ABSTRACT

AN OPTIMUM LAND USE MODEL FOR A DELIMITED AREA CONTIGUOUS TO THE CROSS-FLORIDA BARGE CANAL

by Edward A. Fernald

Land use and land use change are significant subjects for geographic investigation because they involve the study of delimited space. The Cross-Florida Barge Canal project, a high-level lock canal, will traverse approximately 100 miles through central Florida from the St. Johns River to the Gulf of Mexico. This thesis recognizes that the addition of such a structure to the landscape will precipitate changes in the utilization of land contiguous to it, and that such alterations will be influenced by, and will affect, a complex set of natural and cultural phenomena.

The objective of the study was to develop an intellectual model which would provide a means for creating a functional optimum land use model, or set of maps for the year 1980, for an area within at least one mile of the canal banks or the shorelines of the reservoir pools. The study space encompasses nearly 150 square miles.

The study area is dominated by the Oklawaha and Withlacoochee River valleys and is characterized by poor sandy soils which are either inadequately or overly drained. Limestone and phosphate are minerals that offer prospects for the future but have little present utility. Forests have, in many cases, been indiscriminately cut in the past. Today, the effects of this action are seen in the poor quality and non-productive character of much of the woodland. The main types of forests that do exist are pine flatwood on the drier sand and hardwood hammock and swamp forest on the wet lands.

In the spring of 1966 approximately 3,913 persons lived in the study area, the major concentrations being in Dunnellon (population - 1,150) and Inglis (population - 200). Following forestry as the major land use, is unimproved pasture, residential and some improved pasture. Thoroughbred horse farms and beef cattle ranches utilize the high quality grassland.

Man's recognition of the natural amenities of the area and his use of the resource base has resulted in the development of an economy that is too heavily dependent upon retirement incomes, recreation, and highway-oriented tourist trade. Although these uses are desirable, the business climate lacks a sound, diversified base which will provide steady employment for a young, educated (skilled), need-oriented population.

The most important geographic techniques employed were field investigation, interview and cartography. Aerial photographs were used in gathering data, base maps were prepared, and acetate overlays were employed to depict the inventory of cultural and physical features.

The intellectual model was developed as follows:

I. Input: Recognition of problem of identifying optimum land use following construction of the Cross-Florida Barge Canal
   - A. Historical background
   - B. Inventory and analysis of existing phenomena
     1. Physical features
     2. Cultural features

II. Intervening variables
   - A. Superimpose Cross-Florida Barge Canal on the area
   - B. Affecters of future land use

III. Output: Deliberations, decisions and construction of a functional, optimum land use model

Called the intellectual model to differentiate it from the input stage inventory model and the output stage functional model, this model is not mathematical or statistical in nature. It has the utility of forcing the researcher to focus his attention on all of the relevant data gathered and provides a guide to rational decision making which is a requisite to approaching optimum land use.

Most of the region is in less than optimum use owing to low taxes, little population pressure and, in some parts, poor access. Some areas of forests, showing excellent multiple use and management, some pasture land, and several small recreational sites are the best examples of present optimum use. In almost all residential areas a lack of planning and zoning regulations hurt development. This fault is characteristic of the entire study area. Wholistic planning, for the entire region or as a part of county wide development, should be current and in effect.

The existence of the Cross-Florida Barge Canal, as a variable in the growth of the study area, will cause rather immediate land use change at a rate and to a degree greater than is normal for that region. Residential, commercial, industrial and especially recreational uses will increase in quantity and quality, and while the space given to agriculture will probably decrease, it will be more intensively worked.

Due to the complexity of the factors that affect land use change, sound vertical and horizontal planning is a necessity. That is, there must be continuity in the past, present and future uses and harmony among those that exist at any one time.

A trend toward optimum land use, while accelerated will not result solely because of the opening of the barge canal. Normal population and economic growth, a need for

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public recreation land, property reevaluation and the accompanying pressure to put land to work are other factors that affect the utilization of space.

The intellectual model, which provided the frame of reference for constructing the functional maps is entirely adequate. It is limited only by the availability of data and the ability of the researcher to include all relevant material and accurately judge its import. It is successful in helping people establish and evaluate goals. This is desirable because too often there is a tendency to claim excessive potential for available resources. The study provides strength to the argument that in geography and the economics of location one can discover an adequate theoretical foundation for regional development and planning.

AN OPTIMUM LAND USE MODEL FOR A DELIMITED AREA CONTIGUOUS TO THE CROSS-FLORIDA BARGE CANAL

By

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Geography

1967

ACKNOWLEDGEMENTS

This writer would like to express gratitude to his major professor, Dr. Paul C. Morrison, for his valuable advice and criticism which contributed greatly to the writing of this paper. Appreciation is also expressed to the U. S. Corps of Engineers, the Canal Authority of the State of Florida, and to the Secretary of State of the State of Florida for their interest and cooperation in making this research effort possible.

Many interviewees are to be thanked for their patience and cooperation which was so necessary. Finally, the moral support and encouragement of the writer's family and the partial funding provided by the State of Florida is appreciatively acknowledged.

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CHAPTER I

INTRODUCTION

Land use and land use change are significant subjects for geographic investigation because they involve the study of delimited space. Special attention is given to the areal distribution of all, or selected phenomena within that space, and, to be meaningful, to the interaction of those phenomena. To man, the most important of the geographic phenomena, these studies are vital to his efforts to understand and develop his habitat. They are also essential to intelligent decision making about the future use of the land.

One of the basic generalizations of geography, that the significance of the environment is a function of the attitudes, objectives, and the technical skills of man,[1] is applicable to, and supports the need for, land use study because its very logic recognizes both the fact of perpetual change and that man is responsible to apply his ingenuity to the development of his environment. Geography and geographers then, have a unique obligation

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[1]Preston E. James, "Geography" in The Social Studies and the Social Sciences (New York: Harcourt, Brace & World, Inc., 1962), p. 65.

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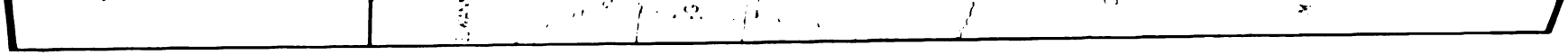
to help man gain an understanding of the land on which he lives through analyzing areas of defined importance and by aiding him to establish plans for their future development.

Since so little of the earth's surface has been subjected to land use studies, both the space and the phenomena to be investigated must be carefully identified. To mitigate the question of identification the author suggests that such a study might be based on a particular problem confronting man. This criterion then allows the geographer to serve both the practical need of society and, at the same time, to perfect the methodological aspects of the discipline. This is not to imply that the practical need must, of necessity, precede the development of methodology.

The Study and Its Objective

This particular study emanates from the decision of the United States Congress to provide necessary funds for the building of a high-level lock barge canal across the State of Florida under the auspices of the Corps of Engineers (Fig. 1). The canal project was authorized by Public Law 675, 77th Congress, dated 23 July, 1942. Actual construction was not started at this time, however, due to a lack of funding. In 1962, Congress provided money for a re-evaluation of the project and construction was started in February, 1964. Completion time for the project is from seven to nine years. However, during the first two years of



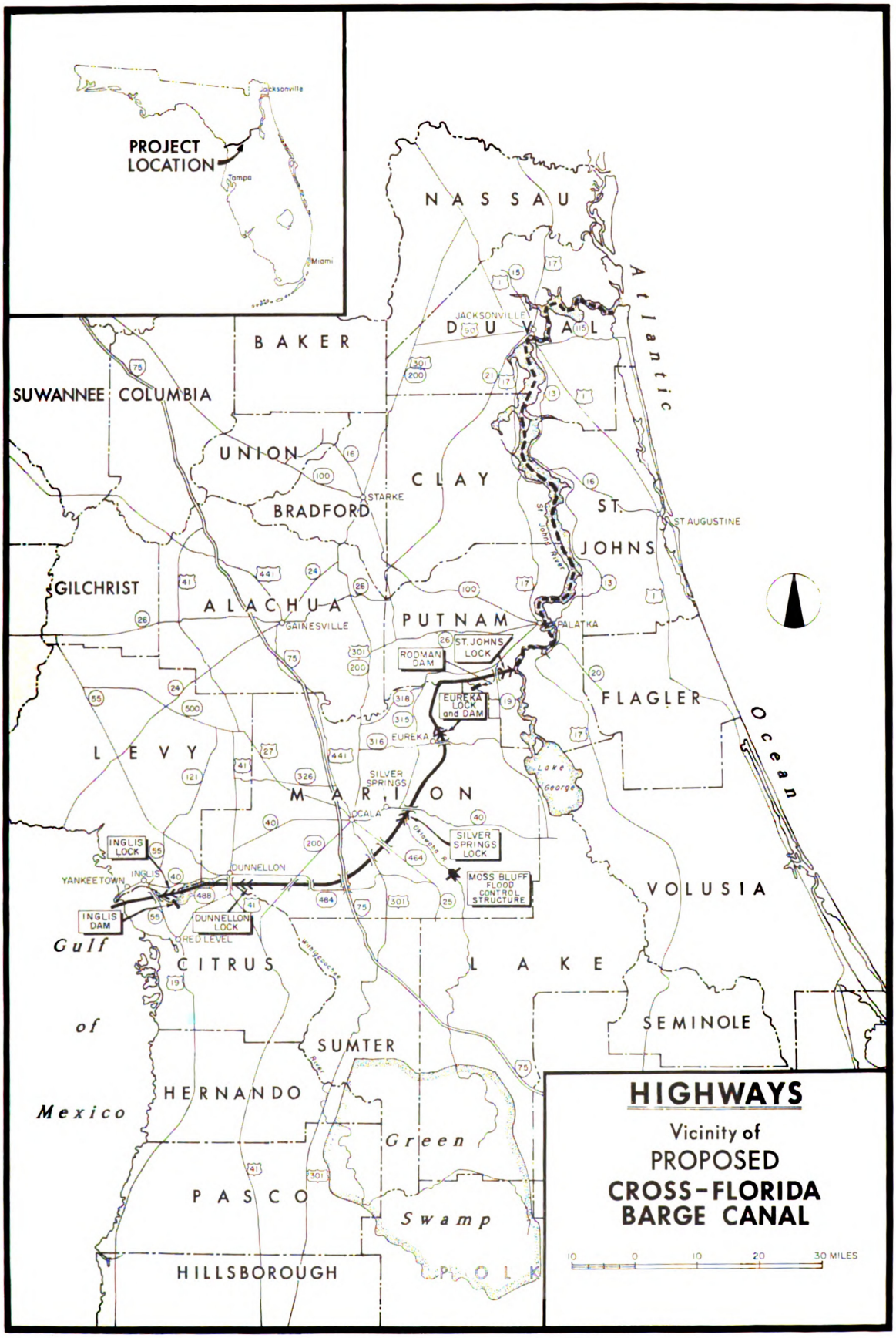

PROJECT LOCATION
Jacksonville
Tampa
Miami
NASSAU
DUVAL
JACKSONVILLE
BAKER
SUWANNEE
COLUMBIA
UNION
BRADFORD
CLAY
STARKE
ST. JOHNS
ST. AUGUSTINE
GILCHRIST
ALACHUA
GAINESVILLE
PUTNAM
PALATKA
ST. JOHNS LOCK
RODMAN DAM
EUREKA LOCK and DAM
EUREKA
FLAGLER
LEVY
SILVER SPRINGS
MARION
OCALA
Lake George
SILVER SPRINGS LOCK
MOSS BLUFF FLOOD CONTROL STRUCTURE
INGLIS LOCK
INGLIS
YANKEETOWN
DUNNELLON
INGLIS DAM
DUNNELLON LOCK
RED LEVEL
Withlacoochee River
CITRUS
LAKE
VOLUSIA
SEMINOLE
SUMTER
HERNANDO
PASCO
HILLSBOROUGH
POLK
Green Swamp
Gulf of Mexico
Atlantic Ocean
St. Johns River
Oklawaha R.
HIGHWAYS
Vicinity of
PROPOSED
CROSS-FLORIDA BARGE CANAL
10 0 10 20 30 MILES

Figure 1

work, construction progressed ahead of schedule so that completion, if funds are available, could be prior to 1971.

The canal, when opened will extend from the Gulf of Mexico, one mile south of the mouth of the Withlacoochee River, to the St. Johns River in southern Putnam County and will be approximately ninety-five miles long. This way was selected by the Corps of Engineers after considering twenty-eight separate routes ranging from Mid-Georgia to Lake Okeechobee. Reasons for the choice were: only shallow excavation is needed, its shortness, construction economy, and the presence of adequate water supply for lockages. The canal will have a minimum depth of twelve feet and a minimum bottom width of 150 feet. Five locks, three to the east and two to the west of the divide, will lift and lower vessels, between sea level at either end of the canal, and a maximum elevation of fifty-five feet in south Marion County (Fig. 2). Each lock will be eighty-four feet wide and 600 feet long in order to accommodate all existing and foreseeable sheltered-waterways' barge traffic. The project, as authorized, will also include two earth dams and the necessary canal crossings of roads (Fig. 1) and railroads (Fig. 3). These structures, ten highway and three railroad bridges, will have a minimum fixed vertical clearance of sixty-five feet. The purpose of the dams is to create reservoirs to supply water to the higher parts of the canal. The pools (Fig. 4) created by

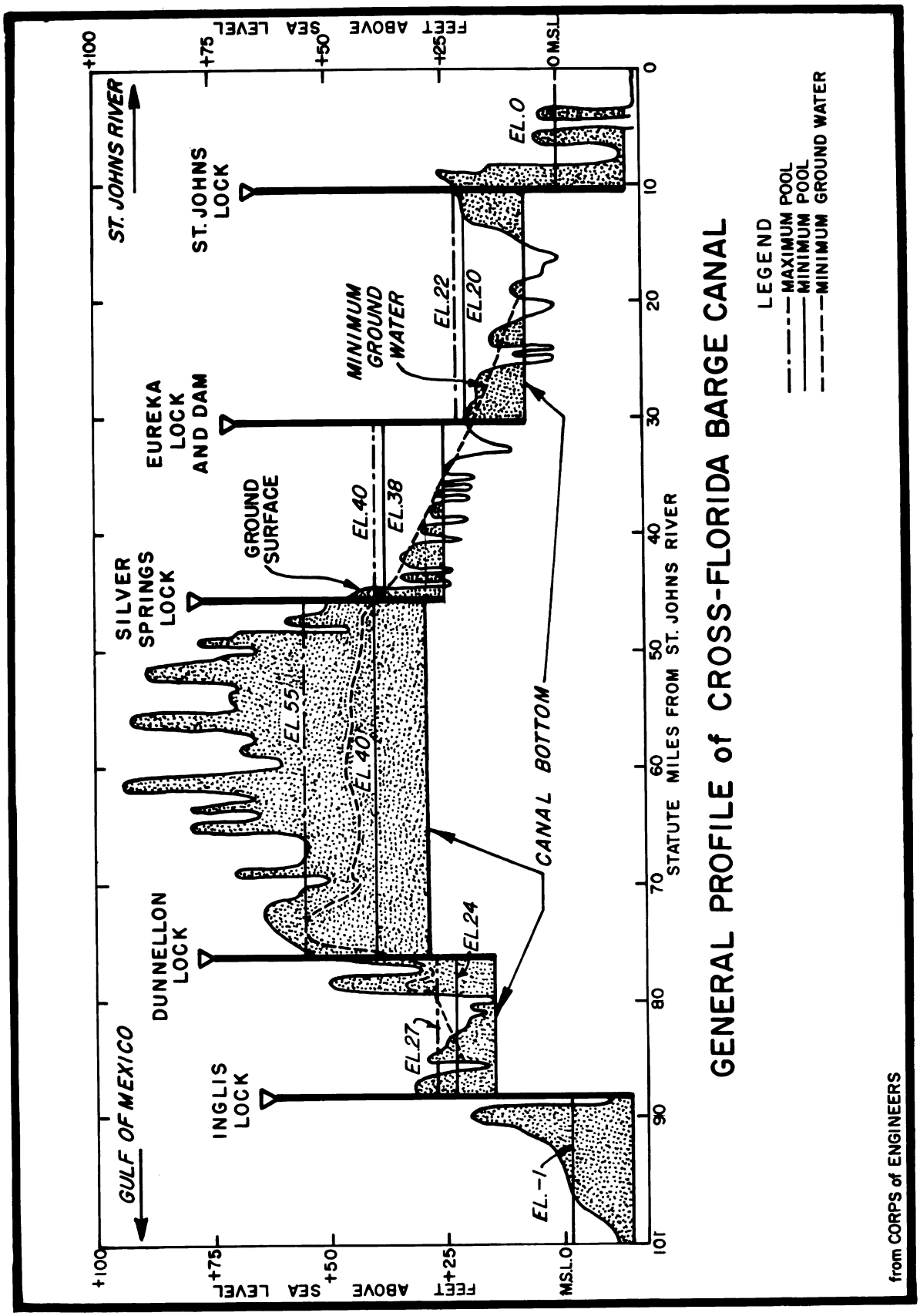

GENERAL PROFILE of CROSS-FLORIDA BARGE CANAL
LEGEND
MAXIMUM POOL
MINIMUM POOL
MINIMUM GROUND WATER
ST. JOHNS RIVER
GULF OF MEXICO
ST. JOHNS LOCK
EUREKA LOCK AND DAM
SILVER SPRINGS LOCK
DUNNELLON LOCK
INGLIS LOCK
MINIMUM GROUND WATER
GROUND SURFACE
CANAL BOTTOM
EL.0
EL.22
EL.20
EL.40
EL.38
EL.55
EL.40
EL.24
EL.27
EL.-1
FEET ABOVE SEA LEVEL
+100
+75
+50
+25
M.S.L.0
STATUTE MILES FROM ST. JOHNS RIVER
0
10
20
30
40
50
60
70
80
90
101
from CORPS of ENGINEERS

Figure 2

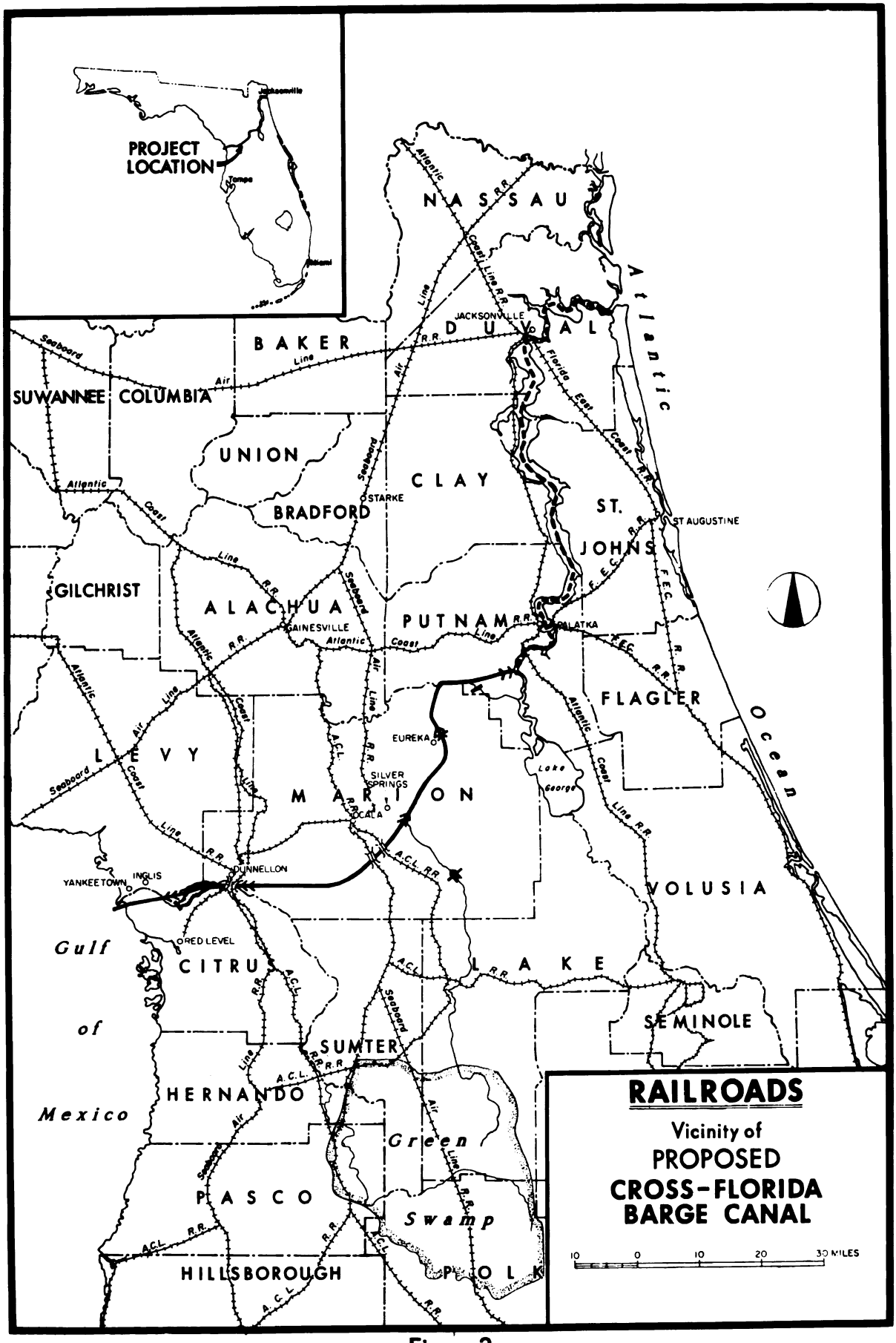

PROJECT LOCATION
Jacksonville
Tampa
Miami
NASSAU
Atlantic
Ocean
JACKSONVILLE
DUVAL
BAKER
SUWANNEE
COLUMBIA
UNION
CLAY
BRADFORD
STARKE
ST. JOHNS
ST AUGUSTINE
GILCHRIST
ALACHUA
GAINESVILLE
PUTNAM
PALATKA
FLAGLER
LEVY
EUREKA
SILVER SPRINGS
OCALA
MARION
Lake George
VOLUSIA
DUNNELLON
YANKEETOWN
INGLIS
ORED LEVEL
Gulf of Mexico
CITRUS
LAKE
SEMINOLE
SUMTER
HERNANDO
Green Swamp
PASCO
POLK
HILLSBOROUGH
RAILROADS
Vicinity of
PROPOSED
CROSS-FLORIDA
BARGE CANAL
10 0 10 20 30 MILES

Figure 3


INVENTORY MAPS

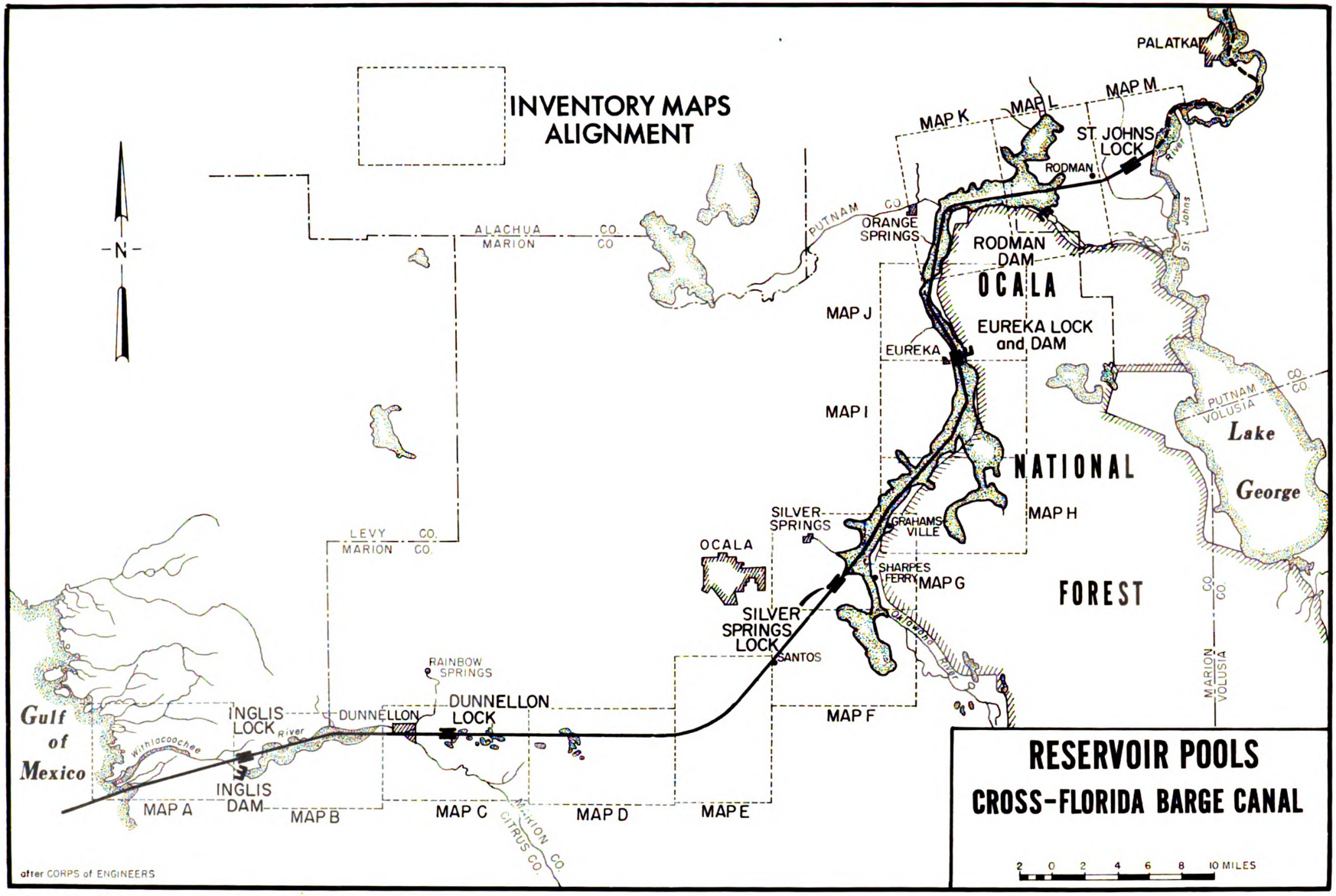

INVENTORY MAPS ALIGNMENT
N
PALATKA
MAP K
MAP L
MAP M
ST. JOHNS LOCK
RODMAN
St. Johns River
ALACHUA CO
MARION CO
PUTNAM CO
ORANGE SPRINGS
RODMAN DAM
OCALA
MAP J
EUREKA LOCK and DAM
EUREKA
MAP I
PUTNAM CO
VOLUSIA CO
Lake George
NATIONAL FOREST
MAP H
SILVER SPRINGS
GRAHAMSVILLE
OCALA
SHARPES FERRY
MAP G
SILVER SPRINGS LOCK
SANTOS
LEVY CO
MARION CO
RAINBOW SPRINGS
DUNNELLON
DUNNELLON LOCK
INGLIS LOCK
Withlacoochee River
Gulf of Mexico
INGLIS DAM
MAP A
MAP B
MAP C
MAP D
MAP E
MAP F
MARION CO
CITRUS CO
MARION CO
VOLUSIA CO
RESERVOIR POOLS
CROSS-FLORIDA BARGE CANAL
2 0 2 4 6 8 10 MILES
after CORPS of ENGINEERS

Figure 4

the dams will total approximately forty-two square miles and will create 182 miles of new inland waterfront.[2]

Expected primary benefits of the canal are based on the fact that it will be the final link in over 29,000 miles of protected inland waterways connecting twenty-nine states between Texas and New Jersey, including those of the Midwest. Giles L. Evans, Manager of the Canal Authority of the State of Florida, presented a statement to the Committees on Appropriations, 88th Congress, 2nd Session, in which he gave three themes which identify the national advantages of the canal.[3]

These were: cheaper transportation for the movement of bulk cargoes; provision of an economic impetus to the economy of the southeast; and facilitation of the movement of space equipment and other strategic goods.

Local justification, in addition to sharing in the benefits mentioned above, can be classed as navigational and collateral. The navigational gains include freight transportation saving, use by commercial fishing boats,

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[2]U. S. Army Corps of Engineers, Economic Evaluation of the Cross-Florida Barge Canal Project (Jacksonville, Florida, March 13, 1962), p. 4.

[3]Giles L. Evans, Jr., "Intracoastal Waterway, Cross-Florida Barge Canal" [concerning appropriations for fiscal year 1965]. (Jacksonville: Canal Authority of the State of Florida, April 27, 1964), pp. 3-5. (Mimeographed.)

transhipment of contractor's floating plants, and improvement of recreational boating. The collateral benefits include expanded outdoor recreation, waterfront land enhancement and facilitation of flood control.

Military or defense benefits, while often used to support the need for the project, are not included in the cost-benefit studies. Economic studies made by the Corps of Engineers show that the ratio of benefits to cost would be 1.2 over fifty years of the life of the project and 1.6 over 100 years.[4]

The presence of the canal will, of necessity, cause changes in the utilization of the land purchased for the project and of some of the area contiguous to it. These changes will be influenced by, and will in turn affect, a complex set of natural and cultural phenomena. It is desirable, in a democratic society, that the changes be the result of careful study and planning in order that the decisions made might provide for optimum land use as measured by the well-being of the majority of the citizens involved.[5]

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[4]U. S. Corps of Engineers, op. cit., p. 6.

[5]The phrase 'optimum land use' is a relative one. However, when dealing with people and attempting to predict their actions arbitrary judgments must be made. This is often done in geographic literature. For example, decisions concerning "river development," and "regional social and economic betterment" were made by geographers in studies for the Tennessee Valley Authority (Victor Roterus, "Meeting Regional Problems and Needs," Economic Geography, XV

Development of an intellectual model which will provide a means for creating a functional optimum land use model for a delimited area contiguous to the Cross-Florida Barge Canal is the objective of this study.[6] The study area includes all land within at least one mile of the canal center line or of the water limits of the pool areas.[7] In all, it comprises approximately 350 square miles of surface. The alignment of the maps covering the project space is shown on Figure 4.

Limits for the area were established as a result of discussions with Dr. John Lounsbury of Eastern Michigan University and Drs. Paul C. Morrison and Lawrence M. Sommers of Michigan State University in the summer of 1964. Lounsbury pointed out that his experience in land use investigation in the Ohio River Valley suggests that an understanding of the area within one mile of a linear water transportation route provides a satisfactory indication of

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(July, 1939), p. 265. In Puerto Rico geographers proposed "accurate and effective rural land planning" (C. F. Jones, The Rural Land Classification Program of Puerto Rico. Northwestern University Studies in Geography, No. 1 [Chicago, Ill., 1952], p. 28).

[6]The intellectual model is a systematic ordering of the steps or structure followed in predicting what optimum land use will be. The functional model, or plan, is the map, or series of maps, that depict the output or results of implementing the intellectual model and can be used for prediction.

[7]Permanently impounded water area created by flooding of low lying land due to maintenance of a constant water level in the canal.

land use further away. The greatest change will tend to occur close to the waterway while the alterations that take place a mile away will differ little from those at additional distances. Drs. James R. Anderson and Robert B. Marcus, geographers of the University of Florida who are familiar with the study area, agree with this supposition.

Brief Description of the Study Area and Environs

The traverse of the Cross-Florida Barge Canal extends from a point on the Gulf of Mexico in northwestern Citrus County, to one on the St. Johns River approximately six miles south of Palatka in Putnam County. Figures 1, 3, and 4 show the general location of the canal, its pool areas, and the major transportation facilities of central Florida.

The canal crosses low coastal terraces on both its easterly and westerly limits, generally following the valleys of the Withlacoochee and Oklawaha Rivers (Fig. 1). Both rivers are of low gradient and rise in the Green Swamp area of central Florida. The Withlacoochee drains 2,200 square miles and flows generally northward ninety-six miles to Dunnellon, where it receives the discharge of Rainbow Springs, located 3.5 miles north of Dunnellon. From here it goes twenty-seven miles west to the Gulf of Mexico. The Oklawaha, on the other hand, flows northward and eastward to enter the St. Johns River. It is about eighty-seven

miles long, drains 2,300 square miles and receives the discharge of Silver Springs, which are located about four miles east of Ocala.[8]

In south Marion County the canal crosses a longitudinal ridge, called the Central Highlands, that extends into the center of the peninsula. It traverses this ridge through a topographic saddle. Land elevations along the canal route range from sea level at the Gulf of Mexico to approximately ninety feet south of Ocala. One nearby ridge reaches approximately 150 feet in the northwestern part of the Ocala National Forest, but in general the Oklawaha Valley has an elevation of less than fifty feet and slopes gradually to approximately five feet at its confluence with the St. Johns. At both ends of the waterway a dry land cut is utilized to provide a more direct route to the Gulf and the St. Johns.

The route of the canal is underlain by Avon Park, Ocala, Suwannee and Hawthorn limestones which range from 4,000 to 15,000 feet in depth. Associations of sandy soils predominate in the valleys, with some muck and marsh soils near the rivers and coastal salt water marsh soils on the Gulf. Drainage is important to much of the use of these soils and is a major characteristic in the associational descriptions discussed in Chapter Three. In general, the soils have very low fertility with the best being found in

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[8]Robert O. Vernon, "Trans-Florida Barge Canal" (Tallahassee: Florida Geological Survey, 1959), p. 1. (Mimeographed.)

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the ridge section of southern Marion County. From the Withlacoochee to the Oklawaha the sands are generally well to overly drained and the natural vegetation is pine and oak. Ocala National Forest has as its western border a portion of the Oklawaha River (Fig. 4). A part of this forest is included in the study area. The U. S. Forest Service reports that the forest includes one of, if not the largest, area of sand pine in the world. Hardwood associations exist in hammocks, high-level rock paved wet areas.

In the entire study area the main agricultural land use is unimproved to semi-improved pasture, although there is some improved grassland devoted to intensive cattle and thoroughbred raising. Very little land is in crops. Small acreages are in feed corn, citrus, watermelon and peaches. Approximately 4,600 acres are planted in pine.

Annual rainfall is approximately fifty-three inches with about two-thirds of that amount falling in the summer. November is usually the driest month when just under two inches of rain normally fall. The wet months of July to September will vary from about six and one-half to just over eight inches of precipitation. The average temperature for January, the coldest month, is 60°F. and for the warmest, July, it is 81° F. About seven and one-half degrees is the greatest temperature variation between any two consecutive months and on only four to six days

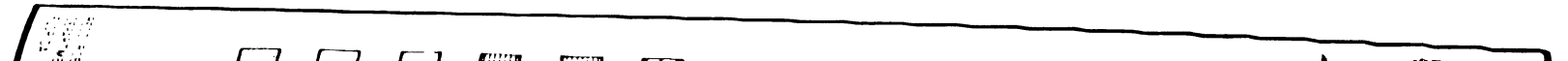
annually will the thermometer record 32° or below. The average length of the frost-free period is over 300 days per year.

There are approximately 4,000 permanent residents in the study area with over one-quarter of these in Dunnellon, which had a population of 1,150 in 1964. Inglis, population 250, is the only other settlement of over 100 persons and is the only other incorporated town. Through discussion with various local leaders it is estimated that about one-half of all the people are over sixty years of age, and over eighty percent of the dwellings have a real value of less than $10,000 each. Approximately forty percent of all dwellings are occupied on a seasonal or weekend basis. These characteristics point out the retirement and recreational nature of the study area.

Nearby urban centers of Ocala and Palatka, with 13,595 and 11,028 residents respectively, experienced a population increase of approximately fifty percent during the last two decades. Although this is a large percentage increase, it is less than half that for the state as a whole during the same period. Most of the growth was due to an increase of residents from out of state. These towns, particularly Ocala, serve the basic wholesale needs of the area and are important because major land owners, developers and banking facilities are located there and they are the county seats for Marion and Putnam Counties.

Per capita income in the counties of the project area is just under $1,700 per year. The state average for 1964 was $2,273. The economy of these counties is basically agriculture, forestry and recreation, with some industry. The canal traverses the coastal and transition economic regions as identified on Figure 5. Levy and Citrus Counties produce field crops, the most important being watermelon, and the latter county is the northern most coastal county that grows citrus fruit. Marion produces citrus, beef cattle and thoroughbreds for horse racing, while Putnam has potatoes as its main crop. Forest industries are important in all four counties with pine the most important wood. Recreation and retirement income is especially important in Levy, Citrus and to a lesser extent Marion. With the important exception of Silver Springs, and to some degree Rainbow Springs, the recreation industry is not highly organized and depends mainly on patronage of people from within the area or from nearby counties. This activity is based on fresh and salt water fishing, hunting, and camping.

The leading industries in the vicinity of the study area are canning, meat packing, extracting of limerock, dolomite and clay, trailer fabrication and producing building supplies. The only industrial activities within the boundaries of the project are a dolomite quarry and a precision tool and die company. Mineral resources, which



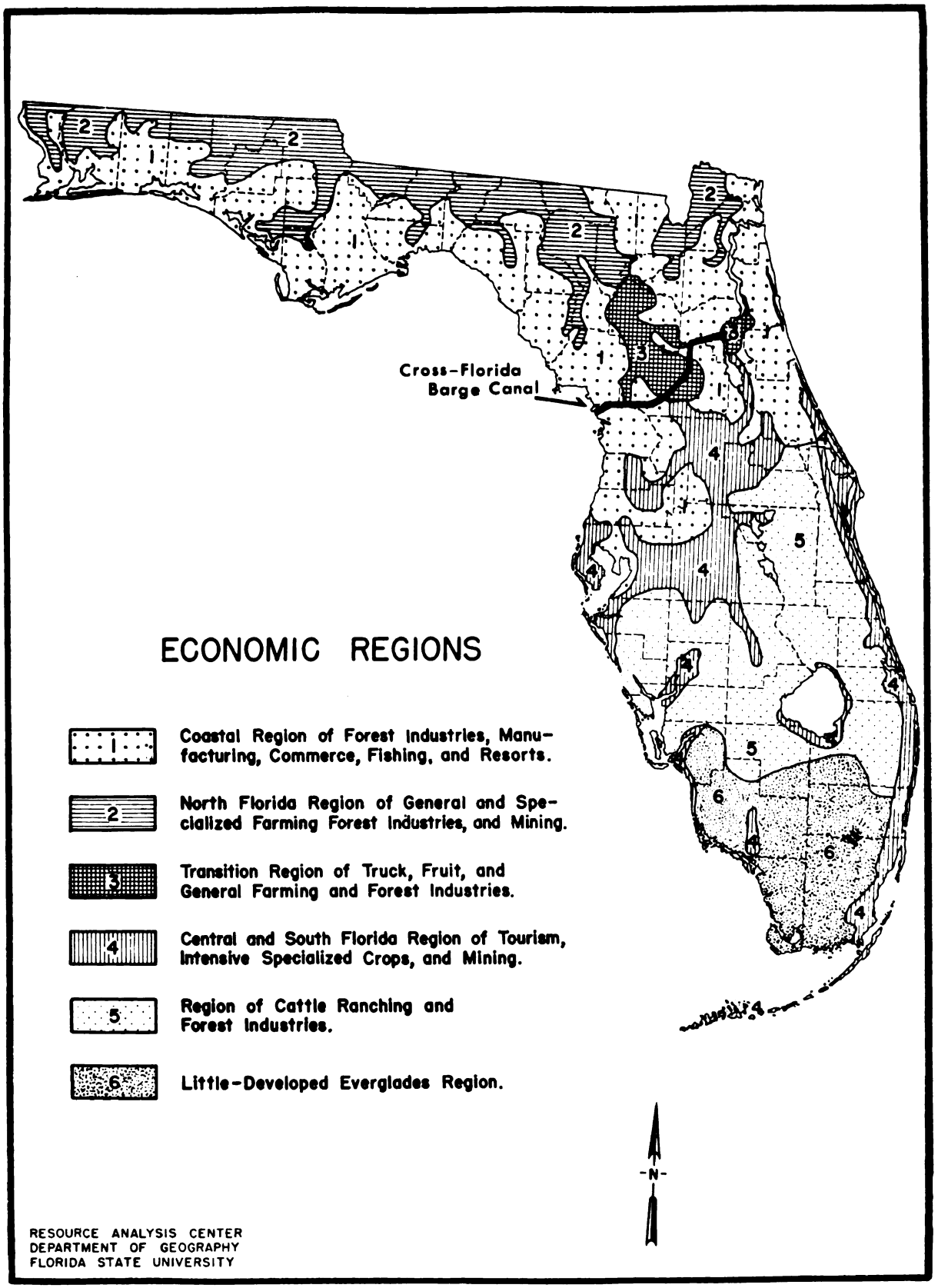

Cross-Florida
Barge Canal
ECONOMIC REGIONS
1 Coastal Region of Forest Industries, Manufacturing, Commerce, Fishing, and Resorts.
2 North Florida Region of General and Specialized Farming Forest Industries, and Mining.
3 Transition Region of Truck, Fruit, and General Farming and Forest Industries.
4 Central and South Florida Region of Tourism, Intensive Specialized Crops, and Mining.
5 Region of Cattle Ranching and Forest Industries.
6 Little-Developed Everglades Region.
-N-
RESOURCE ANALYSIS CENTER
DEPARTMENT OF GEOGRAPHY
FLORIDA STATE UNIVERSITY

Figure 5

are present but not completely developed, are phosphate, dolomite, limestone, sand and clay.

Hypothesis and Major Assumptions

The hypothesis of this study purports that the Cross-Florida Barge Canal will have a measurable impact on the use of the land through which it traverses and that an intellectual model can be developed which will provide the structure for a scientific collection and analysis of cultural and physical data about this land. These data will serve to develop a functional model that will be a plan for optimum use of land after the canal is in operation. Optimum land use is defined as that use which will most benefit the majority of citizens involved, as measured by such criteria as per capita income, land values, production of the land, orderly residential development, job opportunities, recreation opportunities, and concern for conservation of resources for this and future generations.

Major supporting assumptions or generalizations upon which this study is based are:

1. The addition of a major phenomena or structure to an area will affect a complex set of natural and cultural phenomena which will precipitate rather immediate land use change at a rate and to a degree greater than normal for that area.
2. Wholistic land use planning for a large area, where changes are designed in context, is to be

preferred to isolated decision making which has no consideration for an overall plan.

3. The significance of the physical environment is a function of the attitudes, objectives, and technical skills of man.
4. The function of the geographer in developing an optimum land use model is not that of dictating to the land owner, either public or private. Rather, it is to objectively present to both groups the single or multiple uses that are, in the eyes of the geographer, compatible with the public interest. As far as possible, the consequences of the various choices should be presented. This also applies to suggested laws for governing land use.
5. While optimum land use may be defined as the use that is in the best interest of the majority of the citizens of our society, it is recognized that the legal use of public lands is decided upon by formal leaders and the legal use of private lands is decided upon by the land owner unless condemnation litigation is introduced. This study will provide guidelines for future land use, and through its influence on public opinion and, in turn, on law making agencies, will regulate or at least guide both public and private decisions.

6. Because of the ongoing and complex nature of the process of land use change no specific date is set for the attainment of optimum land use. However, projections of population growth and per capita income are provided through 1980 to provide a basis for predictive statements, in the belief that most, if not all, of the proposed changes will have been made by that time.

Justification for the Study

Investigation by the author has established the fact that no detailed studies, public or private, have been made concerning either past or present land use in the canal area. Nor has any work been done toward the development of a land use model or plan for the future. Intensive interviewing of public and private interests concerned with the building of the canal substantiates the need for an optimum land use plan. While several government agencies and private businesses have investigated small areas for the location of parks or industrial sites, no large scale wholistic planning has been done. Ordinary citizens, officials from all levels of government, and business and professional people have all agreed that an optimum land use model would be of great practical value.

Samples of statements made in this connection are: L. C. Ringhaver, Chairman of the Board of the Canal Authority, "A study of this type is encouraged because neither state nor

federal funds for studying land use change has been provided in the project budget."[9] William Kidd, of Moorhead Engineering Company, "We have made intensive studies of several industrial sites but no one has made a study of the entire canal area. It will be of value to both public and private interests."[10] Glenn A. Bland, Realtor near Dunnellon, "This kind of study would be most beneficial to a sound development of real estate in the canal area."[11] The Honorable Tom Adams, Secretary of State of the State of Florida, by letter dated September 8, 1966, ". . . it was obvious that the State of Florida can benefit greatly from your study. For us to ignore the value of your work and the usefulness to which it can ultimately be put would be irresponsible." Similar opinions have been voiced by other governmental officials.

On the theoretical level the development of an optimum land use model would be an addition to the field of knowledge in that it would provide needed study in the development of a more meaningful method for the collection and analysis of land use data. It would also furnish a method for the prediction of land use change, and in the

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[9]Statement by L. C. Ringhaver, Chairman to Board of Directors, The Canal Authority of the State of Florida, on August 15, 1966.

[10]Interview with William Kidd, President of Morehead Engineering Company, Ocala, Florida, May 6, 1966.

