cretaceous	Kp	Pierre Shale (upper member)
	Kph	Hygiene Sandstone
70-100 m.y.b.p.	Kpl	Pierre Shale (lower member)

- Oil Wells
- Anticline
- Syncline

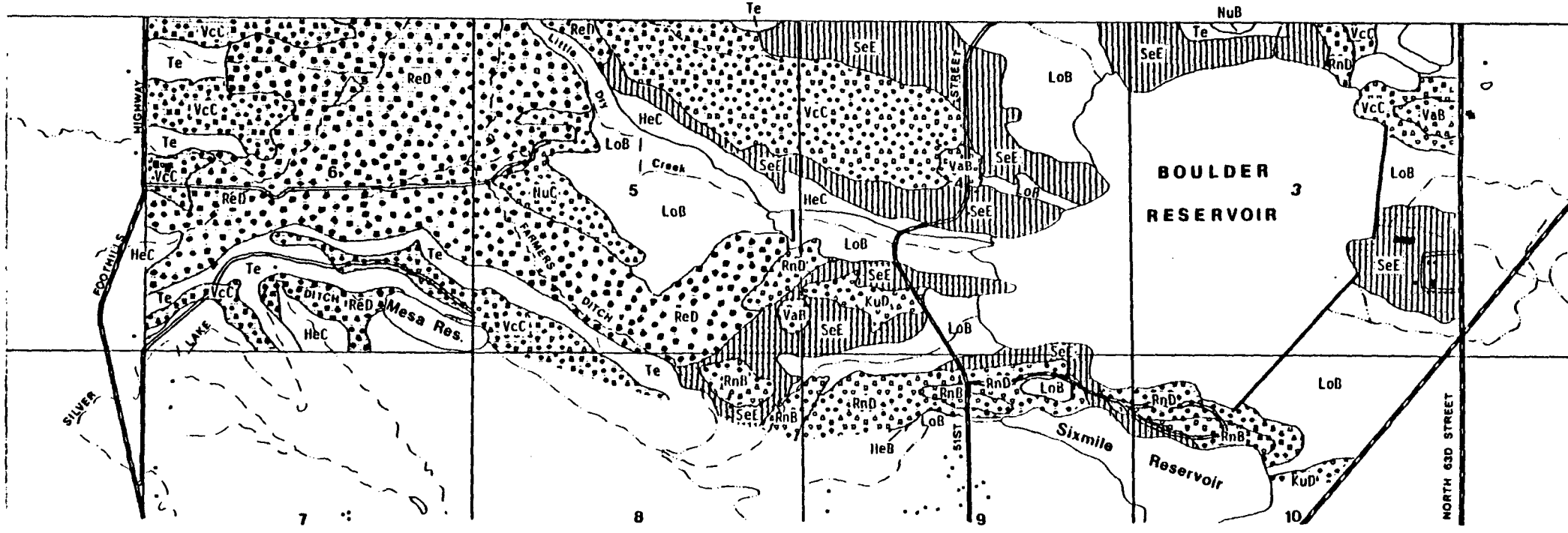
> the soils should be suitable for heavy traffic by people, horses and vehicles. The best soils have mild slopes, good drainage, a surface free of rocks, gravel and cobbles, freedom from flooding during periods of heavy use, and a surface that is firm after rains, but not dusty when dry. In addition, the permeability of the soil is considered (Soil Survey, 1975, p. 51).

None of the soils in the HVR/BR area have less than slight limitations for camp areas. However, several soil types exhibit only moderate limitations which "can be overcome or modified by planning, by design or by special maintenance" (Soil Survey, 1975, p. 48). These soils include Nunn Clay Loams, Kutch Clay Loams, and the Valmont Series; Clay Loams and Cobbly Clay Loam (Soil Survey, 1975, p. 49). All have moderate limitations due to their clay loam surface layer. Renohill Loam possesses a moderate limitation for camp use because of its slow permeability. Renohill Silty Clay Loams also have moderate limitations for camp use because of their silty clay loam surface area.

All other soils in the HVR/BR possess moderate to severe or severe limitations for use as camping areas because of slope conditions or because of a clay surface layer. Severe limitations can only be overcome by "costly soil reclamation, special design, intense maintenance or a combination of these..." (Soil Survey, 1975, p. 48). Therefore, soils with severe or moderate to severe limitations for any specific recreational use will be treated as infeasible for camp grounds.

Picnic areas, according to the SCS are "attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors..." (Soil Survey, 1975, p. 51). The best soils have the same characteristics as the best soils for camp areas as listed above. The soil type best suited for this use is Renohill Loam which has only a slight to moderate limitation for picnic areas. This is due to the slow permeability of this soil type. Renohill Silty Clay Loams, Nunn Clay Loams, Kutch Clay Loams and Valmont Clay and Cobbly Clay Loams all possess moderate limitations as picnic areas because of the clay content of their surface layers. All other soils have severe limitations because of steep slopes of clayey surface layers (refer to Figure 5).

LIMITATIONS FOR RECREATIONAL USES — I



Camp Area Limitations

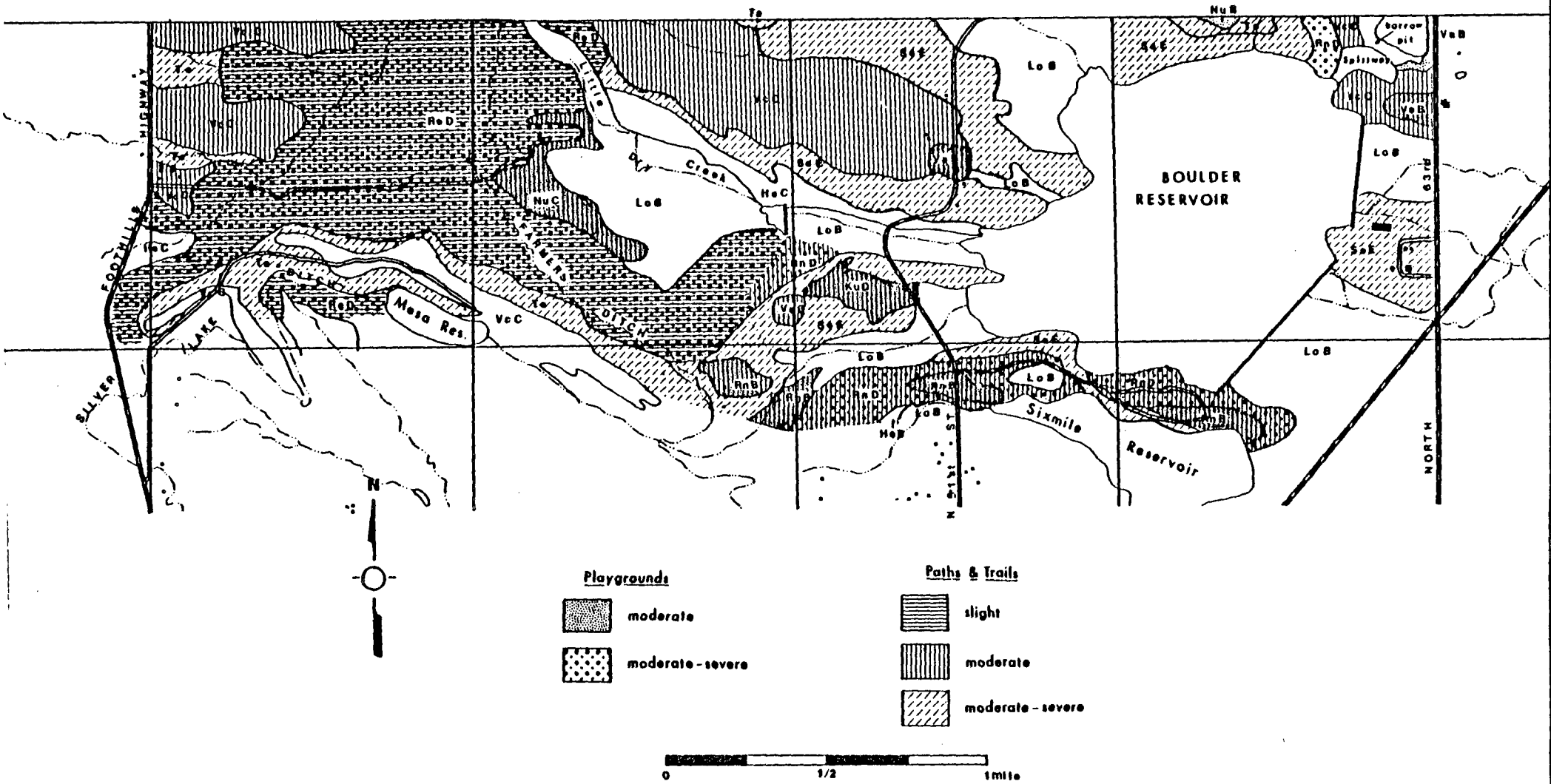
- Severe
- Moderate-Severe
- Moderate

Picnic Area Limitations

- Severe
- Moderate-Severe
- Moderate
- Slight-Moderate

0 — 1 mile

LIMITATIONS for RECREATIONAL USES - II



Playgrounds, areas that are used intensively for organized games, are subject to "intense foot traffic" (Soil Survey, 1975, p. 51).

> They need to possess a soil texture and consistency that gives a firm surface. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to bedrock is also considered. (Soil Survey, 1975, p. 51.)

Nunn Clay Loams, Valmont Clay Loams, and Renohill Silty Clay Loams are the soils best suited for playground use in the study area, having only moderate limitations for this use. These moderate limitations are based on the slow permeability of the soils or the clay loam content of the surface layer. All other soils have severe limitations for playground use due to severe slopes or clayey surface layers.