[11]Interview with Glenn A. Bland, General Real Estate, Route 2, Dunnellon, Florida, May 5, 1966.

development of the model, experimentation would be conducted on the problems of scale and levels of generalizations in mapping land use, multiple use of land and establishing meaningful criteria for classifying both natural and cultural features. Both professional[12] and United States Government[13] publications have noted the need for such research.

Correspondence with commercial barge companies, the American Waterways Operators, Inc., and the Corps of Engineers, verifies that in the past no land use studies or predictions of land use change have been made prior to construction of any canal or similar waterway and that there is little literature directly germane to such endeavors. Related literature in the field of business and economics investigates the movement of commodities and the provision of services, and deals with their dollar values, but fails to formally consider land use and its change.[14] This lack is likewise characteristic of the reports and

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[12]James R. Anderson, "Towards More Effective Methods of Obtaining Land Use Data in Geographical Research," The Professional Geographer, Vol. 13 (November, 1961), p. 17.

[13]Urban Renewal Administration and Bureau of Public Roads, Standard Land Use Coding Manual (Washington: U. S. Government Printing Office, January, 1965), p. iii.

[14]For example see: Joseph R. Cordaro, "The Economic Development of the Ohio River Valley Due to the Influence of Water Transportation" (unpublished Master's thesis, University of Louisville, Kentucky, 1965); or Joseph R. Hartley, The Economic Effects of Ohio River Navigation (Bloomington: Indiana University Press, 1959).

brochures of private businesses, port authorities and others.[15] Feasibility studies made for the Corps of Engineers, for example, omit formal study of the use of land[16] and the Corps does "not formally pursue an investigation as to what occurs [to land use] after construction."[17]

The investigation will also provide a basis for the construction of generalizations regarding the factors that influence land use change along a linear transportation development. It will also provide an indication of the economic impact of the canal on land contiguous to the study area and serve as a basis for future studies.

The Model

Theorizing about land use and land use change in the area contiguous to the Cross-Florida Barge Canal demands, first, a recognition that rational decision making can bring about, or at least approach, optimum land use. Secondly, it demands a clear picture of the nature and scope of physical and cultural changes that will result

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[15]For example see: American Waterways Operators, Waterside Site Plant Locations and Expansions (Washington: American Waterways Operators, 1964); or, Humble Oil and Refining Company, Bayport (Houston: Humble Oil and Refining Company, February 15, 1965). (Brochure.)

[16]U. S. Army Corps of Engineers, Jacksonville. "Economic Evaluation of the Cross-Florida Barge Canal Project" by Arthur D. Little, Inc. (Jacksonville: 1962).

[17]Letter from Bruce A. Sossaman, Chief, Technical Liaison Office, New Orleans District, Corps of Engineers, July 29, 1966.

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from the completion of the project so that data might be organized in such a manner, and on a scale, that it would enable the decision makers, individual or collective, to arrive at rational choices. To meet these demands this study will construct an intellectual model which will provide a functional model to serve as an aid in rational decision making.

The intellectual model has the utility of forcing the researcher to focus his attention on all the relevant phenomena gathered. It also serves as a guide in selecting the most significant data and, as the technique of mapping is utilized, in identifying relationships. As the philosopher Karl Deutsch noted,

> We are using models, willingly or not, whenever we are trying to think systematically about anything at all. The results of our thinking in each case will depend upon what elements we put into our model, what rules and structure we imposed on those elements, and upon what actual use we made of the ensemble of possibilities which this particular model offered.[18]

A model may be defined or explained as, a plan, a design, or something intended to serve as a pattern of a thing to be made. It may also be defined as a simplified representation of some complex real phenomenon. In agreement with these ideas, Deutsch provides a more definitive statement when he says a model is,

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[18]Karl Deutsch, "On Communications Models in the Social Sciences," Public Opinion Quarterly, Vol. XVI (Fall, 1952), pp. 356-357.

> A structure of symbols and operating rules which is supposed to match a set of relevant points in an existing structure or process. Models of this kind are indispensable for the understanding of more complex processes. The only alternative to their use would be an attempt to "grasp directly" the structure or process to be understood; that is to say, to match it completely point for point. This is manifestly impossible. We use maps and anatomical atlases precisely because we cannot carry complete countries or complete human bodies in our heads. Each model implies a theory asserting a structural correspondence between the model and certain aspects of the thing supposed to be modeled. It also implies judgments of relevance; it suggests that the particular aspects to which it corresponds are in fact the important aspects of the thing for purposes of the model makers or users. Furthermore, a model, if it is operational, implies predictions which can be verified by physical tests.[19]

While not a geographer, Deutsch's ideas of a model are in harmony with chorological study. His structure to be studied could be any defined space. He refers to scale, he negates the complete understanding of the total space, he espouses systematic delimitation and description, and identifies the concept of interaction. His reference to the map indicates that the map itself is a model and that its inclusion into a larger intellectual model is acceptable. Finally, and important to this study, is the point that the operational validity of the model is based on its ability to make verifiable predictions.

The intellectual model to be used to identify optimum land use, after the addition of the barge canal to the study area, is given below.

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[19] Ibid., pp. 357-358.

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I. Input: Recognition of problem of identifying optimum land use following construction of the Cross-Florida Barge Canal

   A. Historical background

   B. Inventory and analysis of existing phenomena

      1. Physical features

      2. Cultural features

II. Intervening variables

   A. Superimpose Cross-Florida Barge Canal on the map

   B. Affecters of future land use

III. Output: Deliberations, decisions and construction of a functional, optimum land use model.

Although most of the geographic literature discussing models deals with those of a mathematical or statistical nature, the type presented here has been successfully used by geographers in land use studies of both large and small regions. Courtney applied it to predicting land use in low latitude humid regions.[20] Keller uses a similar model or procedure for ascertaining the developmental potential of an area by taking an inventory of selected resources.[21] That other social sciences also

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[20]Dale E. Courtney, "Problems Associated with Predicting Land Use in Low Latitude Humid Regions: A Case Study of the San Sebastian-Rincan Area, Puerto Rico" (unpublished Ph.D. dissertation, University of Washington, Seattle, 1959).

[21]F. L. Keller, "Resource Inventory: A Basic Step in Economic Development," Economic Geography, Vol. 29 (January, 1953), p. 39.

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make use of this type model is discussed by Deutsch[22] and illustrated, for example, by the work of the political scientist Pak.[23]

Harvey, in a Review Article in the Annals of the Association of American Geographers,

> suggests continued experimentation with model types, employing stochastic processes, aimed at the perfection of dynamic spatial models which will be useful to geographers.[24]

This writer feels that the problem Harvey recognizes involving an "evolutionary change through time" is adequately met through a discussion of the history of land use and the heavy emphasis on future change.

Urban planners indicate the same feelings, for example, Schlager points out the expense and difficulty of obtaining information, and the fact that "design standards for regional land use plan are not yet available."[25] Lowry states that, "The model builder . . . is to a large extent thrown back on his intuitive perceptions and his

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[22]Deutsch, op. cit.

[23]Byung K. Pak, The Cuban Problem In the Organization of American States: A Model for Collective Decision Making (unpublished Ph.D. dissertation, Florida State University, 1965).

[24]David W. Harvey, "Theoretical Concepts and the Analysis of Agricultural Land Use Patterns in Geography," Annals of the Association of American Geographers, Vol. 56 (1966), p. 361.

[25]Kenneth J. Schlager, "A Land Use Plan Design Model," Journal of the American Institute of Planners, Vol. 30 (1965), pp. 109-110.

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sense of style."[26] Lowry encourages that land use models be built and tested because it is better than doing nothing and wringing our hands, it is educational and organizes thought.[27]

This study does not make use of a regional model as such, for several reasons. First, the study is linear and although the area is relatively homogeneous the major characteristic common to every part of the area is the fact that a canal will traverse it and, therefore, change land use. This delimitation of the study area constitutes the basis for calling it a region. Secondly, within the area major differences in land use are based on the physiography, i.e., the Withlacoochee Valley, the ridge section and the Oklawaha Valley. Each of these sections may be considered regions or subregions based on physical criteria. Finally, and theoretically most important, a regional model is used to provide output regionalizations and that is not an objective of this study.

Procedure

Multiple geographic techniques, including field and library research, interview, correspondence, and cartography were used, following the definition of this

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[26] I. S. Lowry, "A Short Course in Model Design," Journal of the American Institute of Planners, Vol. 31 (1965), p. 160.

[27] Ibid., p. 164.

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study. The general procedures are discussed in the following paragraphs.

A scale of two inches to the mile was decided upon for the inventory mapping. This was selected because it would permit land use generalization at approximately one quarter mile, be large enough to allow for the location of existing buildings and other cultural features and provide maps that could be reduced to one inch to the mile for final presentation. The decision about scale was based on discussions with Professors John F. Lounsbury, Paul C. Morrison and Laurence M. Sommers.[28] In field interviews, engineers, planners and county and state officials have concurred with this scale decision. As a basis for recording the model input, thirteen different base maps were constructed, using Florida State Road Department maps,[29] United States Geologic Topographic sheets,[30]

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[28]Interviews were held in August of 1964 in East Lansing, Michigan.

[29]County Road Maps of Levy, Citrus, Marion and Putnam Counties, Florida. Published by the Florida State Road Department, 1963, at a scale of one-half inch to the mile.

[30]Topographic Sheets - U.S. Geological Survey Quadrangles,

Yankeetown	1955	7 1/2' Series
Yankeetown SE	1954	7 1/2' Series
Dunnellon	1954	7 1/2' Series
Dunnellon SE	1954	7 1/2' Series
Ocala	1892	15' Series
Kenka	1949	7 1/2' Series
Rodman	1949	7 1/2' Series
Palatka	1912	15' Series

United States Department of Agriculture aerial photography,[31] United States Forest Service Map,[32] and field maps constructed by the author in the spring of 1966 as sources. Through the use of a Saltzman enlarging projector base maps were constructed from which several copies were made and used both to record data on and as the basis for the final inventory models.

The primary method for collecting data for the inventory maps was field research. Observation and interviews were used, the information obtained being noted both on field maps and on aerial photographs.

The data accumulated are presented by cartographic methods on two maps, a base map which shows major kinds of land use, types of crops and natural vegetation, and one on a film overlay which identifies soil associations, dwellings, business buildings and other cultural phenomena. This presentation provides an ideal means of locating phenomena of a particular type or showing relationships. The use of the same type cartographic patterns and symbols is also suitable for the functional model or map which will predict optimum land use.

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[31]U. S., Department of Agriculture, Agriculture Stabilization and Conservation Service aerial photography.

Putnam County, Florida. Index sheets, Nos. 1, 3, 4, 1965.
Marion County, Florida. Index sheets, Nos. 1, 3, 4, 5, 1965.
Levy County, Florida. Index sheets, Nos. 7, 8, 1965.

[32]U. S. Department of Agriculture, Forest Service, "Ocala National Forest," a map (Washington, 1965).

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Cartographic representation of the data collected was guided by the relative homogeniety within the study area and by the scales of both the field maps, 1:31,680, and the final product,1:63,360. Symbols needed to be large enough to be identified yet not so large that the area they covered was too out of proportion. Standard cartographic screens and patterns, used in many geographic studies, for example, the Tennessee Valley Authority[33] and the Rural Land Classification Program of Puerto Rico,[34] were used to represent land use and natural vegetation associations.

Professional assistance was obtained in setting criteria or parameters for establishing boundaries of soil and vegetation associations. Specialists were also asked to review the analyses of this writer in regard to the interpretation of peculiar data and when the position of another person or firm was stated. After the inventory maps were complete four days were spent in the field re-checking the information shown.

Compiling the history of land use, checking points of analysis, and obtaining help in identification of

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[33]C. C. Crossman, "Determining the Purchase Boundaries and the Use of Reservoir Properties," Economic Geography, Vol. 15 (July, 1939), p. 263.

[34]J. F. Lounsbury, "Types and Patterns of Rural Settlements in Puerto Rico," The Rural Land Classification Program of Puerto Rico, Northwestern University Studies in Geography, No. 1 (Chicago, Ill., 1952), p. 237.

intervening variables was accomplished by interviews and a search of the literature on those subjects. Much of the information came from government publications, newspapers, and public and private records. The public records were largely from offices such as the County Agricultural Agent, the Soil Conservation Service, the Canal Authority of the State of Florida and the tax assessor. Among private businessmen, real estate dealers in particular contributed information for the study and evidenced a high interest in the results.

Study of the literature of political science and urban planning, as well as that of geography was significant in the development of the intellectual model. The most important of these sources are found earlier in this chapter as footnotes 18 through 27. They were especially helpful in providing examples of what can be accomplished with models and by identifying both the problems and potential associated with their use.

Establishment of the intervening variables and the output portions of the model was dependent primarily upon interviewing persons in key positions in government, business, transportation, and those related to land ownership or its transfer. Secondarily, a search of literature describing industrial development on existing waterways, and discussions of factors influencing land use change were helpful.

Important to the functional model, and its explanation, was the careful consideration of all of the factors concerning any particular land use as optimum. When one use is cited as optimum, or when several uses are noted as equally desirable, the decision was made by the author, but substantiating statements and considerations upon which the decision was based are indicated.

Maps and tables are included where deemed of use in presenting the data necessary to an understanding of the study and the conclusions which were reached. Dates on the maps are vital to their future use for studies in historical geography.

Although discussed in relation to the study, the city of Palatka is left out of the study area for two reasons: 1. The Cross-Florida Barge Canal, as a canal, ends where it reaches the St. Johns River, approximately six miles south of Palatka; and, 2. The proposed completion of the St. Johns-Indian River canal, which will follow the St. Johns south to Lake George (Map 3) and east to the coast, will add an important and uncontrolled variable to the study of land use at Palatka. Land on the St. Johns River is included arbitrarily to complete Map 13, but it also provides a study of a transition area.

The following chapter provides historical background on land use and the canal project. This information is vital to an effort to understand present land use and to

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predict future change and, in this way, it provides the foundation for both the intellectual and the ensuing functional models. Chapters Three and Four present an inventory and analysis of the physical and cultural features of the study area. Essentially they state what is there and tell why. The intervening variables, the canal and those factors that will affect land use after the waterway is complete, are discussed in Chapter Five and that is followed by the explanation of the optimum land use model in Chapter Six and the conclusions arrived at as a result of the study in Chapter Seven.

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CHAPTER II

HISTORICAL BACKGROUND

Timucua Indians inhabited the study area prior to the settlement of Caucasians in the 1820's. Abundant fish and game were available in the valleys of both the Oklawaha and the Withlacoochee Rivers, and the climate and soils were conducive to growing corn, beans, potatoes, greens, peas, tobacco and watermelon. In general, the indigenous peoples grew many of the same crops that are found in the area today.

Wood, stone, shell, clay and bone were the main natural resources used in the technology of the Indians. They settled near the rivers and used them as both a source of water and as the best route of transportation.

The Colonial Period

In 1539, Hernando DeSoto probably crossed the Withlacoochee and possibly saw the Oklawaha as he and his men marched northward from Tampa Bay in search of fame and gold. Some accounts state that DeSoto met with the head of all of the Timucuas at a village on the banks of what is today called Silver Springs.

Jean Ribaut, the French explorer, discovered the St. John's River in 1562 and subsequently established a

French Huguenot colony near its mouth. French mapping and scouting expeditions were probably the first Europeans to explore and use the Oklawaha. Both the French and the Spanish, who dislodged the Huguenots from Florida, made contact with the Indians and traded with them in order to obtain food.[1]

In the two and a half centuries of Spanish presence in Florida, their only achievement was to establish a chain of mission outposts across its northern part. This was done in order to gain converts, supply food for the forts, and to provide a bulwark against the English to the north. In so doing, European diseases were introduced, for which the Timucuas had developed no resistance. This, plus an unsuccessful uprising against the Spanish in 1656, reduced the Indian population so drastically that those who were able migrated westward or southward, while others were carried as slaves into the Carolinas.[2]

By 1750 the study area was inhabited by the Seminole Indians who had moved into Florida from Georgia and Alabama. The Seminoles, meaning "Wild Ones," established an agricultural-pastoral economy which was being practiced when the white man came to settle in the late 1700's.[3] The Seminoles grew the same crops as the earlier Timucuas

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[1]C. W. Tebeau and R. L. Carson, Florida from Indian Trail to Space Age, Vol. 1 (Delray Beach, Fla.: The Southern Publishing Company, 1965), p. 324.

[2]Ibid., p. 325. [3]Ibid., p. 337.

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but they also planted orange groves and herded cattle, horses, hogs, and kept flocks of turkeys.[4]

The Territorial Period

Florida became a territory upon its acquisition from Spain by John Quincy Adams, the United States Secretary of State, in 1818. Andrew Jackson was appointed the first territorial governor and, in speaking of his commission, President Monroe wrote in part: "I have full confidence that your appointment will be immediately and most beneficially felt. Smugglers and slave traders will hide their heads; pirates will disappear, and Seminoles will cease to give trouble."[5]

It was the Seminole problem, which developed into the Seminole Wars of 1835-42, that brought the white soldier into the study area. Around 1835 Ft. McCoy was built five miles to the west of Eureka, and Ft. King was established three miles east of Ocala. The function of the forts was to furnish a garrison to patrol the Oklawaha River and the Indian cultivations in that area. As the Indians went on the warpath they moved their villages further south, but came back at irregular intervals to obtain food from the volunteer regrowth of the fields.

During the war years several small battles and ambushes took place in the valleys of both the Oklawaha and the Withlacoochee Rivers. The latter became especially

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[4]Ibid., p. 338. [5]Ibid., p. 113.

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important as a transportation route, as troops patrolled the trails from settled northern Florida and the Gulf ports, to the southern outposts such as Tampa, Fort Braden, and Fort Myers.

One of the first commanders of the Florida militia, General Richard Call, was relieved of his command because, due to the lack of technical help, he could not meet the challenge of the central Florida wilderness. In regard to Call's problem, Tebeau and Carson write,

> he had not been able to plan and execute an effective campaign. In this respect, he was but the first of a long series of commanders defeated by the problem of moving and supplying men in the Florida wilderness. His successor was to suffer some humiliating setbacks (p. 155).

A General Scott, it is reported, "made an impressive list of obstacles to account for his failure. . . ." Most important were insufficient means of transportation, short supply of hard bread and bacon for marchers, and the hot climate which he associated with bad water and sickness of troops. Inadequate roads and bridges and scarcity of grazing and forage for horses also slowed operations. He felt the need of an auxiliary Indian force and the lack of guides or information about the country in which he was to operate.

> General Jessup took over from Call and with 4,000 men under his command campaigned along the Oklawaha and the Withlacoochee through the winter of 1836-37, and then turned to treating with the Indians to induce them to migrate. On March 6, 1837, a considerable number of the Seminoles agreed to depart if the government would buy their cattle, hogs, and ponies and allow them to take their Negroes with them.[6]

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[6] Ibid., p. 155.

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Following a complex set of events a few Seminoles did migrate to Oklahoma, but most escaped and remained to continue the intermittant war until they were pushed into the Florida Everglades.

After the Seminole Wars, permanent settlers came into the study area from Georgia and the Carolinas. They occupied land along the Oklawaha on bluffs overlooking the river and on the old Indian clearings. These pioneers, like the Seminoles, developed an agricultural-pastoral economy which later served as a base for limited trade, with timber, tobacco and furs going up the river and basic consumer goods coming down into the area.[7]

Statehood and the Oklawaha Valley

Homesteading laws and Statehood for Florida, in 1845, encouraged permanent settlers to organize and develop the territory from Silver Springs to Orange Springs (Fig. 4). It was this area that afforded the best land, as far as soil and drainage were concerned, for the development of farmsteads. The relative location near the Oklawaha was also important because water transport was used almost exclusively. Ease of transport on the Oklawaha was facilitated in the late 1840's as expeditions and clearing parties of local men removed the major obstructions and snags from the river between Silver Springs and the St. Johns.

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[7]Interview with Gene Gallant, Staff writer for the Ocala Star-Banner, and local historian, June 8, 1966. This interview provided much of the historical information on the Oklawaha River Valley and the ridge section.

Approximately ten years later, as new settlers began to populate the area, Col. Hubbard L. Hart, an enterprising Yankee from Vermont, started a large cattle and citrus farm north of Silver Springs. Hart assessed the future of the region and contracted with the State of Florida to again remove obstructions to make the Oklawaha navigable for commercial shipping. He was paid $4,500 and in three years the river, which varies from about seventy to nearly 200 feet wide, was clear of all obstruction. Later, in 1860, the Colonel founded the Hart line, a company operating boats which hauled both passengers and goods from Silver Springs to Jacksonville.[8]

The first crafts used were small, steam driven sidewheelers, but they proved too unwieldy and awkward for such a meandering river, so they were abandoned. Hart then had the first of many more-suitable riverboats built. They were sternwheelers, the largest of which was approximately eighty-six feet by thirty-three feet, and quickly became the backbone of the Oklawaha as a trade route. Shipping of passengers and products on the river reached a peak shortly after the Civil War. Later, near the turn of the century this traffic began to dwindle rapidly and it disappeared during the late 1920's.

Prior to 1845 surface transportation went east from Sharpe's Ferry (Fig. 4) following an old Indian trail to the

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[8]Ocala Star Banner (Florida), May 8, 1966, p. 6-J.

coast. This trail tied into a north-south road in Volusia County, but it was used primarily as a route to get salt from the ocean. The fact that an official road north from Silver Springs was not cut until 1855, attests to the importance of the Oklawaha to the area.

Following the Civil War, to about 1920, the economy of the area generally prospered. It was based primarily on timber and secondarily on agricultural goods. Rafts of pine and cypress logs sometimes clogged the river for an entire day, as miles of logs were floated to mills which were located near the proposed Rodman Dam (Fig. 4). These rafts, made by lashing about fifteen logs together, were steered by great log sweeps and often hindered other traffic from either moving along or across the river. Around 1890 a railroad line also operated from Silver Springs north to Rodman to service the timber interests. This was a spur to the Florida Railroad Company which had laid track south to Ocala in 1882 and on to Tampa by 1890.

Grahamville (Fig. 4), founded soon after the Seminole War, flourished as a river port with the handling of miscellaneous freight and lumber stores its main activity. From the 1870's through the 1920's the exports were barrels of spirits, resin, barrels of turpentine, lumber, hides, citrus and tobacco. Household items, other manufactured goods and tourists came into the area.

During this same period Eureka (Fig. 4) and Rodman were also thriving communities. Although it is impossible to give

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an exact population figure for either town, both were probably over 1,000. Estimates go as high as 2,000 for Eureka and up to 3,000 for Rodman. The problem of setting an exact census figure depends upon how Negroes were counted, as well as the lack of defined settlement boundaries. In 1910, Eureka boasted a hotel, two general stores, a post office, and a couple of barrooms. By 1966 it consisted of two fishing camps, a bar, a general store and an estimated population of 150.

In 1920 the saw mill settlement of Rodman had over 200 registered voters for county elections. Its business section was made up of two general stores, two restaurants, a hotel and a movie house. Two churches had also been built, but by 1960 the only building of any kind left standing was a large two-story house on Highway F 310 (Map L2). Most of the old Rodman buildings were destroyed by woods fires. Today, the community exists only as an historical relic, and the term applies to a general area within about two miles west of the intersection of Highway F 310 and F 19 shown on Map L. Only the one home, occupied by a farmer, remains as a reminder of bygone days and just three other houses have been built in the area in the last forty years (Map L2).

Exploitation of the pinelands was the practice through the 1930's. Timbermen would "cut bare" and move on. Little of the Rodman area has been reseeded or planted and the natural growth at present is very sparse, poor quality pine flatwoods.

Formerly, persons who owned or leased this land would burn the grass and low shrub each winter in order to get a renewed growth of wiregrass in the spring and summer on which they pastured range cattle. This practice has been stopped by the Florida Forest Service since about 1960. The burning would usually kill the young pines and generally was a very wasteful practice as it also destroyed the undergrowth needed to support wild game.

The land south and east of the Oklawaha River is almost entirely in the Ocala National Forest. Private holdings form, in general, a narrow strip on the banks of the stream. The national government purchased the Forest acreage in 1910 because, due to poor conservation practices, the woods had little economic value. Today the area has experienced a nearly complete natural regrowth due to Forest Service supervision.

Around 1920 the Florida highway system was improved to the extent that the Oklawaha lost its function as an important transportation route. Better roads also opened up South Florida and most of the farmers left the area because they had access to better lands further south. This, followed by the tapering off in lumbering activity, led to a decline in the economy of the Oklawaha Basin. From that time to the present the area has depended almost entirely on recreation land use for its economic base. The automobile has helped the area develop as a hunting, fishing and camping region.

Hope of revitalization of the Oklawaha area east of Orange Springs was kindled in 1929 when the Florida Power Corporation and the Florida Power and Light Corporation purchased several thousand acres of land on the lower river for the purpose of jointly building a hydroelectric power plant. These plans, however, did not materialize for at least two reasons. Because of the depression, the economy did not recover as had been expected and in later years the river valley did not lend itself to being a site for the more efficient type dams that had by then been developed.[9]

The Ridge Section

In the ridge section of the study area the unincorporated town of Santos was the first settlement. It was established by a group of people who had left Florida at the beginning of the Civil War and later returned. They did not want to participate, or take sides, in the War so they went to Brazil. In Brazil they lived in Santos; therefore, on their return to Florida, about 1890, they settled south of Ocala and named the settlement after their Brazilian haven (Fig. 4 and Map E).

The ridge area was settled on a subsistance agriculture basis and some of the men also worked in the timber industry. They grew the same vegetables that were grown in the Oklawaha area and they kept farm animals.

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[9]Interview, G. W. Dowsett, Manager, Property Tax Department, Florida Power Corporation, St. Petersburg, Florida, October 21, 1966.

Around the time of World War I the Santos area developed a dairying industry which lasted until just after World War II, when it was moved into more suitable land in western Marion County. In the last twenty years the Santos area, which is now largely Negro, has been a non-farm rural area. The people often have garden patches, but their living comes from work in or near Ocala.

West of Santos, the land has developed as county and state roads were constructed in the late 1800's. From subsistance agriculture, surface not forested has been moved into extensive pasturage and cattle production. The hardwood forests are not of sufficient quality to be exploited commercially. Since 1960, three thoroughbred horse farms have been established.

The Withlacoochee Valley

The Withlacoochee Valley had few settlers until after the Civil War when roads were cut through from Ocala to the Gulf and from the Tampa Bay area to the Capital in Tallahassee. The earliest homestead in this area, according to United States Land Office records, was established January 1, 1878.

Dunnellon (Fig. 4) was founded about 1884 as an agricultural center for farmers who grew cotton, sugar cane, tobacco, and raised cattle. An important influence in the location of the town was the site of a ferry landing on the Withlacoochee River. Today Dunnellon, discussed more fully in Chapter Four, is a slowly growing town with an economy

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based primarily on recreation and highway-oriented tourist trade, and supplemented by some agricultural and forestry activity.

The discovery of hard-rock phosphate on Blue Run near Dunnellon in 1889, had a great impact on land use and land values in the area. Ownership of land, which was in small holdings of less than 100 acres prior to the phosphate discovery, soon came into the hands of various phosphate interests and speculators who amassed holdings up to the 90,000 acres owned by the Dunnellon Phosphate Company. Land valued at $2.00 per acre in 1888 was sold at $250 per acre in 1890. The mineral content of some of this land ran as high as eighty percent phosphate lime.[10]

Within one year of the discovery, up to 1500 tons of phosphate a week were being loaded for Europe. The product was transported via Ocala to the port at Fernandina, twenty miles north of Jacksonville, by railroad. Track laid by the Dunnellon Phosphate Company connected with a line coming near Dunnellon which had been built from Ocala to Homosassa in 1888. By 1898 the railroad had been extended west to a new port at Inglis (Fig. 3) where a phosphate dryer plant was also constructed. These activities gave birth to the towns of Inglis and Yankeetown, the latter a village just north of the study area on the Withlacoochee River (see Fig. 3 and Map A).

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[10]Ocala Star Banner, May 8, 1966, p. 4.

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Under a War Department permit, issued to Camp Phosphate Company in 1904, a dam was constructed on the Withlacoochee River about three miles east of the center of Inglis (Fig. 4). The dam was a hydroelectric power structure which had a lock for phosphate barges. Then, as now, the dam maintained a water level normally ranging from twenty-four to twenty-seven feet. The natural elevation of the river at the dam was about seven feet.

Approximately 3,500 acres were inundated, forming Lake Rousseau (Map B), with the phosphate company making compensation to any person or corporation whose lands were "taken, overflowed or otherwise damaged by the construction, maintenance and operation of the said works in accordance with the laws of the State of Florida." No dwellings were flooded as the land was in its natural state, mostly swamp forest with some pine flatwoods.

Phosphate was mined both north and south of Dunnellon and shipped to Port Inglis by either rail or barge on the Withlacoochee River. In 1914, Inglis had a population of about 200 persons and the basis of the economy was the transhipment of phosphate and operation of a chemical plant which produced various acids. Iron sulphate was imported from Europe and sulpher from Louisiana.

World War I and the development of phosphate mining in the Polk County area 100 miles southeast of Dunnellon caused a curtailment of the phosphate production in the

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Withlacoochee Valley. By 1926 the port had deteriorated, the railroad no longer operated, and the chemical plant had closed its doors.

One bright spot in the economic picture in 1926 was the construction, by the Florida Power and Light Company, of a power plant to service the central Gulf coast area. Port Inglis was a satisfactory site due to the availability of river water for the evaporators and the port facilities for importing oil for power. In 1966 this plant is being phased out of operation due to the construction of a new plant about five miles south of the present site.

After the demise of the phosphate industry the Withlacoochee Valley was used primarily by the farmer and the timberman. Large scale use of the area for residences and recreation was thwarted because of the ownership of large tracts by persons or companies that would not sell. According to the Town Clerk of Dunnellon,[11] there was only one fishing camp and about six farms between Dunnellon and Inglis in 1935. The southern bank of Lake Rousseau was opened up to summer cottages after World War II. Then, in the early 1950's retirees began moving into the area, and by 1960, some seventy to eighty percent of the eighty to one hundred dwellings were occupied year around.

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[11]Interview with David R. Dickenson, City Clerk of Dunnellon, Florida, June 9, 1966.

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Highway U. S. 19 (Fla. 55), was designed as a federal road and improved in 1938-39. That action has had a positive influence on Inglis. The town, since that time, has slowly developed an economy based on recreation, retirement living, and highway oriented businesses. Seasonal cottages, most of which were constructed after 1955, are popular along the banks of the Withlacoochee.

Several hundred acres of citrus groves were planted north of Lake Rousseau in the 1930's and early 1940's. The groves were profitable until a hard freeze in 1957 destroyed them. The following year the growers moved to land south of the lake where the winter temperatures range from five to ten degrees warmer due to the tempering influence of the water on the northern winds.

In 1966 the Withlacoochee Valley was an area with a slowly increasing population and a stable economy based on highway trade, tourism, recreation, retirement living, with some support from timber, farming, and phosphate interests.

Generalizations Regarding Land Ownership

Historically, land ownership in the entire canal area has been characterized by holdings of over 500 acres. Acquisition of large blocks of Indian land began in the mid-1800's in the Oklawaha area, while about 1890 many extensive tracts near the Withlacoochee were purchased from the State. The primary reason for obtaining land was timber cutting, in the former case, and phosphate mining in the latter one.

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Homesteading of smaller tracts, less than 100 acres, was a more common practice in the ridge section than it was in the river valleys.

Following the end of the general land boom of the early 1920's, Florida's economy faced near collapse in the winter of 1927. The general industrial prosperity of the Coolidge years was not shared by the agricultural south and depressed conditions, which almost completely deflated land values, continued through the thirties.

In the mid-thirties, because of hard times and the low value of land, thousands of tax delinquent acres in the study area reverted to state ownership. Such land was unused for about five years until the Murphy Act was passed in 1939. This Florida law provided for the sale of the tax delinquent lands to get them back on the tax rolls. These were purchased for the price of the unpaid taxes and, in general, became parts of large holdings.

In the mid-1950's numerous large tracts throughout the study area were broken up and sold either as homesites for retirement living or as recreational sites. These uses are particularly characteristic of land contiguous to the two rivers in the study area. Increased incomes, especially for retired people, better access roads, more automobiles, and an increased interest in outdoor recreation, are conditions that have caused the greater demand for recreation land. This market raised the value of the land to the

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point that the holders of both homesteads and large acreages found it economically beneficial to sell.

Cross-Florida Barge Canal History

It is alleged that the Spaniards, while in possession of the territory that is now the State of Florida, conducted several surveys to locate the most desirable route for a cross-Florida ship canal. It is a fact that the United States government has been interested in the project since Andrew Jackson was Territorial Governor in 1820. A survey of the peninsula south of the St. Mary's River was ordered by an Act of Congress in 1826 to determine a feasible route for such a canal.[12]

Inadequate financing prohibited a complete survey of the peninsula at that time, but finally a tentative route was projected across the state through the St. Mary's River Valley in 1878, and in 1880 a canal plan for this route was reported to Congress. A lack of funds precluded final authorization, but further investigation suggested at least four other possible routes.[13]

> From 1880 to 1909 there appears to have been no concerted effort made to obtain a commercial waterway across the state. This was doubtless due to several causes, but principally to the great expansion of

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[12]G. A. Youngberg, The Gulf-Atlantic Ship Canal Across Florida, The Florida Engineering Society Bulletin, No. 6 (August, 1935), p. 2.

[13]Sinclair Chiles, A Florida Cross-State Ship Canal (1928). A pamphlet reprinted by the Canal Authority of the State of Florida.

> railroad building throughout the country during this period, and the unrestrained rate cutting and rebating so freely indulged in by the railroads in the effort to obtain the bulk of the carrying trade by destroying their waterway competitors.[14]

Rivers and Harbors Acts in 1909, 1927, 1930, and 1932, each directed surveys to be made in regard to a trans-Florida canal. The 1932 Act stated that surveys should be made ". . . to determine the feasibility, cost and economic advisability of, and the best location for a ship canal between the Atlantic Ocean and the Gulf of Mexico."[15] The Army Engineer's report stated that twenty-eight possible routes had been explored and the one using the Oklawaha and Withlacoochee Valleys was most desirable.

In 1933 the Florida Legislature created the Florida Ship Canal Authority and adopted a memorial to President Roosevelt urging that construction of a sea level ship canal be authorized. The Canal Authority assumed the task of obtaining the land needed for the right of way which was to be paid for by the counties in what is known as the Canal District.[16]

Important opposition was felt at this time. The railroads fought the canal as federally supported competition. More important, many people in south Florida, plus

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[14] Ibid., p. 2.

[15] Robert O. Vernon, "Trans-Florida Barge Canal" (Tallahassee: Florida Geological Survey, 1959), p. 1. (Mimeographed.)

[16] R. N. Dosh, Ocala Star-Banner (Florida), May 8, 1966, p. 1-E.

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the United States and Florida Geological Surveys, were opposed to a sea-level canal on the grounds that there was a possibility of damage to groundwater supplies. This chance was due to the proposed thirty to thirty-five foot depth of the sea-level canal. The Florida Survey, however, went on record as approving a lock-type canal.[17]

In spite of this opposition, the President authorized construction of a sea-level canal in 1935. Five million dollars of WPA funds were allocated to such activities as clearing of vegetation, building housing and shops, excavation in the summit area and laying bridge foundations. Camp Roosevelt, a site for administration and worker housing, was established, 13,000,000 yards of dirt were dug in Putnam and Marion Counties, and bridge foundations were built near Santos. The citizens of the affected counties voted a $1,500,000 bond issue to purchase canal right-of-way, and the land needed for immediate construction was obtained.

Eighteen thousand acres were purchased at that time at a cost of from $1.50 to $7.00 per acre. This represented approximately twenty percent of the total amount required for the project. Title to some 6,000 of the 18,000 acres acquired was taken through condemnation proceedings and held in the name of the United States government. The rest was purchased directly by the Ship Canal Authority.

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[17]Vernon, op.cit., p. 4.

Although the Authority paid for all 18,000 acres, one-third of these remained in the possession of the Corps of Engineers until 1960, when they were transferred to the Authority.

At the time of purchase, all of the land acquired in Putnam County was swamp or cut-over woodland, some of which was being used for range cattle.[18] In Marion County, however, most of that procured was timberland which had not been overcut. Although some lumbering had been done there, according to R. N. Dosh, Chairman of the Authority at that time, only a small portion of the land was in pasture and almost none in crops.[19]

President Roosevelt placed the construction of the canal under the direction of the War Department but a request for twelve million dollars was defeated on the grounds that the ship canal would jeopardize the ground water table of Florida. Again construction of the Cross-Florida Barge Canal became dormant. It was an authorized and partially completed river and harbor project, awaiting an appropriation.

Since their acquisition in 1935-36, the 18,000 acres have been administered by the Canal Authority and the Corps

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[18]Interview with Mr. Lewis E. Tinney, Tax Assessor of Putnam County, June 6, 1966. Mr. Tinney was the appraisor for the Canal Authority in the purchase. None of the land in Putnam had to be condemned.

[19]Interview with Mr. R. N. Dosh, Editor-Emeritus of the Ocala Star-Banner and former chairman of the Canal Authority of the State of Florida, June 8, 1966.

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of Engineers. These agencies have leased the lands to farmers and timbermen since 1936. Most of the acreage, about ninety percent, is leased every year. Grazing is the major activity on this land, although timber and agriculture leases are also available. Timber leases are second in importance, although the cutover characteristics of much of the holdings today precludes greater use for this purpose. No reforestation has been practiced, so very little of the land has been cut over twice even though available for lease for the last thirty years. In the past, turpentine leases were made, but none have been concluded in the last several years.[20]

In Marion County, west of Santos, there have been a few acres put into improved pasture, especially where the forests were cleared by the work crews before funds ran out in late 1936. No private use has ever been made of those areas where the digging was begun. One excavated area in Putnam County was used during World War II as a practice bombing target.

Leases for these lands have been based on the prevailing land values in the county and the purpose for which the land is to be used. Only buildings used to facilitate the grazing, lumbering, or whatever, may be built and the lease calls for government inspection of the land every

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[20]Interview with V. R. Feorene, right-of-way clerk of the Canal Authority of the State of Florida, June 5, 1966.

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six months. In the case of timber cutting or turpentining, the terms and conditions of each lease are separately written according to the specific character of the land in question.

In 1943 the plan for a lock-type canal was identified as a defense measure, but no money was appropriated for construction. Finally, after several more evaluations[21] ending in 1962, money was appropriated and construction was begun in 1964. Even so, the project was not without opposition.

Politically, the late Representative Clarence Cannon, Chairman of the House Appropriations Committee, was opposed to it. He had omitted it from the public works bill. Robert Sikes, Head of the Florida House delegation, introduced an amendment to the bill which included something for Oregon, Texas, Washington, Illinois, and the Cross-Florida Barge Canal. The bill passed, and implying pork-barrel legislation, Cannon said, "No bigger bunch of pirates ever sailed the Spanish Main. All the money that Captain Kidd and Long John Silver stole is infinitesimal compared to this raid on the federal treasury."

Other resistance has been based on the following points: lack of adequate economic justification; dangers of saltwater intrusion or damage to Florida's ground water

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[21]For example see, U. S. Army Corps of Engineers, Economic Restudy of Cross-Florida Barge Canal (Jacksonville, Florida, January 10, 1958). Also, U. S. Army Corps of Engineers, Economic Evaluation of Cross-Florida Barge Canal Project (Jacksonville, Florida, March 13, 1962).

supply; and damage to wilderness, fishing, and the wildlife regime of the Oklawaha River Valley. Each of the arguments has been weighed by the authorities and the decision is that the canal is a feasible project. Each will also receive attention in the following chapters of this paper.

An appropriation of one million dollars was approved by Congress in December, 1963, to begin construction of the canal. In February, 1964, excavation contracts were let for a six mile stretch southwest of Palatka, from the St. Johns River to the St. Johns lock site, and from the lock to the Oklawaha River; also for a bridge on State Road 19. By the summer of 1966 contracts had been let on four of the locks and both of the dams in the project. On these contracts, totaling nearly 20 million dollars, the costs were averaging 11.6 percent lower than the Corps of Engineer estimates.[22]

The $160,000,000 undertaking was granted additional funds in 1964, and in 1966 it was considered to be one of the fastest-moving federal projects in the country. Therefore, after many years of study and restudy the Cross-Florida Barge Canal has received an appropriation for construction and is becoming a reality. It is noted by proponents that there is no precedent for Congress abandoning a public works endeavor once such funds have been approved.[23]

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[22]Ocala Star-Banner, May 8, 1966, p. 1-E.

[23]Ibid., p. 2-E.

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Completing the Cross-Florida Barge Canal will attest to man's ability to plan his actions and to modify the physical environment. However, if he fails to understand the affect the structure will have on land use change, and if he does not prepare for it, his design is incomplete and his action is less than desirable. To plan for man's changing use of the land after the project is finished, it is vital that he understand past utilization as a basis for prediction, and that an analysis be made of the physical and cultural phenomena that will be involved in such change. Chapter Three will inventory the physical features of the study area as they were in the spring of 1966.

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CHAPTER III

NATURAL CHARACTERISTICS OF STUDY AREA

Description and analysis of the natural characteristics as they relate to present use of the land in the study area are the objectives of this chapter. In concert with the discussion of the cultural features in Chapter Four and Maps A-M, this section comprises the inventory data in the intellectual model. An understanding of the areal distribution of phenomena on the land, and of the relationships between and among those phenomena is important. This knowledge is crucial as it provides a basis for a rational plan for future land use.

Complimentary to the historical background of land use, this inventory step is an essential portion of the input stage of the intellectual model. The inventory maps, A1 and A2 through M1 and M2, utilizing the opaque map and overlay, provide an excellent means of locating phenomena, and by using each pair as one map, i.e. Map A, relationships can be identified. Also desirable is the fact that the inventory maps are the same scale as those illustrating the functional model (Chapter Five) which predicts optimum land use as output of the intellectual model.

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Symbols representing the canal, locks, dams, and the pool areas are also shown on the inventory maps. These phenomena are indicated to provide a frame of reference for the reader, to enable him to gain an understanding of the land as it is before excavation is begun and before reservoirs are full.

Landforms and Mineral Resources

Physiographically the study area traverses, from west to east, the Gulf Coastal Plains, the Central Highlands and the Atlantic Coastal Plains regions of peninsular Florida. From the west, the canal route crosses Pleistocene marine terraces of the Coastal Plains characterized by surface sands, clays and some swamp or bog areas, into the Withlacoochee Valley. This valley is entrenched into limestone bedrock. The river, west of the Ocala uplift and east of Dunnellon, has cut a steep walled channel through the limestone. This is characteristic downstream to Lake Rousseau and then to the coast. Only a thin veneer of highly organic mud, fine quartz sand and fresh water marls has been deposited along its banks.[1] Land elevations range from sea level at the coast to about sixty feet at Dunnellon.

In Marion County, the terraced coastal sand ridges give way to the Central Highlands composed of materials of

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[1]Robert O. Vernon, "Geology of Citrus and Levy Counties, Florida," Florida Geological Bulletin, No. 33 (Tallahassee: Florida Geological Survey, 1951), p. 29.

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Eocene and younger ages. This is a complex physiographic region. It has karst topography which has developed on a complicated fault system and is overlain by clastic sands that, in some areas, are several hundred feet thick.

The canal route crosses the highlands in a topographic saddle resulting from fault activity. This action is also responsible for the route of the Oklawaha River. Minor faulting still occurs in central Florida.[2] Ground elevations vary from about sixty feet on either side of the ridge to 100 feet above sea level southeast of Ocala.

Geology of the Oklawaha basin, like that of the entire study area, is characteristic of the peninsula as a whole in that there is underlying limestone at varying, but generally shallow, depths. Rather deep sands with some clay of the late Tertiary and Quaternary Periods predominate in the basin east of Ocala whereas the phosphatic sand and sandstone of the middle Miocene Hawthorn Formation occur near Orange Springs. Late Pleistocene marine sands occupy the area near the St. Johns River.[3]

Limestone outcrops are common throughout the study area. These are primarily of Eocene and Miocene ages; the

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[2]Interview with William F. Tanner, Professor of Geology, Florida State University, Tallahassee, November 12, 1966.

[3]Department of Water Resources, Review Report of Oklawaha River Basin, A report prepared by Gee and Jenson, Consulting Engineers, Inc. (Tallahassee, Florida: Dept. of Water Resources, 1961), p. 2.

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beds generally dip to the east. Well developed karst is present throughout much of this area, with sinkholes being commonplace. Karst features will continue to appear, due to the development and collapse of solution channels in the limerock formations, as long as Florida's surface is higher than sea level.

Mineral resources in the study area that have possible commercial value are: limestone, dolomite, hard rock phosphate, soft rock phosphate, clay, and sand. The general location of the deposits is just west of Santos and from the Dunnellon area to the Gulf coast. The specific locations of present and past mining activity are shown on the inventory maps B, C, and E.

Limestone occurs at or near the earth's surface in much of the study area. For the most part, the limestone is of a very high grade; in many instances, the calcium carbonate content reaches 99.9 percent.[4] But even though the rock is of a high quality, there is no mining of limestone in the study area. This fact is due to the existence of highly developed mining operations about thirty miles south of the canal route in Sumter County, twelve miles south in Citrus County, and in an area about five miles west of Ocala where six quarries now operate.

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[4]W. D. Reves, "Mineral Resources Adjacent to the Proposed Trans-Florida Barge Canal" (Tallahassee: Florida Geological Survey, November 6, 1960), p. 1. (Mimeographed.) This source was used for information relating to mineral resources in the study area.

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Although there are many possible uses of limestone, the primary ones are: as a base for road construction, in cement and lime manufacturing, and as a soil conditioner. The two abandoned rock quarries shown on Map E were used to obtain rock for county road construction. Of the limestone mined in the state today, Florida consumes the entire supply.

Dolomite, or magnesium limestone, is found in both Citrus and Levy Counties about five miles from the Gulf coast. Studies have not been made to determine either the extent or the composition of the supply, according to the Florida Geological Survey.[5] Local, private studies have indicated a commercial supply, however, as shown in the operation of two dolomite quarries in the area. One is at Lebanon Station, thirteen miles north of the study area. The other is located at the western end of Lake Rousseau (Map B).

Spot checks by the Florida Geological Survey in a study of the magnesium resources of the state indicated that some samples of dolomite in this area had a magnesium carbonate content of 44.82 percent.[6] The average content is slightly lower. Production amounts and values are not available due to the small number of operations involved.

Major uses of dolomite are as agricultural limestone and fertilizer filler. The mineral, consumed mostly in

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[5]Interview with R. O. Vernon, Director of the Florida Geological Survey, Tallahassee, November 18, 1966.

[6]Reves, op. cit., p. 9.

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Florida, helps control soil acidity and adds nutrients to the soil. Other uses, all of which are within the state, are in glass manufacture and as flux for claiming magnesium from sea water.

A zone just over ten miles wide running north and south and centering on Dunnellon in the study area contains hard and soft rock phosphate. Soft rock mines are located north of Dunnellon, as shown on Map C, and both hard and soft rock mining is carried on south of the city. The higher-value hard rock has been nearly exhausted from the area south of Dunnellon over the past years, but in the process much of the silt, soft clays, and some hard rock ore were left as debris. These sump areas are being reworked today. Some of the hard rock ore may exceed eighty percent bone phosphate of lime.[7]

Combined hard and soft rock phosphate production in the area, while important locally, has amounted to no more than two percent of the total output in Florida.[8] This region is only an extension of one of the world's largest phosphate deposits which is centered in Hillsborough and Polk Counties. The 1964 U. S. Bureau of Mines Preprint on the Mineral Industry of Florida indicated, however, that prospecting in the Dunnellon area had located a twenty-one year supply of phosphate raw material.

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[7] Ibid., p. 11.

[8] Ibid.

Principal uses of phosphate are in the manufacture of superphosphate or triple phosphate for fertilizer and in stock and poultry feed. Marketing of the product is world-wide. Most of the mineral mined is taken, by rail, to the industrial and shipping operations complex in the Tampa Bay area.

The Oklawaha River Valley is a potential resource area for phosphatic sands and clays, limestone and fuller's earth, according to the Florida Geological Survey's "Mineral Resources and Industries of Florida" map dated 1956. Sand and gravel pits and two kaolin mines exist in Putnam County within twelve miles northeast of Orange Springs, but there are no pits or mines inside the study area.

Kaolin is the most valuable clay mined in close proximity to the canal. It is of high quality, having 38.7 percent aluminum oxide, 45.9 percent silicon dioxide, 14.16 percent ignition loss, and 1.23 percent trace oxides.[9] White firing kaolins from Putnam County are of high quality for use in the ceramics industry. Brick manufacturing is a local use for other clays.

Quartz sand, for the local building industry and for the Anchor Hocking Glass Manufacturing Company in Jacksonville, is the most important sand product. Surveys are being conducted by private concerns in relation to the value of heavy mineral sands in southwest Putnam County.

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[9] Ibid., p. 17.

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Whereas most of the sand is being marketed in Florida, most of the kaolin is shipped out of the state. Sands and clays in this area are presently being surveyed by private firms to test their content for the purpose of identifying commercial minerals.

Each of these minerals has great reserves in the state and each has the potential for development in the study area. Limestone has the only estimate given as to the amount of the reserves. The counties adjacent to the canal route and to the St. Johns River (Fig. 3) contain nearly 1.5 trillion tons of rock. This resource has less than fifteen feet of overburden and could be mined from a depth of less than forty feet.[10] Reves, noted in footnotes above, asserts that in these counties dolomite and phosphate reserves are "great," clays are "quite extensive," and sand reserves are "voluminous."

Open pit mining is the type used in obtaining each of these minerals, although the specific methods differ. On occasion, limestone is mined below the artesian water level, and some clays and sands can be obtained from rivers and lakes.

As a result of this open type of mining, large scars have been left in the earth after mining operations have ceased. In several counties, Manatee and Sarasota, for example, laws have recently been passed which will greatly

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[10] Ibid., p. 5.

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ameliorate this problem in the future. In these counties, mining operators must present plans for land reclamation before an operation is started and they must complete these plans within a specified period after operations cease or lose a preposted bond to the county.

Map C shows railroad spur lines that have been built to facilitate the movement of phosphate. Use of rail transportation is characteristic of most of the mining operations near the study area. The dolomite quarry at the west end of Lake Rousseau (Map B) is an exception. From it the stone is taken by truck approximately five miles south to a plant on the railroad at Citronelle. In Putnam County, a small amount of the sand and clay products have been trucked to the St. John's River to be transhipped to northeastern markets. Intra Florida movements of these materials are almost exclusively made by truck.

Ground and Surface Waters

Ground and surface water is found in abundant supply in the study area. The Floridan aquifer, however, provides much of the water used in this part of the state from source rocks of Eocene to middle Miocene epochs. Ocala, Dunnellon, and Palatka get their municipal supplies from wells that are about 600 feet deep. Dunnellon, with the only municipal water system in the study area, pumps approximately 40,000 gallons per day to meet its needs. Industrial and major

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agricultural supplies mostly come from shallower wells about 100-150 feet deep. Small domestic wells generally produce from a depth of fifty to one hundred feet.

Over one billion gallons of water per day flow from Rainbow and Silver Springs without being used by man. This lack of use is because good quality ground water is available, at a reasonable cost, by digging wells. An exception to this general availability of potable ground water is along U. S. Highway 19 south of Inglis. One reason for the lack of development there is the high iron and sulfur content of the water. The best water is from wells which are six to seven feet deep, and even this must be conditioned before utilization.

A brief history of the use of the Oklawaha and Withlacoochee Rivers has been provided in Chapter Two. To gain a more complete understanding of these two rivers, attention must be given to water control problems associated with each. In both cases the more severe flooding and drought conditions are found in the upper reaches of the rivers rather than in the study area. A review report on the Oklawaha River Basin, prepared for the Department of Water Resources, states that the portion of the Oklawaha below Silver Springs experiences less severe problems due to periodic flooding and drought than does the upper reaches and headwater lakes.[11] Several factors explain this point. The

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[11]Department of Water Resources, op. cit., p. 13.

population density is higher above Silver Springs Run and agricultural and residential land use is more developed. In addition, extremely high and low water is detrimental to fishing and the latter impedes navigation.

Below Silver Springs Run the steady flow of artesian water, approximately 650 million gallons per day, drains down a winding, woods-bordered, channel and continually undercuts the banks. This steady source of water mitigates the drought possibilities, but the undercutting often causes trees to fall and passage is blocked. In this reach the walls of the waterway are higher and more precipitous than above the run, which lessens the problem of the flood periods.

Because of the large size of the Oklawaha basin, a period of continuously heavy rainfall creates a surplus of water in the lakes, swamps, and marshes of the upper portion of the valley. Consequently, as the run-off reaches the main channel, flood conditions occur. To some extent the periods of flood and drought are ameliorated by the small flood control structure on the Oklawaha at Moss Bluff about ten miles south of Silver Springs Run. Short periods of high water in the winter are characteristic of the whole valley in most years.

From the Oklawaha River Basin report a general assessment can be made of the damages incurred in the lower basin area during the flood of 1960.[12] In March, 1960, a

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[12] Ibid., pp. 20-25.

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stationary front lay across north-central Florida and the 2,130 square mile drainage basin received about ten inches of rain in four days. Flooding resulted from the discharge of the excessive accumulation of water. Major losses were: 1. improved pasture, in the Heather Island area (Map F), where the existing drainage system was overtaxed and nearly 1,000 acres of grass were inundated at an estimated damage of twenty-five dollars per acre; 2. slash pine, at various locations along the river, where the trees were in water for a period of over three months; 3. the development at Silver Springs which reported damages of 50,000 dollars to landscaping, docks, and sea walls. The timber losses noted above were estimated at an average of thirty dollars per acre.

Additional problems, due to high water on the lower Oklawaha, include damage to wild game habitat, poor fishing, flooded woods roads, interrupted ferry service, and septic tank malfunction. Cabins built close to the river often flood, especially in the area just south of the Orange Ferry (Map K).

Reasons for flooding are the same in the Withlacoochee basin as in the Oklawaha and the rivers flood at the same time due to their common climate and the close proximity of their sources in the Green Swamp. The study of the Withlacoochee flood of 1960 indicates that the

damages were similar to those in the Oklawaha basin.[13] Due to the greater use of Lake Rousseau and the lower Withlacoochee for residential development, there was a greater amount of damage to residential structures, landscaping, paved roads, and septic tank sewerage systems. Correspondingly, there was less damage to agricultural and forest lands.

The Inglis dam, which is now maintained by the Southwest Florida Water Management District, is an adequate structure for the regulation of water flow in most years, but it is totally inadequate as a flood control structure following a period of excessive rainfall such as happened in 1960. In March of that year, which was preceded by three abnormally wet years, there was an average of over 12 inches of rainfall in the 2200 square mile drainage area in a five-day period. As a result the constricted channel at and below the dam could not handle the torrent of water seeking sea level. The river level exceeded the twelve-fifteen feet maximum below the dam and Inglis and Yankeetown suffered considerable residential and road damage.

The water level in Lake Rousseau is maintained between twenty-five to twenty-seven feet under normal

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[13]Department of Water Resources, Preliminary Report on Flood Control Problems-Withlacoochee River, Florida, A report prepared by Maurice H. Connell and Associates, Inc. (Tallahassee, Florida: Department of Water Resources, March, 1961), pp. 12-18.

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conditions. In spite of a disclaimer clause in the deeds to property on Lake Rousseau, both the Florida Power Corporation and the State of Florida have had liability suits brought against them due to flood damage. This problem has been given as a factor in the transfer of dam ownership to the state from the power company.[14]

The Corps of Engineers has studied the upper Oklawaha (south of Silver Springs Run) and the Withlacoochee River Basins as a part of the Four River Basins Project in central Florida. The purpose of the project is to review the overall flood protection and water-control problems in these rivers and the Hillsborough and the Peace Rivers. This report indicates that a minor flood such as the one in 1959, has an estimated frequency of occurrence of once in ten years, while the severe type, like the 1960 flood, has one of once in twenty-five years.[15]

Characteristics of Soil Associations

Soil conditions in the study area are relatively complex. This is true even though over 90 percent of the soils are sandy in texture. Complexities arise due to the varied conditions of drainage, base materials and depth of

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[14]Interview with Donald Feaster, Engineer of Operations, Southwest Florida Water Management District, Brooksville, Florida, August 22, 1966.

[15]Corps of Engineers, Four River Basins, Florida, Multiple-Purpose Project (Jacksonville: U. S.Army Engineer District, September 28, 1965), p. 7.

the sand. Generalized soil association maps are the only ones available for the four counties crossed by the canal route. A modern survey is in progress in Marion County to up-date the one made by the federal government in 1894. According to the Soil Conservation Service, however, no detailed studies are contemplated in the near future for Levy, Citrus, and Putnam Counties.[16]

Based on data available and interviews with various soil conservation agents and the county agents of Putnam and Marion Counties, the decision was made to identify the soils in this investigation by soil associations. These broad-area generalizations usually cover several thousand acres and often include several quite different kinds of soil that appear in juxtaposition in a small area. However, the use of soil associations assures a satisfactory degree of reliability at the scale of mapping used in this study.

The discussion that follows designates the various characteristics of the soil associations noted on the inventory maps and indicates their relation to vegetation and land use. Numbers ascribed to the associations, and used to identify them on the inventory maps, are those used by the Soil Conservation Service. A quantitative measure of the distribution of soil associations and land use by map region is shown on Table 1 and 2. These

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[16]Interview with D. P. Powell, Soil Specialist for Interpretation, Soil Conservation Service, Gainesville, Florida, May 3, 1966.

tables may be useful as the sections on soils and vegetation are read.

Soil Association 1 is typified by undulating sand hills with occasional isolated lakes. The dominant soils are light colored, excessively drained, acid sands usually over twelve feet deep. The horizons are coarse textured, usually more than thirty inches thick, and rest on stratified sandy clay substrata. Slopes are predominantly gentle, but often become precipitous close to lakes and sink holes.[17] These soils make up a large part of those in the Ocala National Forest. Their distribution in the canal area is indicated on Maps D, E and H-L.

Sand pine, scrub and turkey oak, palmetto and rosemary make up the natural vegetation on these sands. Some hardwoods such as laurel oak, black gum and bay are found on these soils in a band (or ecotone) about twenty feet wide bordering the fresh water swamp soils.[18] This phenomena is due to frequent high water periods and occurs primarily in areas shown on Maps H-K.

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[17]Soil descriptions given here are taken from interviews in the Soil Conservation Service offices in Gainesville and Ocala, Florida, in the spring and summer of 1966, and from the "General Soils Maps" of Putnam County, October, 1959, Marion County, August, 1956, Citrus County, October, 1959, and Levy County, October, 1959. Also used were loose leaf descriptions of each soil association provided by the Soil Conservation Service, Gainesville, Florida, October 24, 1966.

[18]Interview with Paul Bielling, Marion County Farm Forester, Ocala, Florida, June 15, 1966. Information concerning vegetation on each of the soil associations was gained from this interview.

TABLE 1

DISTRIBUTION OF SOIL ASSOCIATIONS
CROSS-FLORIDA BARGE CANAL STUDY AREA

Map	Region Approx. Area[a] (Sq.Mi.)	Soil Associations (Approx. Percent of Area of Each Map Region)												
		1	3	4	5	8a	12	13a	19	21	22	26	27	28
A	21.7			2				2		78			2	16
B	26.7		29	25			31	4		2			9	
C	17.7		33				42	22					3	
D	23.3	3	74				19						4	
E	21.8	10	40		30	20								
F	29.5		31		15	2		10	3			36	3	
G	29.6		20			1		9	42			9	19	
H	38.0	17	25					26	17				15	
I	27.1	24	8					5	36				27	
J	17.2	39	17					22	2				20	
K	28.8	37	19					22			1		21	
L	31.0	8	8					43					41	
M	12.6	10						44					46	

[a]Excludes water areas.

TABLE 2

LAND USE DISTRIBUTION
CROSS-FLORIDA BARGE CANAL STUDY AREA

Types of Use	Map Regions (Percentage of Area by Use)												
	A[a]	B	C[b]	D	E[b]	F[b]	G	H	I	J	K	L	M
Dry Sand Scrub				22	21			18	8		20	6	
Pine Flatwood	74	39	10			16	52	63	49	38	25	52	49
Upland Pine and Oak			13	72	28	20	7		8	31	24		
Hardwood Forest					5								
Swamp Forest	2	9	3			3	18	15	28	19	21	18	39
Hardwood Hammock	7	3	8			15	14	3	7	5		22	3
Coastal Salt Marsh	17												
Residential-Commercial		16	10		3	1	2			4	5		
Unimproved Pasture		19	17	2	29	30	7	1		3		1	6
Improved Pasture			31		11	14						1	3
Citrus		4											
Peaches		1		1									
Planted Pine		7	1	1		1					5		
Watermelon		2		2									
Corn			1		3								
Inactive Mine			1										
Abandoned Airport			5										
Approx. Area of Map Region in Square Miles	21.7	26.7	17.7	23.3	21.8	29.5	29.6	38.0	27.1	17.2	28.8	31.0	12.6

[a]Excludes water areas.
[b]Dunnellon and trailer parks considered residential and commercial.

The soils of Association 1 are not used for agriculture because they are too infertile and droughty for cultivation and have only limited use for pasture. Some hardwoods are cut for timber and some sand pine for pulpwood, but the primary land use is for recreation, principally hunting and camping.

Soil Association 3 has much the same characteristics as number 1 with two exceptions. The drainage is not as excessive and there is some loam found in the substrata. These soils are found on all inventory maps except A and M. The most common vegetation is longleaf pine, but the extremes of sand pine and oak and other hardwoods are also found. There is some question as to whether this range is the result of differences in drainage, base rock material, or ecological development. A combination of these conditions is probable. More about this topic will be found in the summary discussion of vegetation.

Most of the commercially valuable pines and some of the hardwoods have already been harvested from these soils, therefore most of the woodlands are second growth. Scrub oak is a common understory in the pinelands. Occasionally this growth is very dense, as exemplified in the pine flatwoods south of Lake Rousseau (Map B).

Although the soils are naturally infertile and droughty, irrigation and fertilizer programs allow some agriculture. South of Lake Rousseau citrus, watermelon and

peaches are grown (Map B), and southwest of Ocala there are small acreages of watermelon and peaches (Map D). Only small, irregular patches of soil are good for crops such as corn. A small cornfield put in for feed is seen on Map C, east of Dunnellon. The yield of this field was a low forty-five bushels per acre in 1966. In short, the soils of this association are poorly suited to general farming and only moderately fit to improved pasture. An example of how intensive development can produce good pasture is on the thoroughbred farms southwest of Santos (Map E).

Soil Association 4 is typified by undulating sand hills and occasional karst features. The dominant soils are well drained, medium to slightly acid sands that occur in an irregular pattern. The coarsely textured horizons together form a profile more than thirty inches thick, which rests on sandy clay or sandy clay loam substrata. Limestone outcrops are common and the soils are influenced by this alkaline material.

The natural vegetation and agricultural characteristics of this association are the same as for Association 3, with the exception that turkey oak as well as scrub oak is scattered through the pine flatwood. These sands are well suited to pine tree production.

Agriculturally, the soils are so poor that they mainly serve the function of supporting the crop, while the farmer applies water and plant food in prescribed quantities. While

some watermelon is grown, citrus is the better crop. Improved pasture is also expensive to establish, especially in the better drained areas. There is no high quality pasture. An intensively developed pasture in the area of these soils shown on Map B, for example, would support only one cow per four or five acres. Cows pastured on these soils are given supplemental feeds in the summer and are supported almost exclusively on purchased feed from December through February.

Soil Association 5 is found on undulating land and the dominant soils are well drained, medium to slightly acid sands and loamy sands, influenced by phosphatic materials. The coarse textured horizons together are more than thirty inches thick. Small isolated karst depressions are common.

The natural vegetation on this association is predominately hardwood with pine scattered through it. On the less loamy sands there is a more dense population of pines. Most of the original hardwood has been harvested and some of the cleared land is used as pasture (Maps E and F). Stands of virgin forest and second growth are interspersed near Santos.

This association provides only fair soils for cultivated crops. The only crop grown on these soils in the study area is feed corn (Map E). Improved pastures can be developed under intensive care, such as in the case of the thoroughbred farms west of Santos.

Soil Association 8a is made up of soils which are found on undulating land that is moderately well, to well drained. These dark gray soils are medium to slightly acid, loamy fine sands, which have profiles less than thirty inches thick, and are influenced by underlying phosphatic materials.

Hardwoods make up the natural vegetation on most of the land in this association (Maps E-G). Much of this cover has been harvested and the land is now used for pasture. While this is the best soil in the study area for crops, only a few acres of feed corn are cultivated (Map E).

Soil Association 12, located in the areas shown on Maps B-D, is found on nearly level to gently undulating land with some small ridges and isolated swampy areas. The predominant soils are moderately well to poorly drained, acid sands. They have coarse textured horizons more than thirty inches thick.

The vegetation is pine and oak, with water grasses bordering the swampy depressions. Scrub oak is common under much of the second growth longleaf and slash pine. In the wetter areas, turkey oak and live oak are predominant, with little pine.

Woodland recreation, some pasture and scattered plots of planted pine make up the bulk of land use on these soils. A few acres of watermelon are cultivated on the north bank of Lake Rousseau. Due to the low fertility, and to unsatisfactory drainage conditions in some areas, these soils have

little agricultural potential. Map C shows an exception to this statement. Because of a good drainage program and liberal fertilization a sizable area of excellent pasture is grown.

Soil Association 13a, is found in all parts of the study area except those in the ridge section (Maps D-E). Its soils are characterized by nearly level surface with some swampy areas and numerous small karst depressions. The deep, gray acid sands are somewhat poorly drained and, in general, have an organic pan at a depth from one to four feet. This hard pan inhibits drainage and during wet periods the ground is easily saturated.

Good pasture can be developed on these soils, but in the wetter areas establishment of a water control system is a prerequisite to best use. An example is in the area shown on Map C, where several hundred acres of this soil supports an intensive pasture program.

Oak, bay and cypress are found in the wetter areas. Longleaf and slash pine, saw palmetto and gallberry comprise the predominant growth on the somewhat better drained sites. Planted pine does very well in this soil when the pan is over two feet deep, but the only area now used for this activity is shown on Map K.

Soil Association 19, is found almost exclusively on the west bank of the Oklawaha River (Maps F-J). This association differs from 13a only in that the soils are more loamy,

not as deep, and have a more permeable, acid clay loam or clay substrata rather than a hardpan.

Slash and loblolly pine, cabbage palm and scattered hardwood dominate the vegetation, except close to the river. There, high water periodically covers the sandy soil and wetland hardwoods exist as an ecotone between the pine flatlands and the swamp forest.

Soils of this association are best suited to growing pine trees and have little agricultural potential. In the study area there is presently little use for pasture and none for planted pines. The major uses are forestry and woodland recreation.

Soil Association 21 is found only at the western end of the study area (Map A). The association is comprised of nearly level, somewhat poorly drained, slightly acid to neutral, very shallow, sandy soils underlain by either hard limestone or marl.

Low wet soils in this association develop a hardwood hammock vegetation, while dryer ones support longleaf pine which is dominant in the study area. With adequate water control, good pasture can be developed on these sands, but this use is not found near the canal route. Hunting is the major activity on this land today.

Soil Association 22. Map K shows approximately a half square mile of this association just north of Orange Springs. This group is characterized by nearly level terrain

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and soils that are strongly acid, somewhat poorly to poorly drained, with more than thirty inches of sand surface. The original vegetation was pine and oak. The best use is for planted pine or pasture, if water control measures are developed for the wetter areas.

Soil Association 26. The soils in this association are very poorly drained, organic soils of more than twelve inches of muck over coarse textured substrata. The area where this group is found is indicated on Maps F and G. It is level land. The natural vegetation is composed of water grasses, sedges, lilies, and trees including cypress, bay and other wetland hardwoods. Oaks and pines grow on the periphery where the muck is thin and the sands tend to dry out during most of the year.

Drainage is necessary if these soils are to be used for agriculture. With water control and adequate fertilization these are excellent soils for truck crops and improved pasture. The Heather Island area (Map F) was once used for crops, mainly feed corn, but for the last twenty years has been used almost entirely for improved pasture and bird hunting. Forestry and woodland recreation are also important uses of these lands.

Soil Association 27 is correlated with fresh water swamp or marsh. These soils are classified as miscellaneous because they are often a mixture of alluvial sands, clays and organic matter. Water commonly stands on the surface and

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during the dry period, if there is one, the drainage is very poor. This association is represented on all maps except E. Swamp forest vegetation, chiefly cypress, bay, sedges, grasses and lilies, grows on these soils. An exception is identified on Map D, where, due to vertical drainage in dry periods, the vegetation is water oak and marsh grass. Forestry, hunting and other outdoor recreational activities are the main uses of these lands.

Soil Association 28 is found in poorly drained, salt water marsh and swamp that is interspersed with numerous, small wooded islands. Such land borders on the Gulf of Mexico at the western terminus of the study area (Map A). The surface horizons vary in material from fine sand to peat. Limestone usually occurs less than forty-two inches deep and outcrops frequently. The vegetation cover consists of needlebrush and mangrove in the marsh and swamp areas and cedar, palms and hardwoods on the islands. The land is used chiefly for hunting.

Generalizations, regarding the relationship of soils and dominant vegetation in the various parts of the study area, are the following. The somewhat excessively to moderately well drained sands support primarily pine flatwood and sand scrub vegetation. Oak and other hardwoods appear where the sands contain more loam. The less well drained soils support more hardwoods, from live and white oaks and hickory, to the swamp forest species of gum, bay and cypress.

Vegetation Groups

Designations of the vegetation groups (with a list of the predominate species of each) shown on the inventory maps are:

DRY SAND SCRUB - Sand pine, scrub oak, saw palmetto, and rosemary

PINE FLATWOODS - Slash, loblolly and longleaf pine, scrub oak, cabbage palm, saw palmetto and wire grass

UPLAND PINE AND OAK - Slash and longleaf pine, turkey and scrub oak, some saw palmetto and wire grass

HARDWOOD FOREST - White, laurel and live oak, hickory, sweet gum and magnolia

HARDWOOD HAMMOCK - Laurel, red and chestnut oak, hickory, sweet gum, bay, magnolia and basswood

SWAMP FOREST - Water and laurel oak, black gum, bay, cypress, cabbage palm and ash

COASTAL SALT WATER MARSH - Mangrove, sabal palm, cedar, wax myrtle and marsh grass. Longleaf pine are found on local sand islands.

Vegetation groups identified above, on the inventory maps, and on the land use Table 2 do not indicate the density of the stands. Commercially valuable natural stands of timber are found only in the Oklawaha Valley on both sides of the river in the areas shown on Maps F and G and in the National Forest lands depicted on Maps I-L. These forests are in the protection and management programs of the Florida Forest Service and the U. S. Forest Service respectively. Due to the past practice of total cutting, discussed in Chapter Two, no other large area of high quality forests remains in the study

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area. The economic aspects of the present stands of timber are discussed in the section on forestry in Chapter Four.

Overlapping of the borders of the soil associations and the vegetation groups in some places on the inventory maps spotlights an interesting conflict of opinions between and among ecologists, soils scientists, foresters and others. An ecologist, Whitney, presents one long held view as he discusses the ecology of the sand pine, the upland pine and oak, and the hardwood hammock communities. He writes,

> . . . so far as our investigations show, there is no difference in the soil. The only explanation for difference in the character of the vegetation is that it is accidental and that one kind of crop or another received a start and simply spread, the two kinds of vegetation not being able to grow together.[19]

Miller explains the problem as a matter of succession. He says that the high pine and turkey oak naturally succeed the sand pine.[20] The consensus opinion was stated by Laessle who refutes both Whitney and Miller. Laessle believes that there is "no successional relationship between the pine scrub and the pine and oak communities," and that "both would be

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[19]M. Whitney, The Soils of Florida (Washington: U. S. Department of Agriculture Bulletin No. 13, 1898), p. 15.

[20]R. Miller, Ecological Comparisons of Plant Communities of the Xeric, Pine Type on Sand Ridges in Central Florida (unpublished Master's thesis, School of Agriculture, University of Florida, 1950), p. 97.

succeeded by predominately evergreen hardwood tree communities."[21]

Furthermore, Laessle states that the explanation of the occurrence of high pine and pine scrub on similar soil types is due to a difference in the nutritional elements in the soil caused by the particular geomorphological development of the area.[22] For example, he speculates that the occurrence of turkey oak in the sand pine community is due to the presence of "citronelle" limestone within a few feet of the surface.[23] This position is also taken by an ecologist with the Florida Forest Service who declares,

> The correlation of soils, as presently defined, gives the forester a problem. Tree growth is dependent on, and affected by, nutrients that come from deep in the soil. The surface studies presently used to explain these relationships are inadequate.[24]

These arguments foretell the complexities involved in making sharp relationships between the soil and vegetation associations on Florida's sands. Additional factors that complicate this, as any other problem of ecological succession,

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[21]A. M. Laessle, "The Origin and Successional Relationship of Sandhill Vegetation and Sand-Pine Scrub," Ecological Monographs, Vol. 28 (October, 1958), p. 386.

[22]Ibid.

[23]Ibid., p. 378.

[24]Interview with John A. Butz, Assistant Chief of Forest Management, Florida Forest Service, Tallahassee, Florida, May 11, 1966.

are the texture and ph of the soils, drainage and the ecotones in both associations.

There are no natural grass lands in the study area. Broome and wire grasses are common when the canopy of the hardwoods is not too thick and when the pines are not so dense that the pine straw mat chokes them out. Marsh grasses are characteristic in both the salt and fresh water swamps.

Fish and Wildlife Resources

Fish and wildlife resources have had, and will continue to have, significant influence on both the economy and the land use in the area of the Cross-Florida Barge Canal. Fishery resources of the affected rivers, lakes and salt water areas represent a wide range of species and quality. On the St. Johns River (see Map M) sports fishing centers around the catching of largemouth bass and the anadromous shad and striped bass. Commercial fishing in this area is done for shad and, more lucratively, for river catfishes and blue crab.

The Oklawaha River, from the St. Johns River to Silver Springs, supports fairly heavy sport fishing throughout the year. The most heavily fished section is between Eureka and Silver Springs where four fish camps and scores of campsites are located (Maps G-I).

Largemouth bass, channel catfish and panfish, such as redbreast, shellcracker and bluegill, are all caught in

the Oklawaha and in nearby lakes. The bass and catfish are more common in the river, while the panfish are more so in the lakes. The striped bass is also caught, as he makes his way to spawn in the Silver Springs Run.

Lake Eaton is designated as a Fish Management Area by the Game and Fresh Water Fish Commission. This is because the Commission has undertaken several development projects at the lake. A vegetation control program is in effect, shell has been placed in spots on the lake bottom for spawning beds, and public access points have been created. As a consequence, Lake Eaton is much more heavily fished than are Lakes Mud and Charles, although both the latter are good fishing lakes. The principal reason Eaton is more heavily fished, however, is the existence of the better approach roads, boat landings and other facilities at public access points.

According to William Wegener, a fish biologist, the Oklawaha River has not been developed to a maximum for sports fishing.[25] He states that even without application of special practices controlling the river habitat, the resource could support more fish camps, more public boat landings and more man-days fishing than it now does.

Wegener believes that a twenty-five percent increase in man-days fishing could be achieved on the river in its

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[25]Interview with William Wegener, Fish Biologist, Florida Game and Fresh Water Fish Commission, Ocala, June 15, 1966.

present condition. The primary reasons for the river not being utilized to the maximum are: the lack of a large population concentration in the immediate area; the existence of good fishing, both salt and fresh water, in close proximity; and the lack of enough strategically located public access points. A problem of some importance arises in the use of high powered boats in the relatively confined fishing areas.

Presently, three trends point to greater recreational use of the river by fishermen. The population is rapidly increasing (3.3 percent for Marion County from 1964-1965), waterfront property in this area is being privately developed to the detriment of public access which causes more use of the river, and a larger proportion of the population was engaging in fishing in 1966 than previously.

A problem in the upper Oklawaha centers around the periodic pumping of organic matter into the river through the drainage program at the muck pastures shown on Map F. Another problem in the same area comes from the moving of insecticides, herbecides and fertilizer into the river through leaching and surface wash. These problems have not reached serious proportions as yet, but the situation is being watched by the Fish and Wildlife Commission. No other water pollution problems are present in the Oklawaha or Withlacoochee River valleys.

A study in 1963 indicates that Lake Rousseau is the most heavily fished area in the vicinity of the proposed

canal.[26] The same sports fish are caught here as in the Oklawaha. Commercial fishing is limited to some trot lines put out to catch river catfish. The flooded river basin has proved a boon to the sport fisherman because the remains of stumps and trees, plus the decayed vegetation, provide a habitat conducive to fish propogation and growth. Eight fish camps are located on Lake Rousseau.

Fishing is good in the river both above and below Lake Rousseau, but water hyacinths have restricted fishing in the upper Withlacoochee. They multiply at a rapid rate, close open areas and choke out other river vegetation. This condition inhibits boat access as well as growth of the fish population. The State Department of Conservation has begun studies to ascertain the best method of coping with this problem.

Salt water fishing in the vicinity of the proposed canal outlet is not highly developed. There are no marinas or fishing piers. The only fishing camps are on the Withlacoochee, several miles from the Gulf, in Yankeetown. When fished for sport, spotted sea trout and channel bass are the species caught. Minor commercial catches are made up of sea trout, black mullet and blue crab.

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[26]U. S. Bureau of Sport Fisheries and Wildlife, A Fish and Wildlife Report on Cross-Florida Barge Canal Intracoastal Waterway, Florida (Atlanta: U. S. Department of the Interior, February 26, 1963), p. 12.

Wildlife resources in the study area,

> consist mainly of small game, fur animals, wading birds, waterfowl, white-tailed deer and wild turkey. Non-game bird species such as herons, limpkins, egrets, and other wading birds are common. Game species supporting most hunting activity include deer, wild turkey, squirrels, bobwhite quail, waterfowl and black bear. Bobcat, raccoon, opossum, gray fox, rabbits and other animals are present but their importance as sports species is limited.[27]

The coastal marsh is the hunting ground for some pintail and ringnecked ducks and the wet hammock and swamp forest areas are good to excellent for gray squirrel. Fox squirrels, because they eat the pinecones, are found in the high pines. Deer and turkey are found where the undercover is thick. Wood ducks are heavily hunted on Lake Rousseau, especially on the undeveloped shores. These ducks return to the same roosts year after year.[28]

East of Dunnellon, some deer are found in the upland pine and oak, and ducks are located in the marsh areas shown on Map D. The Map E area, however, is one where human occupance has limited hunting activities to some shooting of squirrel in the hardwoods and of dove in the unimproved pasture and open woodland areas.

Hunting is a major activity in the Oklawaha River valley. The limited human presence is an important factor in the abundance of game in this area (Maps F-M). In general,

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[27]Ibid., p. 10.

[28]An interview with Larry Martin, Game Biologist, Florida Game and Fresh Water Fish Commission, Ocala, June 15, 1966.

the habitat of the turkey is found in the low areas close to the river, while that of the deer is on the higher land where the cover is dense. While wildlife is plentiful on both sides of the river, it is more so in the Ocala National Forest and on the large private landholdings around Heather Island. This is because of closer supervision in the forest and good protection and fewer hunters on the private lands.

Numerous hunting and fishing campsites are located in the Oklawaha basin. Some of the better known are identified on Maps H-K. These are only examples of hundreds scattered throughout the area. Some are mere cleared spots, while others may have trailers, temporary shelters, or makeshift cabins. In most cases these shelters are moved in and out, repaired or rebuilt continually. Dwellings identified on the inventory maps are more substantial structures with modern conveniences.

While not very prevalent today, illegal hunting is still a nuisance. The most common of such practices are hunting out of season and hunting deer at night with a light. The alligator is illegal game. Very few are found in the study area, however, because hunters in the past killed them off for their valuable hides.

A summary of the natural features indicates that the study area is dominated by two river valleys and is characterized by poor, sandy soils which are either inadequately or overly drained (Table 1). Limestone and phosphate, representative

of the sedimentary base has been utilized in the past and offers prospects for the future, but has little present utility. Forests have, in many cases, been indiscriminately cut in the past. Today, the effects of this action are seen in the poor quality and non-productive character of much of the woodland. The main types of forests, which comprise ninety percent or more of the land in all but four of the inventory map areas, are pine flatwood on the drier sand and hardwood hammock and swamp vegetation on the wet lands (Table 2). Nine of the regions in that table include four or more of the seven vegetation groups discussed.

Resources that have recreational uses, namely, water, forests and animal life, give this region a specific character. The natural features existing today cannot be considered as a foundation for the economic support of a densely settled permanent population. Recreational use, by retirees, tourists and native sportsmen, provides the basis for the present economy, as is pointed out in the following chapter. Chapter Three has emphasized the physical features of the study area and discussed their use. Chapter Four focuses on the cultural characteristics of the area and relates them to the physical base.

INVENTORY MAPS

LEGEND

- Proposed Cross-Florida Barge Canal
- Boundary of Study Area
- Boundary of Soil Associations
- Level of Proposed Reservoirs
- Electric Power Line
- Paved Roads
- Dirt Roads
- Abandoned Dwelling
- Dwelling
- Farmers Dwelling

- Restaurant
- Service Station
- Grocery
- General Store
- Motel
- Church
- $^{TP}_{32}$ Trailer Park (Number indicates trailers)
- Fire Tower
- Thoroughbred Horse Farm
- Abandoned Rock Quarry
- Fish Camp
- Auto Junk Yard
- Used Car Sales
- Tourist Shop
- Bar
- Tourist Attraction
- Sewerage Disposal Plant
- Gas Pipeline
- Power Relay Station
- Cemetery
- Camp Site
- Lumber Yard
- Stone Works
- Real Estate Office
- Tool and Die Co.
- Nursery
- Vacant Building
- Dolomite Quarry
- State Roadside Park
- $^{X}_{117}$ Elevation Point
- Abandoned Clay Pit

LAND IN NATURAL VEGETATION

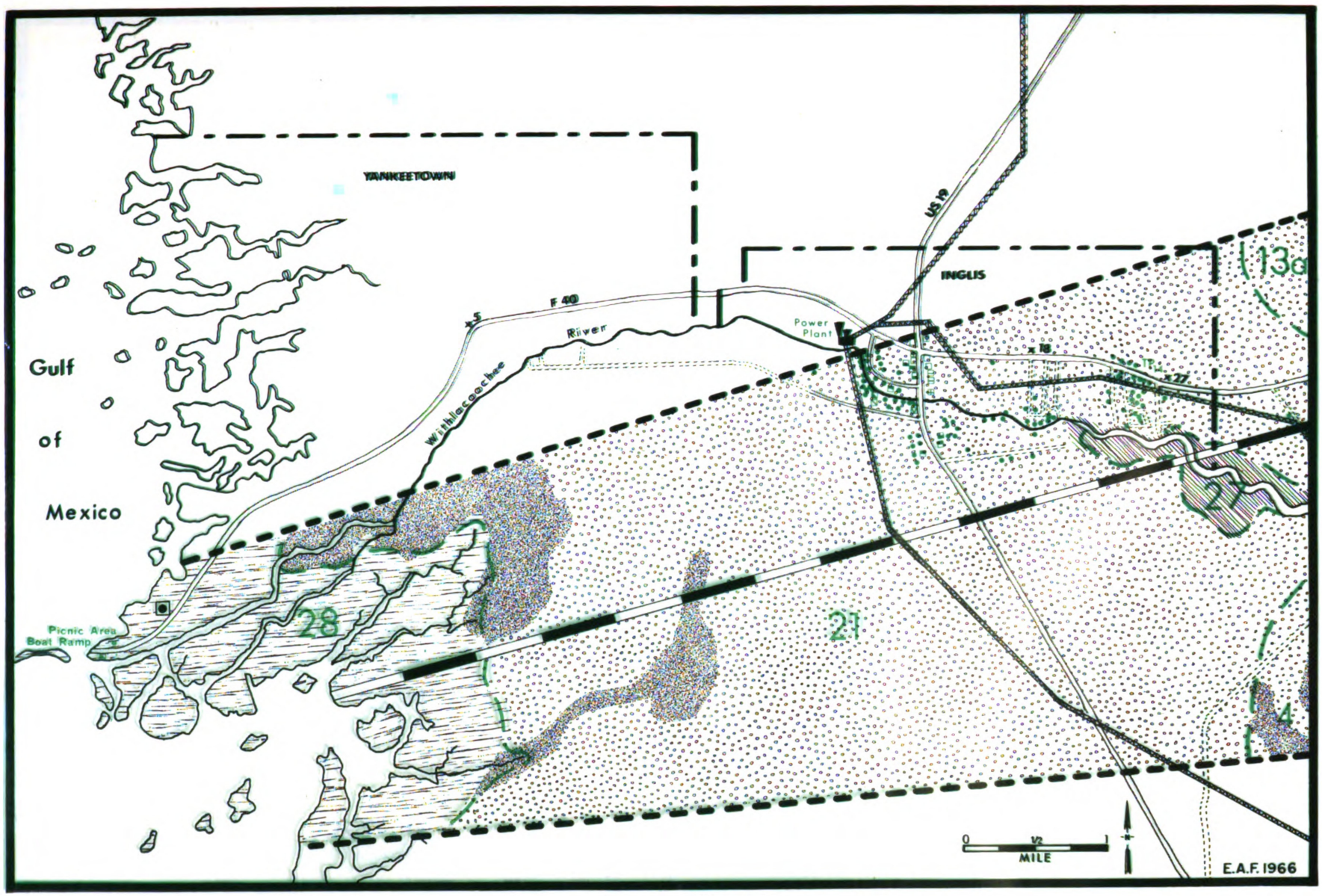
- Dry Sand Scrub
- Pine Flatwood
- Upland Pine and Oak
- Hardwood Forest
- Swamp Forest
- Coastal Salt Water Marsh
- Hardwood Hammock

CULTURAL LAND USES

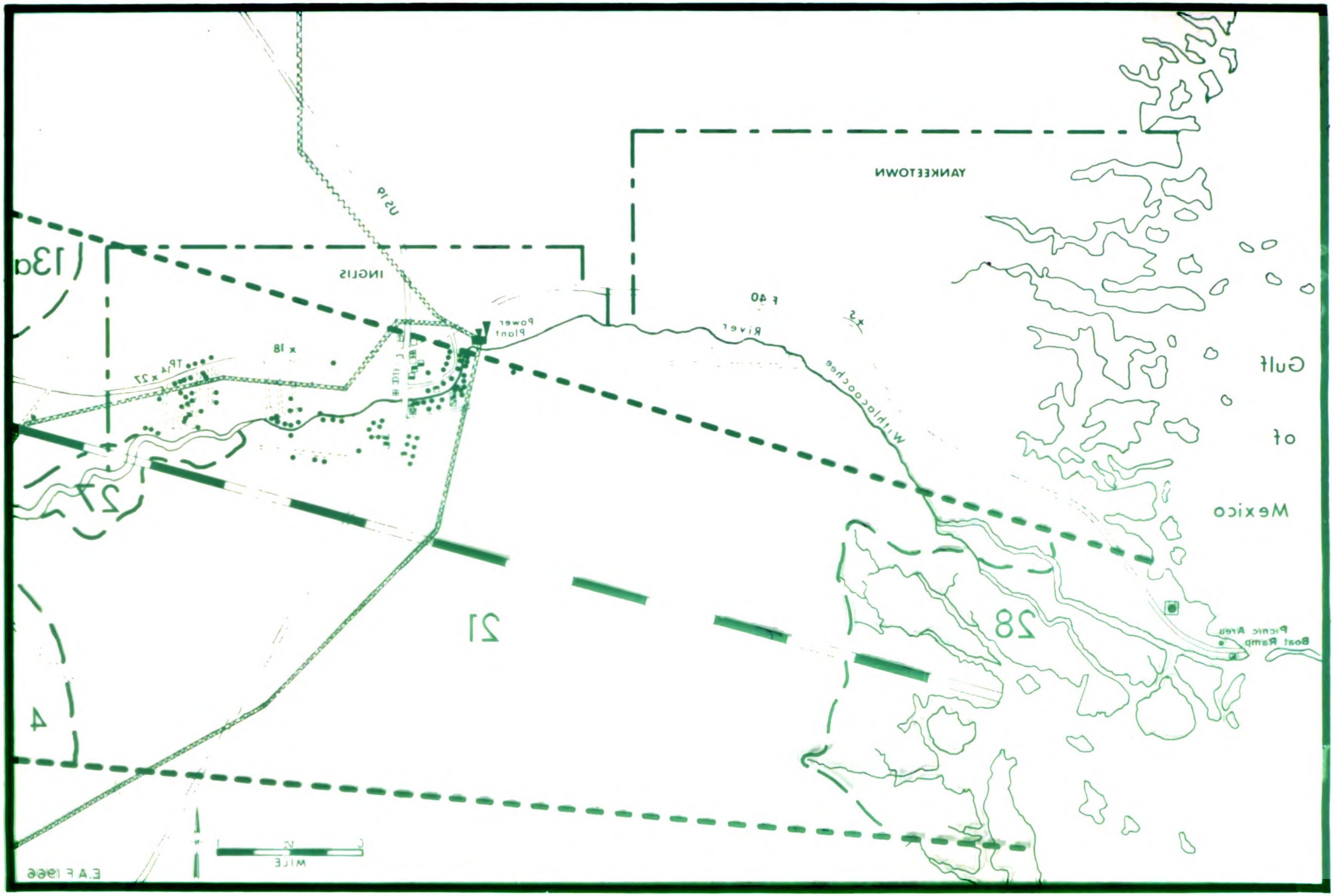
- Platted Residential or Commercial
- Unimproved to Semi-improved Pasture
- Improved Pasture
- Citrus
- Peaches
- Planted Pine
- Watermelon
- Corn

SOIL ASSOCIATIONS

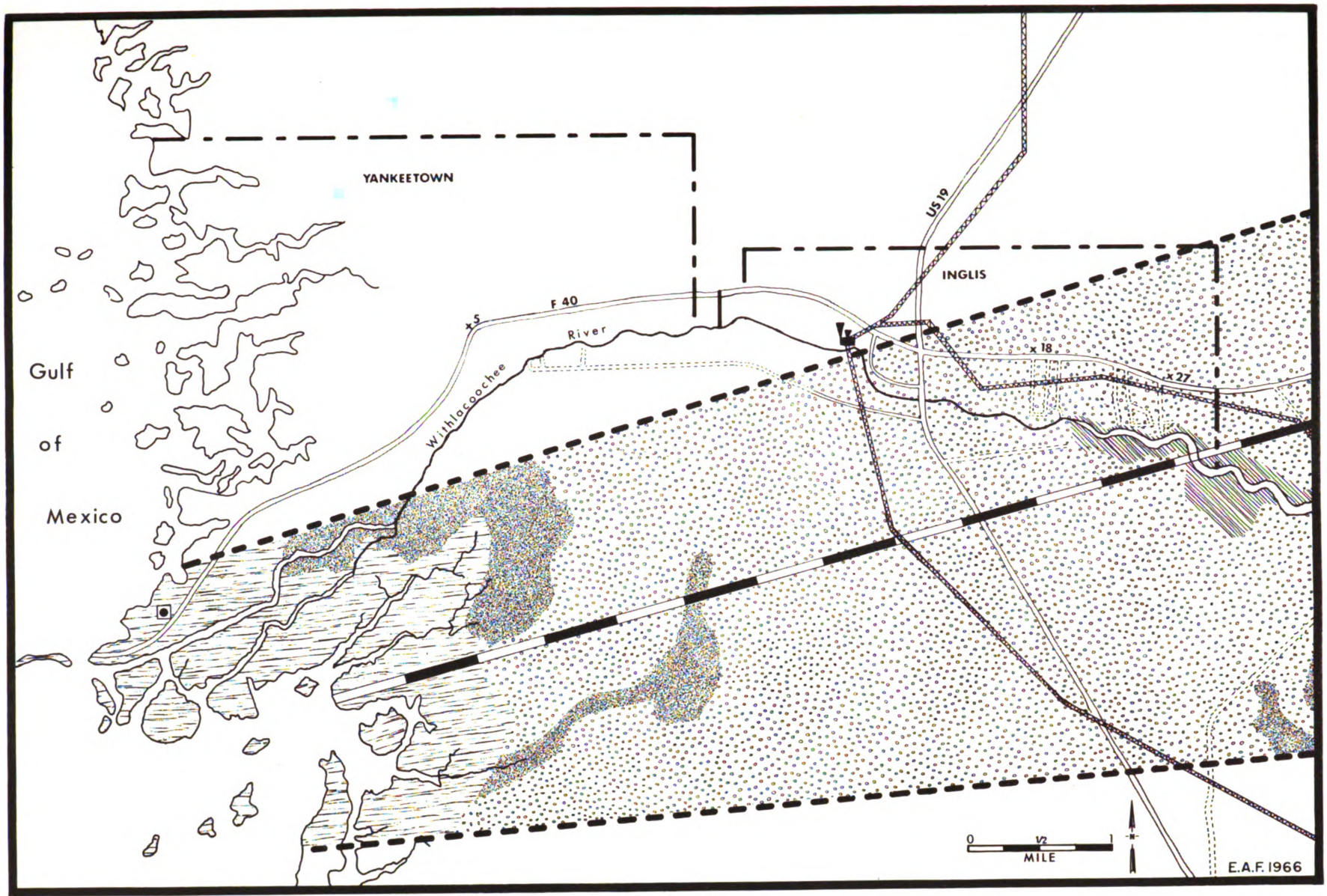
1 Nearly level, acid, excessively drained, more than 30 inches sand surface.
3 Nearly level, acid, somewhat excessively drained, more than 30 inches sand surface.
4 Undulating, slightly acid, well drained, more than 30 inches fine sand surface underlain by limestone.
5 Nearly level, slightly acid, well drained, more than 60 inches sand surface influenced by phosphatic materials.
8a Nearly level, slightly acid, moderately well drained, less than 40 inches sand surface influenced by phosphatic materials.
12 Nearly level, acid, moderately well drained, more than 40 inches sand surface over sandy clay loam.
13a Nearly level, strongly acid, poorly drained, more than 40 inches sand surface over organic pan.
19 Nearly level, acid, somewhat poorly drained, sandy loam with clay pan at less than 30 inches.
21 Nearly level, slightly acid, somewhat poorly drained, less than 30 inches sand surface over limestone or marl.
22 Nearly level, acid, poorly drained, more than 30 inches sand surface.
26 Level, poorly drained, organic soils, 12 inches or more peat or muck.
27 Fresh water marsh and swamp, highly organic.
28 Salt water marsh and swamp, mostly sand.