Paths and trails, the last of the four types of recreational uses considered by the SCS are "used for local and cross-country travel by foot or horseback" (Soil Survey, 1975, p. 51). The soil survey assumes that the areas will be used and recommends that design and layout should require little or no cutting and filling. "The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 per cent, and have few or no rocks or stones on the surface" (Soil Survey, 1975, p. 51). Renohill Loam is the soil best suited for paths and trails in the study area having only slight limitations for this use. Soils having moderate limitations for use as paths and trails include Renohill Silty Clay Loams, Nunn Clay Loams, Valmont Clay and Cobbly Clay Loams, and Kutch Clay Loam. Moderate limitations are based upon clay loam or silty clay loam surface layers. All other soil types in the study area have moderate to severe or severe limitations for use as paths and trails based on slope or clay surface layer conditions.

For a spatial representation of soil suitability, refer to Figure 6. The best soils (those having only slight limitations) for use as paths, trails and picnic areas are located in the eastern parts of the recreation area where the Renohill Loam occurs. Camp areas, other picnic, path and trail areas might be best located on the Valmont Cobbly Clay Loam in the

northern part of Sections 4 and 5 (T.1N., R.70W.). Assuming that the moderate limitations of this soil for these kinds of uses can be overcome by good planning and design techniques, several soil types have only moderate limitations for playgrounds. However, such soil types seem to be somewhat isolated from one another. The area of each of these soil types is also rather small when compared to the acreage overall.

Pendleton (1976) of the Engineering Department of the City of Boulder has recommended that further studies and tests should be made on the soils before any final recommendations are made, and before any construction takes place. The Soil Survey is oriented towards agricultural rather than engineering purposes, and thus lacks the detail necessary for making engineering recommendations about specific sites.

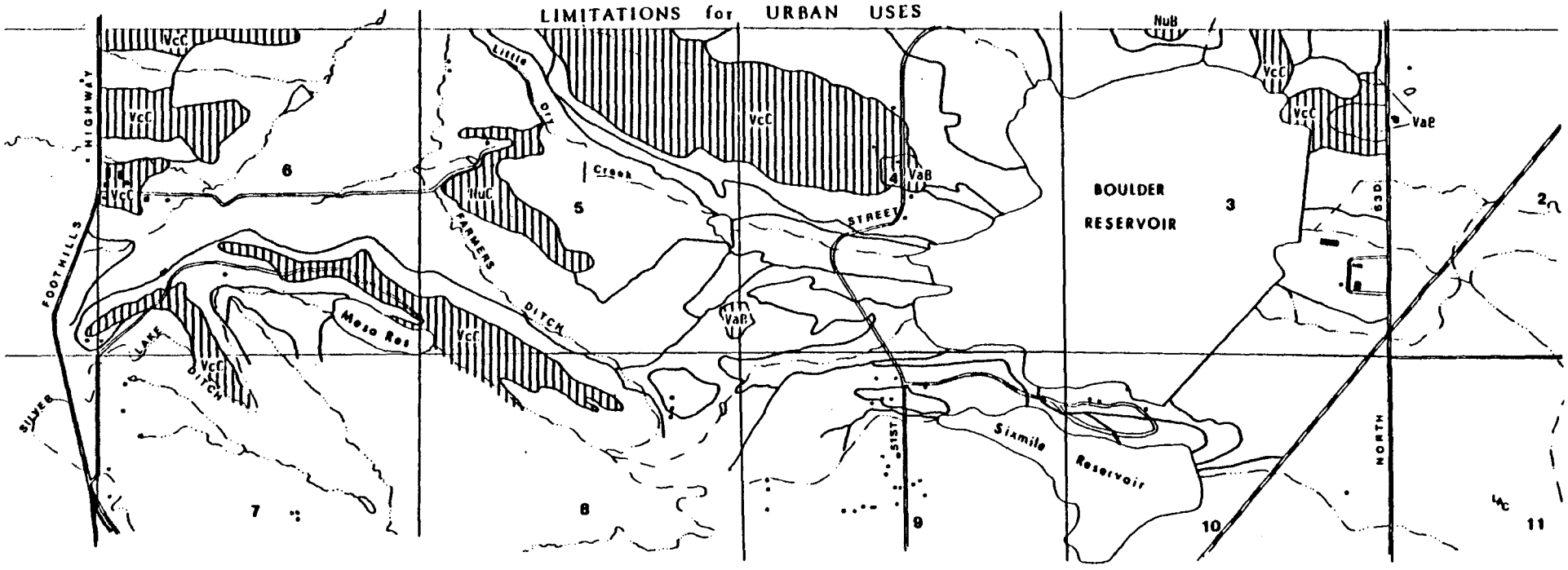
The Soil Survey treats "dwellings without basements" as buildings not more than three stories high and supported by foundation footings placed in undisturbed soil (Soil Survey, 1975, p. 69).

> The features that affect the rating of soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks. (Soil Survey, 1975, p. 67.)

Soils in the study area suited for dwellings without basements have moderate to severe limitations based on moderate to high shrink-swell potential. More comprehensive studies and tests must be done before any actual construction takes place. The soils with moderate to severe limitations include the Valmont Clay and Cobbly Clay Loams, and Nunn Clay Loams. These soils are located along the eastern and southern boundaries and in the northern section of the study area, just north of Little Dry Creek.

Pre-construction site preparation for buildings includes excavation and removal of swelling soils, preswelling, or construction of a specifically engineered foundation. Hart (1974) recommends a drilled pier and grade-beam foundation with a floating slab in areas of moderate to high shrink-swell potential (Figure 8). Wood frame structures are also recommended because

LIMITATIONS for URBAN USES



Explanation

Dwellings without Basements and Local Roads and Streets that have Moderate to Severe Limitations

All other soils have severe limitations

Figure 8 -- Drilled Pier and Grade Beam Foundation With Floating Floor (from Hart, 1974).