YANKEETOWN
US 19
INGLIS
F 40
Power Plant
Withlacoochee River
Gulf of Mexico
Picnic Area
Boat Ramp
28
21
27
13a
4
0 ½ 1
MILE
E.A.F. 1966

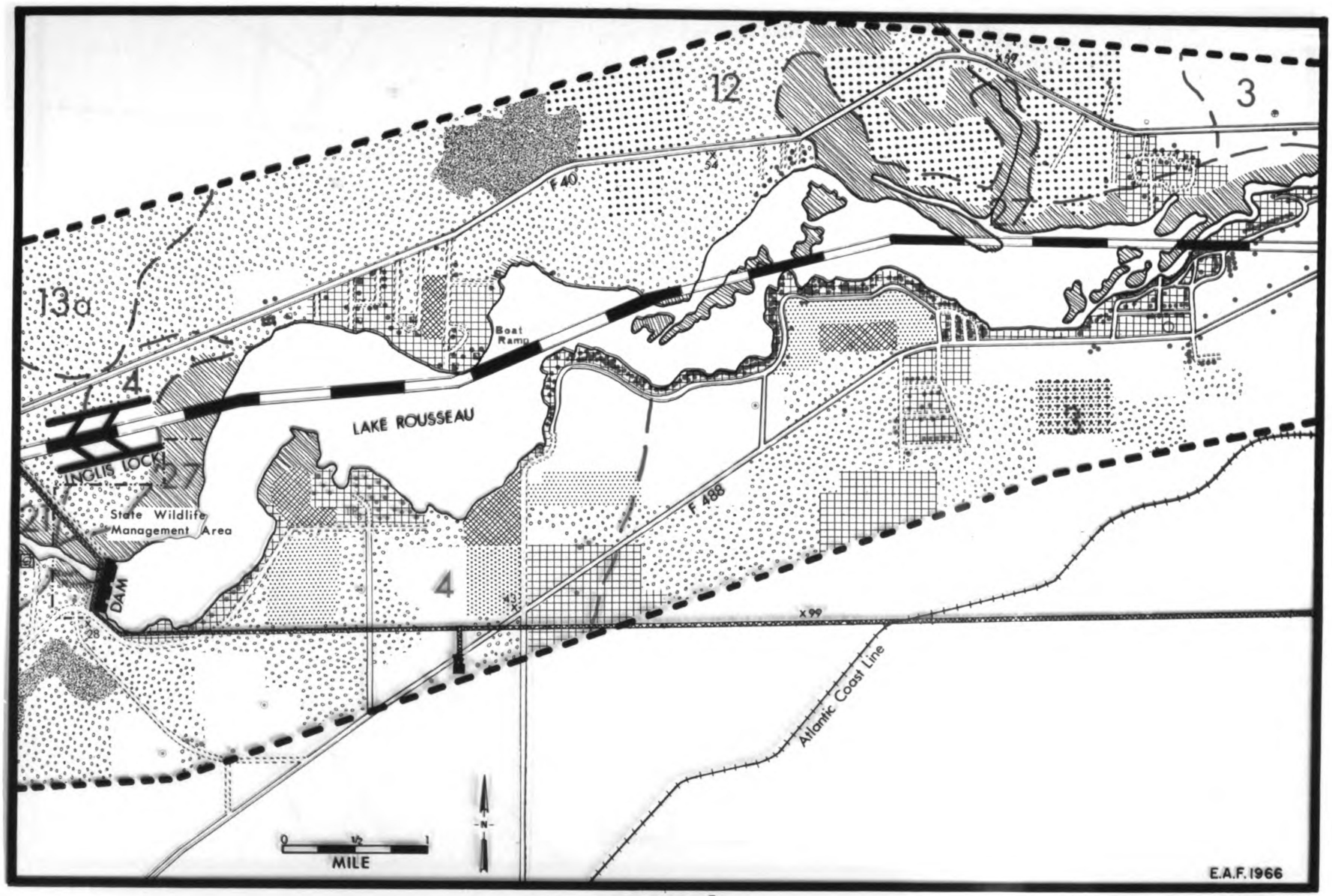
MAP A1/2


Gulf
of
Mexico
YANKEETOWN
INGLIS
US 19
Power Plant
Withlacoochee River
F 40
x 18
Tpk x 27
13a
27
21
28
4
Picnic Area
Boat Ramp
MILE
E.A.F. 1966

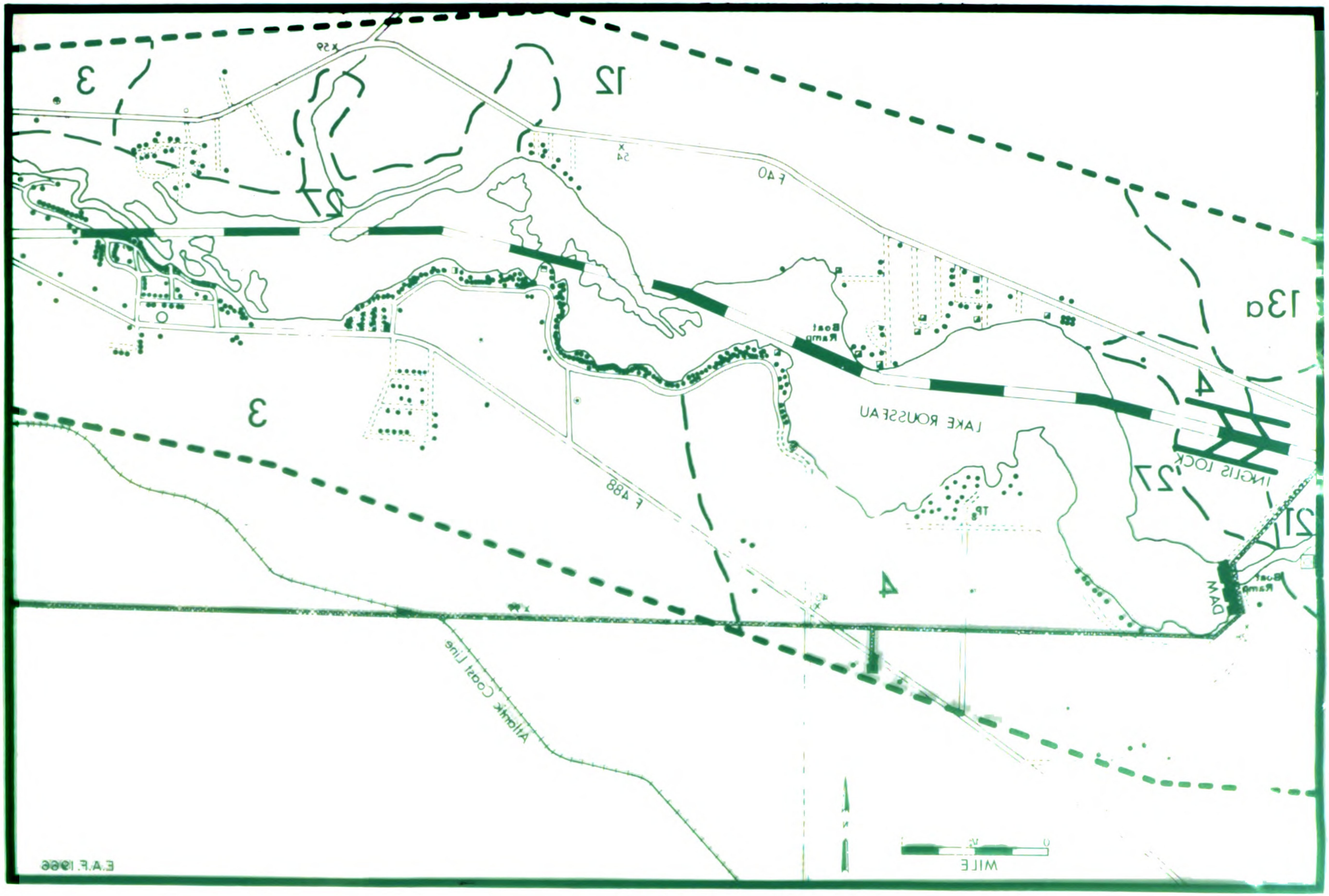
MAP A2


YANKEETOWN
INGLIS
US 19
F 40
X5
X18
X27
River
Withlacoochee
Gulf
of
Mexico
0
½
1
MILE
E.A.F. 1966

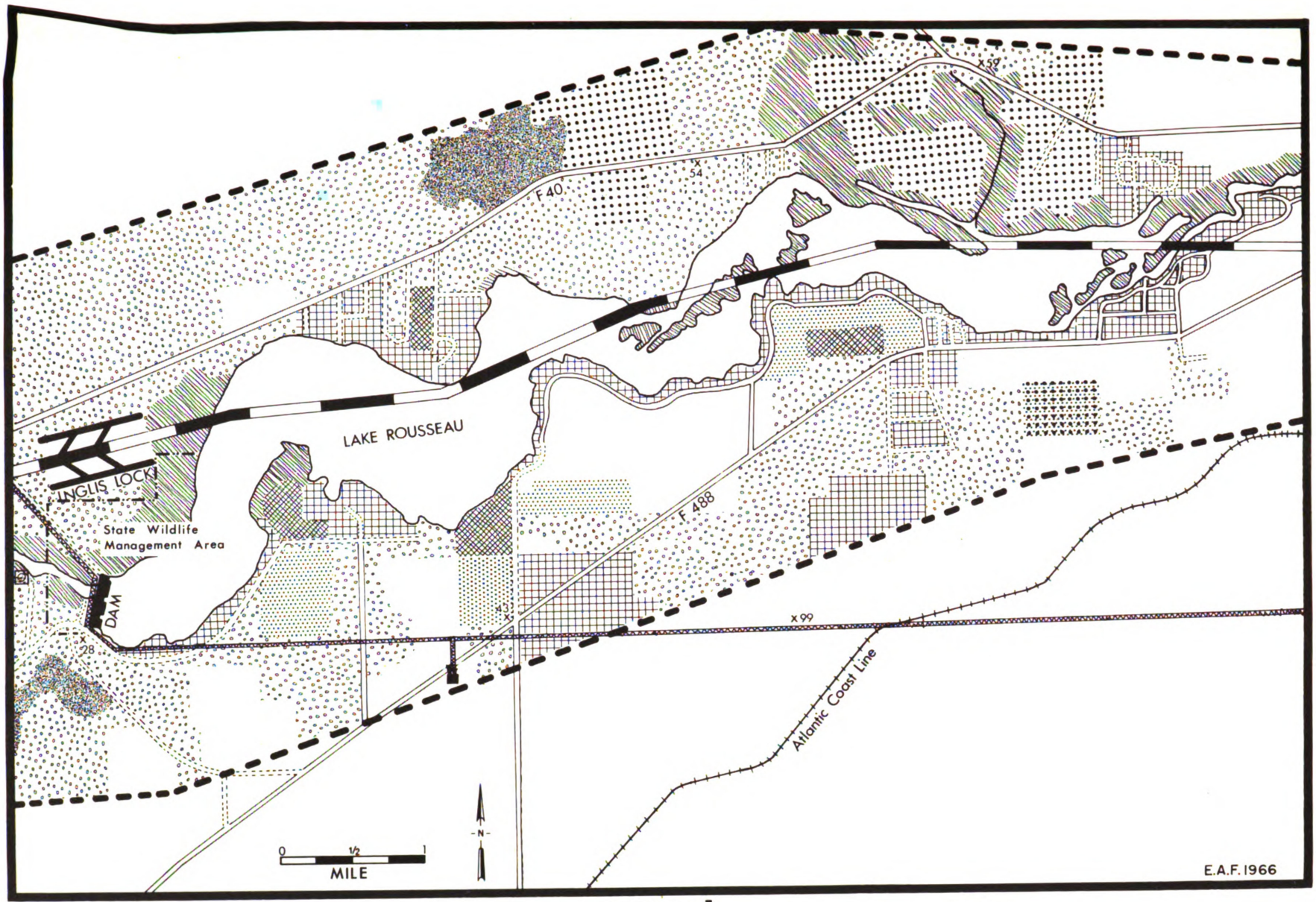
MAP A[1]


12
3
13a
4
F 40
Boat Ramp
LAKE ROUSSEAU
INGLIS LOCK
27
State Wildlife Management Area
DAM
F 488
4
x99
Atlantic Coast Line
0
½
1
MILE
N
E.A.F. 1966

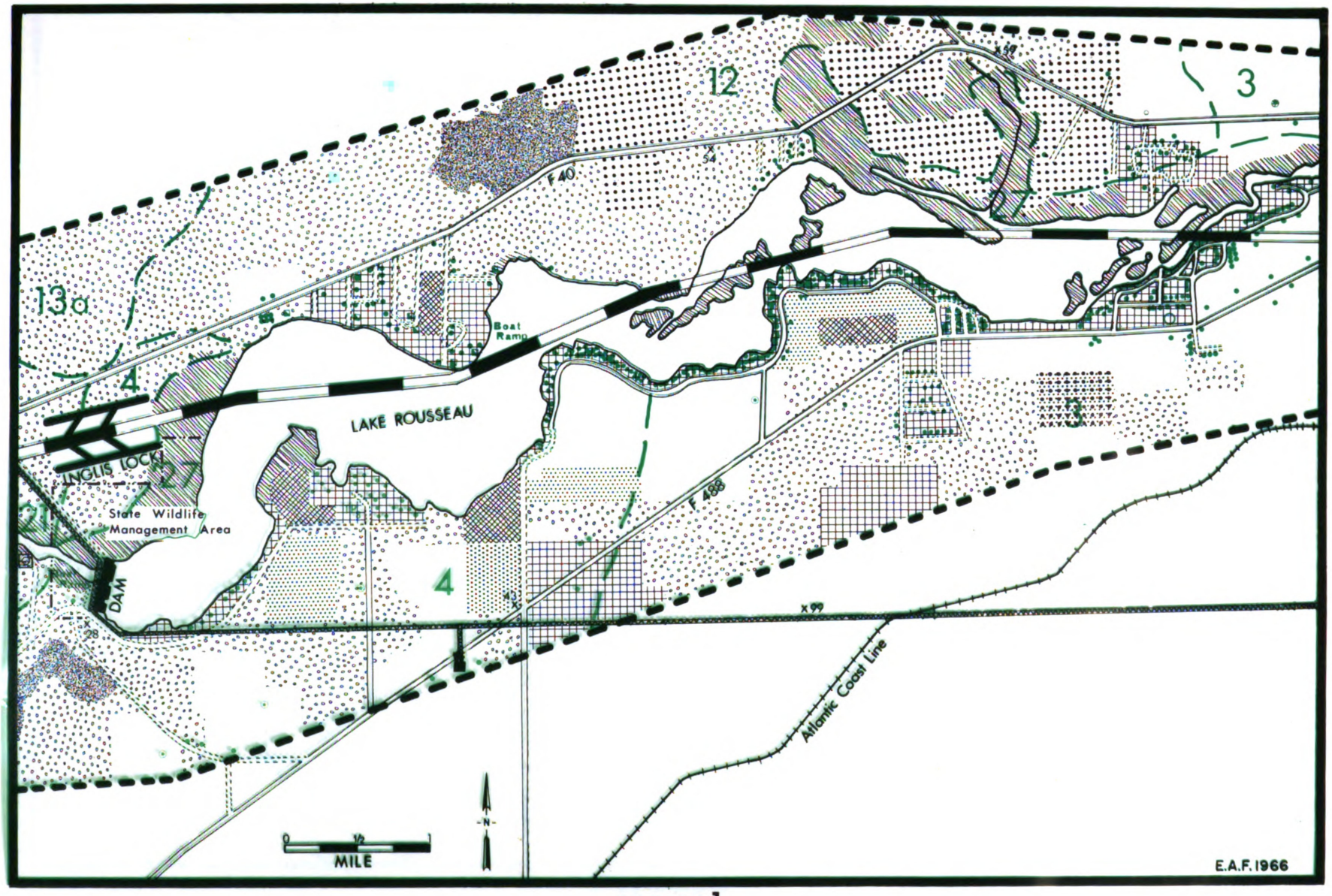
MAP B½


LAKE ROUSSEAU
INGLIS LOCK
DAM
Boat Ramp
Boat Ramp
Atlantic Coast Line
F 488
F 40
3
3
4
4
4
12
13a
21
27
27
MILE
E.A.F. 1966

MAP B2

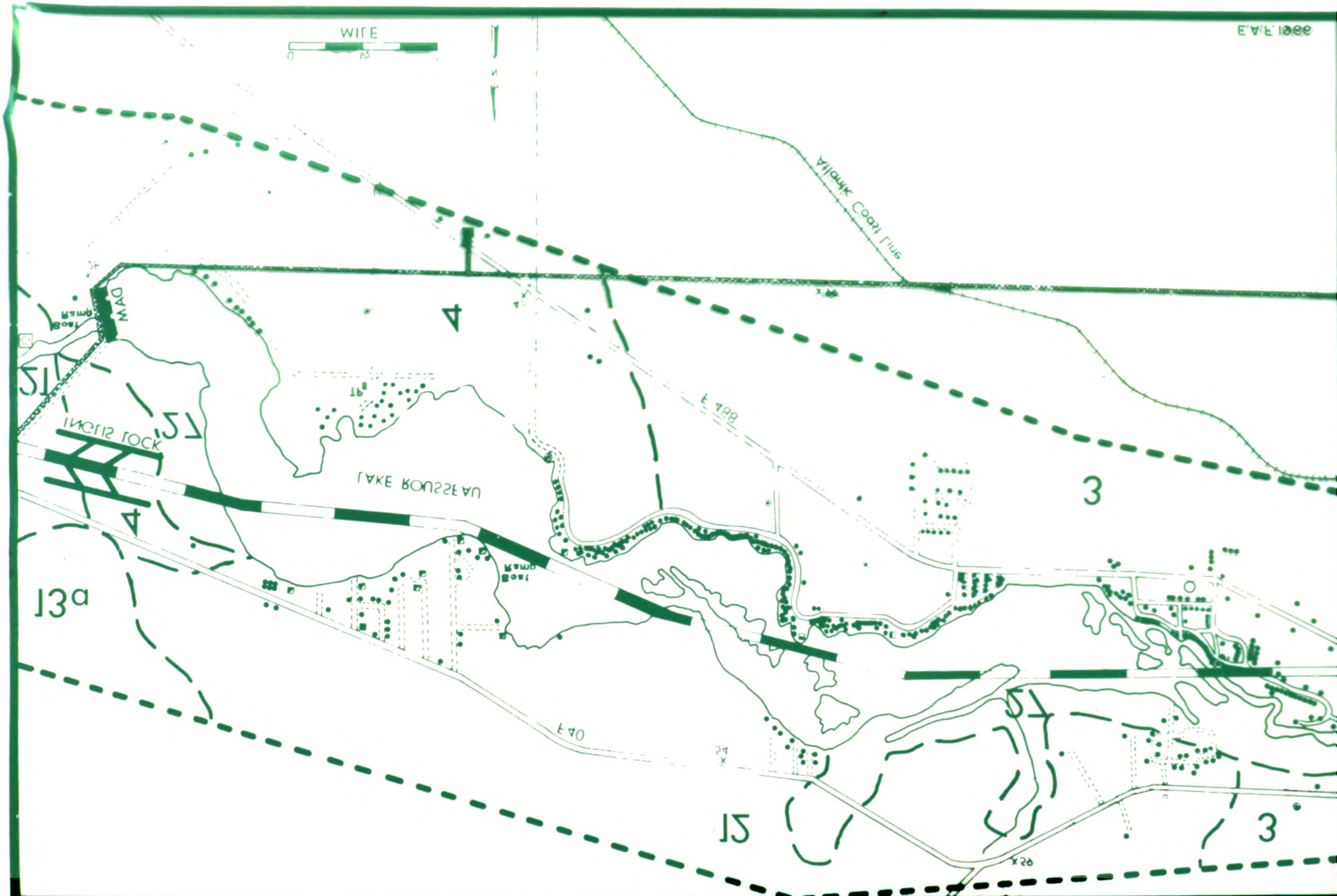

F 40
LAKE ROUSSEAU
INGLIS LOCK
State Wildlife
Management Area
DAM
F 488
Atlantic Coast Line
0 ½ 1
MILE
N
E.A.F. 1966

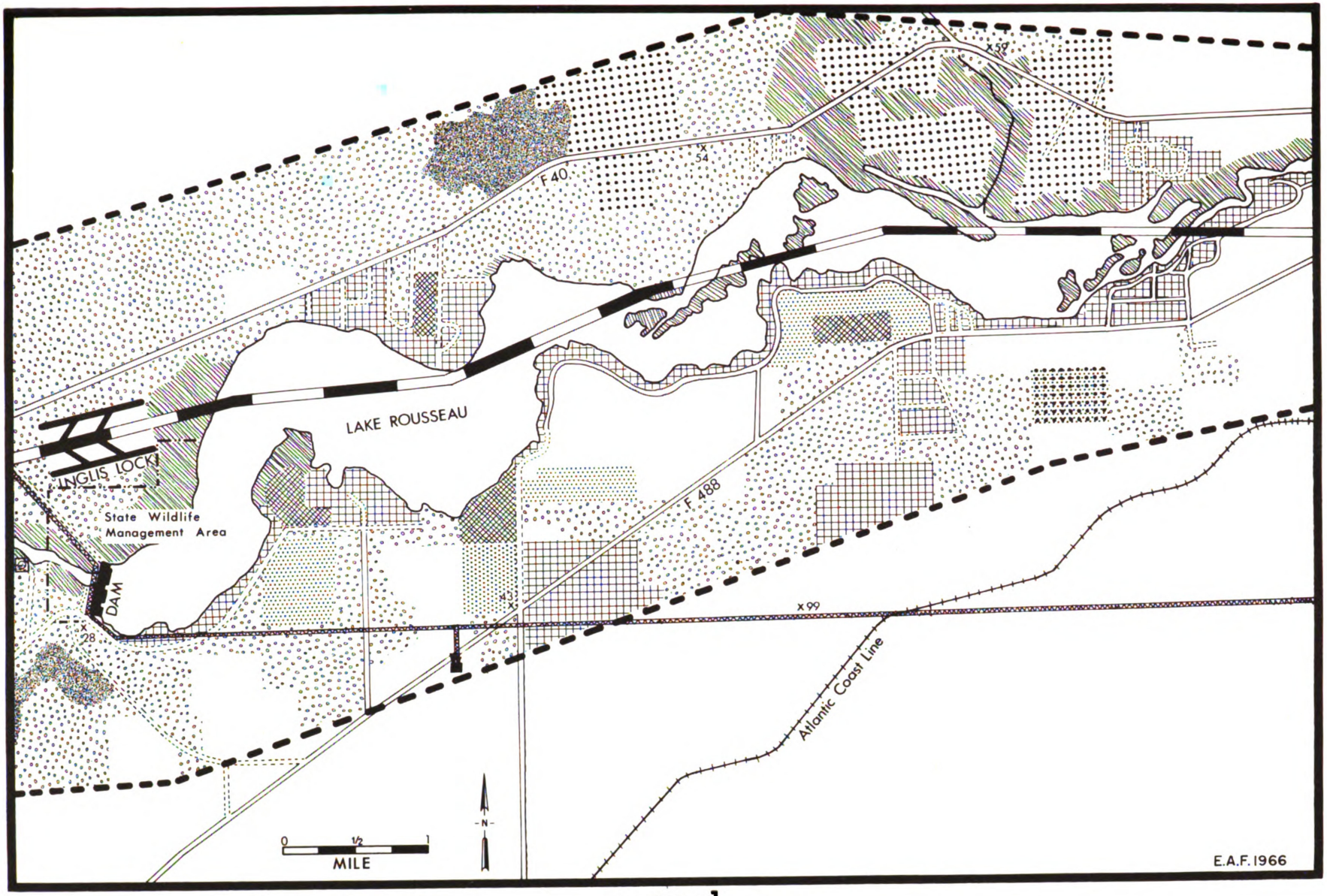
MAP B[1]


12
3
13a
4
F 40
Boat Ramp
LAKE ROUSSEAU
INGLIS LOCK
27
State Wildlife Management Area
DAM
4
F 488
x 99
Atlantic Coast Line
0 ½ MILE
N
E.A.F. 1966

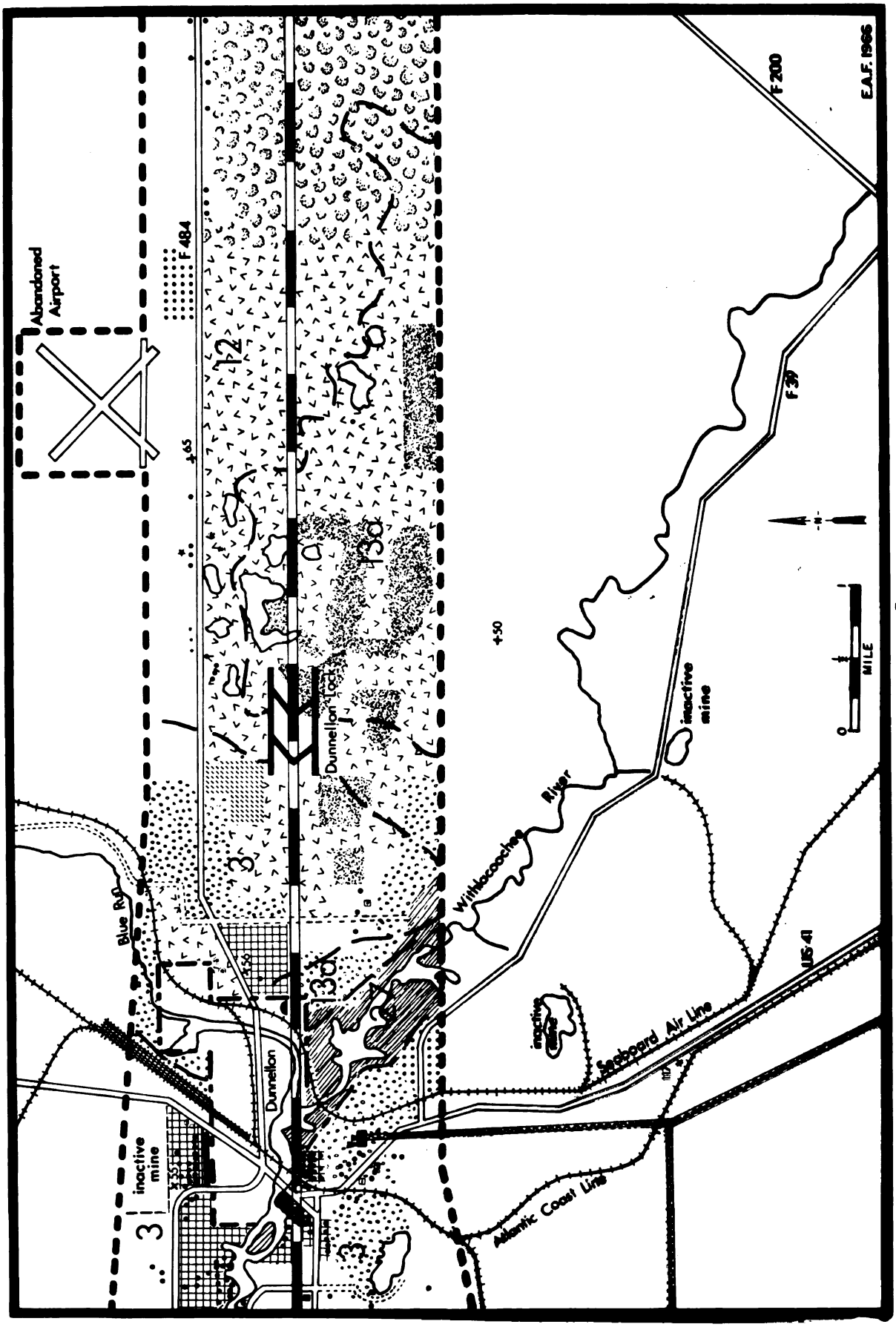
MAP B½

MAP B2

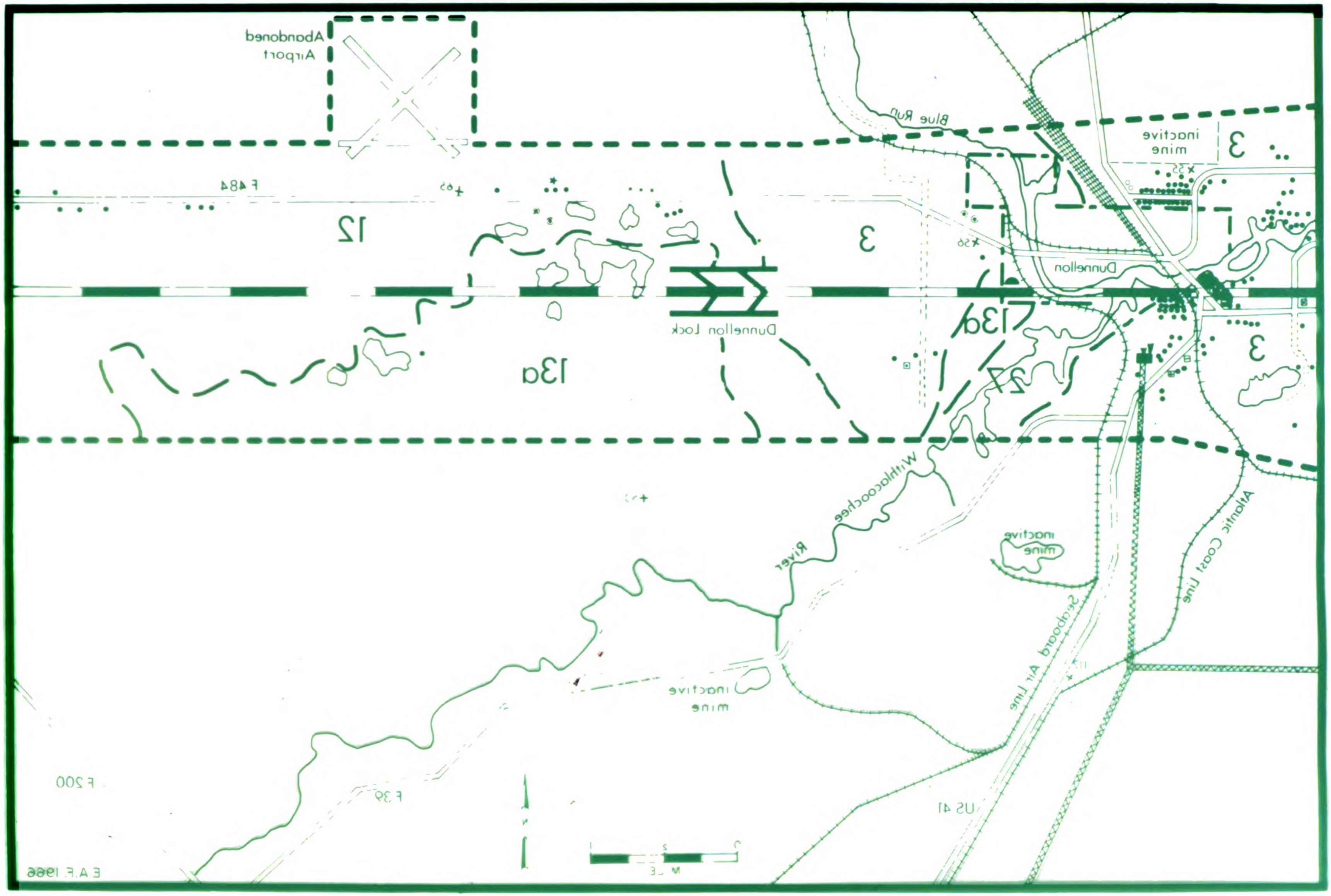

MILE
E.A.F. 1966
Atlantic Coast Line
DAM
Boat Ramp
INGLIS LOCK
LAKE ROUSSEAU
Boat Ramp
4
3
12
13a


F 40
x 59
x 34
LAKE ROUSSEAU
INGLIS LOCK
State Wildlife
Management Area
DAM
F 488
x 99
x 28
Atlantic Coast Line
0 ½ 1
MILE
N
E.A.F. 1966

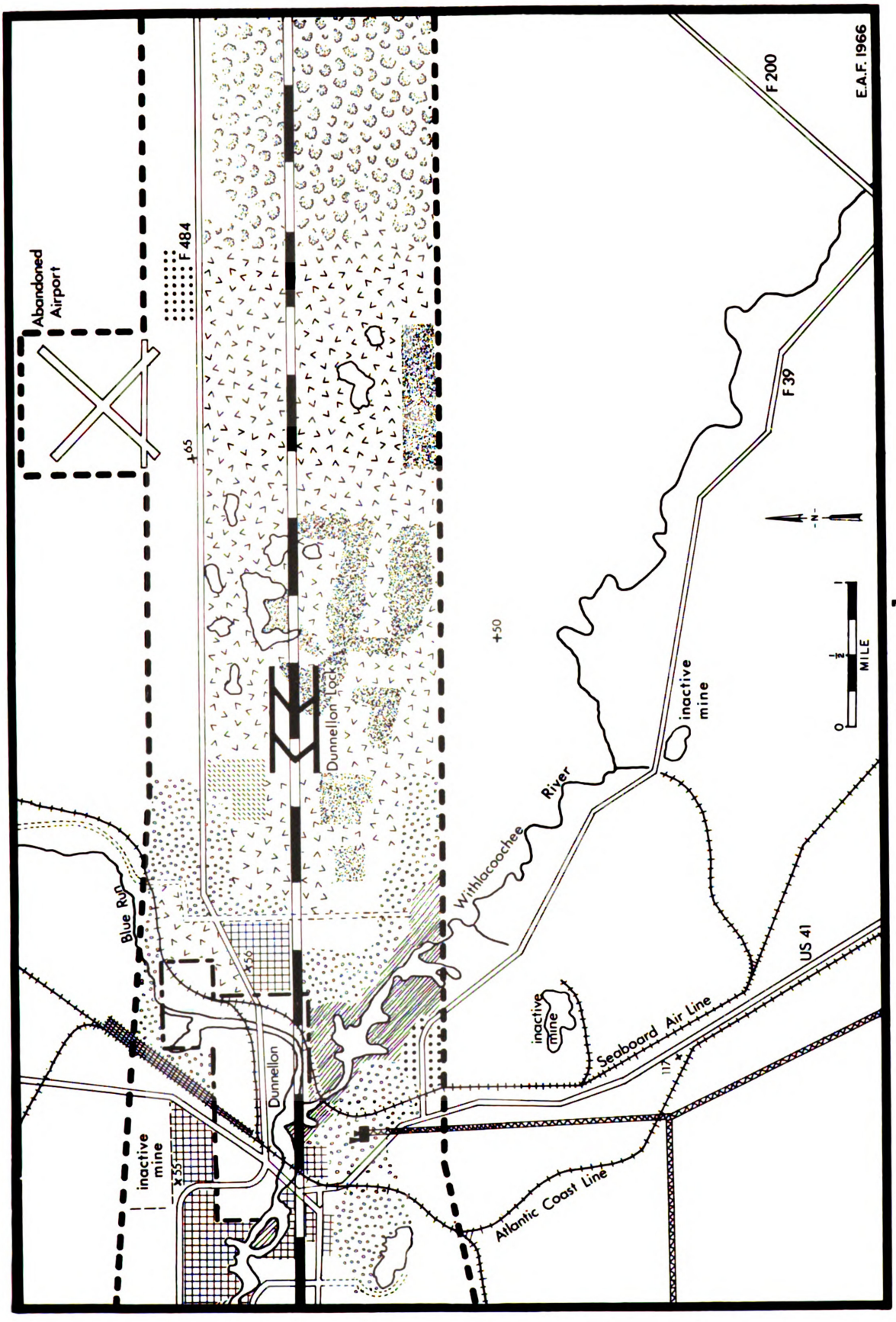
MAP B[1]


Abandoned Airport
F 484
F 200
F 39
E.A.F. 1966
Withlacoochee River
Dunnellon Lock
Dunnellon
Blue Rd
inactive mine
inactive mine
inactive mine
Seaboard Air Line
Atlantic Coast Line
US 41
MILE
+50
+65

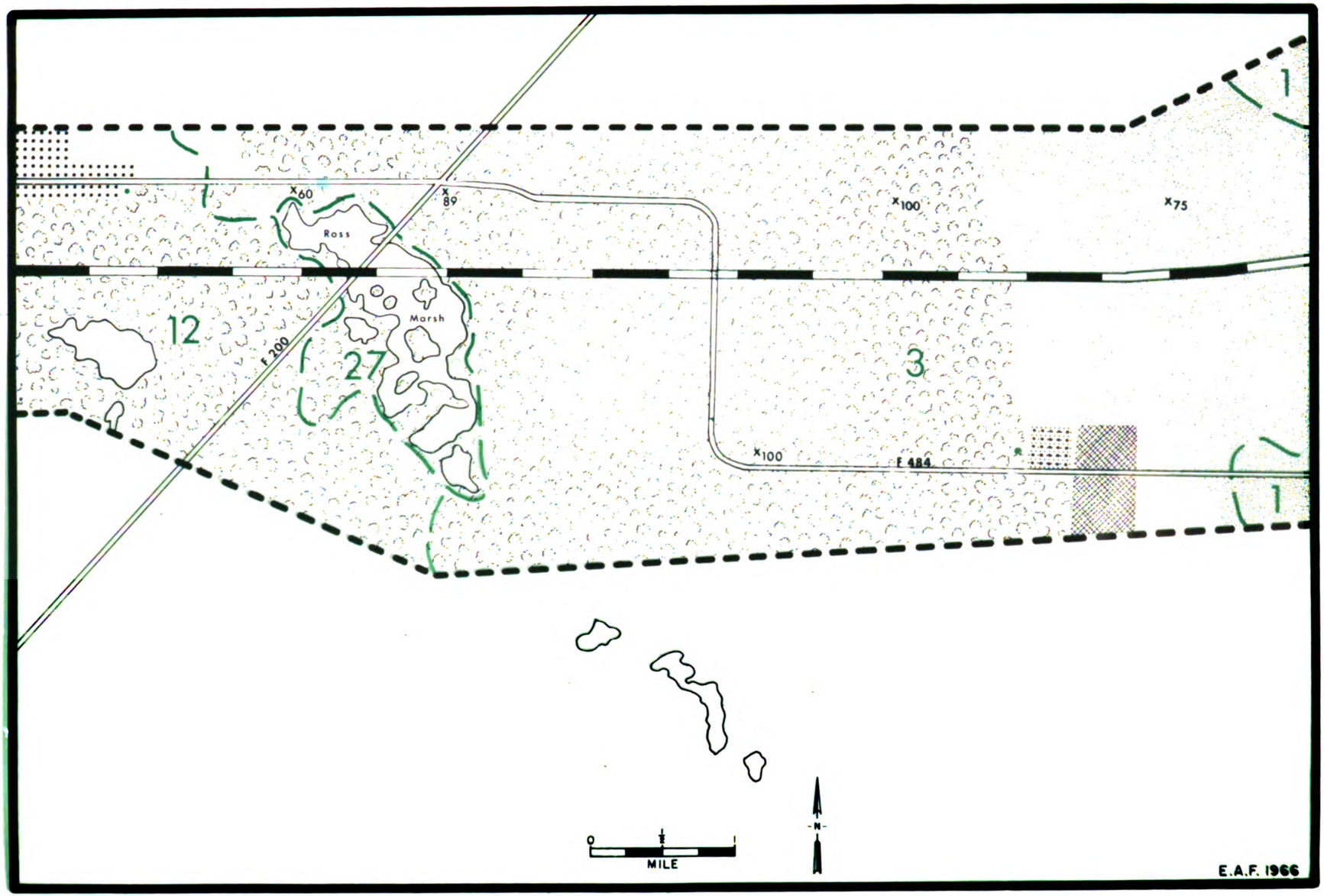
MAP C2


Abandoned Airport
Blue Run
inactive mine
3
F 484
12
3
Dunnellon
Dunnellon Lock
13a
13a
27
3
Withlacoochee River
inactive mine
Atlantic Coast Line
Seaboard Air Line
inactive mine
F 200
F 39
US 41
MILE
E.A.F. 1966