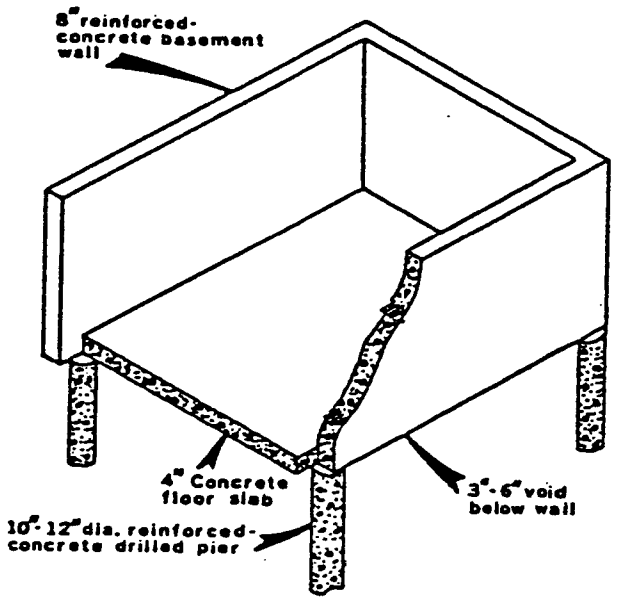


Figure 12d. Drilled pier and grade beam foundation

they can absorb differential stresses better than brick or masonry structures. The area around any building should be landscaped to assure drainage away from the building.

Paved roads constructed in the Hidden Valley Ranch-Boulder Reservoir area will also require pre-construction preparation. Excavation and recompaction, pre-swelling, or treatment with lime ($CaCO_3$) in conjunction with use of a flexible pavement (asphalt) can reduce damage and repair costs for roads built on expansive soils (Hart, 1974). Pendleton (1976) suggested treatment with lime would be the course the City would probably follow if a road was to be constructed in the HVR/BR area.

Swelling soils do not present much hazard to foot or equestrian traffic other than that these soils are inherently slick when wet.

Pleistocene alluvial terraces consist of low grade gravels, considered uneconomical and therefore unaffected by the Colorado Open Mining Act, House Bill 1529 (Pendleton, personal communication, 1976). Pendleton (personal communication, 1976) suggested terraces might provide a gravel source for local construction within the Hidden Valley Ranch-Boulder Reservoir area.

Swelling soils in the Hidden Valley Ranch-Boulder Reservoir area present the only major potential problem associated with development in the area. Specific site studies by a registered engineering geologist and soil engineer should be conducted prior to any construction.

Pleistocene upland terraces may provide low grade sand and gravel but are uneconomical for use except in the local area.

If the HVR/BR area is used more intensively, it must have improved access.

> Soil properties that most affect design and construction of roads and streets are load-supporting capacity, and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of the soil material, and also the shrink-swell potential indicate traffic-supporting capacity. Slope, depth to hard rock, content of stones and rocks affect ease of excavation and amount of cut and fill needed to reach an even grade. (Soil Survey, 1975, p. 75.)

The same soils which have moderate to severe limitations for dwellings have moderate to severe limitations for road-building, based on high shrink-swell potential.

PART III

SUMMARY AND ALTERNATIVES

CHAPTER 14

SUMMARY

A large number of conditions have been cited which affect the development of the HVR/BR as a recreational site. These include population projections, recreational needs, legal and municipal considerations, and the comprehensive plan of the City and County of Boulder. Likewise, the climate, geology, hydrology, flora and fauna, and the soil types of the HRV/BR area affect the kinds of recreational development which will be most suitable in the area.

The population of Boulder County is estimated to reach nearly 300,000 people by 1990, with over 100,000 of those people living in Boulder. The population is expected to be predominently young and affluent, and highly motivated toward outdoor recreation. The Comprehensive plans for the City and County of Boulder call for growth along the Longmont Diagonal Highway, and it is estimated that there will be full development of existing platted areas around HVR/BR. Thus any recreational facility at HVR/BR is expected to be heavily used.

Sports and recreational activities favored by present user types in Boulder include tennis, swimming (both indoor and outdoor), hiking and bicycling as the most popular. Residents spend more than ten days per year on these activities. Bowling, softball, baseball and basketball, football, iceskating, backpacking, camping and fishing are the next most popular sports. The average resident spends more than five days per year in these pursuits.