MAP C2

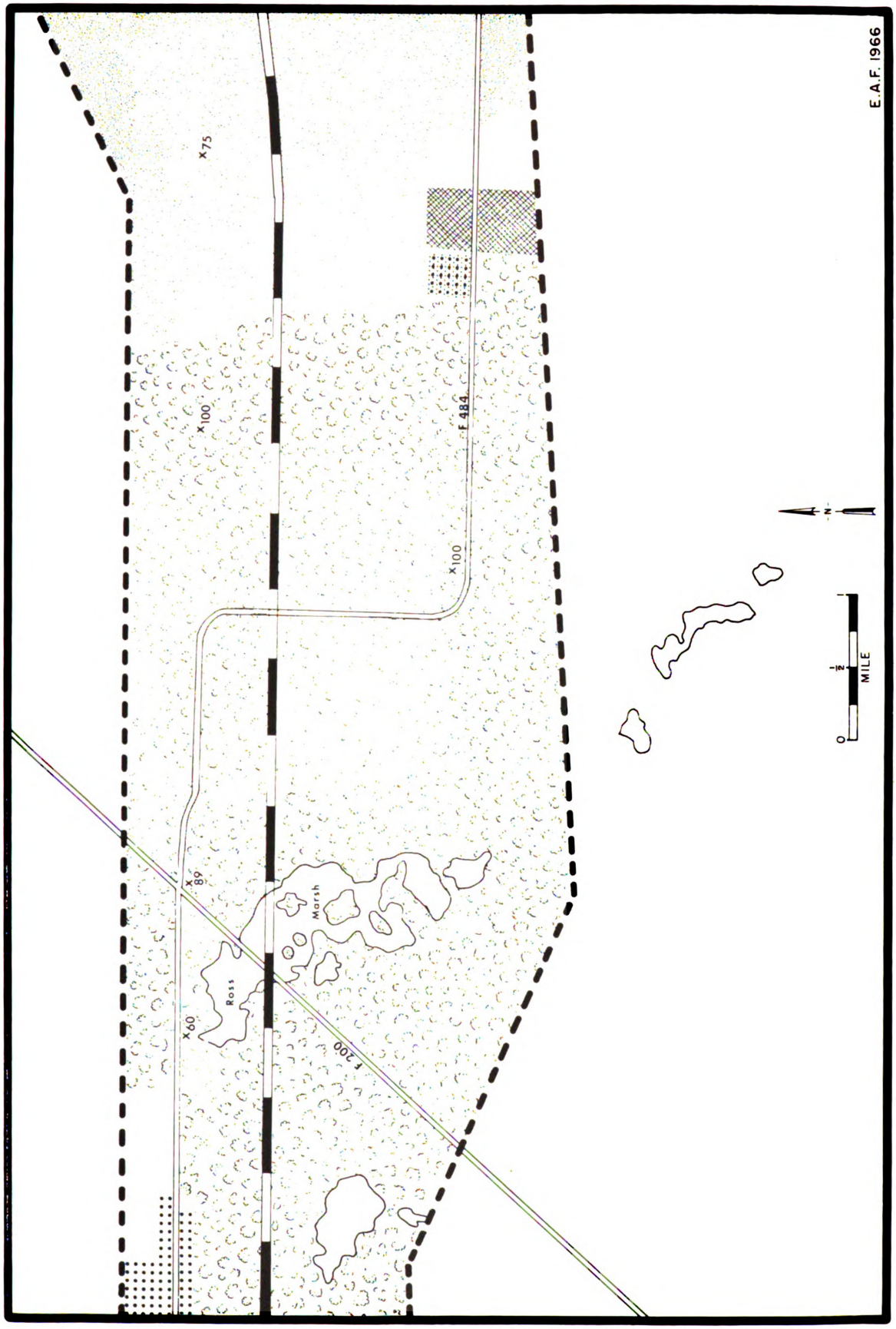

Abandoned Airport
F 484
+65
Dunnellon Lock
Withlacoochee River
+50
F 200
F 39
E.A.F. 1966
inactive mine
Blue Run
X 56
Dunnellon
inactive mine
X 55
Seaboard Air Line
US 41
Atlantic Coast Line
0
½
MILE
-N-

MAP C[1]

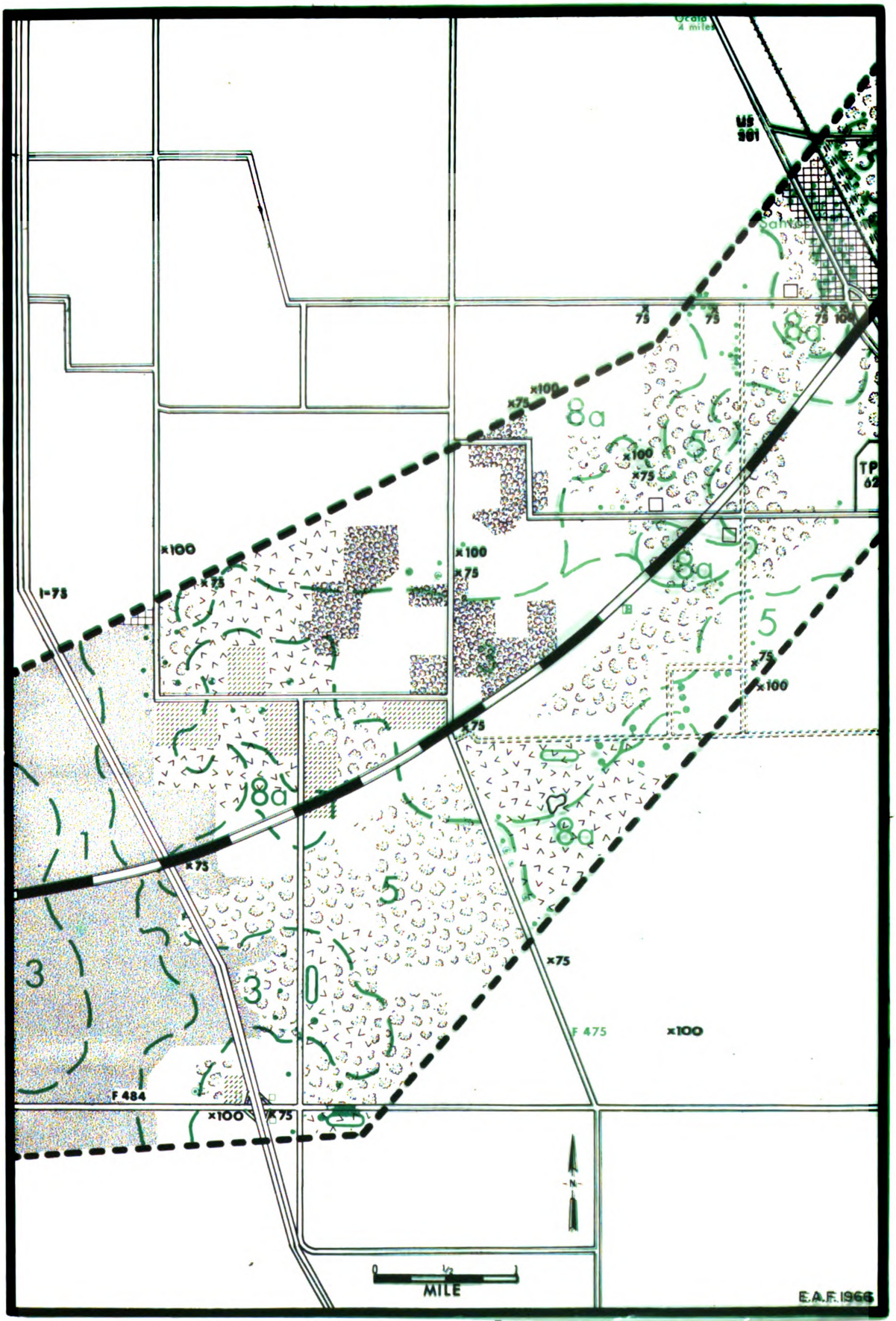

1
x60
x89
Ross
x100
x75
12
Marsh
F 200
27
3
x100
F 484
1
0
½
1
MILE
N
E.A.F. 1966

MAP D½

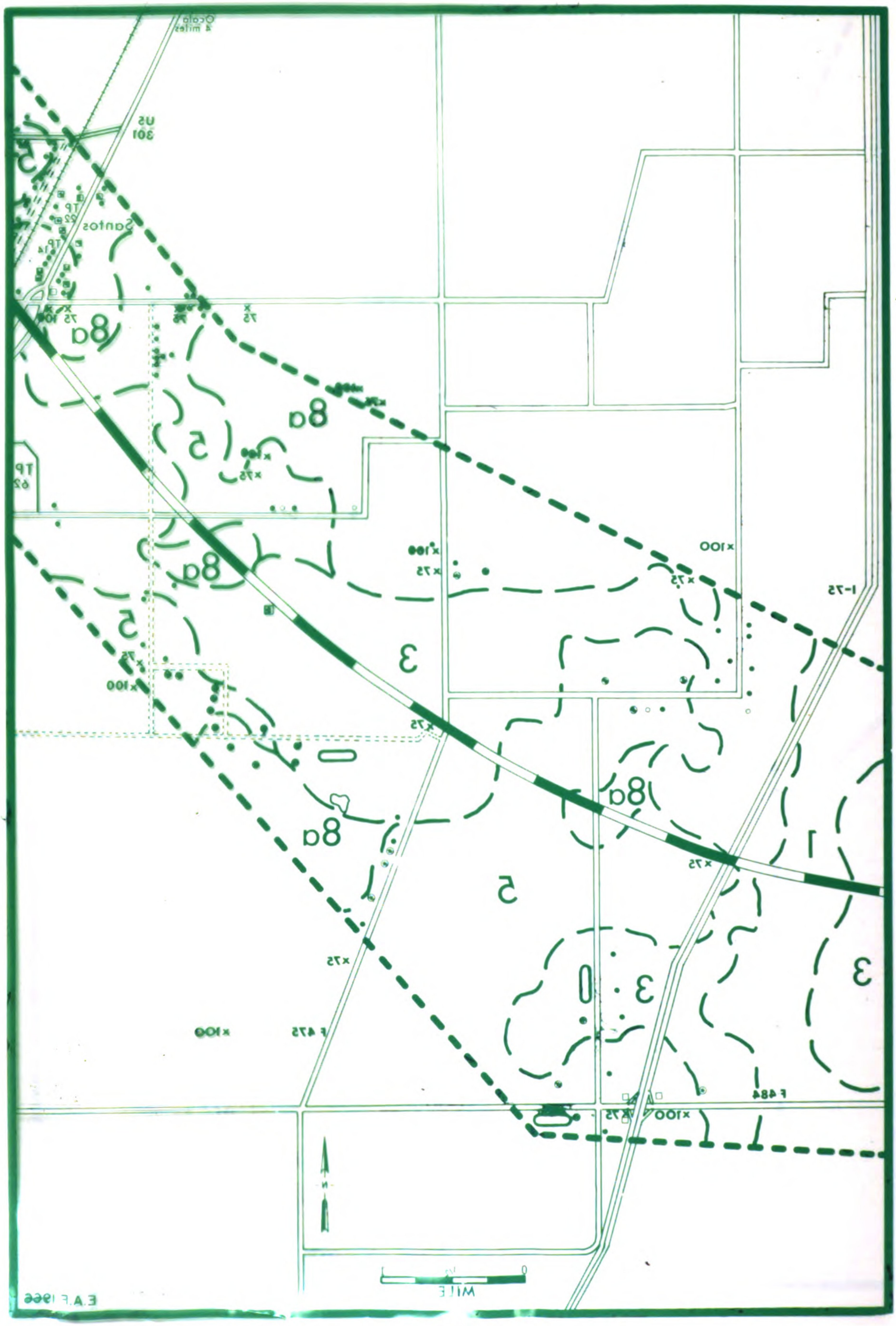
MAP 12



MAP D

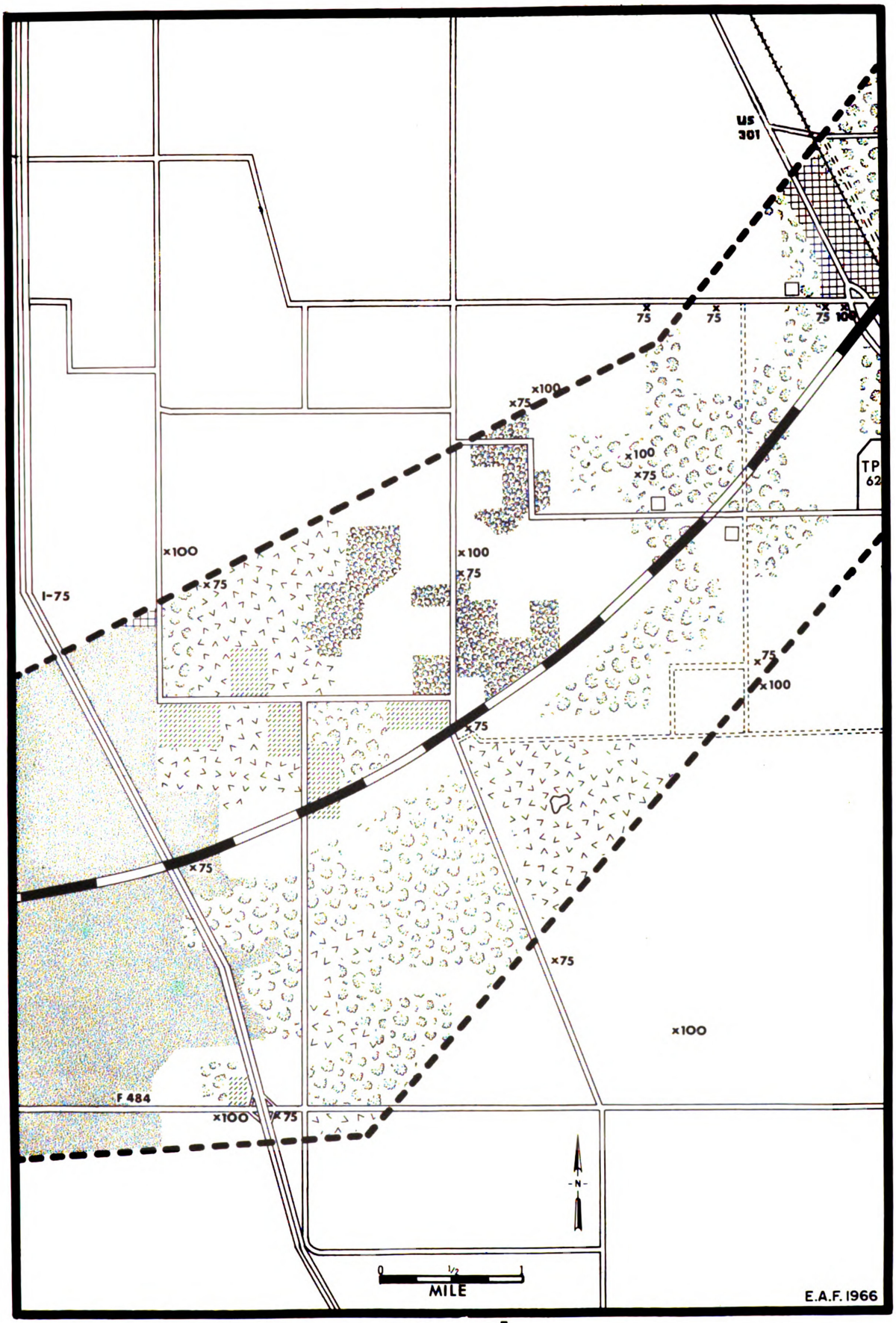

Ocala
4 miles
US 301
Santos
TP 62
I-75
8a
5
3
1
x100
x75
F 475
F 484
N
½
MILE
E.A.F. 1966

MAP E½

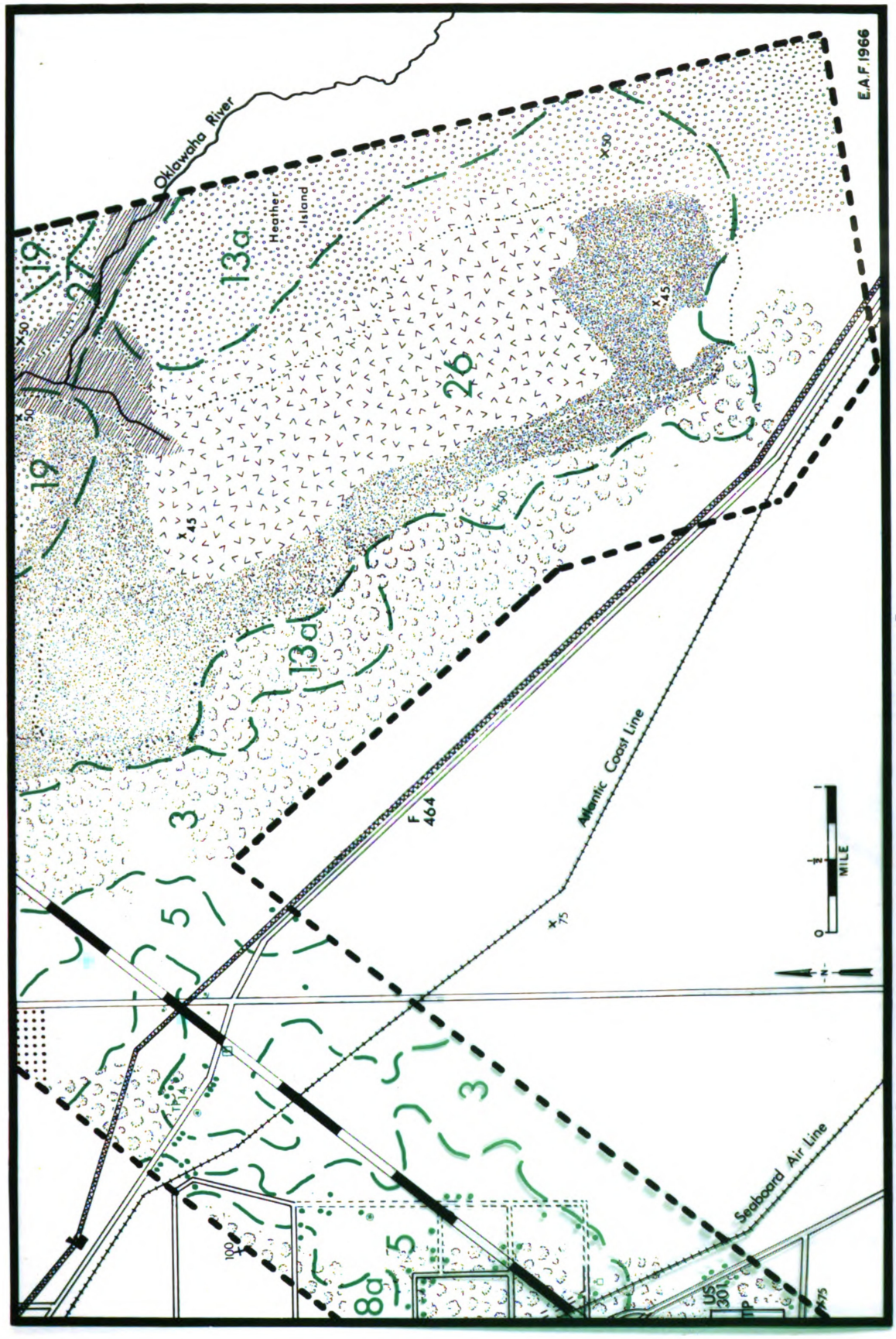


Ocala 4 miles
US 301
Santos
TP 92
TP 62
I-75
F 475
F 484
8a
5
3
1
MILE
E.A.F. 1966

MAP



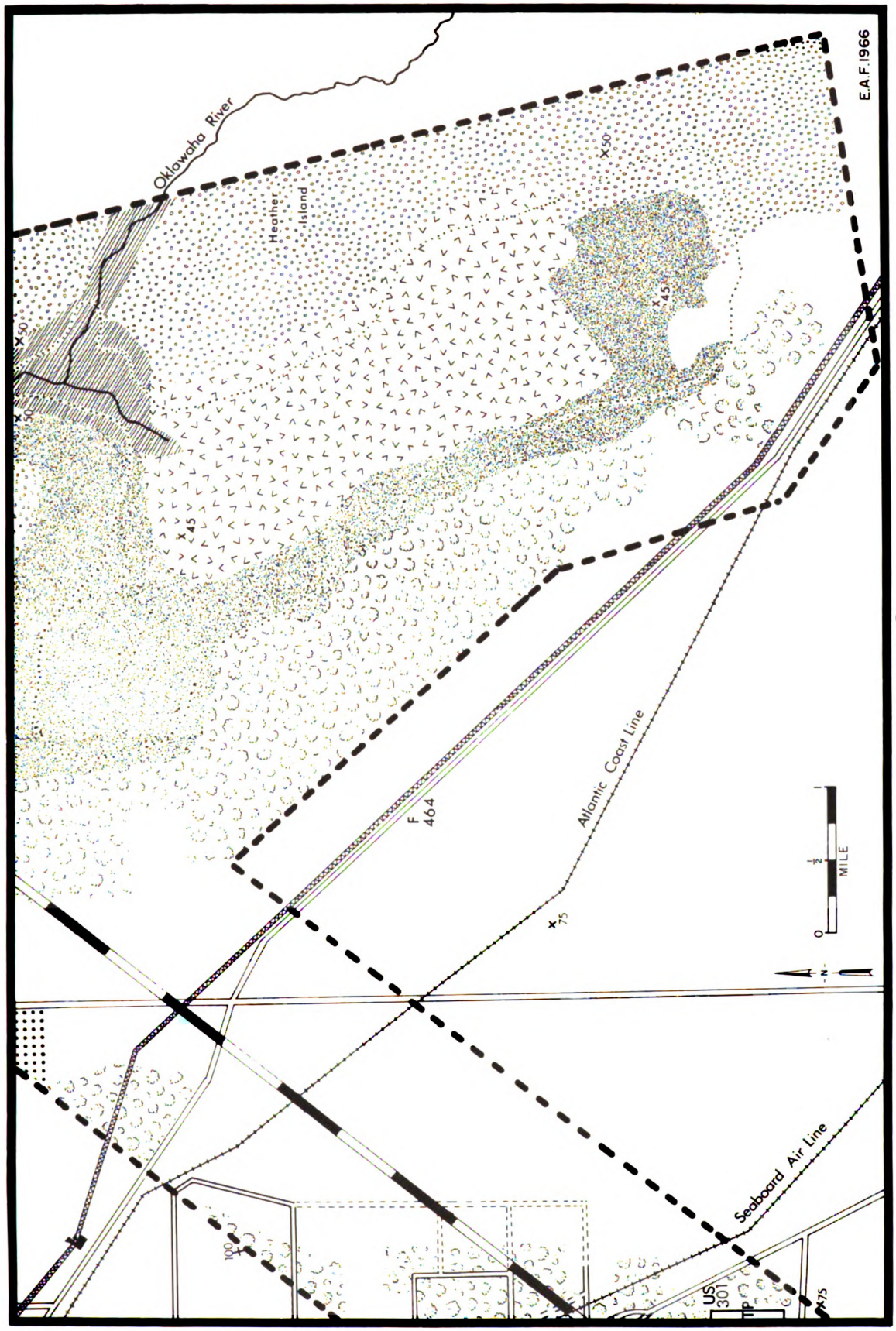
MAP E[1]


Oklawaha River
Heather Island
E.A.F. 1966
19
27
13a
26
3
5
8a
F 464
Atlantic Coast Line
Seaboard Air Line
US 301
MILE
N

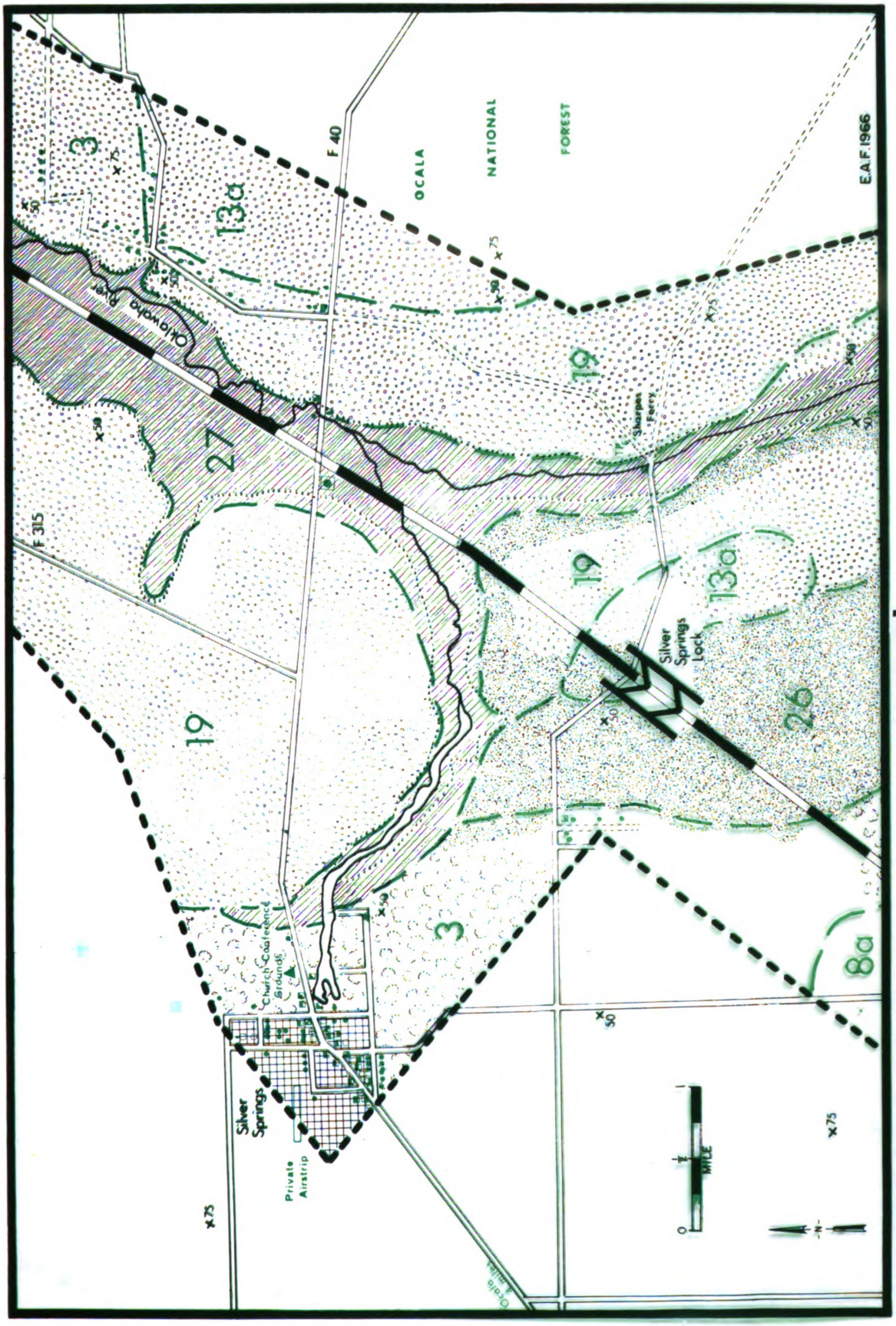
MAP F1 2

MAP 2

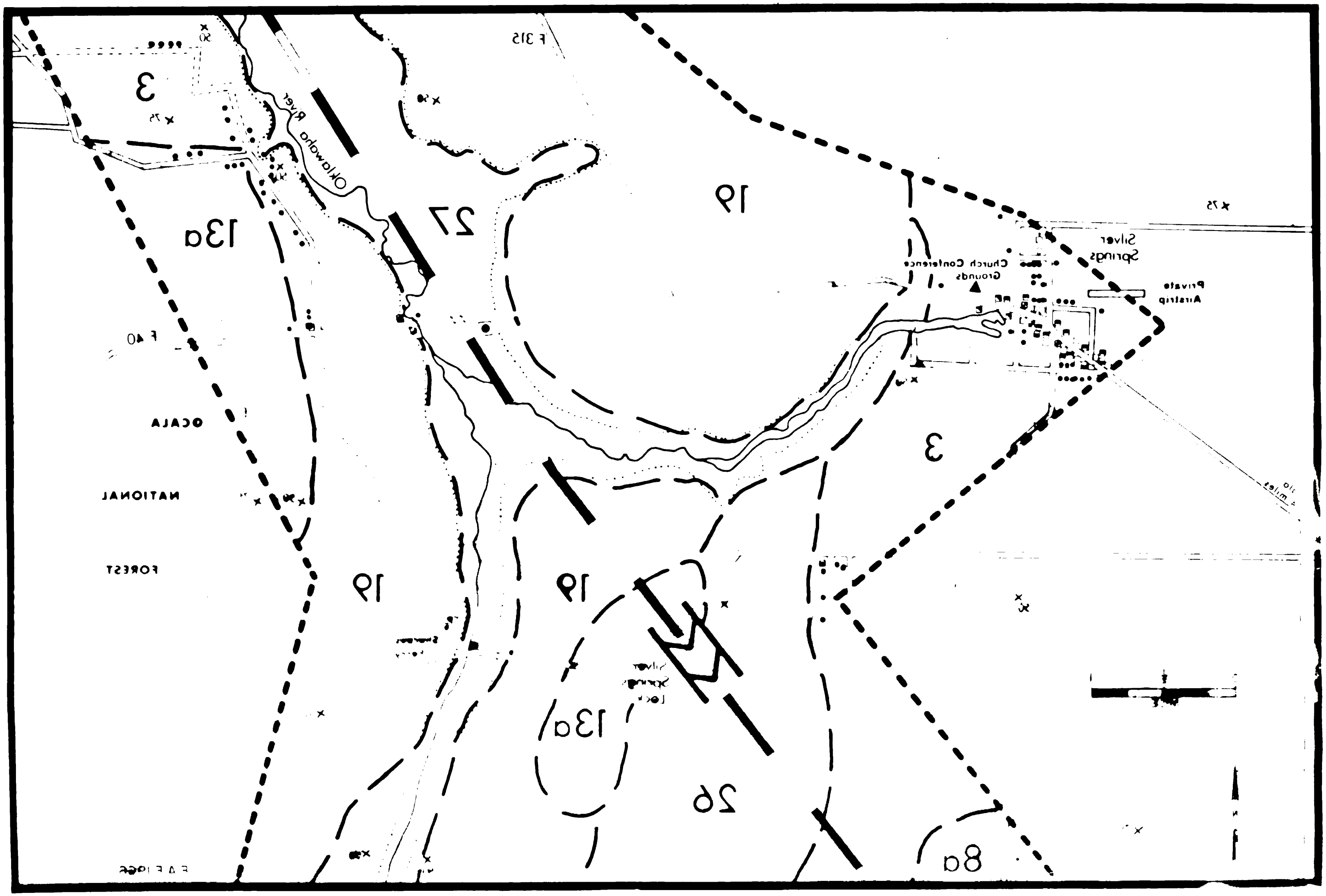
Oklawaha River
Heather Island
13a
26
19
2
13a
3
5
3
5
8a
Atlantic Coast Line
Seaboard Air Line
E A F 1966


E.A.F.1966
Oklawaha River
Heather Island
X50
X45
F 464
Atlantic Coast Line
X75
MILE
0
1
N
Seaboard Air Line
US 301
TP
100

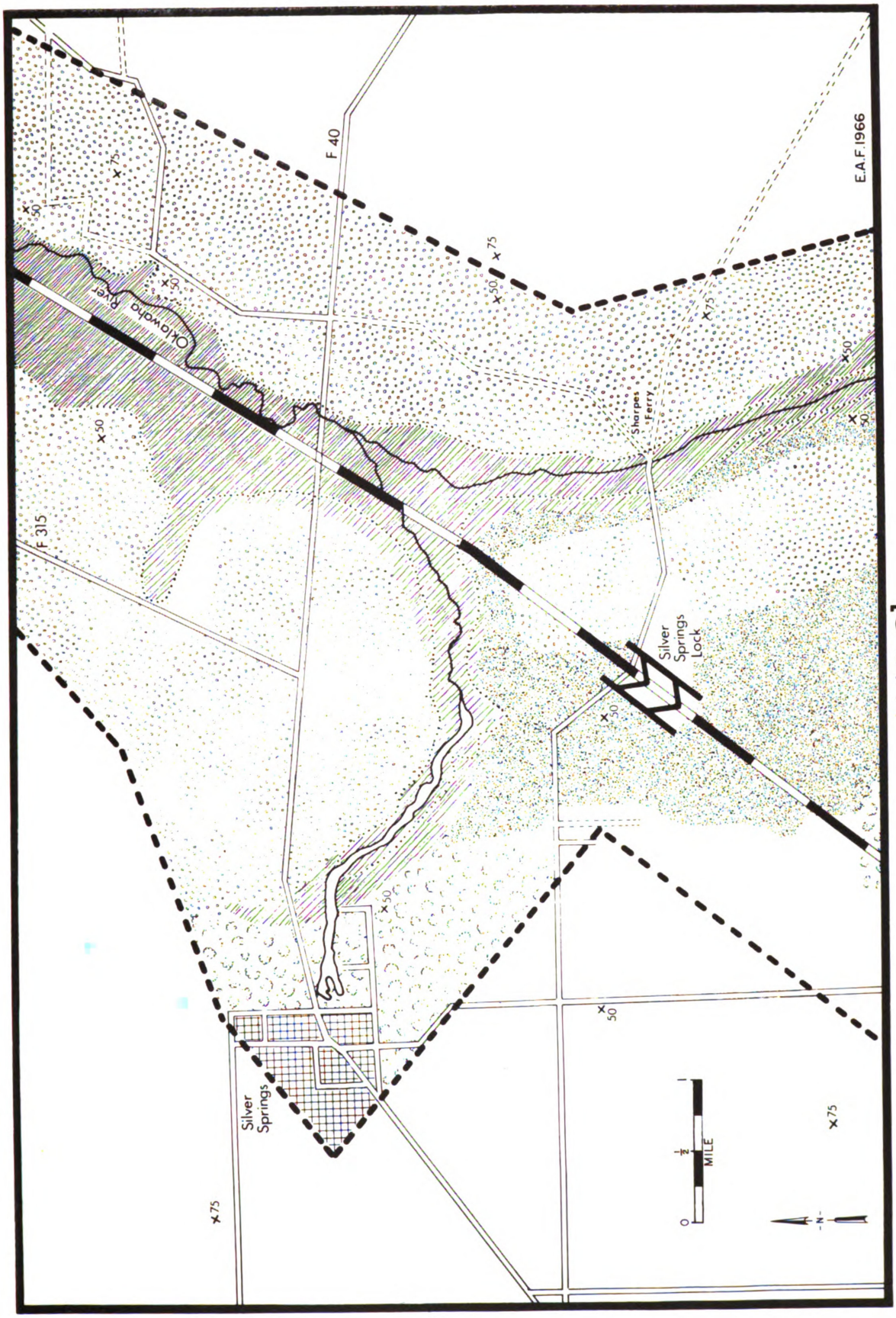
MAP F1


OCALA
NATIONAL
FOREST
E.A.F. 1966
F 40
F 315
Silver Springs
Church Conference Grounds
Private Airstrip
Silver Springs Lock
Sharpes Ferry
Ocklawaha River
MILE
N
3
13a
27
19
26
8a

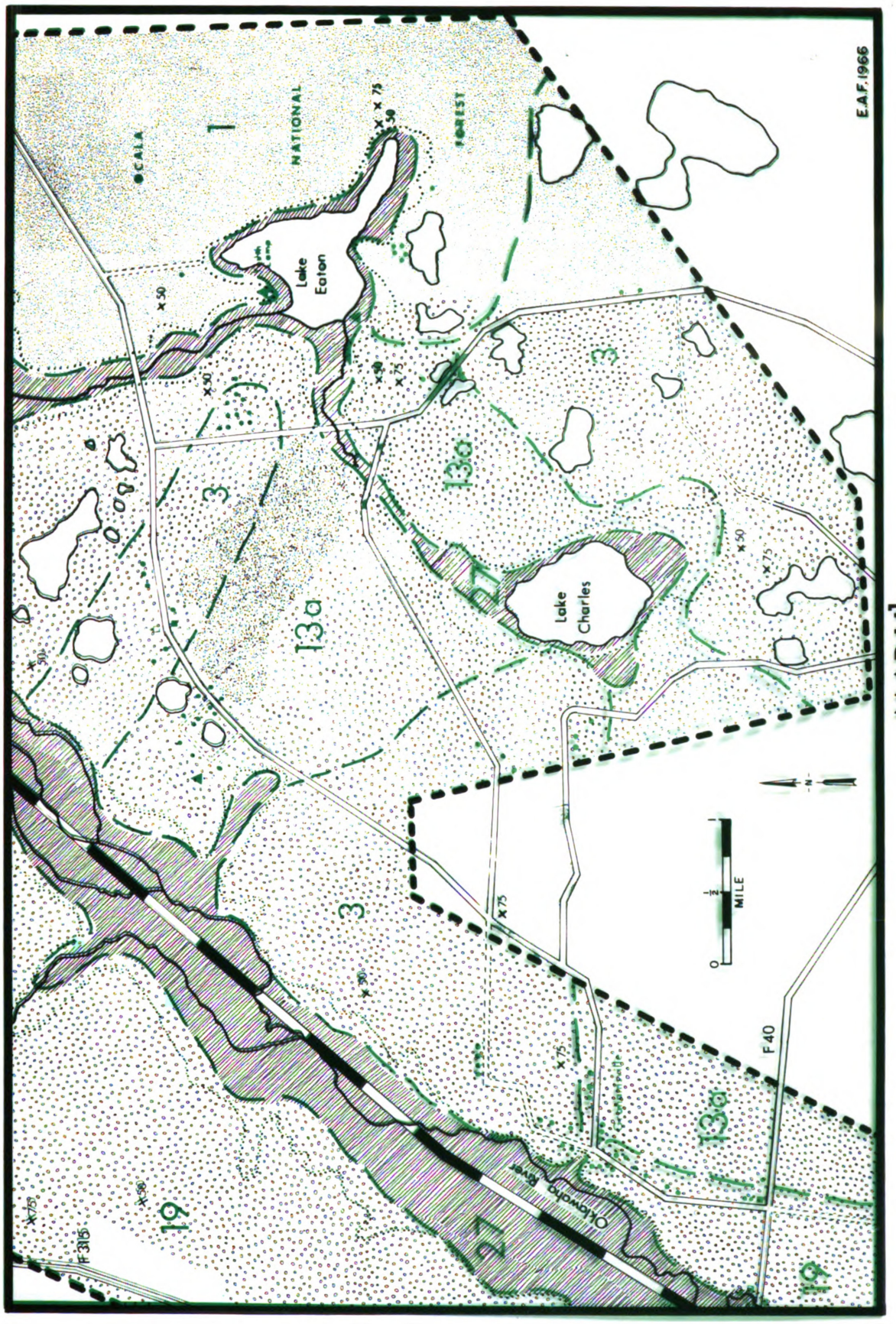
MAP G1/2

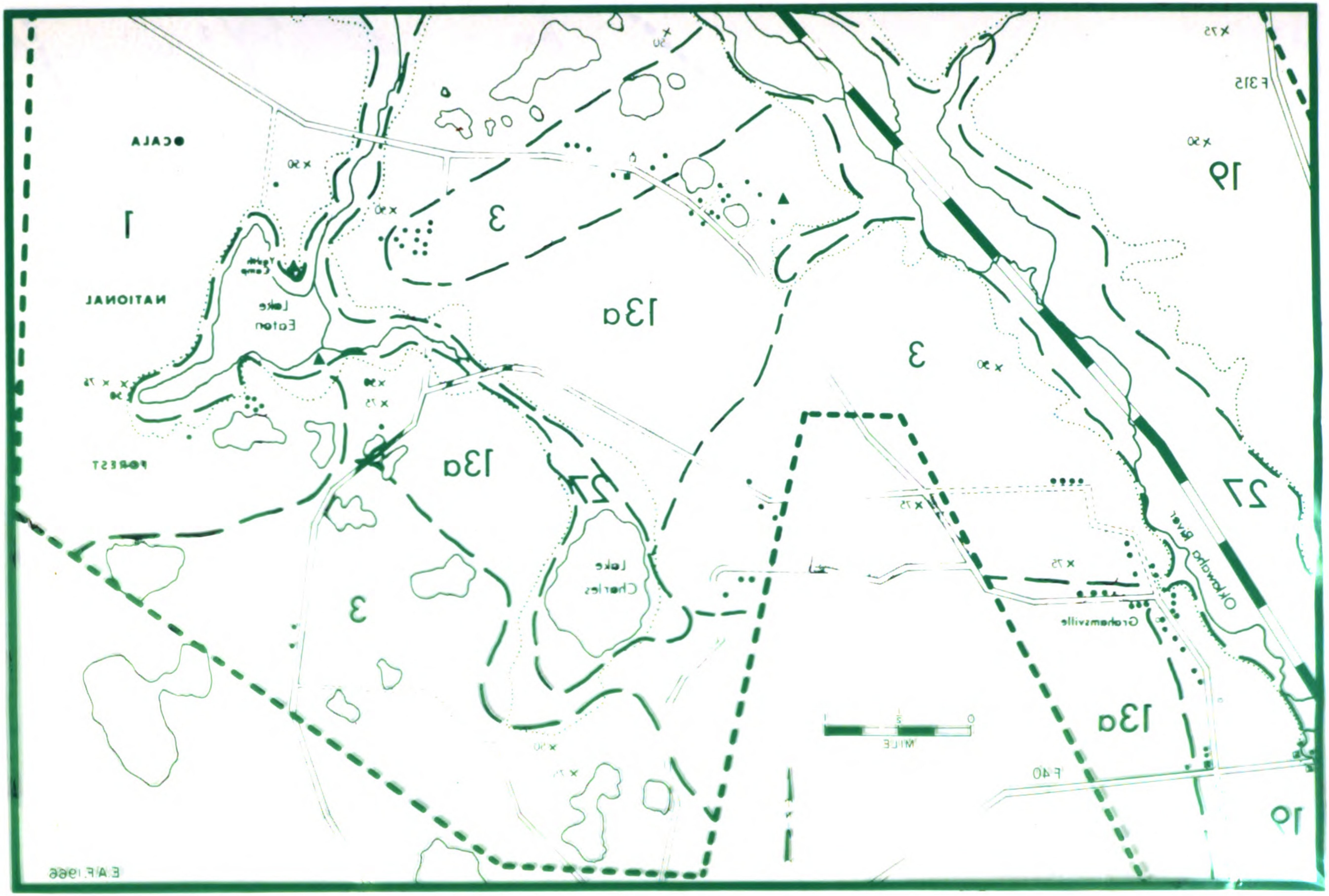

3
13a
Oklawaha River
27
19
F 315
Silver Springs
Church Conference Grounds
Private Airstrip
F 40
OCALA
NATIONAL
FOREST
3
19
19
Silver Springs Lock
13a
26
8a

MAP G2

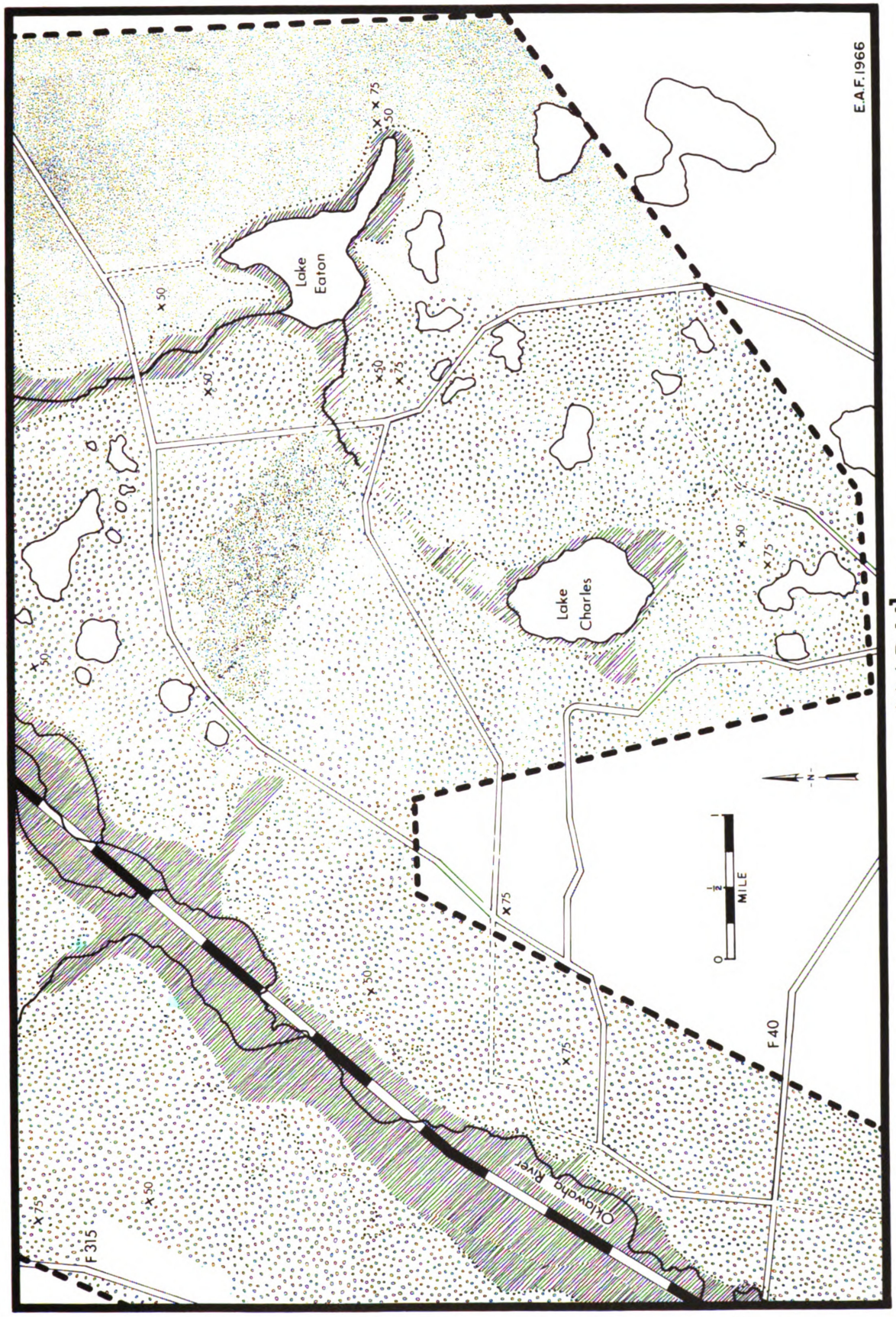

F 40
F 315
Oklawaha River
Sharpes Ferry
Silver Springs Lock
Silver Springs
E.A.F. 1966
0
½
1
MILE
-N-

MAP G1

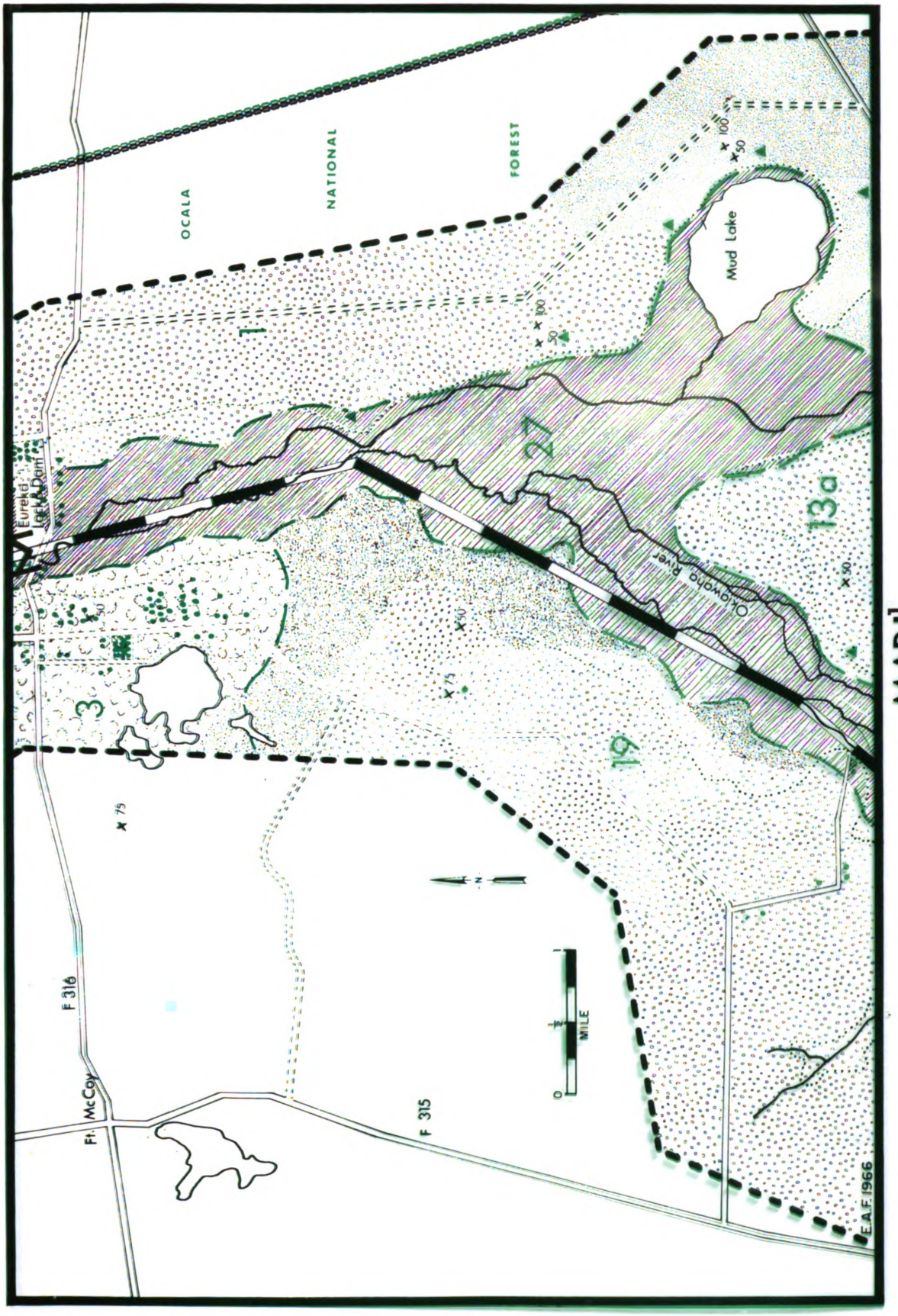

OCALA
NATIONAL
FOREST
Lake Eaton
Lake Charles
Ocklawaha River
MILE
F40
F316
E.A.F. 1966
MAP H1/2

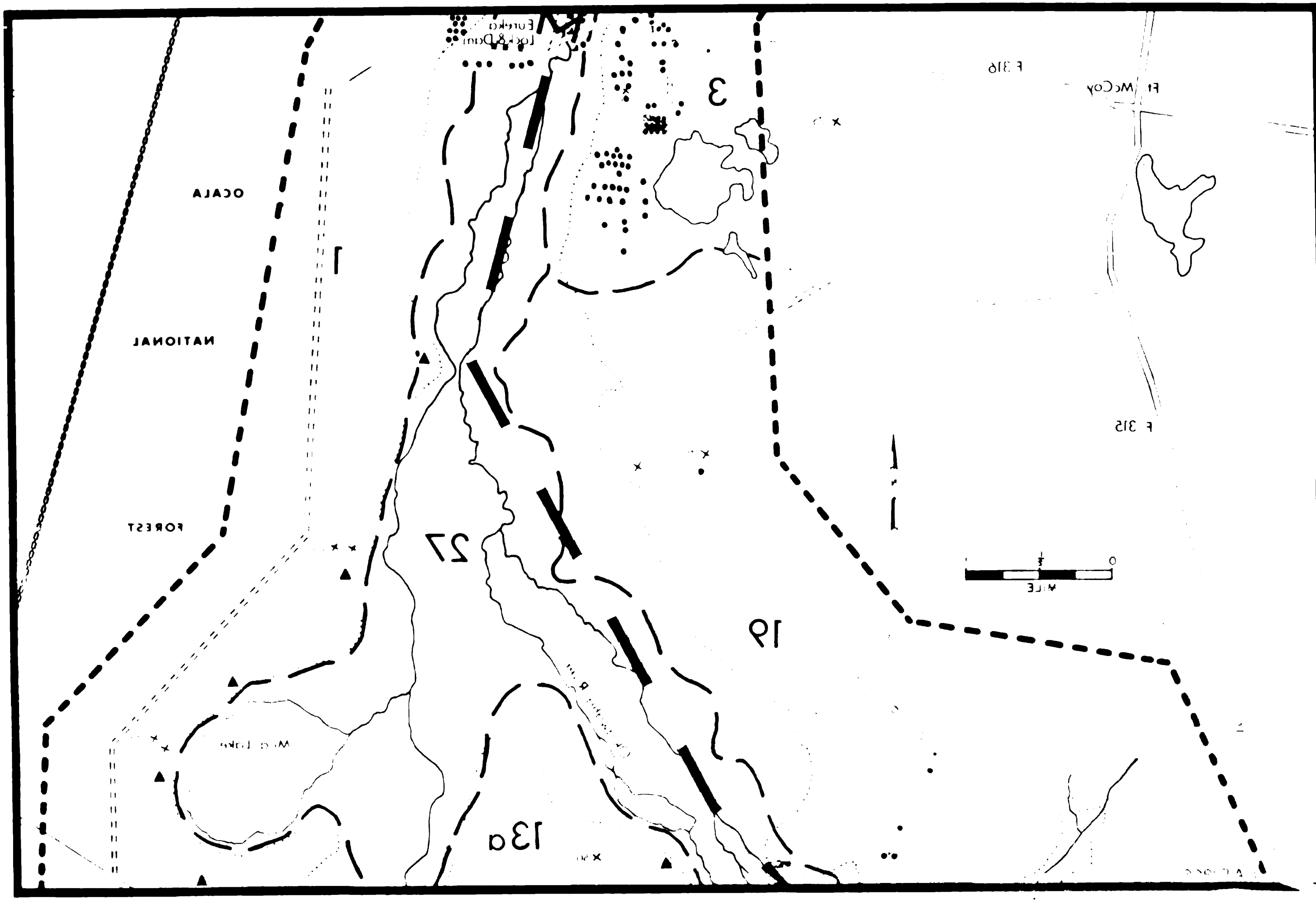

OCALA
NATIONAL
FOREST
1
Lake
Eaton
Youth
Camp
3
13a
13a
3
27
Lake
Charles
3
13a
19
27
19
Oklawaha River
Grahamsville
F40
F315
MILE
E.A.F. 1966

MAP H2

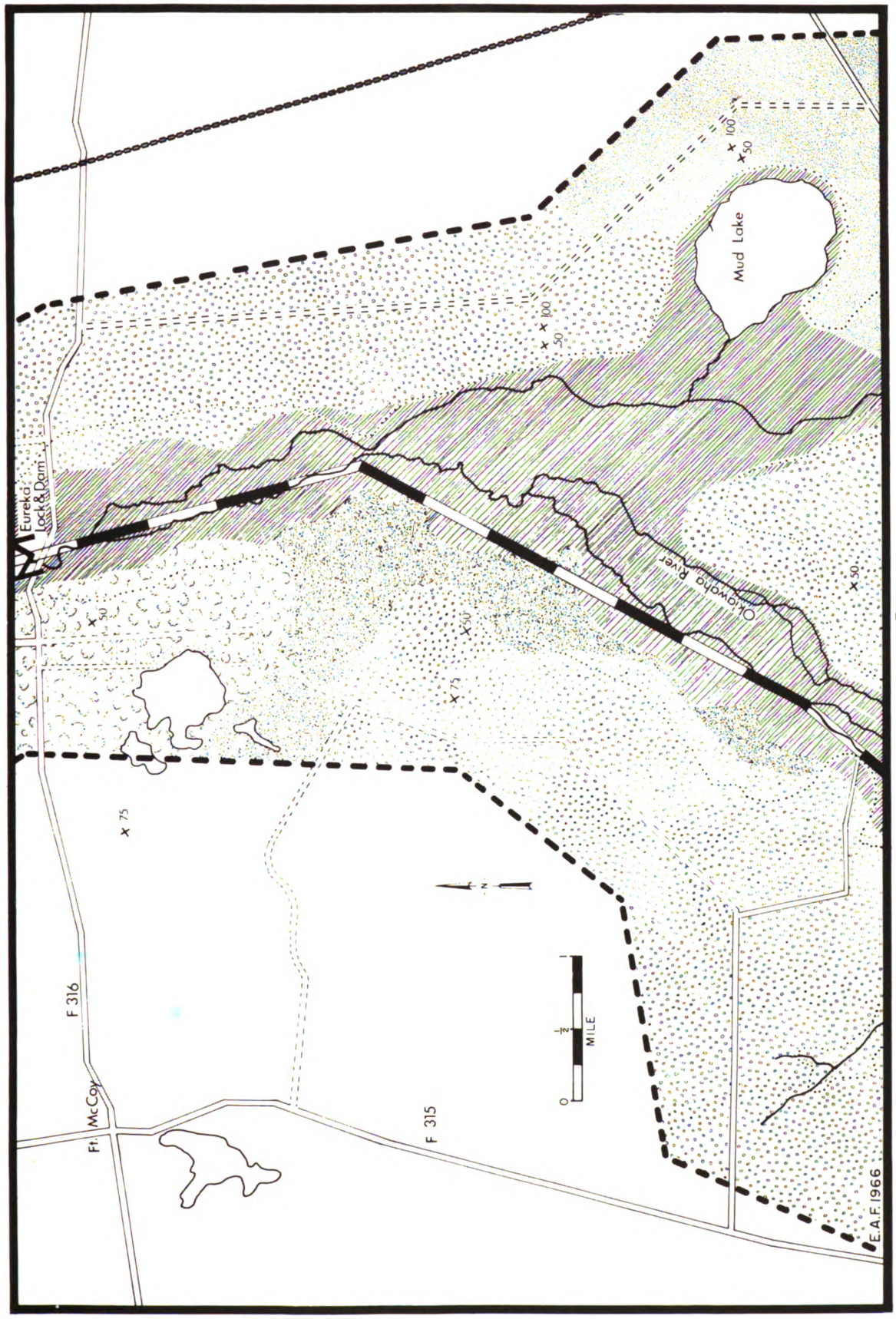

E.A.F.1966
Lake Eaton
Lake Charles
Oklawaha River
F 315
F 40
MILE
0
½
N

MAP H1

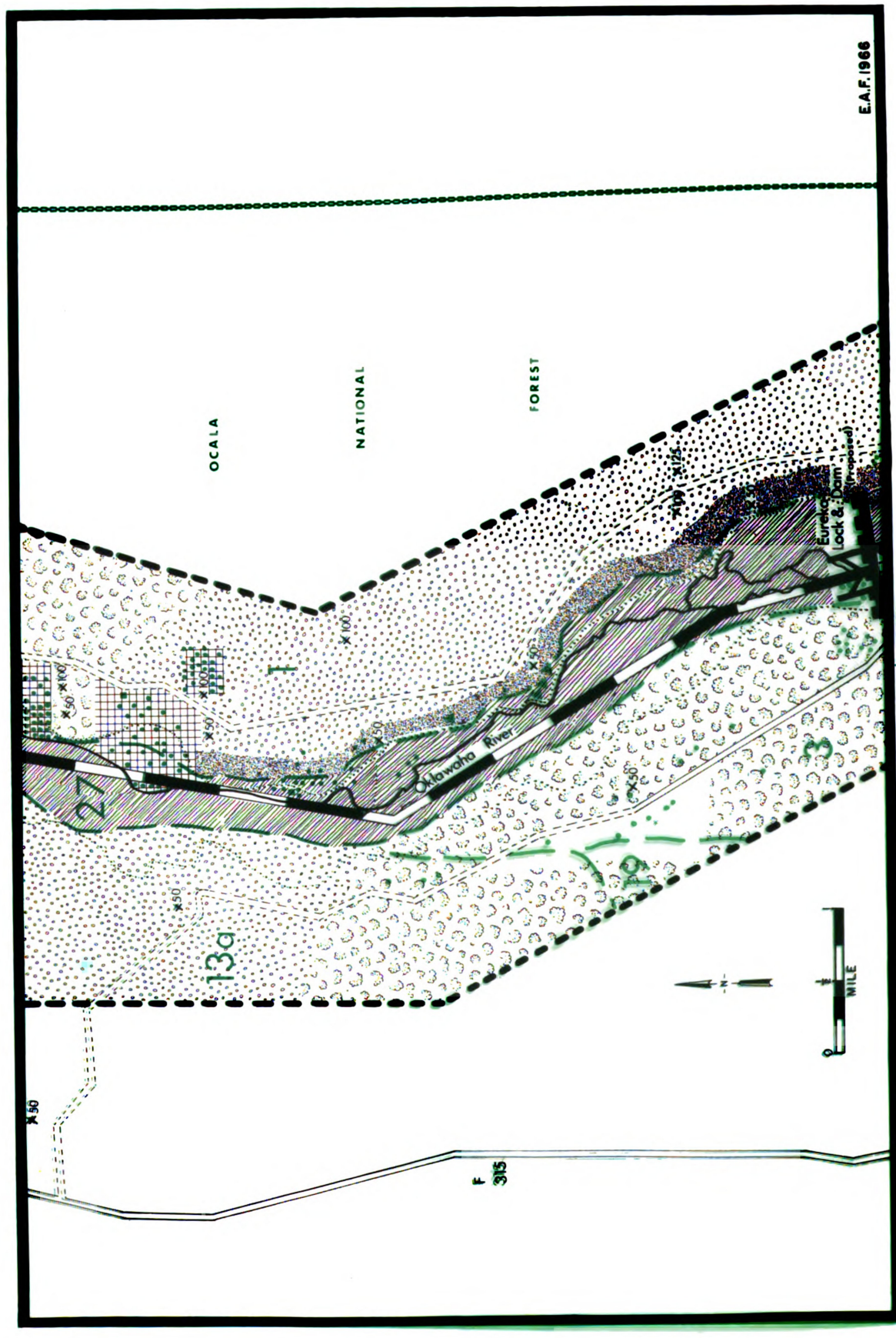

OCALA
NATIONAL
FOREST
Mud Lake
Ocklawaha River
Eureka Dam
Fl. McCoy
F 316
F 315
MILE
E.A.F. 1966
MAP 1½

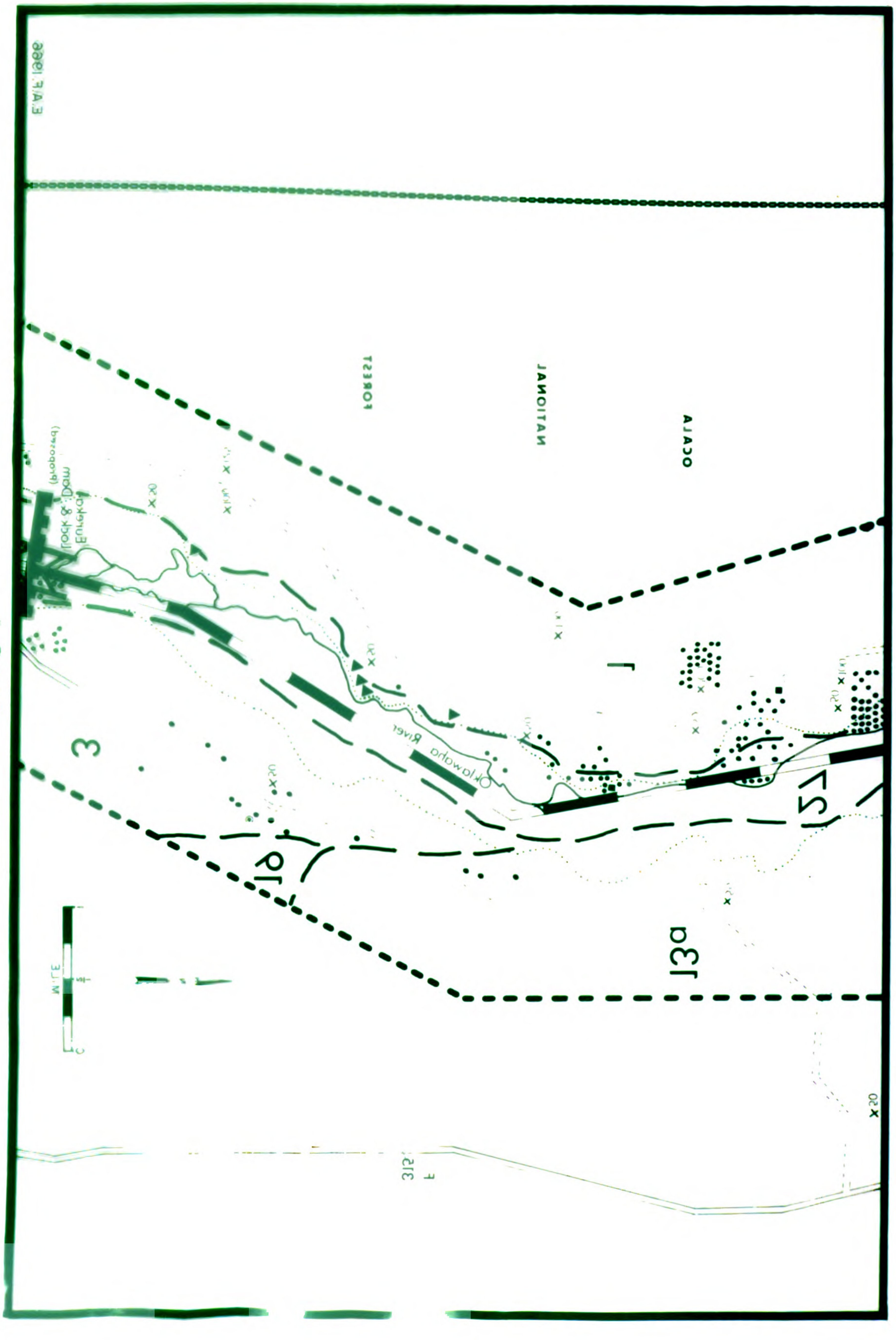

OCALA
NATIONAL
FOREST
Eureka
Lock & Dam
3
1
27
19
13a
F 316
Ft. McCoy
F 315
MILE
0

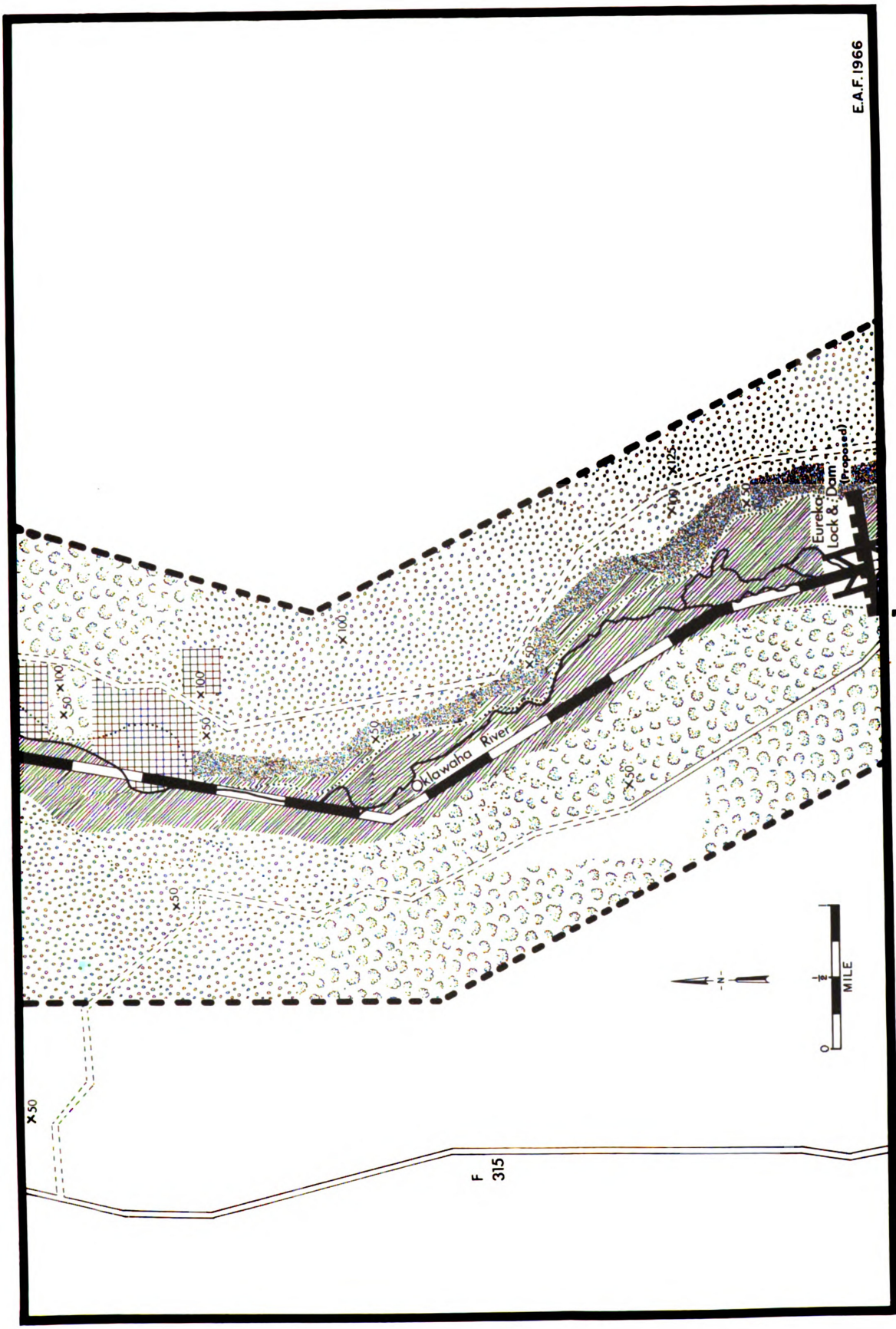
MAP 12


Eureka Lock & Dam
Mud Lake
Okaw River
F 316
F 315
Ft. McCoy
MILE
E.A.F. 1966

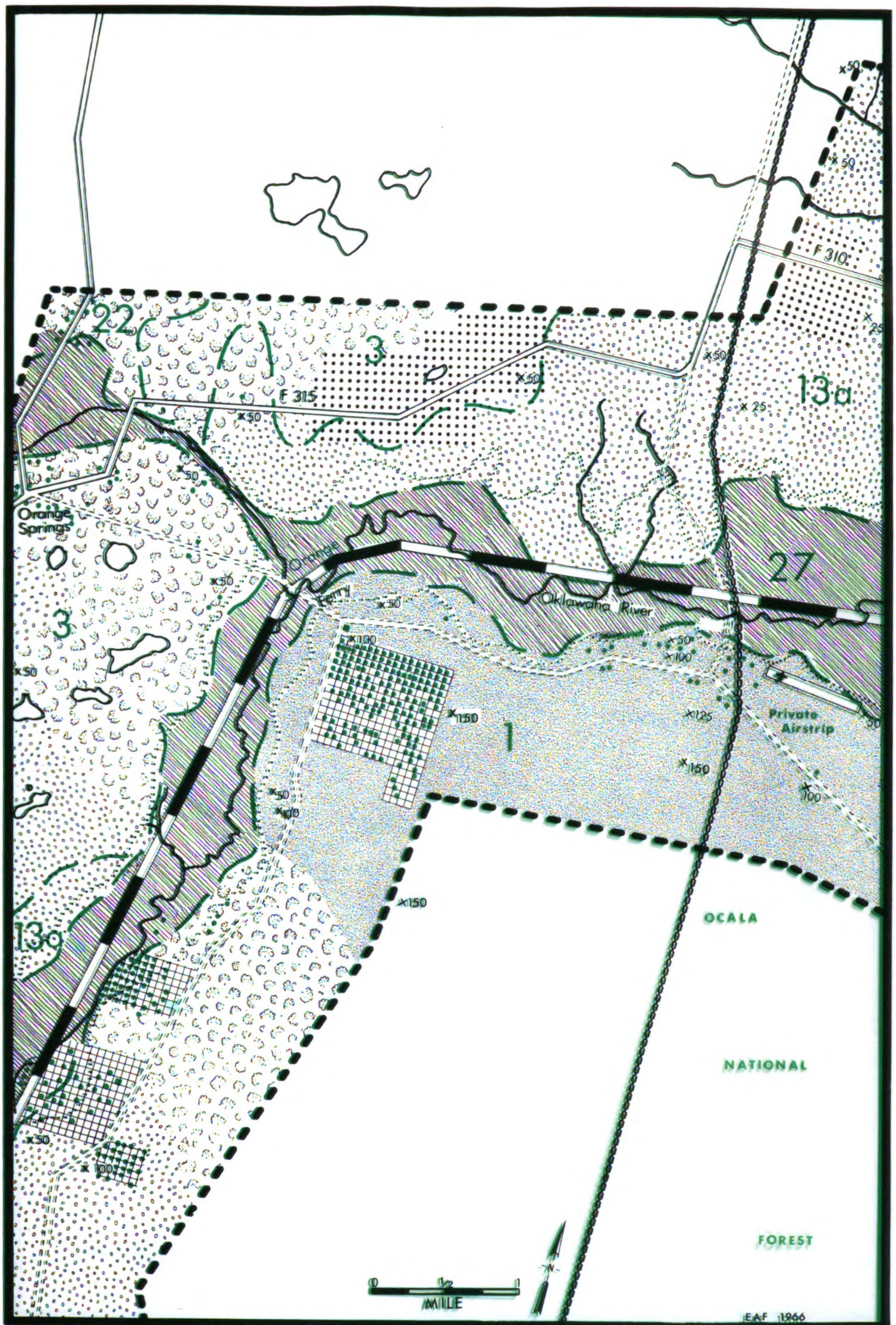
MAP I[1]


E.A.F. 1966
OCALA
NATIONAL
FOREST
Eureka Lock & Dam (Proposed)
Oklawaha River
27
13a
1
3
F 315
MILE
MAP J2


OCALA
NATIONAL
FOREST
Oklawaha River
Eureka
Lock & Dam (Proposed)
3
1
13a
19
27
315
MILE
E.A.F. 1966
MAP 2

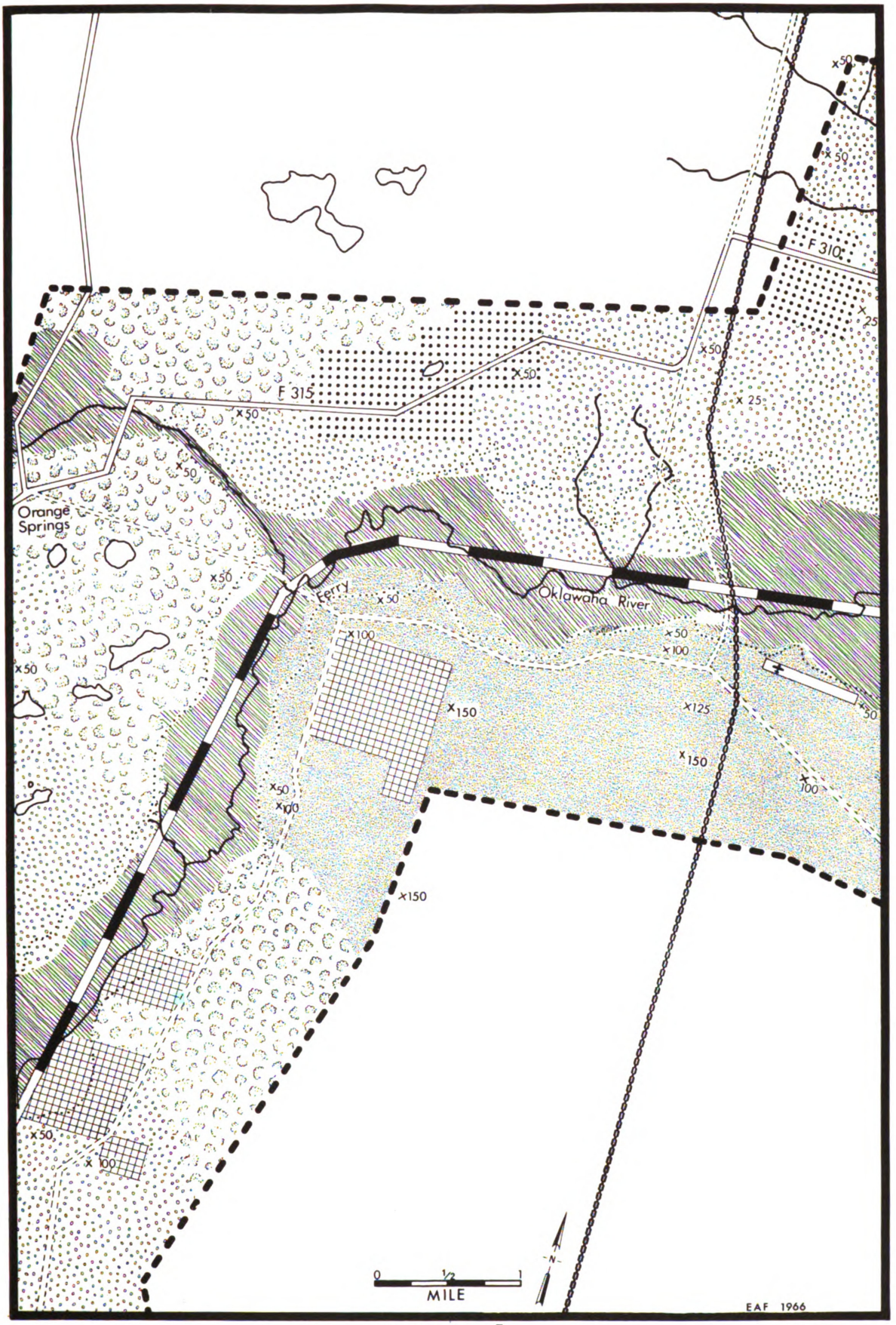

E.A.F. 1966
Oklawaha River
Eureka Lock & Dam (Proposed)
F 315
N
0
½
MILE

MAP J1

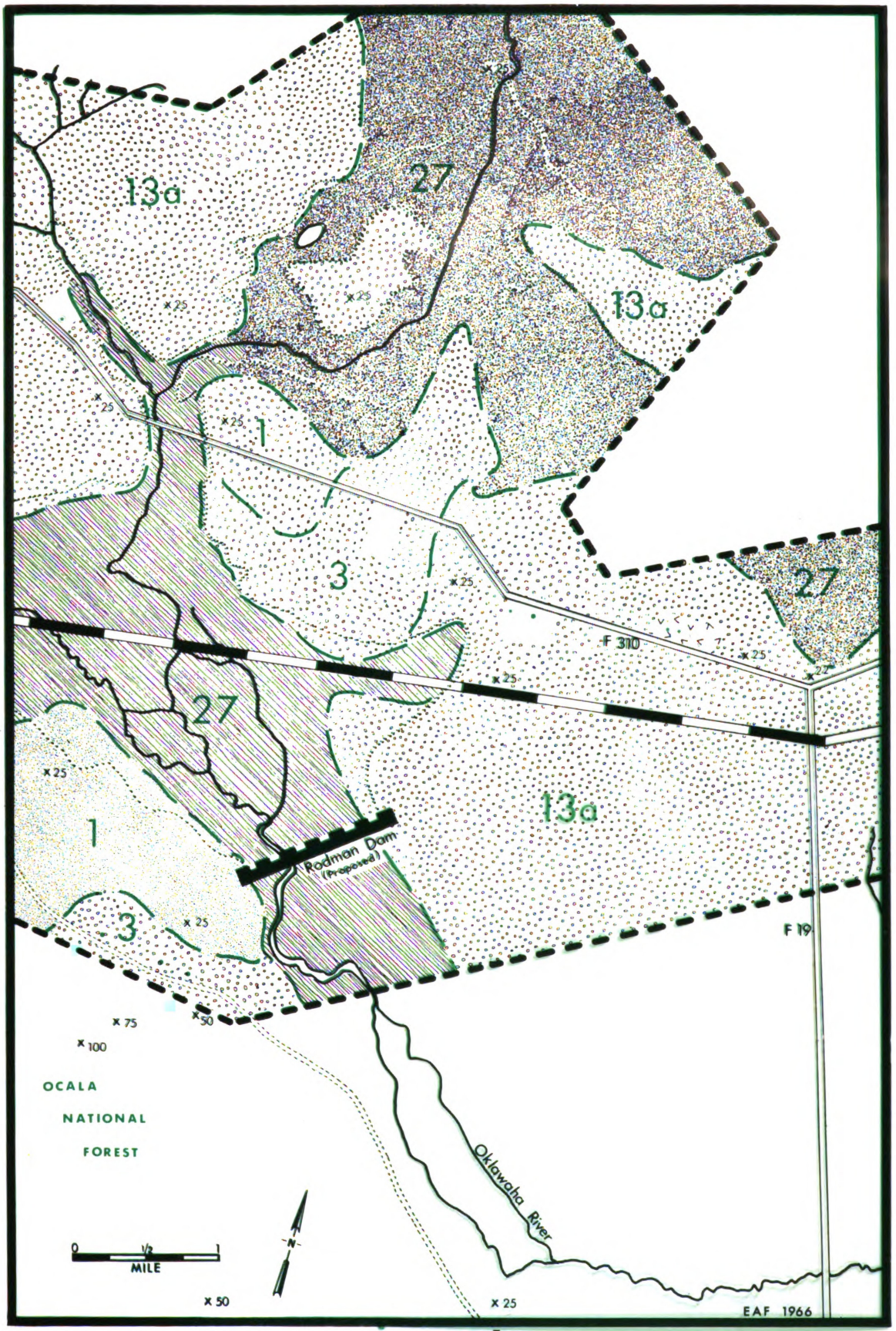

F 310
F 315
22
3
13a
27
1
13c
Orange Springs
Orange Springs Ferry
Oklawaha River
Private Airstrip
OCALA
NATIONAL
FOREST
MILE
EAF 1966

MAP K$_2^1$

27
13a
3
F 315
Orange
Springs
Orange
Ferry
Oklawaha River
Private
Airstrip
1
OCALA
NATIONAL
FOREST
13a
3
27


F 310
F 315
Orange Springs
Ferry
Oklawaha River
x50
x100
x150
x125
x25
0
1/2
1
MILE
N
EAF 1966

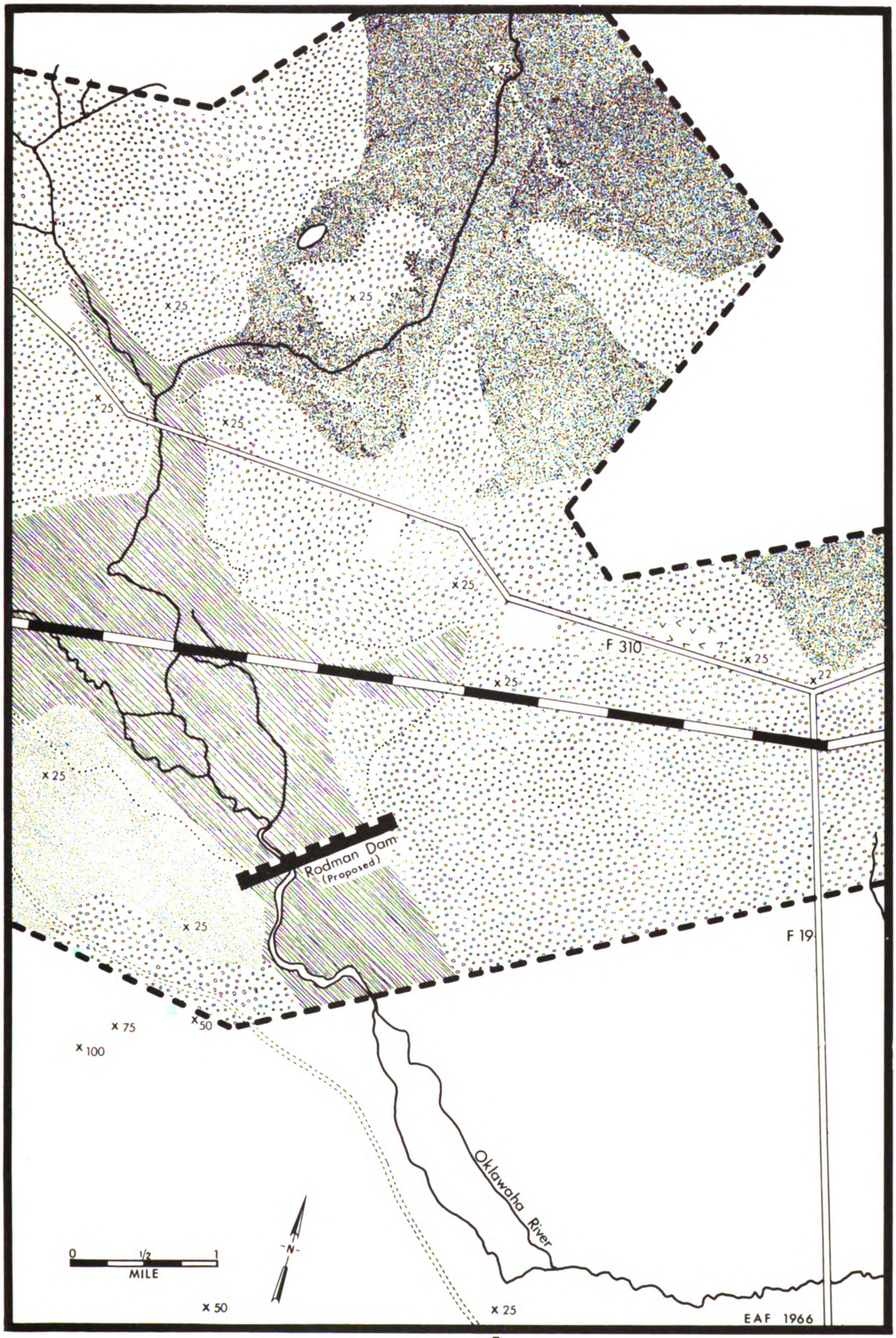
MAP K[1]


13a
27
13a
1
3
27
F 310
27
27
13a
1
Rodman Dam
(Proposed)
3
F 19
OCALA
NATIONAL
FOREST
Oklawaha River
0 ½ 1
MILE
N
EAF 1966

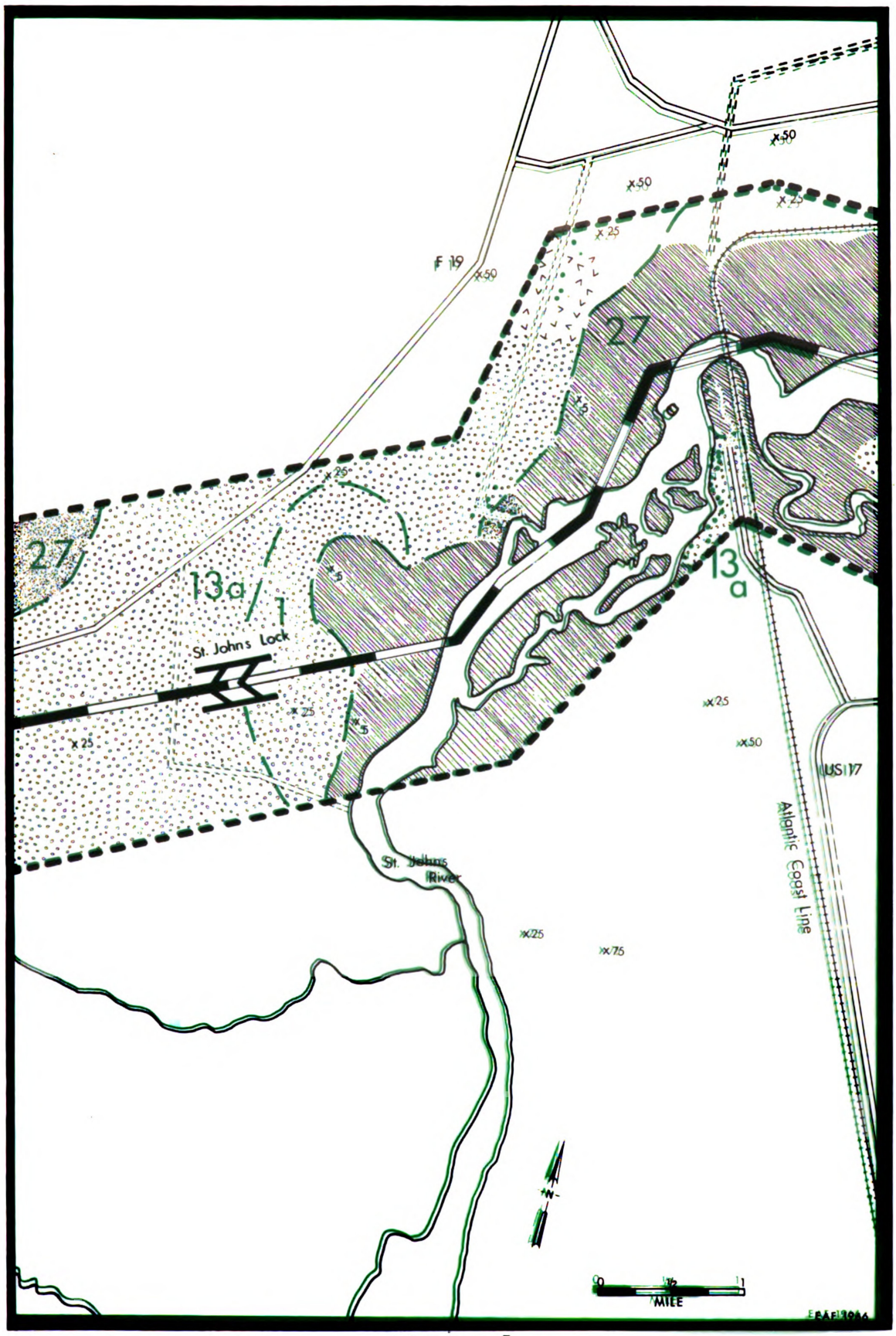
MAP L 1/2

13a
27
13a
1
3
27
27
13a
1
3
Rodman Dam
(Proposed)
OCALA
NATIONAL
FOREST
Oklawaha River
MILE

Appl 1

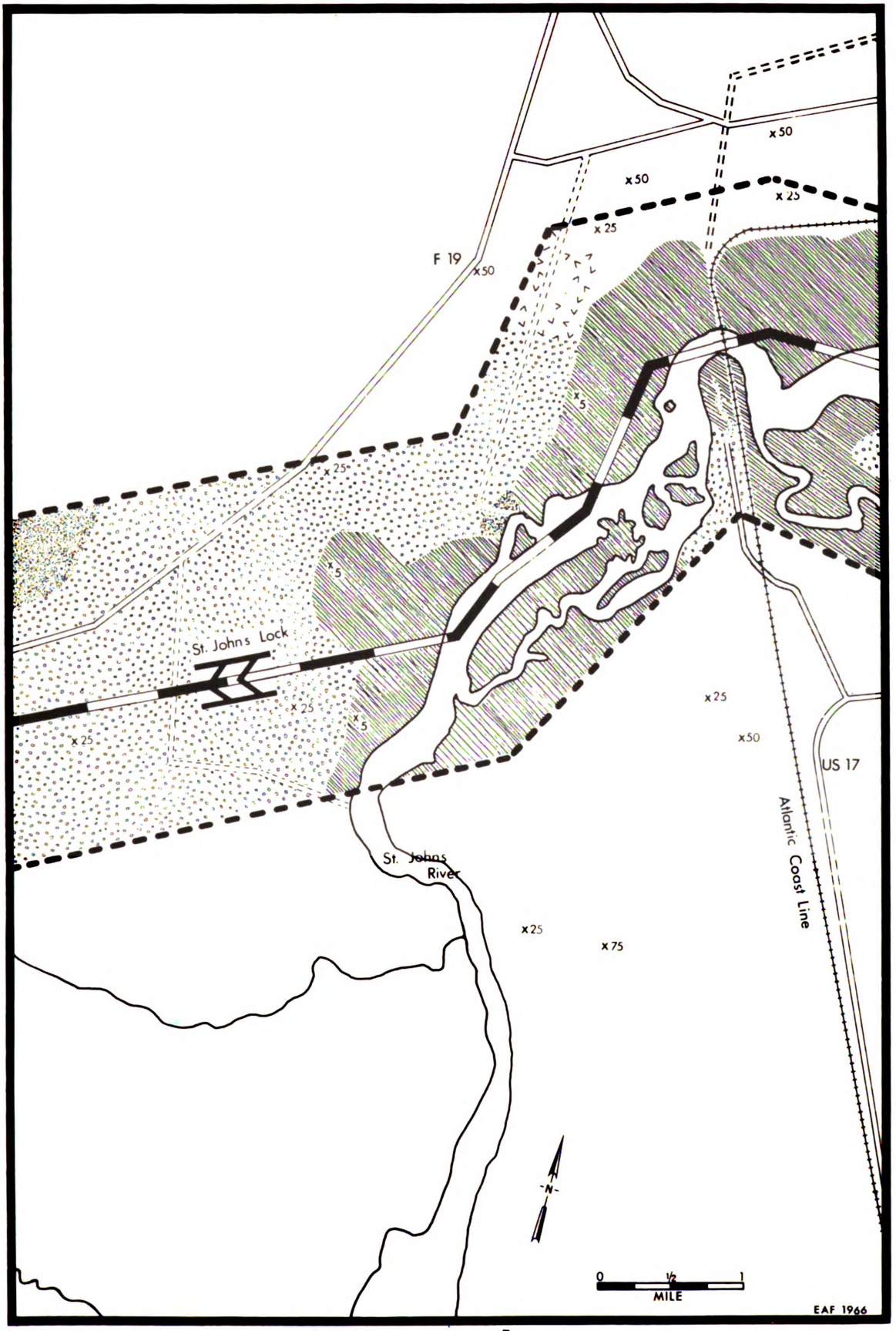

x 25
x 25
x 25
x 25
x 25
x 25
x 25
x 22
F 310
x 25
x 25
Rodman Dam
(Proposed)
F 19
x 75
x 50
x 100
Oklawaha River
0 ½ 1
MILE
N
x 50
x 25
EAF 1966

MAP L[1]


F 19
27
27
13a
1
St. Johns Lock
13
a
US 17
Atlantic Coast Line
St. Johns
River
MILE

MAP M12

MAP M2


x50
x50
x25
x25
F 19
x50
x5
x25
x5
St. Johns Lock
x25
x25
x5
x25
x50
US 17
Atlantic Coast Line
St. Johns River
x25
x75
N
0
½
1
MILE
EAF 1966

MAP M[1]

CHAPTER IV

MAN AND HIS WORKS

Although the natural characteristics of the land were discussed first, and the important relation between the land and man is acknowledged, it must be realized that man is the most important of the phenomena on the land. Man is independent of his environment to the extent that he can modify it. A human's ability to think allows him to plan and evaluate his use of the space in which he lives. The proper application of this talent can lead to wise land use, whereas a lack of it can culminate in the desecration of the land. This chapter, in concert with the inventory maps, helps to further explain the present use of the land inventoried by analyzing the cultural features of that space.