HVR/BR is zoned for agricultural use, and is surrounded by areas zoned for light industry, agriculture and suburban residence. There is no city water or sewage in the HVR/BR area, and it is unlikely that Boulder will initiate water and sewage service there soon. Hidden Valley Ranch is owned by the City of Boulder. Although it is managed by the City Department of Parks and Recreation, it was purchased from Open Space Funds

and must be preserved and maintained in its present open state. All recreation on the HVR must be passive in nature. In 1973, the land was purchased for $850,000 and a transfer of the land from the Open Space Trust is not judged politically feasible. Boulder Reservoir is jointly owned by the City of Boulder and the Northern Colorado Water Conservency, but managed by the City Parks and Recreation Department. There are some private lands and some mineral rights of low value in that part of the area.

The environmental considerations of the area complicate the social considerations. The climate is highly unpredictable, as are the seasons. The lee winds of Boulder are among the strongest in the nation. Precipitation is low, and evaporation is high. Little of the water is absorbed by the soil, which in the study area is primarily shale and clayey gravel. The topography is rolling in nature. The water table fluctuates, rising several feet during the irrigation season. Large numbers of native grasses, small mammals, and birds may be found in the area, although the native flora is slowly succumbing to overgrazing and general use. Although some soils in the area are suitable for dry land trees and shrubs, other soils are suitable only for grasses. Development of sewage facilities and the construction of roads and buildings are severely handicapped by the clayey content of the surrounding soils. The HVR/BR recreational complex is located in an area where recreational needs are expected to expand remarkably over the next two decades although there are great legal and environmental restrictions on the use of the land.

CHAPTER 15

ALTERNATIVES FOR DEVELOPMENT

A number of recreational alternatives have been considered by this study group for the use of the land. These range from full development of a regional recreational complex to the management of the land in a natural state encouraging only passive recreation. Using the State Comprehensive Outdoor Recreation Plan (SCORE) for 1976, recreational needs have been listed in decreasing order of priority. These priorities are then evaluated according to demand, in cost of dollars, land vulnerability and the degree of limitation imposed by each land condition.

Table IX categorizes the demand, cost in dollars and the land vulnerability according to a simple lettering basis. H = high, M = medium, L = low, and NA = not applicable.

Ratings of the demand column (Table IX) were taken from the Leisure Behavior, Patterns and Opinions of Boulder Residents, a survey conducted in 1974 by the Business Research Division at the University of Colorado.

Cost in dollars and environmental cost are subjective ratings proposed by this study group in order to place a comparative value on the various categories. For example, tennis courts would have a high monetary cost in comparison to hiking trails or motor cycle riding on improved trails.

In order to achieve a workable development alternative for the HVR/BR area, three schemes have been developed. They are: limited development, moderate development and high development. The common denominator for all the alternatives is land vulnerability. This particular aspect was chosen because 1) the group had a limited knowledge about the dollar cost for each item and 2) demand does not necessarily indicate what a group wants at all times since ideas and needs are constantly changing. Land vulnerability is the only measurable factor for all items. Included in its measurement are those limitations proposed by Table X (climate, soils, landforms, hydrology, vegetation, and wildlife) and anything which will have an impact on future land use in the area.

Table IX

THE ECONOMICS AND VULNERABILITY OF RECREATION ALTERNATIVES

CATEGORIES	DEMAND	COST IN $	LAND VULNERABILITY
Extremely High Priority			
1. Hiking on trails	H	L	L
2. Horseback Riding on Trails	H	L	L
3. Biking on Paved Roads & Sidewalks	NA	NA	NA
4. Swimming Pool	H	H	M
5. Game Playing on Marked Off Field	H	H	H
6. Tennis Courts	H	H	M
High Priority			
1. Horseback Riding on Roads	NA	NA	NA
2. Bicycling on Improved Paths & Trails	M	H	M
3. Motorcycle Riding on Improved Trails	M	M	H
4. Motorcycle Riding on Open Land	M	L	XH
5. Camping in Campground (Recreational Vehicles)	H	H	H
6. Boating-Water Skiing	H	L	H
7. Boating-Speed Power Boat	H	L	H
8. Fishing-Lake Shore & Rowboat	M	L	L
9. Skiing-Cross-Country	L	L	L
10. Skating-Outdoor Rink	L	H	M
11. Regional Multi-Purpose Fairground Complex	NA	NA	NA
Additional Categories			
1. Natural Area	M	M	L
2. Picnicking with Facilities	M	H	M
3. Sailing	H	L	L
4. Recreation Center	H	XH	H
5. Shooting--(Skeet, Target)	L	M	H
6. Archery	L	L	L
7. Equestrian Facilities & Stables	H	XH	L
8. Hunting--Boulder Reservoir--Yes Hidden Valley Ranch--NA	M	M	H
9. Lake Swimming with Facilities	H	M	M
10. Rural Western Recreation Center	M	H	L

Table X

Limitations on Recreational Alternatives

CATEGORIES	Landforms	Soil	Water	Climate	Vegetation	Wildlife	Legal	
							HV	RES
Extremely High Priority								
1. Hiking on Trails	L	L	-	-	-	-	-	-
2. Horseback Riding on Trails	L	L	-	-	-	-	-	-
3. Biking on Paved Roads & Sidewalks	NA	NA	NA	NA	NA	NA	NA	-
4. Swimming Pool-Outdoor	-	H	H	M	-	-	H	L
5. Game Playing on Marked Off Field	L	H	H	L	H	L	H	-
6. Tennis Courts	L	H	M	L	-	-	H	-
High Priority								
1. Horseback Riding on Roads	NA	NA	NA	NA	NA	NA	NA	-
2. Bicycling on Improved Paths & Trails	L	H	-	L	NA	-	H	-
3. Motorcycle Riding on Improved Trails	-	H	-	L	NA	-	H	-
4. Motorcycle Riding on Open Land	-	XH	L	L	-	-	H	H
5. Camping in Campground (Recreational Vehicles)	L	H	H	L	L	-	H	-
6. Boating-Water Skiiing	-	NA	H	M	NA	-	NA	L
7. Boating-Speed Power Boat	-	NA	H	L	NA	-	NA	L
8. Fishing-Lake Shore & Rowboat	-	L	-	-	-	M	NA	L
9. Skiing-Cross-Country	-	-	-	H	L	-	-	-
10. Skating-Outdoor Rink	L	H	H	H	-	-	H	-
11. Regional Multi-Purpose Fair-ground Complex	NA	NA	NA	NA	NA	NA	NA	-
Additional Categories								
1. Natural Area	-	-	-	-	-	-	-	-
2. Picnicking with Facilities	-	H	M	-	L	-	H	-
3. Sailing	-	NA	-	M	-	-	NA	L
4. Recreation Center	M	H	H	-	-	-	H	-
5. Shooting--(Skeet, Target)	L	L	-	-	-	-	?	-
6. Archery	L	L	-	-	-	-	?	-
7. Equestrian Facilities & Stables	M	H	H	-	H	M	?	NA
8. Hunting--Boulder Reservoir--Yes Hidden Valley Ranch--NA	-	-	-	-	L	-	NA	L
9. Lake Swimming with Facilities	-	H	H	M	-	L	NA	L
10. Rural Western Recreation Center	L-M	H	H	-	-	-	?	NA

These alternatives are NOT recommendations. Any mixture of uses can be implementated in the area as long as the Recreation Department is willing to pay the environmental, political or dollar cost. The divisions are not and can not be made mutually exclusive. The alternatives are made in order to explore the land vulnerability ratings and the relating limitations affecting the alternative category as a whole.

Limited Development (Low Land Vulnerability)

Hiking on Trails
Fishing
Cross-Country Skiing
Natural Area
Sailing
Archery
Equestrian Facilities (already present)

Few major limitations affect the development of a low land vulnerability alternative. As can be deduced from the body of the paper, climate is a major factor for all recreational uses. Lack of precipitation, changing weather patterns and wind can be deterrent climatic limitations, whether it be lack of snow for cross-country skiing or lack of available water for grazing and water fountains.

Soil character is the only other major limitation affecting development. With the clayey nature of the soils present, hiking, equestrian facilities and natural area tend to be slippery when wet. Also inherent in the soils, is the lack of suitability for introducing new vegetation; the few limitations are minor. Vegetative cover is already present and has caused no major problem.