Population and Housing

Permanent inhabitants in the study area number approximately 3,913 (Table 3). All of these, in agreement with United States census definitions, are rural folk in that there is no concentration totaling 2,500 people. Dunnellon, the only town, has a populace of 1,150, while the village of Inglis consists of 300 persons, according

TABLE 3

SELECTED POPULATION AND ECONOMIC DATA, 1966
(Estimated Numbers Based on Field Work, Interviews, and Available Statistical Sources)

Map	Permanent Population	Average Persons Per Permanently Occupied Dwelling	Number of Dwellings	Dwellings Permanently Occupied	Retired Occupants	Economic Enterprises (including farms)	Jobs Provided (including farms)	Farm Workers	Farms
A	180	3	75	60	24	20	50	0	0
B	829	2.6	456	319	239	13	26	7	7
C	1443	3	534	481	72	125[a]	650[b]	9	6
D	6	3	2	2	0	1	1	1	1
E	414	2.3	191	180	98	27	51	23	12
F	262	3.5	77	75	25	7	8	6	6
G	162	2.5	73	65	21	37	168	1	1
H	84	2.4	44	35	20	1	2	0	0
I	149	2.1	101	71	55	7	8	2	2
J	165	2.3	135	55	20	2	2	1	1
K[c]	138	2.1	234	66	44	4	4	0	0
L	16	2.6	8	6	3	3	4	4	3
M	65	2.1	35	31	23	3	4	1	1
TOTALS	3913	2.57	1965	1446	671	151	978	55	40

[a]Includes an estimated 111 enterprises in Dunnellon.
[b]Includes those in Dunnellon based on Chamber of Commerce 1966 estimates.
[c]Does not repeat information duplicated on previous Map J.

to the 1966 estimates of the Florida Development Commission. An estimated 200 of the residents of Inglis live within the boundary of the study (Map A).

There are fifty-five farm families in the area. The designation "farmer" is given to persons who make over one-half of their income working on a farm. It includes laborers, owners and retirees who work a farm as a commercial enterprise rather than as a hobby. These farmers worked on the forty farms indicated by farmers' dwellings on the inventory maps and on farms just outside of the canal zone.

Excepting residents of Dunnellon and Inglis, approximately 2,343 rural non-farm persons live permanently in the area studied. The figures regarding population and dwellings were derived from field mapping and interview sources. Table 1 presents selected population and economic data for the tracts shown on the inventory maps A-M.

Population density has seasonal variations due to the movement of tourists and sportsmen in and out of the area. On Lake Rousseau (Map B) and in the Ocala National Forest (Maps G-L), there are numerous structures which are seasonally occupied. Many of these are trailers; some are temporary in design and construction, and most of those on the Oklawaha River are not located on public access roads. Therefore, the dots representing structures on the east side of the river on Maps I-K are somewhat general in location. They have, however, been verified through interviews with local people as being approximately situated.

Summer is the season when up to eighty percent of the cottages on Lake Rousseau are occupied, while the cabins in the forest are more nearly full during the fall and winter hunting seasons. During July, August, and through the Labor Day weekend, the subject population is at a maximum of nearly 5,000 persons.

By actual count outside of Dunnellon, and based on a ratio of one dwelling to each 3.2 persons for that town, there are 1,965 dwellings in the study area (Table 3). This number does not include the separate living units in motels and fishing camps, but it does include individual house trailers.

Over eighty percent of the dwellings are valued at less than $10,000 and more than half of these at $5,000 or below. This low value is explained in three ways. There are many old houses that have deteriorated in worth; many of the living quarters are hunting and fishing cabins not built for permanent tenants; and, finally, there are hundreds of house trailers, both for temporary and lasting occupancy. An agglomerate of slum housing exists in Citrus County just south of Dunnellon (Map C) where approximately 200 Negroes live in about fifty dilapidated homes. Here, according to homestead exemptions claimed, only forty percent of the dwellings are owned by the occupants. This is the only area where non-owner lodging is characteristic.

More expensive homes, valued between $10,000 and $20,000, are for the most part found in four clusters. One is at the eastern end of Lake Rousseau, on the south shore; a second is on the Withlacoochee River and Blue Run at Dunnellon; a third in Silver Springs; and, the fourth at Grahamsville, in the Ocala National Forest. One development of homes all valued above $20,000 is Vogt Springs, less than a mile west of Dunnellon on the north bank of the Withlacoochee.

It must be noted that, while generalizations given here are valid, some variance does occur. Less than half of all the dwellings are serviced by paved roads, and curbs and sidewalks are to be found only in Dunnellon and along the highway through Silver Springs. There are no subdivisions where two or more homes, built for speculation, are available to the public. This points out the fact that the people coming into the region tend to want a retirement or recreation dwelling in the woods, close to water, or near open fields rather than have it a part of a uniform, suburban subdivision. Several non-retirement and non-recreational subdivisions are shown on Maps B2 and C2. They either have no buildings at all, even though they were opened in 1965, or they have grown slowly and homes consist of trailers and low value houses ($5,000 or less).

Housing is an index of the income status of the population. In the project area, per capita income is

approximately $2,065.[1] This is below the 1964 state average of $2,273, but is above the averages for the counties which the canal route traverses. These are Citrus, $1,458; Levy, $1,494; Marion, $1,699; and Putnam, $1,692.

Recreation and Tourism

Although income totals are not available for the study area, income sources can be identified. Of major significance are retirement funds and money from tourism, recreation, and agriculture. Of less consequence, but still important, are earnings from retail sales, forestry and mining. Several of these sources, such as retirement, recreation and tourism are closely related, and all influence retail sales in the area.

Inglis and Dunnellon benefit from the highway-oriented tourist trade using U.S. 19 and U.S. 41 (Fig. 1). These routes are heavily traveled by northern tourists who visit Tampa and St. Petersburg, each about ninety miles south, and Florida's lower Gulf Coast. Dunnellon has six motels and Inglis three, as well as service stations and

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[1]This per capita income figure was established in consultation with Dr. John Boynton, Director of Research, Florida Development Commission on December 16, 1966. It is based on forty-five percent of the population being retired. Development Commission research has set the estimated retirees per capita income at $3,000 per year. This was averaged with the remaining fifty-five percent of the population who have an estimated $1,300 yearly per capita income. The low $1,300 figure is influenced by the estimated 150 Negro families and many white families whose income depends on often spasmodic laboring jobs.

restaurants. The canal-zone areas east of Dunnellon do not benefit as much from the highway traffic due to the existence of service facilities in Ocala and Palatka.

Rainbow and Silver Springs are special tourist attractions that have limited impact in the project region. Although 1,750,000 persons visit Silver Springs each year their economic contribution is negligible along the proposed canal route. The financial benefits are enjoyed by the owners of the vast enterprise, the American Broadcasting Company, and by businesses located in the six miles west to Ocala. This is explained by the predominantly east-west traffic flow between Silver Springs and highways U.S. 301 and Interstate 75 and by the sophisticated publicity program of the city of Ocala.

Rainbow Springs, with a flow of 450 million gallons of water per day, is a much smaller tourist attraction than Silver Springs. Rainbow, while rich in natural beauty, has about 55,000 visitors per year, most of whom are tourists who stop as they drive south on Highway 41. In the fall of 1966 the springs were sold and the new owners have presented plans to develop both the physical facilities and the promotional program of the attraction.[2]

Nineteen fishing camps, four public boat ramps, two state roadside parks, and fourteen identified camp-sites in the Ocala National Forest indicate the organized recreation

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[2]Interview with James A. Sherrill, Manager of Rainbow Springs, Dunnellon, Florida, on December 28, 1966.

features between the St. Johns River and the Gulf of Mexico along the proposed canal route. These figures do not include non-commercial boat ramps, nor any of the private campsites in the area.

The small number of improved recreational sites correctly indicates that outdoor recreation is underdeveloped in this area. Three basic reasons for this condition have been: the lack of population pressure in the immediate locale; the existence of many natural spots for outdoor diversion, to which the public has access; and the poor quality of many of the service roads to the potential locations. As stated in Chapter Three, present trends are reversing the first two of these reasons, while the third is being compounded because landowners are developing and protecting their land and this limits public access.

Each of the counties in the area has recently participated with the Florida Outdoor Recreation Committee in inventoring existing recreation facilities, and in preliminary planning for the development of public outdoor recreation land and accommodations in the state.[3] This study sets up general guidelines for construction and use of recreational areas but does not identify specific sites to be developed.

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[3]State of Florida, An Interim Plan for Comprehensive Outdoor Recreation Development in Florida (Tallahassee: Florida Outdoor Recreational Planning Committee, December, 1965).

The Ocala National Forest is prominent in the recreational picture. The Forest occupies the greater part of the land in the study area east and south of the Oklawaha River to Sharp's Ferry on Map G. The statement is general because there is a random pattern of small private land-holdings along most of the river. Two areas where several conterminous tracts are privately owned are at Grahamsville, where many individuals have small holdings, and along the river south and east from Orange Springs, where the Florida Power and Light Company is selling land as small campsites.

The Ocala National Forest plays a significant part in the recreational character of the region. The use of this land exemplifies the Forest Service policy of multiple-purpose development. The Forest Service manages the land "for the greatest good for the greatest number of people in the long run. The Service sees this as optimum land use and management."[4] Leases for supervised harvesting of forest products, recreational development for fishing, hunting, swimming, and camping, and forest management research are all activities in the National Forest.

The Forest is managed on a sustained yield basis in order to maintain the use of this renewable resource. Contracts are let by bids for harvesting wood. Twenty-five percent of the income is turned over to Marion County for

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[4]Interview with Robert Jackson, U. S. Forest Service, Ocala, Florida, December 29, 1966.

roads and schools, sixty-five percent goes to the Federal Government and ten percent is used as capital to develop the Forest. In 1965 Marion County received $66,556 from the U. S. Forest Service. No planted pine is found in the forest; all new growth comes from natural reproduction.

Congress appropriated money in the Forestry Multiple Use Act of 1960 for the development of small recreation sites. While several of these facilities have been developed in the Ocala National Forest, none is in the area shown on the inventory maps. Several will be developed in the future, however, at sites determined in cooperation with the Florida Outdoor Recreation Committee, the Corps of Engineers, and Marion County.

An economy, based primarily on income from retirees, tourism, and recreation has characteristic problems. The retiree, who in this area has a higher than average income, is a person who is not need-oriented. A retired couple buys few groceries, appliances, and fewer personal commodities than a young couple with children. In addition, their activities tend to provide few jobs for other people. The recreational and tourist sources are, at best, seasonal and always decline in the face of a national recession or even prolonged inclement weather.

Retail sales are an important factor of the economy as has already been pointed out. Highway-oriented establishments are most common, yet the general store, which usually

dispenses gasoline and oil, groceries and meats, some dry goods, and even hardware, also finds a significant place in the business of the area.

Town, Village, and Hamlet

Dunnellon offers the usual small town business establishments to serve the community and its umland, that is, its immediate surrounding area. Located here, for example, are five grocery and meat markets, four concerns selling dry goods and clothing, two drugstores, and two laundry and dry cleaning businesses. There has been a loss of three of these store types since 1962. Two groceries have closed and two have consolidated. One closed because of the widening of the highway on which it was located. If a new and desirable location is acquired, there are plans to reopen it.[5]

Dunnellon is pictured by its Chamber of Commerce in the Community Industrial Survey as a slowly growing town, with the rise in population credited to "natural growth - increasing interest in fishing and hunting facilities - retirees."[6] The report, dated 1962, notes that the trading

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[5]Interview with David Dickenson, City Clerk, Dunnellon, Florida, December 27, 1966.

[6]Dunnellon Chamber of Commerce, "Community Industrial Survey" (Dunnellon, Florida, March 15, 1962), p. 1. (Mimeographed.)

area for the community extends fifteen miles and that the annual dollar value of trade amounted to:[7]

Manufacturing	$100,000	Tourists	$800,000
Agriculture	$250,000	Cattle	$100,000
Lumber	$1,000,000	Mining	$200,000

While more recent data are not available, interviews with business and civic leaders show agreement on the following changes in the last four years. Manufacturing has advanced due to one new industry which has an annual payroll of about $400,000. Lumber, tourism and cattle have increased ten to fifteen percent while agriculture has decreased slightly. Mining has dropped to nothing as all mining near Dunnellon has been phased out, at least for the present. The companies are concentrating on mining areas south of Dunnellon at this time.

Jobs are provided for about 450 male and 200 female semi-skilled workers. An average of approximately fifty workers are unemployed, while nearly 100 others experience seasonal unemployment. The prevailing wage rates per hour, in Dunnellon, are: skilled, from $2.50 to $3.50; semi-skilled, from $1.50 to $2.50; and unskilled, from $1.25 to $1.50. No unions have been organized in the community.

Plant site information[8] shows the availability of industrial sites in abundance around Dunnellon with a unique

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[7] Ibid., p. 9.

[8] Ibid., pp. 7-9.

possibility for development at the abandoned Dunnellon airport (shown on Map C). This airport was built by the Federal Government during World War II and used as a fighter training base. It was transferred to Marion County when the local field was relinquished by the Air Force. After that the facility was used very little and was closed in the late 1940's.

Industrial services such as power, roads, water, sewerage and telephone are either existent or will be made convenient to prospective industry, according to the Mayor of Dunnellon.[9] To meet future needs of this section of Florida the Florida Power Corporation is scheduled to complete, in 1967, a multi-million dollar power plant at Red Level five miles south of Inglis (Fig. 1). The Dunnellon industrial survey suggests that the production of plastic and wood products would be the best suited industries to come to that town because of the abundance and variety of lumber nearby. Phosphate and lime rock minerals are listed as being available.[10]

In addition to two lumber mills a mile and one-half north of town, there is a precision tool and die company southwest of the city limits. This company is in Citrus County, but it is an integral part of Dunnellon's economy.

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[9]Interview with H. D. Edmonson, Mayor of Dunnellon, Florida, December 27, 1966.

[10]Dunnellon Chamber of Commerce, op.cit., p. 9.

It uses various types of steel raw materials from which are made dies and injection molds for the plastic and metal industries. Both the raw materials and the finished products are primarily transported by truck, although some are shipped by railway express.

The plant is in its present location primarily because of the amenities of central Florida. The founder had retired to this area, but became restless and established this plant where he could still enjoy the local sunshine and recreational opportunities. Low taxes, low wages, and an available labor supply were factors that made the plant development possible. The distance from the raw material sources and major markets was not significant because of the lack of bulk in the materials shipped. The fact that the local labor force was unskilled was satisfactorily solved through a work-training program. By early 1967 the plant will have doubled its 1966 workforce and payroll to about 100 workers and $800,000.

The company's vice-president states that as more aviation and space related enterprises come to Florida, their plant and other industries of a satellite nature, will prosper in central Florida. He also feels the company has helped the Dunnellon economy because it has provided good jobs that will keep the young people of the area "at home."[11]

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[11]Interview with A. P. Whitney, Vice-president of Ocala Precision Company, Dunnellon, Florida, December 28, 1966.

The Community Development Program of Dunnellon has been active in the last two or three years providing leadership toward improvement and initiating change in the town. Several local projects undertaken in the past two years are: four-laning of the main street (U.S. 41); a sewage collection and treatment system; development of three modern subdivisions; a new nine hole golf course four miles north of town; a new junior-senior high school; and, a new city hall. The widening of the main street is a factor causing most of the businesses there to remodel and rebuild the store fronts.

Similar efforts at community planning are not evident in Inglis or any of the unincorporated hamlets in the study area. As mentioned before, Inglis is almost entirely highway-oriented, Santos is both highway-oriented and a working class dormitory area for persons employed in Ocala. Each hamlet in the Oklawaha basin is dependent upon secondary highway traffic, sportsmen and retirement neighborhoods, such as Grahamsville, for their trade.

The City of Ocala, incorporating those characteristics and functions typical of its central location, has an influence on the people in the study area which varies with their distance away and their economic position in society. The attraction of Ocala diminishes past Orange Springs as the relative proximity of Palatka becomes a factor. The

same principle applies to the area west of Dunnellon as the towns and cities to the south meet the needs of the people.

In south and east Marion County the retiree who likes the rural atmosphere, whether it be a trailer lot or a farmstead, finds his limited needs are met by few trips to the town even though it may be less than ten miles away. The laboring man, who in many instances, has himself changed from farming or is one generation away, is able to commute to work each day and use the town to satisfy most of his shopping and entertainment requirements. He still is able to maintain a garden and follow other rural pursuits as he uses the city more.[12]

In both cases the pressure in the urban area for residential land and the existence of more cars and better roads has established a land use trend from agriculture to rural non-farm. The next probable use for some of this land will be suburban residential.

The recreation-oriented businessman is also influenced by Ocala through its functions as a wholesale and

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[12]Remainders of this rural past are two old cemeteries south of Ocala in the area shown on Maps E and F. Both are small, having less than one acre each, and neither has many identifiable graves (about twenty plots in one and twenty-seven in the other). The most recent date of death on a headstone in the George Fishburn burial ground (Map E) is 1905; the oldest is 1865. Interviews indicate that this is a Negro cemetery and the last burial was over twenty years ago. The Capulet graveyard (Map F) has only six markers dated since 1944, although one is 1966. Both sites are in disrepair and apparently have few visitors. Cattle run freely over the Fishburn burial ground.

retail center. It has a further role as the home of sportsmen who wish to participate in outdoor recreational activities. For all of these people the town also serves as a social and religious center.

Palatka serves to meet the needs of the residents in areas depicted on Maps L and M, and the pressure of an expanding population to change land use does not exist. The residences on the east and south bank of the St. Johns River are located there for recreational reasons. This section is almost exclusively a retirement settlement.

Transportation

Transportation in the project area is now largely north-south. Four major U.S. highways cross the proposed canal site and each runs north-south (Fig. 1). These routes, the nearby east-west roads, and their average daily traffic at selected locations in 1965, as shown by data taken from the 1966 Florida State Road Department "Frequency of Highway Use" map, are:

Highways with a north-south orientation--

U.S. 19 - south of Inglis - 3,610 vehicles
U.S. 41 - south of Dunnellon - 2,060 vehicles
Interstate 75 - south of Ocala - 7,025 vehicles
U.S. 301 - south of Ocala - 12,870 vehicles
Fla. 200 - south of Ocala - 2,505 vehicles
Fla. 315 - north east of Ocala - 510 vehicles
Fla. 19 - west of St. Johns River - 1,025 vehicles

Highways with an east-west orientation--

Fla. 40 - east of Silver Springs - 1,775 vehicles
Fla. 40 - Inglis to Dunnellon - 525 vehicles
Fla. 484 - east of Dunnellon - 767 vehicles
Fla. 488 - southwest of Dunnellon - 440 vehicles

The U.S. highways are heavily traveled by both tourists and routine intrastate traffic. Interstate 75 is a limited access thoroughfare and, like 301, is four-laned with north and south bound traffic lanes divided. Four-laning of U.S. 19 is in progress both north and south of Inglis but will not be completed until at least 1968 or 1969. The interstate has greatly reduced traffic on U.S. 41 and, with the improvement of U.S. 19 and a lack of this on 41, the traffic might diminish even more.

The east-west State roads tend to be narrow, have dangerously narrow shoulders, and sometimes be in disrepair. These highways meet the needs of the local inhabitants, but, if improved, could contribute more to the economy of the area as tourist routes. Few tourist-type advertisements on U.S. 19 or U.S. 41 encourage east-west movement, and large scale investment in improving these routes is not warranted under present use.

Automobile transportation in the canal zone adds to the economy because highway-oriented development exists to service north-south travelers going across the area. The local inhabitant and the lumberman or sportsman are adequately served, but the existing roads do little to encourage area development beyond providing good connections between the north and south.

Rail transportation is provided by the Atlantic Coast Line and Seaboard Air Line Railroad Companies. In

Dunnellon the Atlantic Coast Line main line provides freight trains each day and the Seaboard Company's branch line service has two. The major items of commerce are fertilizer inbound and pulpwood outbound. Additional freight and all passenger service available is through either Ocala or Palatka. Both railroads traverse the area shown on Map F, and the Atlantic Coast Line route south from Palatka is indicated on Map M. There are no scheduled stops made in the areas shown on either of these maps. Railroad freight rates in 1966 averaged fifteen mills per ton-mile, according to the Florida Development Commission.

Interstate bus service is available in each of the towns mentioned above and in Inglis, but air transport is limited to Ocala where Eastern Air Lines operates six flights daily. One trucking facility is located in Dunnellon and there are several in Ocala and Palatka. The average freight cost in Florida by truck transportation, according to the Florida Development Commission, is over fifty mills per ton-mile.

Agricultural Land Use

Agriculture is important to only a small number of people in the study area. The most significant agricultural operation is the raising of thoroughbred horses. While there are only three of these farms, all located on Map E, they represent over ninety such farms in Marion County. The

majority of these are west of Ocala and northwest of the three shown on the map.

Horses foal from January to May, and the colts nurse until September, when they are weaned and put out to pasture. In July, when the animals are slightly more than one year of age, they are fed in the barns, broken, and trained on the training track at the farms. Then, about the first of the following January, they are taken to the thoroughbred auction at Hialeah, Florida, for sale. These horses, depending on their breeding, physical qualities, and training times, will sell for prices ranging from $1500 to $30,000.

During the breaking and training period one man is needed for every four horses. The training is important and skilled trainers are in short supply. Although thoroughbred farms in Marion County range in size from 40-1600 acres, the average size is about 400 acres. The farm in the center of Map E is over 600 acres and the other two are under the 400 acre average. There are approximately 3000 thoroughbred horses in Marion County.

Cattle raising is also an important industry in southern Marion County. One large operation, with over 1000 head of cattle, is located east of the proposed Dunnellon lock (Map C). The only other large acreage of cattle pasture is west of Heather Island (Map F). Here, too, over 1000 head of cattle graze grass grown on the drained organic

soil. Several other cultivated ranges are identified on Maps C, E, L and M.

The most common cattle raised are specially developed breeds--Brangus and Braford. These animals are developed by crossing the Brahman, for its resistance to high humidity and parasites, with Angus and Hereford, for their beef-producing qualities.

Calves are born between January and March. They are pasture fed until October or November, when they are sold as feeder calves, at about 500 pounds, to be slaughtered locally or to be fed out in other states. Most of the animals sold for fattening are trucked out of Florida to Texas, California, or the mid-West. Few are fattened in Florida because of the high cost of imported feed. Hay costs $70 a ton and corn $1.55 per bushel in Ocala.

Corn is difficult to grow for feed in Marion County because of the lack of rainfall in the spring. Land used to produce corn in the county has decreased from 20,000 to 8,000 acres in the last six years, according to the County Agent.[13]

Bahia, coastal bermuda, and pangola are the basic pasture grasses; for enriching this forage such useful legumes as velvet beans, hairy indigo and Dutch clover are also grown. The improved pastures are plowed and planted

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[13]Interview with Carl Rowan, Marion County Agent, Ocala, Florida, December 29, 1966.

every three to four years. If the soil is sandy, lime and dolomite (calcium phosphate) as well as general fertilizer are needed for healthy grass growth.

No pasture in the region is irrigated because of the expense involved. If it were possible, both the cattle and the horse farms would benefit from this process because the grass often needs water in April and May. This is not the case in the Heather Island area, however, where the land is low and the major problem is drainage.

On most of the improved pasture in the study area, one cow and one calf need four or five acres for year-round pasturage with a minimum of commercial feed. This is true if about 400 pounds of general fertilizer is applied per acre. An intensive soil enrichment program may reduce this ratio to two acres.

Natural pastures do not exist here for commercial use. In the area mapped, between twenty to thirty acres of unimproved range are required to pasture one cow for a year, and on this type of land the cow puts on very little weight.

Supplemental feed used, in addition to corn and hay, is a mix of citrus pulp and black strap molasses. Both of these products come from south Florida and are trucked into the central part of the state. Though the pulp and molasses is not as high quality a feed as are corn or hay, it is much less expensive.

Of the several thousand acres of pasture land shown on the inventory maps, nearly all is semi-improved pasture. It has been cleared, usually to harvest trees, and in most cases it has been farmed. But today the planted pasture grass is not cultivated nor is fertilizer systematically applied each year. Some of this pasture is idle, but most of it supports a few cattle or horses which are raised for private use.

Sheep raising is a part-time activity on a farm at Rodman. Although not common in this part of Florida, it is a profitable enterprise. The animals are raised for their meat rather than for wool; however, fleece is acquired as a bonus. These livestock make good pasture partners with cattle, for they eat some grasses and weeds that cows will not eat. The problem of the sheep grazing the pasture too close is solved by providing good grass and eliminating the need for the animal to "skin" the ground.[14]

No special pasture is needed for sheep raising; however, careful attention must be paid to the curbing of parasites through the application of drugs mixed in the supplementary feed. Mutton markets readily in Ocala and Palatka after the animal is raised on pasture grass and then fattened for several months on commercial feeds.

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[14]Interview with W. W. Tilton, farmer and landowner, Rodman, Florida, June 14, 1966.

Vegetable and fruit growing, although very important to the economy of each of the four counties, is of little consequence near the proposed canal. Approximately 120 acres of watermelon, 30 acres of peaches, and 115 acres of citrus are grown south of Lake Rousseau (Map B) and in south Marion County (Map D). A few kitchen gardens of sweet corn, watermelon, beans, and sugar cane exist in a random pattern over the inventoried land, but they have no great commercial value.

Noticeable is the perfect negative correlation between the heavier, more fertile soils of Associations five and eight, and the location of commercial fruit and vegetable crops. The fact is that the crops are grown on very sandy, well-drained, infertile ground. This is indicative of an agricultural trend in several areas of central Florida today. Farmers use the earth for little more than structural support of the plant; they then apply a rigorous watering and fertilizing schedule to the crop. This provides a better check on nutrients absorbed by the plant, and it mitigates the problems of too much moisture and plant disease. This procedure involves a large investment, and because of only moderate success in the area, its future is limited here.

Moisture is controlled through the use of row mounds and a portable irrigation system. The latter utilizes a deep well, 40-60 feet, and aluminum piping and large

sprinklers. The pipes are fitted by section, are above ground, and can be moved from one part of the field to another as needed. As noted, the expense involved is significant.

Watermelons and the citrus crops, oranges and some grapefruit, are marketed by trucks. The melons go to the northern markets while the citrus is sent primarily to the concentrate plant in Ocala.

Peaches are still considered an experimental crop in Florida. Those grown in Citrus and Marion Counties are small and they bruise easily. The trees are susceptible to attack by insects, and need at least 200 hours of temperatures below forty-five degrees to achieve dormancy. The fruit has a good flavor, however, and is ready for market in April, six to eight weeks earlier than that from Georgia. Peaches from the study area are usually marketed locally or in the Tampa produce market.

Presently research is being carried on in the Agricultural School of the University of Florida to develop varieties of peaches that can mature in the warm climate and that will ripen at different times. The Tijon is the variety grown in the vicinity of the proposed canal, and its harvesting period lasts only one week. This guarantees pickers only about a week of work; therefore, pickers are hard to find.

Forestry as a Land Use

Lumbering follows recreation-tourism in economic importance in the study area. The forests provide the equivalent of approximately thirty-five full-time jobs for harvesting timber. There are only four continuously producing commercial tree stands in the inventory area. Pine and hardwood comes out of the National Forest and out of the area west of the Oklawaha River and north of Highway 40 (Map G). Pine is taken from the Heather Island area, and hardwoods come primarily from the hammock area south of Silver Springs.

Most of the hardwood cut is marketed at an Ocala crate mill. The pine used for lumber is also sold in Ocala, while the pulp logs, chips, and wood pieces, go by rail to pulp plants in either Palatka or Fernandina Beach, north of Jacksonville. Digging stumps is not allowed by either the Forest Service or by the private corporations which own the other commercial forest land. While stumping is profitable, because of the chemical extracts which can be taken from the stumps and roots, the practice leaves holes in the ground which present problems for future use of the land.

Forestry is particularly significant to the economy of Dunnellon. Two large lumber mills, located immediately outside of the study area north of the city, provide about forty jobs and produce construction timber for markets in

south Florida. The wood, almost exclusively pine, comes from forests within twenty miles north and south of the Withlacoochee River, but none comes from the area covered on the inventory maps. The planted pines identified on the various maps are from three to ten years old and therefore will not be harvested for pulpwood for at least another six years.

This analysis of the economy identifies land use as primarily recreation-tourist oriented with agriculture and timber as secondary, but important, uses. Only a very small percent of the area is intensively developed for any economic activity. An important factor is the multiple use of much of the land for various types of recreation along with either agriculture or forestry. Under present conditions these uses do not have much more population supporting potential, either for a larger permanent populace or for providing a high per capita income for the present inhabitants. A program to strengthen the economic base of the area is needed.

Taxes and Land Value

To plan for an increase in the population-supporting potential of a region, an important step is to gain an understanding of its political structure. It is through government that zoning codes, tax and safety programs, and most of the other service functions of society come. Politically, this area is under a county organizational system

executed by an elected board of county commissioners. Two commissioners, one from Putnam and one from Marion Counties, live in the project area. Dunnellon and Inglis have an elected mayor-council type of town administration.

City and county taxes and money from various state funds finance the local governmental operations. Historically the county real estate tax has borne the burden of most of the expenses since much of the highway and education budgets were county responsibilities. While the counties received state funds, they still had financial problems because of a low or out-dated property valuation and the need for a broader tax base. Many homeowners have paid little or no charge at all on homes worth ten to fifteen thousand dollars because the property was valued at fifty percent or less, and each resident owner claimed Florida's $5,000 homestead exemption.

Land values in the study area are characterized by the phrase, "it is worth what someone will pay for it." Landowners and tax assessors will not quote prices. Estimates from other persons tend to differ as they identify with either buying or selling. In 1960, before the proposed canal was begun, the following prices are reasonable examples for the stated types of land in the locations specified. They are estimates arrived at through interviews and by examining sales made in about 1960, of similar land away from the proposed waterway alignment.

Thus, the following can be given as the value of one acre in 1960: land south of Inglis was worth approximately $300; high banked land on Lake Rousseau sold for $800 to $1000, but the lower, wetter land for $300 to $500; high land away from the lake was priced from $150 to $250; high land near Dunnellon and south of Ocala was worth $300 to $400, and in Santos it brought around $200; dry non-timber land on Highway 464 was evaluated at $350; acreage for sale east and south of the Oklawaha River in the Ocala National Forest was valued at $350 to $800 depending on its site features and proximity to the river; waterfront property east and north of the river brought about $500, but that away from the water only $100 to $250; the sand pine land south of Ocala sold for around $100 and swamp forest from $20-$100. These amounts are general and do not include improvements or the presence of commercial timber which would raise the price about $200 per acre. Of course it must be realized that many factors, such as site characteristics, frontage on highways, relative location to cities or points of interest, etc., affect specific land values.

Following a ruling of the Florida State Supreme Court in 1964, most of the counties in Florida underwent, in 1965-66, a reevaluation of the property on their tax rolls. This was true of three of the four counties included in this study. Marion County was the exception. Provisions of a court order gave that county an additional year

to update the tax rolls on the basis that the tax assessor did not have time to accomplish the job for the 1966 assessment. This review furnishes a more equal appraisal of all land and provides a tax basis at a purported 100 percent of value. In the counties reevaluated, land contiguous to the proposed canal route was appraised at the same rate as similar land a mile or two away. In 1966, the general county millage assessed against each $1000 of property was: Citrus, 10.65 mills; Levy, 9.3 mills; Marion, 26.87 mills; and Putnam, 13.42 mills.[15]

In the recent past, land purchased 30 years ago would be taxed on the same valuation placed on it at the time of purchase, even though a contiguous tract was taxed at a much higher figure because it had been more recently sold at an increased price. This situation has encouraged, or at least allowed, some land to be held unproductive because the low tax did not encourage more profitable land use.

The Need for Planning

Land use planning, both on a county and municipal level, is either missing or inadequate. Marion County, with a federal grant from the Urban Renewal Department of the Housing and Home Finance Agency, developed a comprehensive

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[15]Fred O. Dickinson, "Analysis by County of Florida's 1966 Tax Assessment Rolls" (Tallahassee: Comptroller of the State of Florida, 1967), p. 2.

planning report for itself in 1963.[16] The use of this report has been limited to planning and zoning in an area five miles from the center of Ocala and for 500 feet on each side of "the main highways" in Marion County. To implement county planning in Florida, the state legislature must give its approval, and this has not been granted because of the lack of backing of the Marion County legislative delegation.[17]

Planning today in the project area consists of minimal municipal zoning in Inglis and Dunnellon and a strip 500 feet wide on each side of Highway 301 at Santos. The code here is for "general business (indoor-outdoor)." The same width strip is identified on each side of highways 75, 40, 200, and 315, and in each case is classified agricultural which is the minimal category.[18] No other land is under any zoning ordinances. Putnam County officials indicate that they will seek authority from the 1967 legislature to develop and implement a county development and zoning plan.

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[16]Board of County Commissioners, Marion County, Florida: A Comprehensive Planning Report, 1960-1975, by Robert G. Kelsay and Associates Planning Consultants (Ocala, Florida, 1963).

[17]Interview with John L. Hastings, Marion County Planning and Zoning Director, Ocala, Florida, January 12, 1967.

[18]Board of County Commissioners, "Zoning Regulations for Marion County" (Ocala, Florida, 1962), p. 29.

Conclusions

In summary, man's recognition of the natural amenities of the area and his use of the resource base has resulted in the development of an economy that is too heavily dependent upon retirement incomes, recreation, and a highway-oriented tourist trade. Although recreation is a rational use of the land, and the other two sources are desirable, the economy lacks a sound, diversified base which will provide steady employment for a young, educated (skilled), need-oriented population. Conditions encourage ambitious and schooled young people to emigrate to the larger cities. An increase in most present types of agriculture and lumbering industries is also not particularly desirable because of the low average income they provide.

Optimum land use at the present time is not entirely absent in the study area. Most phases of the economy are represented by one or more areas exemplifying wise use of resources under the conditions described in this and the previous chapter. Suggested use in agriculture is identified on Maps C, E, F and L as some land has been developed into excellent pasture through water control and cultivation programs. Examples of superior use of timber land are the Heather Island area and the area north of Highway 40 east of the Oklawaha River. Here careful management, protection, and cutting practices, plus the added hunting use, provide full utilization of the land. The Silver Springs attraction

(Map G) and the Lake Eaton Fish Management Area (Map H) are premium areas in recreation land use. Vogt Springs is a highly desirable residential subdivision with private planning and zoning regulations which protect the value of the land and its use.

Near-optimum use could be ascribed to a number of tracts of land in the inventory. The National Forest is one, but the Forest Service needs more men and money to implement the plans it has for the area. Several forest areas require only better management to provide maximum benefit at the present time. Silver Springs Corporation has plans to develop the swamp forest and hardwood hammock south of Highway 40 on Map G, and to provide jungle rides and picnic areas as an extension of their present development. Other wilderness tracts would be in best use if management practices were employed. Finally, several residential areas, especially at Grahamsville (Map G) and on the south bank of Lake Rousseau (Map B), are well developed, but they have no zoning codes and blight spots devalue each neighborhood.

Operational goals of society are identified by the planning it does. While not entirely lacking, neither the present land use patterns nor the few zoning regulations that exist are as sophisticated as they should be. Wholeistic planning, either as a program for a region, or as a part of county wide development, should be current and in effect.

Too many people erroneously see the mere advent of the Cross-Florida Barge Canal as a panacea for the economic ills of the region. In regard to land use, no plan has been developed to identify the factors which must be considered in directing the anticipated change. These factors will be discussed in the following chapter.

CHAPTER V

FACTORS TO BE CONSIDERED IN DEVELOPING AN OPTIMUM LAND USE MAP

Work began in 1964 on the Cross-Florida Barge Canal project. This waterway, when completed about 1973, will traverse the area analyzed in Chapters Three and Four. Its existence will affect a complex set of natural and cultural phenomena which will precipitate rather immediate land use change at a rate that is greater than normal for that area.

Since uncontrolled or undirected change often results in inefficient land use, a waste or misuse of resources, and, on occasion, harm to persons and property, efforts to provide a rational plan are highly desirable. The theme of this chapter will focus on those factors which must be considered in order to devise, in Chapter Six, an optimum land use map.

Physical, demographic and social, economic, and political factors must all be considered, not only in relation to the use of specific tracts, but in the context of an overall plan. The time dimension is also important. As Graham states,

> To think wisely of the future use of land, we must first look carefully at its past, for a knowledge of what has caused a landscape helps materially in judging its future.[1]

This has been done in previous chapters and serves as a basis for what follows.

In the intellectual model the canal itself is the major intervening variable. Maps A-M provide a portrayal of the waterway superimposed on the land as it existed in the spring of 1966. This immense project attests to man's technical ability to modify the physical environment in order to fulfill his objectives, but unless he applies himself to planning for land use change, harm can be done and many of the subsidiary benefits of the program will be lost. What, then, before the changes are examined, are some guidelines for land use planning?

Leadership and Goals

Though rural planning has not received the attention from geographers and others that urban and regional designing have, there are lessons that can be learned from those studies, and similarities that can be noted. First, the rationale of Kaplan, quoted by Mayne for planning in Puerto Rico, can be equally applied to both fields. Kaplan stated,

> Essentially, planning is a device for allowing many people of moderate skills to contribute to wise

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[1]Edward H. Graham, Natural Principles of Land Use (New York: Oxford University Press, 1944), p. 3.

> decision-making, rather than leaving it wholly to the great skill of a small group of leaders.[2]

In this chapter that rationale is followed by discussing important factors involved in land use change and by presenting the opinions and goals of many interested persons. Then, in Chapter Six, the citizens are supplied with a functional land use model for their action. Land use geographers and urban and regional planners follow this practice, and from them guidelines may profitably be taken to provide direction.

Land use development faces similar problems at every scale. In addition to gaining an understanding of the physical and cultural aspects of the environment, as important as that is, the planner, or model builder, must try to identify the "power structure" in the area, the prejudices that are apt to arise, and the possibility of a conflict in objectives. Further, the goals of optimum development and optimum land use should not be considered as synonymous.

The power structure includes leadership, both formal and informal, and what Mayne calls "operational authority": that is, legal, social and financial sources that must act or react to an implementation of a land use plan. Prejudices must be considered because people do not always make decisions

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[2]Abraham Kaplan quoted in Alvin Mayne, "Designing and Administering a Regional Economic Plan with Specific Reference to Puerto Rico," in Walter Isard and J. H. Cumberland (eds.), Regional Economic Planning (Paris: 1961), p. 142.

based solely on logical and factual motives. In regard to the problem of objectives, conflicts can arise between long and short range goals; for example, elected officials often are partial to immediate results. Other disagreements of aims may arise between the following: various governmental bodies, persons who back incompatible projects, an individual and society, and the relative roles of the public and private sectors.[3]

The choice of goals is itself a critical point in identifying desirable land use change. The goals must be based on the factors previously mentioned and they must not be set just because they bring about change. They must be more than one dimensional. For example, Leven points out that if securing the largest possible number of jobs for a region was the sole purpose of a plan, it would be achieved at the expense of other relevant goals, such as: 1. increasing the per capita income, 2. raising wages, 3. achieving stability of employment over time, and 4. a healthy, longterm growth of employment and income.[4]

A positive aim, on the other hand, is to consider the concept of multiple uses of the land. This is especially applicable to rural uses where a combination of

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[3]Ibid., pp. 143-147.