Moderate Development (Medium Land Vulnerability)

Horseback Riding on Trails
Swimming Pools
Tennis Courts
Bicycling on Improved Paths and Trails
Outdoor Skating Rink
Lake Swimming
Picnicking

The items included in a moderate development scheme have more severe limitations imposed upon them. A point to remember is that these limitations are not permanent. For instance, the limitations imposed by the nature of the soils on the building of tennis courts or swimming pools can be overcome by various construction or design methods.

Swimming pools face several other problems. First of all, they must have water. At present there are no water mains in the area and they would have to be constructed first. Secondly, in order to drain the pools, a sewer system is needed. It is neither environmentally nor lawfully feasible to drain a pool into the present reservoir because of the effects of the chemical content on life and water quality of the reservoir.

Lake swimming and horseback riding on trails is included in a moderate development scheme, even though they already exist, for several reasons. First of all, it has been found that lake swimming presently affects water quality through the lack of proper sanitary facilities. Water is a valuable resource and in this area is difficult to replace. Second, horseback riding presently stands on the border between moderate and severe land vulnerability. If one traverses the present trails, places can be found where the top soil is gone and criss-crossing trails cut down to bedrock. Continual riding on these trails causes further erosion which in turn destroys the vegetation and finally the vegetated habitats of wildlife.

Bicycling on improved trails and paths would also cause this same problem. If the trails were to be paved or asphalted, the limitation imposed by the soil constraints would have to be overcome.

Climate also produces limitations for the area. These run from the lack of consistent warm weather for outdoor swimming to the lack of persistent winter conditions for ice skating.

Legal considerations should also be examined if the area were to be developed with any one of these ways.

High Development

Outdoor Organized Games
Motorcycle Riding
Camping--Recreational Vehicles
Motorcycle Riding--Open Land
Boating--Water Skiing
--Power
Recreation Center
Shooting
Hunting

Any one of the above-mentioned activities under a high development scheme, have severe land vulnerability ratings. The effect on the land or area would be direct rather than indirect as depicted by a moderate development alternative. These uses will produce a non-reversible effect on the quality of the land.

High economic, legal, and environmental impacts are recorded as severe limiting factors (Table IX). Soils impose their limitations through erosion of soils from motorcycle riding, slippery consistency for camping when wet, and the shrink-swell potential in building a recreation center.

Outdoor organized game playing would also have vegetation and water constraints. This is in addition to a soil limitation because grasses would have to be planted in the present soil and watered to keep them alive.

Water quality and quantity is not very good. Power boating and water skiing are included in this section because of their effect upon the reservoir. Again there is a lack of sanitary facilities at Boulder Reservoir but, in addition, the insertion of oil and gas also has a high and degrading environmental impact. There is an incompatability with swimming, sailing, power boats and fishing on a single, small body of water. Sailing and fishing causes the least impact, swimming next and power boats are the most destroying environmentally and affect negatively waterfowl habitats.

Incompatability between various recreation functions, quality of ground and surface water and land, and finally the quantity of available area (within the scope of legal constraints) all impose various limitations for the development of any new intensive recreation activity.

It is not the purpose here to discuss the individual constraints imposed on each. To do so under a high-development scheme would reiterate the preceding body of the report. For specific limitations, one needs to consult the various preceding sections. As an example, let us examine tennis courts and then study the various limitations imposed by their development. Under landform, tennis courts have a low limitation based on the rolling nature of the land in the area which would have to be leveled. There is a high soil limitation due to the clayey nature of the soil and the building variances necessary to overcome the high shrink-swell tendency of the soil. On the other hand, there are moderate ground water and low climate limitations because drinking fountains are a necessity in the Boulder area which has many sunny and clear days throughout the year. Legal limitations are divided into two subcategories, those for HVR and those for BR. Tennis courts have no legal constraints in the BR area but have a high constraint for the HVR area because of the greenbelt nature of the land.

This paper is not conclusive. It merely offers ideas for the development of the HVR/BR area. When considering any alternatives, one must remember that the use of land is a tradeoff between the changing demand, the dollar cost as an investment and, most importantly, the depletion of land as a nonrenewable resource.

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