[4]C. L. Leven, "Establishing Goals for Regional Economic Development," Journal of the American Institute of Planners, XXX (May, 1964), p. 103.

several activities such as forestry, hunting, grazing, flood control, and others, might take place on the same land.

These affecters of land use change are vital, yet, as has been stated, the most significant variable is the canal itself. The structure and the alterations born from the construction and utilization of the navigable waterway will be examined next.

Physical Change

Approximately 100 miles of excavation will be required to provide a lock-level barge canal, with a bottom width of one hundred and fifty feet and a minimum depth of twelve feet, from the Gulf of Mexico to the St. John's River. Five locks, located near Inglis, Dunnellon, Silver Springs, Eureka, and near where the canal enters the St. John's River, will maintain the existing ground water levels (Fig. 2). Two dams will be built, one at Eureka and one near Rodman, on the lower Oklawaha River.

The Rodman structure will create a 9,350 acre reservoir, with a surface between twenty and twenty-four feet above mean sea level, and seventy-four miles of new waterfront. At Eureka, the new dam will result in an 18,000 acre pool thirty-eight to forty feet above the sea, and 108 miles of new waterfront. Remodeling to add two spillways to the existing dam at Lake Rousseau will leave the lake level there unchanged, at a height between twenty-four and twenty-seven feet.

Each of the five locks will be eighty-four feet wide, 600 feet long, and will provide a water depth of thirteen feet over the sills. These structures, through which lockage will be free for all craft, will be a part of a highly organized and coordinated traffic regulation system which will supply maximum efficiency for navigation. One wall in each closure has been designed to facilitate the building of a parallel lock if the future use of the canal warrants such a move.

In addition to the lockage facility, each lock site will include a park and picnic area, a scenic overlook, and other recreational facilities. For navigation purposes a mooring basin, a recessed area in the side of the canal, will be located at each end of the lock. The plan also calls for similar basins, with securing cleats, to be spaced along the entire length of the canal.

The Canal Authority of the State of Florida has the responsibility for obtaining the land required by the U. S. Corps of Engineers for the building, operation, and maintenance of the canal, including the pool areas. The various methods and consequences of land acquisition will be discussed in a later section of this chapter. These lands include: the right-of-way for the canal proper; spoil areas for excavated materials; the inundated areas in the reservoirs and the adjacent land that is either less than one foot higher than the maximum water level or within 300 feet from the water's edge, whichever expanse is greater.

Included in the right-of-way is the 200 foot-wide waterway channel, the sloping banks, and a flat berm, about seventy-five feet wide, at the top of each bank. Outside of the berm another 150 to 350 feet of land is required. This land may be unused or, as is true in the case of the first cuts, from the St. John's River west and the Gulf of Mexico east, it may be partially used as a spoil area. The width of the standard right-of-way will be between 600 to 800 feet.

Spoil areas are typed as temporary (or construction), and as permanent (or maintenance). These are needed because the construction, which includes the straightening and deepening of existing channels, requires the movement of nearly seventy million cubic yards of unconsolidated sediments and about eighteen million cubic yards of rock.[5] This spoil will be deposited, where necessary, in belts that run parallel to the canal ditch.

In the case of the construction spoil areas, the height and width of the resulting banks will vary according to the materials excavated and the type of digging process employed. Hydraulic excavation will tend to produce a lower, wider and better consolidated deposit than will the dry methods. In size, these mounds may vary both in width,

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[5]Robert O. Vernon, "Trans-Florida Barge Canal" (Tallahassee: Florida Geological Survey, 1959), p. 11. (Mimeographed.)

with some reaching nearly 1000 feet, and in height, from ground level to about thirty feet. Certain areas will not require any excavation; in others the excess material may be used to fill in tracts of low land. The temporary or construction spoil areas outside of the right-of-way, may be returned to the title holder after the specified life of the easement.[6]

The permanent or maintenance spoil areas will be separate blocks, generally square or rectangular in shape, and may be ten to fifteen acres in size. The number and location of these will be decided upon after construction is underway or completed. They will lie on either side of the canal and will be used for the deposition of materials excavated during maintenance operations after the canal is in service.

Contracts which are awarded for the construction of dams and locks and for canal excavation specify that the berms and spoil mounds must be landscaped. Grass and vegetation which will complement the natural setting will be planted and the spoil banks will be graded. These steps will not only add to the beauty of the project, but they will reduce erosion and provide for controlled drainage. Thus, unsightly piles of overburden will not exist, and if future land use is planned, the rock and dirt could possibly

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[6]The information concerning the types of land acquisition comes from, The Canal Authority of the State of Florida, "Land-Owners Information Bulletin No. 1" (Jacksonville, Florida, July 20, 1964), pp. 1-7. (Mimeographed.)

be placed in a manner that would be advantageous to future users.

Some Corps of Engineer plans for the physical characteristics of the reservoir pools must be considered in planning for optimum land use. In each pool the excavated material will be deposited to form beaches or to create islands, from about five to thirty acres in size, with low contours and gentle sideslopes. These features will also be landscaped. In each reservoir the amount of spoil will vary in relation to the excavation needed to produce a twelve-foot-deep channel. The surface areas of these backwaters, i.e., the water area between the locks, will be:[7]

Rodman Pool -	13,000 acres	
Eureka Pool -	18,000 acres	
Summit Pool -	2,250 acres	
Inglis Pool -	3,500 acres	(unchanged)
Total	36,750 acres	

This total area will exceed that of eighty-nine percent of all Corps of Engineers' projects in the United States.

Each reservoir before flooding will undergo several types of vegetation clearing. Some areas will be wholly cleaned out for boating, water skiing, and swimming, but others will be left uncleared to provide havens for fish

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[7]From a speech presented by Colonel R. P. Tabb, District Engineer, Corps of Engineers, in Jacksonville, Florida, September 22, 1966, p. 3.

nurture and improved fishing sites. Selective cutting will be practiced around the shorelines to leave the water-tolerant species of trees, such as cypress, gum, and bay, and to remove the underbrush and the species which would be killed by the water.[8]

The summit pool, the term applied to the stretch of canal from the Silver Springs lock to the Dunnellon lock, will necessitate a tremendous amount of excavation. This cut will have a bottom elevation of twenty-eight feet and will be carved through an area averaging about sixty-five to seventy feet above sea level with several knolls ranging up to thirty feet higher. In the portion of this reach, between Highway 301 and Interstate 75, preliminary plans of the Corps of Engineers include utilization of the spoil to construct scenic drives, bridle paths, nature trails, overlooks, and park areas.

The surface of this pool will fluctuate between forty and fifty-five feet elevation and will be maintained by water pumped from the flows of the Oklawaha River and Silver Springs. Water used by the Silver Springs lock will discharge into the Eureka Pool; then it will be repumped into the summit pool. The minimum-maximum range of fifteen feet in the height of the summit pool, with the normal surface below fifty feet, will adversely affect the water level in

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[8]Ibid., p. 4.

the Ross Marsh area (Map D) unless a water control study is made for that area. The minimum level of the marsh is about fifty feet and the maximum just over fifty-five feet.

Opponents of the barge canal have stated that the structure would impair the ground-water conditions both in the project area and farther south. Consulting engineers for the Corps of Engineers, the State Geologist, and the State Director of Water Resources, have assured the people of Florida that this fear is unfounded and that, in fact, studies indicate that the project will benefit groundwater conditions.[9]

Locks at each end of the canal will stop all encroachment of salt water. A continual fresh water discharge, through the Inglis Dam and Lock in the west, and the Rodman Dam and St. John's Lock in the east, will insure preservation of the present water characteristics in the St. Johns and Withlacoochee Rivers.

In the summit section the pool elevation of forty to fifty-five feet has been established to coincide with the natural fluctuation of the ground-water table. This groundwater is part of a low pressure artesian system which results from the heavy discharge of that water by large springs.

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[9]Giles L. Evans, Jr., Intracoastal Waterway, Cross Florida Barge Canal, Statement to Committees on Appropriations, 89th Congress, 1st Session, Concerning Appropriations for Fiscal Year 1966 (Jacksonville, Florida: The Canal Authority of the State of Florida, May 18, 1965), p. 7.

Since ground-water flows into this section of the state from both north and south, there is no way for the canal to lower the flow of water in adjacent areas. In fact, as the summit and reservoir pools impound water, the movement of water into the aquifer will outbalance the amount lost.[10]

The flow of water in the two river systems will be modified due to the project construction. The gradient of Silver Springs Run will be decreased by about two feet, and this will cause a minor decrease in the flow from the springs. In addition, the regulated outflow of the three reservoirs will allow man to control excess water during periods of potential flooding.

Other physical factors that must be considered when contemplating an optimum land use model are soil and natural vegetation. Although each will be mentioned later in the discussion of economic factors, several points can be made at this time. The only potentially productive agricultural soils that will be inundated will be the organic soils of Association 26. The others will be those of relatively infertile sand and swamp areas.

A more significant change will be the yet to be determined hundreds of acres of soil that will be covered with spoil. Nevertheless, according to the Corps of Engineers, most of this spoil will be capable of growing both

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[10] Ibid., pp. 8-9.

pasture grass, such as the hardy Pensacola Bahia, and various types of trees. The surface covered will therefore not be made unfit for productive use.

Primarily, the lands to be flooded contain the swamp-forest and hardwood-hammock type vegetation associations. Only a few of the most water-tolerant species, mainly the cypress, will continue to live in the water. As mentioned above, clearing programs will be undertaken in each reservoir. Vegetation native to the area will be planted on the spoil areas. This will include red maple, sweet gum, bald cypress, bay, dogwood, and pyracantha. The Corps has explained to a conservation group that,

> this planting, with the grassing, will enable a build-up of sufficient organic material to support other native grasses, trees, and shrubs which will eventually be brought to the areas by wind, water, and wildlife.[11]

Basically, the treatment of these spoil areas should result ultimately in their restoration to a reasonable semblance of their native state. This goal should be consistent with other uses, such as recreation and the development of a habitat that will provide food and shelter for wildlife.

A consideration of wildlife is necessary because the project will produce significant wildlife losses. A large portion of the two eastern pools will occupy private

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[11]From a speech presented by B. N. Goode, Planner for the Corps of Engineers, in Jacksonville, Florida, September 22, 1966, p. 2.

and Federal lands, administered for public hunting by the Florida Game and Fresh Water Fish Commission. The swamp-forest and hammock type habitats, which make up much of this area, are of substantially higher value in terms of wildlife than are the pine flatwoods on adjacent uplands. Except for these two pool areas (Eureka and Rodman), the canal will traverse game habitats of relatively low quality and value.

The life in the water will also be affected by man's modification of the environment. This is significantly more true of the Oklawaha River than of the Withlacoochee. In the latter case the level of the river is to be maintained at the present elevation, and the amount of excavation which would destroy fish-spawning beds in Lake Rousseau will be relatively small. Below the Inglis Dam the Withlacoochee will intersect the canal, but the movement of water from the lock and the dam will continue to provide normal flow in the lower reach of the river. In addition, the new pool level control system will ameliorate the high and low water conditions that are detrimental to aquatic life.

Obviously, the addition of some 30,000 acres of pool area to the Oklawaha basin will change the fish habitat in the valley. The Florida Game and Fresh Water Fish Commission feels that, if certain precautions are taken, the fishing use of the Oklawaha will be greatly increased in the long run. Paramount is the need to refrain from

depositing spoil in the existing river channel. The reason for this is to keep unchanged as much of the present spawning and feeding grounds as possible. A second need is to be found in a lesson learned when the Lake Rousseau backwater was created in 1910. Some areas should be left uncleared of vegetation, as was true of the earlier flooding, so that in the future portions of the Rodman and Eureka Pools will develop into excellent fishing sites as happened in the case of Lake Rousseau.

As the benefits of the newly impounded pools are noted, a major negative result should be considered. Foremost, to some individuals, is the fact that the "natural wilderness" quality of the Oklawaha will be destroyed. This, coupled with problems already discussed, would be enough reason for these people to want to stop the project completely. However, since the waterway is to be a reality in spite of their protests, plans should be made to protect the wilderness qualities of those stretches of the river just below the Eureka Pool and the eleven miles from Rodman Dam to the St. Johns River.

Project implementation should affect the area of the upper Oklawaha only in a positive manner. During periods of drought, it will hold water at a higher level than before, and during extremely wet periods the use of large spillways in the dams can better ward off floods than has been the case in the past. The lower portion of the river, however, could be damaged by the barge canal structures.

Although the Oklawaha below the Rodman Dam will be left in its natural state, as is highly desirable, care must be taken to regulate the flow of water over the dam in order to maintain the normal movement to the St. Johns River. If, during periods of prolonged drought, this flow were to be drastically reduced, the "natural wilderness" character and the fishing resources of the down-river area might be affected. The result could be an unfortunate by-product of land use change unless adequate steps are taken to provide for a sufficient minimum discharge over the dam to the St. Johns.

Accessibility

Accessibility is another factor to be considered in completing the waterway. Most of the larger problems will be met by building ten highway and three railroad bridges as planned. A number of problems of local access will remain, however. The residents along the Withlacoochee River, east of Lake Rousseau, and north of the canal (Maps B and C) must be provided with a remodeled bridge, as an island will be formed by the digging of the canal. A new road must be built for the occupants of the four homes east of Dunnellon south of the waterway (Map C). The system of access routes tributary to Highway 484 (Map D) will have to be modified to maintain the present level of access. Farther east, entry and exit will be very poor to the area between the canal beyond the Silver Springs Lock

and the Oklawaha River (Map G). These are some examples of circulation difficulties that construction of the canal will cause in the immediate area. There are others, as study of the maps will reveal.

Rail access will be of concern to industrialists who might wish to extend a line to the area north of the canal south and southwest of Inglis. That land will be an island, and the nearest railroad to the north is about twelve miles away; extending a spur from it to the canal would involve a bridge across the Withlacoochee (Fig. 3). An existing railway is located about seven and one-half miles south of the western terminus of the canal. This type of transportation is also about six miles distant at its eastern end (Fig. 3 and Map M).

Population and Income

Each of the problems and opportunities which will confront man because of the construction of the barge canal must be considered in light of the population that will inhabit this and adjoining land after the project is completed. What resources and goals will they have, or should they have, to develop the land? How many persons will be forced to relocate because of the opening of the waterway? How many persons will probably live in the area? The answers to these and other questions have been sought through research and by interviewing many persons, including those who now live on or near the planned right-of-way as well as those who represent the land owners and companies that have a

concern in the canal. Also consulted were spokesmen for the various governmental agencies that are in some way affected by the waterway project and whose duty it is to protect the public interest.

The phrase, "the public interest," represented the concerns of 5,805,000 persons in Florida in 1965. Of this number, 118,300 lived in the four counties which the canal will traverse and about 4,000 lived in the study area. By 1980, using 2.8 as the percent of annual change, the population of Citrus, Levy, Marion,and Putnam Counties will have increased to about 178,990. The figure, 2.8, is used as it was the average percent of increase in the four counties during the past five years. The total population in these counties was 103,460 in 1960, and 118,300 in 1965 (see Table 2).

TABLE 4

POPULATION

	1960	1965	Average % Annual Change
Citrus	9,268	11,800	5.4
Levy	10,364	11,500	2.2
Marion	51,616	62,200	4.1
Putnam	32,212	32,800	0.2
Total	103,460	118,300	2.8 (not a total)

Under normal conditions, which include a continuation of an economy based on recreation, tourism, retirement income, and some industry in Ocala, Dunnellon, and Palatka, the population of the study area should increase at about the same or at a slightly higher rate than that recently experienced. A three percent growth rate would expand the present permanent population of some 4000 to about 4636 by 1970, and 5371 by 1980. Most of these people would locate in the Withlacoochee Valley west of Dunnellon and in the ridge section east of Interstate Highway 75. This outcome is expected because these areas are close to the towns of Ocala and Dunnellon, and they are best suited to residential development owing to their generally adequate physical characteristics of elevation, drainage, and wooded condition. It is also true of these places that the present land use trend is toward greater residential use.

With the advent of the canal and the economic boost it will give, the population of the four-county area, based on the 2.8 percent annual increase, is expected to grow to about 135,800 by 1970 and to 179,000 by 1980. Although there is no formula which can accurately predict a specific rise in the number of people or even assure an expansion of any kind, studies give very positive indications that growth will come about. The Chief of Engineer's report predicts that the ten counties closest to the canal will show an

increase in population from 704,000 in 1960, to 1,065,000 in 1980.[12]

Further indications of population gain related to the advent of the waterway were obtained from interviews with leaders in business, industry, agriculture, forestry, and government. Although unrealistic claims were frequently made, competent real estate agents, businessmen and government officials agreed that the growth rates predicted in this study are reasonable. Specific examples of the expected increase in numbers will be described later in this chapter. The additional population pressure, both in and outside of the study area, will create an expansion of the competition for land.

Changes in the characteristics of the population will also have an impact on the use of land. The people who come to the area because of industrial growth, in response to the increased demand for service functions, and as the result of a more concerted effort to increase and upgrade the tourist and recreation facilities available, will tend to be younger than the present populace. They will have, on the average, more children, be more need-oriented, and live in $15,000 to $20,000 houses, rather than in a house trailer

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[12]Department of the Army, Office of Chief of Engineers, "Cross-Florida Barge Canal Chief of Engineers' Evaluation" (Washington, D. C., June, 1962), p. 7.

or a small retirement home or cottage, typical of the more self-sufficient and sedate retiree.

The wants of the younger families will create a need for land use for shopping centers, schools and the service businesses that are demanded by a growing populace. The influx of new people and the meeting of their needs will raise the per capita income to approximately the state average which, based on the present five percent average annual increase, would be $2636 by 1970 and $4298 by 1980.

These trends toward a younger population do not mean that the area will lose its older members, but rather that the proportion of senior citizens will decrease. Actually, they will increase numerically. Another group that will show at least a small increase will be that group of persons which is financially able to buy what is locally called a "ranchette," a relatively large acreage (five to ten acres) for a non-farm home. These people are not generally classifiable by age, but rather by their desire to live away from town and by their having the financial resources to enable them to fulfill this wish. Each of these kinds of residents must be considered in planning for optimum land use.

The segment of the population which will be most affected by the construction of the waterway is that group which must move because their homes or businesses are situated within either the right-of-way or the area to be inundated.

Their number cannot be exactly stated because the right-of-way lines had not been established from Eureka to the Inglis Lock at the time of this writing, in January, 1967. The situation is most serious, however, in the case of approximately eighty-two families who it is known will have to move. Many of these, about fifty, live in a run-down area just south of Dunnellon. These people are Negro and only about forty percent of them own their homes.[13] This is significant when considered in the context of the Canal Authority of the State of Florida policy for obtaining easements for canal land requirements, and of local segregated housing customs.

The general policy of the Canal Authority is to acquire all the needed land in fee. However, if the land owner desires to donate easements in exchange for certain access and canal use considerations at a later time, this may be done. Such a transaction must not entail any expense on the Canal Authority and must meet the requirements of the Corps of Engineers. Condemnation will be used only as a last resort.[14] In the case of all property the appraiser appointed by the Authority will set a fee, and the landowner

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[13]From an interview with Hugh C. Barco, Tax Assessor of Citrus County, Inverness, Florida, December 28, 1966.

[14]The Canal Authority of the State of Florida, "Canal Authority Right-of-Way Policies and Procedures for Acquisition of Cross-Florida Barge Canal Right-of-Way" (Jacksonville, Florida, April 13, 1964), p. 1. (Mimeographed.)

may accept it or appeal the amount before a judge and jury. When a home is involved, the owner may receive its cash value or the amount necessary to move and restore it to its original condition. The same is true of business property with compensation for business losses provided.

Problems of Relocation

A special problem is created in the Negro district mentioned above. The twenty families who own their homes must find a place to purchase or rent with the funds awarded. In most cases this amount will be only about two thousand dollars at the highest estimate. For the thirty families that rent this sub-standard housing the dilemma is critical: they will be denied a place to live and they will not be provided money with which to move. At present, according to local business leaders, there is no place for either group to relocate.

This is an important human-relations problem. Not only should these citizens be provided with a place to live, but they should also have council and a part in formulating a solution to their problem. If State or Federal funds are necessary in relocating this segment of the population, they should be sought.

Approximately twenty-seven other homes will be acquired and they are all occupant-owned. On the south bank of Lake Rousseau (Map B2), about five dwellings in the $15,000 to $20,000 price range will be taken. Each of these is

concrete-block construction and cannot be moved. Of the remaining twenty-two houses (Maps F-K) most are over twenty years old and are valued at less than $10,000. Other structures tnat will be either moved or destroyed are: about fifty-four seasonally occupied trailers and cabins (Maps J-K), six fishcamps in the Oklawaha basin (Maps F-K), twelve improved campsites, including some facilities at the Youth Conservation Camp on the Lake Eaton, one State Road Department Wayside Park (Map G), one service station south of Dunnellon, four groceries (Maps C and I), one ferry (Map K), and two small cemeteries (Maps E and F).

The future of these several uses of land varies from an optimistic view of increased activity to a somber one of non-existence. The service station owners are undecided about what they will do. Five of the operators of fishcamps will move to higher ground as will the small grocery shown on Map J, all of the trailers, and some cabins. It is expected that the use of each of these facilities will increase.

Operations will cease in two of the grocery stores south of Dunnellon and on the ferry on the lower Oklawaha (Map K). Owner decision is responsible for the closing of the two grocery stores; the third one to be displaced in tne area will move into Dunnellon. The ferry will continue functioning as a private concession leased by the Corps of Engineers. The present car-raft, which works by the use of an outboard motor and a guideline, will no longer be

practicable since the navigational character of the canal will prohibit the existence of the cable. The pool, however, will not have the flow characteristics that make the line necessary.

Relocation of the two old cemeteries (footnoted in Chapter Four) will not present the problem that might be expected. Three factors make this project feasible: first, each one is of relatively small size; secondly, most of the graves are old; finally, the new areas are within a mile of the present sites. No complaints have been received by the Canal Authority concerning the movement of the graves. This writer would suggest that the Marion County Historical Society consider a study of these two burial sites for information of local interest before the moves are made.

Recreation Facilities

Another factor of broad import to directing change in the use of space is the place of recreation in the post-canal period. This use of land will be in growing demand because of the increase of population both in the study area and in the state as a whole. It is an important aspect of the present economy, and a decision must be made. The question to be resolved concerns the role of diversionary activity as a continued major use of land. Should it be stimulated, or be discouraged as detrimental to the major function of the canal, which is navigation, and as obstructive to other potential uses of the land?

The consensus of a wide range of interviews is that recreation should and will hold a high place in the future of the area contiguous to the canal. To implement this broad objective and to enable the citizens of Florida, as well as out-of-state visitors, to gain the maximum benefits from this project, a comprehensive plan is an absolute necessity. Various governmental bodies have developed general aims, or at least have indicated their intentions to promote increased recreational land use, but the Corps of Engineers is the only agency which has gone past the initial planning stage.

A total of twenty-six public use areas, consisting of one or more sites and ranging from thirty to 1,500 acres in size, have been approved by the Corps of Engineers for recreational development by county, state, and federal agencies. Their locations, shown on the maps in Chapter Six, were selected on the basis of established Corps criteria including, but not limited to, the following considerations:

(a) Current and expected needs of the resident and tourist population within one-hundred miles of the canal project

(b) Proximity to population concentrations and major tourist routes

(c) Site characteristics such as accessibility, and, topographic, vegetative, soil, water and general scenic qualities

(d) Existing and projected land uses along the project alignment

(e) Existing and projected fishery and wildlife resources and habitat

(f) Proximity to and character of existing recreational resources within the one-hundred-mile zone[15]

Following the completion of the waterway, the Corps expects the total visitation to increase from 2,300,000 annually, which represents two visits for each person within fifty miles of the canal, to 10,000,000 at the end of the fifty-year life of the project. Average annual attendance is expected to approximate 6,000,000, with the focal points to be the major structure sites such as locks and dams.

If the ultimate recreational development objectives of the project are to be attained, cooperation is necessary between the Corps, the United States Forest Service, and the state and county governments. So far, however, local and state agencies have failed to commit themselves to a program, either with funds or manpower. This writer feels that these groups believe that if they do not provide funds for a scheme, the federal government will subsidize it for them. This belief is in error and must be corrected before the sport and outdoor use potential of the Cross-Florida Barge Canal can be realized.

Interviews with representatives of the Corps, the Florida Outdoor Recreation Planning Committee, and commissioners from each of the counties bordering the canal,

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[15]Information on the recreational development plans of the Corps of Engineers was received from an interview with Ard L. Eulenfeld, project planner, Corps of Engineers, Jacksonville, Florida, December 22, 1966.

substantiate a prevailing willingness to cooperate in the evolution of the recreational aspects of the waterway project. These talks further revealed that leadership and guidelines for improvement are much needed factors. Basic direction in these regards is provided in the Corps of Engineer's report on the development of recreation sites.[16]

Optimum land use for recreational activities will not only include swimming, boating, fishing, hunting, and camping; the plan must also consider diversions such as horseback riding, pleasure driving, nature study, water skiing, hiking, and picnicking. These latter activities are just as important to users as are the former, and planning is necessary in order to provide for them. Some general "guidelines" for each one mentioned are given below.[17]

Swimming--It is not advisable to allow swimming in the entire pool area. Selected sites where beach and safety facilities are available should be established.

Boating--This activity should be encouraged within certain limitations. Fast moving boats should be confined to the main navigation channel with intermediate speed

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[16]Corps of Engineers, Jacksonville District, "Preliminary Master Plan, Part of the Master Plan: Cross-Florida Barge Canal Project" (Jacksonville, October 14, 1965).

[17]Much of this information is taken from a letter from William R. Kidd, President of the Marion County Chamber of Commerce, to Colonel R. P. Tabb, District Engineer, Corps of Engineers, Jacksonville, Florida, September 22, 1966.

travel allowed between that point and the special use areas. Boat ramps, docks and ingress and egress channels should be provided.

Fishing--Properly developed fish habitat in the reservoir areas is necessary in order to attain full fruition of this activity. Shell and sand should be deposited in selected areas to furnish spawning beds; some portions of the reservoirs should be left uncleared to encourage fish growth, and fingerlings planted to facilitate a rapid increase in the fish population. Boat speeds in fishing areas should be limited, and secondary access channels ought to be cut.

Public access to berm areas is desirable since many people do not have a boat and bank fishing is popular. At the Gulf entrance, the spoil banks created by canal dredging might be the bases for fish-reefs, manmade structures which attract aquatic life.

Hunting--Because of both the large acreage needed per hunter and the increasing popularity of the sport, more land should be utilized for this activity. The danger involved makes it mandatory that the choice of hunting lands be restricted to locations away from other use areas, especially reservoirs, and that these lands receive close supervision at all times. State Game Biologists and Wardens must be consulted and utilized in the development and protection of wildlife.

Camping--Adequate camp sites will be needed. These might be established along the perimeter of the backwaters and in some parks. Small sites, with basic facilities provided, would be preferred to large, highly organized camps. These smaller campgrounds could be constructed with, in many cases, unpaved, rustic-type means of access.

Pleasure Driving--The entire canal will be a matter of great interest, and sightseeing must be planned for by providing scenic, low-speed roads for pleasure driving. Parking areas and overlooks will be necessary as a safety factor as well as for esthetic reasons. Planners should consider work already done for the State Road Department in the Scenic Roads and Parkways study of 1965.[18] Criteria for the development of such facilities for the whole state would have application in the study area.

Nature study, hiking, and bridle paths--These activities should make use of the natural environment with the only improvements being the established paths that bring the participant into confrontation with the natural resources and beauty of the area. Separate paths for horses are necessary for safety reasons.

Water skiing--Careful clearing of vegetation in selected areas of the reservoirs is vital to safe water skiing. The activity should be limited to these well-marked locations.

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[18]State of Florida, Scenic Roads and Parkways (Tallahassee: State Road Department, 1965).

Picnicing--This family-type recreation would be desirable at structure sites, appropriate locations along scenic drives, and in some special use areas. If accommodations were provided this would be a popular activity.

Each of the pursuits discussed will be dependent upon service facilities that will add to the economic character of the canal region. Some accommodations such as access roads, picnic tables, water fountains, and rest rooms must be publicly provided in order to gain benefits for the private sector of the economy. As the activities noted above become popular, a need will be created for marinas, service stations, restaurants, motels, and other businesses, not only in juxtaposition to the waterway but in all of central Florida.

Several existing factors will facilitate the implementation of an ambitious program of recreational land use. First, it is compatible with both the present economy and the future needs of a growing population. Second, most of the land that will be needed is either already in public ownership, such as the National Forest, the Wildlife Management Area east of Inglis, and the acreage purchased by the State for the canal in 1936, or in private ownership with recreation the primary use, such as Silver Springs and the fishing camps. On other private holdings, outdoor activities are a part of a multiple-use program, the best example being hunting wildlife on timber land. Finally, there is not a

critical problem of conflicting uses competing for these lands.

As noted, use for recreation will be of utmost importance in striving for optimum land use in the project space. However, consideration must also be given to other economic activities which will occupy the area mapped. Several questions arise. How will the construction of the waterway change the factors of location or resource availability through barge transportation? What needs must be met to provide industrial sites? How will agriculture and forestry be modified? How are changes apt to affect the resident population? Each of these questions will be discussed in the remaining part of this chapter.

Industrial Development

When the Cross-Florida Barge Canal opens, it will provide a direct barge transportation route from central Florida to markets and resources of the states along the inland waterways of the Eastern Seaboard, the Midwest and the Gulf Coast. Because transportation charges, on the average, make up approximately seventeen percent of all industrial expenses, the low per-ton-mile costs of moving products by barge could increase the shipment of bulky goods between the study area and points along the inland waterway. At places where change of goods between land and water carriers occurs, transhipment aids will be built, storage

facilities will be established, and some industrial development will likely take place.

A list of the most probable goods or types of products to have the study area as their point of origin or destination has been gained from a report of the Chief of the U. S. Corps of Engineers,[19] from a feasibility study of port sites in Marion County,[20] and from interviews. Possible exports are: limerock, dolomite, phosphate derivatives, lumber, sewer pipe, possibly pulpwood, wood products, and miscellaneous manufactured items. Credible imports can be identified as feed grain, fertilizer, petroleum products, construction brick, newsprint, sugar, flour, and perhaps large appliances and automobiles. Various industrial chemicals will no doubt also be included, some as imports and some as exports.

This potential movement of products indicates that there will be a major need for port facilities (such as depot and transhipment accommodations including warehouses, docks, wharves, loading and unloading equipment), and good access between canal and other modes of transportation. Many of the items mentioned could utilize unprotected depository space; however, much protected storage would be necessary, including buildings, tank fields, and mineral bins.

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[19]Office of Chief of Engineers, op.cit., pp. 4-6, 14-16.

[20]Port Authority of Marion County, "Preliminary Engineering Study of Feasible Port Sites in Marion County" (Ocala, Florida: Marion County Chamber of Commerce, 1966), p. 11.

The American Waterways Operators state that although ports may be in either public or private ownership, the general policy is for local governmental bodies to provide the accommodations.[21] To establish an adequate shipping center on the canal these criteria must be met:[22]

1. Location near primary highways with good access roads.
2. Railroad service available.
3. Cheap electrical power.
4. Adequate fresh water supply.
5. Good physical characteristics in regard to foundation and drainage.
6. Proper zoning.
7. Situated so that if items 1-4 are not available they may be provided at reasonable cost.

Port location will be important to the development of land in the study area. The feasibility study made in Marion County indicates that a tract immediately east of Blue Run is that county's best port site.[23] The major drawbacks noted are the lack of adequate zoning, the necessity for a large amount of excavation behind the docks, and the planned relocation of a railroad grade in that same area (Map C3, Chapter Six).

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[21] Big Load Afloat (Washington: American Waterways Operators, 1965), p. 46.

[22] Port Authority of Marion County, op.cit., p. 5.

[23] Ibid., p. 7.

A second location indicated by this report is just west of Santos. The use of this site will not be possible because the Corps of Engineers has designated that land for a scenic parkway. However, a small facility might be built east of Santos. Excavation would be a problem in addition to the complicating factor of the fifteen-foot variation in the surface elevation of the summit pool, but the main difficulty would be gaining permission from the Corps of Engineers to dig a basin at this point. Maintaining the needed water level will be critical in this reach of the waterway.

Representatives of barge lines indicate the primary terminal should be at the Gulf entrance and that lesser facilities might be located on Lake Rousseau and near Dunnellon. The configuration of the coast at this entrance is highly desirable for such a development. The location of islands supplies a natural barrier for protection, and indentations can be modified as slips to give more berthing space. Old phosphate pits, which are now a part of the Withlacoochee River southeast of Dunnellon, provide deepwater areas for wharf development. A problem here, as in several other areas, is the need to fill in swamp land along the river bank. Engineering studies, money available for construction, and indicated need will ultimately determine the specific locations for development.

Usually marshalling areas, where barges are docked while waiting to be loaded or added to a tow, and repair

facilities are parts of a barge port. According to the American Waterways Operators, however, the best place for marshalling bays on the Cross-Florida Barge Canal will be at or near the end of the waterway.[24] Moreover, only minor repair facilities will be needed locally because the existing yards at Tampa and Jacksonville will be able to handle any major jobs.

According to businessmen the same two cities, Tampa and Jacksonville, will affect land use along the waterway because of their status as industrial and wholesale centers. These businessmen represent firms which produce and market the goods identified above as potential canal-area imports and exports. Few of them, however, would commit their firms to specific building plans or use of the waterway. Each one did agree that the canal was desirable in that its presence would cause a reduction in trucking rates and rail rates for most items, and that transhipment and storage facilities would doubtless be developed.

Manufacturing plants suitable for establishment along the canal fit several categories. One class might be industries that modify local resources for sale elsewhere, such as the processers of dolomitic limestone and hardrock phosphate, the producers of white and finish cement, and lumber mills. Another class consists of those that ship in

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[24]Letter from Braxton B. Carr, President of American Waterways Operators, Inc., Washington, D. C., February 1, 1967.

products to be combined with Florida resources to produce animal feed, fertilizer, or chemicals. Finally, plants might be constructed which would import bulk resources to be processed and packaged for consumption in Central Florida. The latter businesses might include petroleum refining and the processing of sugar and flour.

Interviews indicate that the processing and/or packaging of dolomitic limestone, hardrock phosphate, flour, and sugar are the industries most likely to be built on land close to the canal. Cement, fertilizer, and feed plants presently exist in Tampa and Jacksonville; establishment of additional plants in the project area through 1975 are therefore unlikely.

Several published reports, the Marion County Chamber of Commerce,[25] and the Florida Development Commission[26] agree that grain silos and a feed mill are certain to be constructed on the canal in order to meet the needs of expanding cattle, horse, and chicken farming businesses in Central Florida. There is also a strong general opinion that a greatly increased meat-packing industry will make considerable use of the waterway as Florida begins to feed out and slaughter more of its own beef cattle and export meat to other states.

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[25]Interview with William R. Kidd, President of the Marion County Chamber of Commerce, Ocala, Florida, January 12, 1967.

[26]Interview with John Boynton, Director of Research, Florida Development Commission, Tallahassee, Florida, November 10, 1966.

Interviews revealed several factors which challenge these views. Although it is agreed that the raising of animals will greatly increase in the next ten to fifteen years, some feel the use of the canal by these interests may be minimal. For example, according to a leading feed retailer in Ocala, the savings gained over trucking corn from Tampa will be offset by the expense of constructing silos and mills on the canal, especially if the product must still be transported from Dunnellon.[27] An Ocala meat packer states that since Florida now imports over ninety percent of the meat consumed here, he cannot envision the home livestock industry out-producing the state's needs.[28]

Two other factors will affect the development of a feed mill. For such a business to be successful, a demand for about three million bushels of corn per year is needed. At the present time less than one million bushels are sold within one hundred miles of Dunnellon. The cost of transporting Georgia-grown corn is another consideration. Presently a trend is appearing that shows that there is an increase in the use of trucks of the Florida citrus industry to import Georgia corn inexpensively as a return load.[29]

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[27]Interview with O. C. Branch, Jr., Manager of Seminole Stores, Inc., Ocala, Florida, March 2, 1967.

[28]Interview with I. E. Erickson, Manager, Swift Packing Plant, Ocala, Florida, March 2, 1967.

[29]Interview with Ralph Sumner, Manager, Illinois Grain Company, Tampa, Florida, March 3, 1967.

Because this is not a study on industrial location, the possibility of a feed mill on the canal cannot be ruled out. This discussion does serve to illustrate, however, some of the many market influences which must be studied.

A petroleum industry spokesman identifies the service area of one of its terminals as within one hundred miles, with costs positively related to distance. The waterway will allow this industry to locate a plant on the artery in order to better serve the region between the existing facilities at Tampa and Jacksonville. Such an enterprise at the Gulf entrance would include docking structures, transfer pipes, storage tanks for gasoline, kerosene and diesel oil, and it would occupy a minimum area of seven to ten acres.[30]

Industrial land use for storage space in connection with the loading and unloading facilities was also noted by representatives of firms which manufacture clay pipe[31] and process citrus fruit.[32] These plants, each presently located in Ocala, will use the canal as conditions permit. If possible, the clay pipe company will move in both clay and shale and ship out the finished pipe by barge rather than by truck, the present means of transport. Both truck and

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[30]Interview with James H. Moody, Regional Manager, Murphy Oil Company, Tallahassee, Florida, November 23, 1966.

[31]Interview with J. LeRoy Smith, Regional Sales Manager of the United States Concrete Pipe Co., Ocala, Florida, March 2, 1967.

[32]Interview with Dennis Gallagher, Traffic Manager, Libby, McNeil and Libby, Ocala, Florida, March 2, 1967.

rail transportation cause a high incidence of breakage. The citrus plant will possibly use the waterway to ship pulp, which is a low-value bulk product, and to import sugar. The slow time factor in barge traffic will preclude the shipping of concentrate juices and other items, for which, promptness of delivery is important to insure prime condition of the product.

Industrial companies commonly make economic studies of plant location and consider certain site criteria not unlike those previously mentioned for a port. In addition, modern industry is interested in the community services offered not only to the business, but to its employees. These include educational, religious, social, and recreational opportunities. For the study area this means that the canal alone will not attract industry. On the other hand, it is reasonable to believe that some plants will locate near the waterway because of the particular market conditions or resources, because the owners want to enjoy the amenities of Central Florida, or because they are a satellite industry of a larger firm located in the vicinity.

Local interests must also be aware of the effect a new business will have on both the cultural and physical environment. For example, what change, if any, will it make in the income characteristics mentioned earlier in this chapter? The consequences of a factory adding to the level of noise, smoke, obnoxious odors, and water pollution must

be considered. The compatibility of land uses is also important. The thoroughbred owner, for instance, doesn't want any of the conditions mentioned above (noise, smoke, etc.) because of the adverse effect on the animal being trained; nor should residential or recreational and industrial uses be located in juxtaposition. In short, the location of industrial land use in the study area will have a many-faceted effect on the surrounding area, and it is to the advantage of all interests to plan with this in mind.

Florida is one of only two states in the United States which does not have a general enabling act to allow its counties and cities to establish planning commissions. This permission has been granted by the legislature through local bills in the past. The counties in the study area do not now have the means to plan for development or to solve the problems mentioned in the preceding paragraph.

Like recreational, industrial development requires cooperative planning among the four counties. Soundly planned industrial development will encourage additional firms to locate near the canal; on the other hand, petty competition between governmental groups, including provision of unwise incentives for business location, will harm each of them. Enabling legislation is needed to establish local planning boards, to prepare county plans, and to permit adoption of zoning ordinances, subdivision standards, and construction codes. Adequate enforcement policies are also

needed to support the program. Without this control, improvements such as new streets, water mains, and other public facilities cannot be provided and optimum land use is virtually impossible. Property owners must be afforded reasonable protection if they are to invest large sums of money in property.

Agriculture and Forestry

To understand agricultural land use change after completion of the waterway project, it is just as vital to consider present trends as it is to contemplate the specific influence the canal will have. Current competition for rural land to be put to residential use is important, as is the effect of the land re-evaluation for tax purposes. Also, the presence of the navigation artery will increase this competition as more dwelling, recreational, and industrial sites are developed. The cattle operation west of Heather Island must be relocated since that land will be inundated, and the project construction will occupy a considerable acreage now in farming.

Particularly affected will be the marginal lands which are farmed today. The increase in value and in taxes will make agricultural use unprofitable. Some of the better agricultural land that is inefficiently developed will be farmed more productively because of these same pressures. No person interviewed indicated that he thought there would be an increase in the acreage cultivated in the study area after the completion of the canal.

A more intensive use of forest land should result as the value of land increases. This is especially true in regard to the owners of large tracts who can put the land in a cost sharing Federal pine land program, in which the government shares the cost of buying and planting pines and preparing the site. In this area, the total cost of planted pine stands varies from about eight dollars on minimally prepared land to about twenty-seven dollars on ground given maximum preparation. Careful administration of a publicly or privately owned natural forest in cooperation with the Florida Game Commission is more compatible with the multiuse objective which is desirable in this area than are the "biotic desert" characteristics of the young planted pine woods. No outdoor recreation activities take place where the young trees are all six to eight feet apart, undergrowth is cleared away, lower branches are trimmed off, and fertilizers and pesticides are liberally used. The uses of chemicals in both forestry and agriculture must be regulated near streams and pool areas, because of the possibility of water contamination through percolation and surface wash.

When one is considering the use of land, all of the foregoing factors are important, but a primary fact must be acknowledged if the waterway itself or the reservoir areas are to be utilized. The Corps of Engineers must approve of any structure, or construction, or excavation in the right-of-way or on the reservoir shoreline, or any use of the water therein. The basic function of the Corps is, "to insure

the protection of the reasonable rights of navigation. The Corps does not wish to interfere with development by private owners; in fact, it encourages the use of all waterways and will allow facilities to be built which will promote efficient utilization."[33]

Some examples of rights retained by landowners who donate easements to the Corps are: to have access to waterway for livestock water-points, to pump water from waterway, to farm berm area, to erect non-permanent structures on berm or in water to edge of channel, to excavate and remove berm and spoil areas, to excavate berthing slips or channels. These rights are denied the owner who sells lands to the Canal Authority. In any case the Corps must grant permission for such activity, and owners in the summit section are warned that restrictions will be very stringent between the Dunnellon and St. Johns Locks.[34]

In summary, the existence of the Cross-Florida Barge Canal, as a variable in the growth of the study area, will cause an increase in the rate of land use change in every category discussed. The factors discussed in this chapter suggest that recreational, residential and industrial use

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[33]Interview with Ard L. Eulenfeld, Project Planner, Corps of Engineers, Jacksonville, Florida, December 22, 1966.

[34]The Canal Authority of the State of Florida, "Land-Owners Information Bulletin No. 1: Cross Florida Barge Canal Right of Way" (Jacksonville, Florida, July 20, 1964), pp. 7-9.

will increase in quantity and quality. The area of agricultural land will probably be smaller, but it will be more intensively worked. Forestry lands will generally develop more multiuse features. Some acreage will be lost to inundation, but there will be an increase in the amount of planted pine.

The factors involved in this change are complex, as are the problems related to planning for optimum land use. Therefore, both public and private interests need to consider the possible effects of the various types of development before resources are expended toward implementing unwarranted programs. Sound vertical and horizontal plans are a necessity. That is, there must be continuity in the past, present, and future uses and harmony among those that exist at any one time.

The data in this chapter and the preceding ones provide the basis for the output of the optimum land use model. Presented in Chapter Six is a functional map which predicts the best use of land after the waterway project is completed.

CHAPTER VI

THE FUNCTIONAL MODEL

Optimum land use, as shown on the functional maps presented in this chapter, is the focal point of the output provided by the intellectual model described in this report. These uses of the land were decided upon after a consideration of the following: a history of land use in the study area; a knowledge of what the physical and cultural characteristics were there in the spring of 1966; and those factors that will affect, and will in turn be affected by, man's utilization of land after the Cross-Florida Barge Canal is constructed.

General Guidelines

This chapter includes the maps that recommend optimum land use in the year 1980, approximately seven years after the expected completion of the canal, and an explanation of the decisions made in the construction of these functional maps. This explanation provides a discussion, where needed, of the land-use categories employed and an acknowledgement of some alternative choices. In keeping with the belief that, to obtain optimum utilization, each use must be compatible with those contiguous to it, the main part of this chapter

will explain the maps in order, from the Gulf of Mexico (Map A3) to the St. Johns River (Map M3).

As on the inventory maps, forest land is classified according to its natural vegetation, such as pine flatwood, swamp forest, and others. The suggestion is made, however, that none of this land should be idle forest as was often the case in 1966. Multiple uses including commercial timber production, hunting, camping, and very low density residential use would be necessary to attain its optimum utility. These tracts would, of necessity, come under careful management and fire protection programs whether the timberland is privately or publicly owned. Not to be ignored is the need for different types of management based on the primary goals of the owners. Multiple use, as stated, is important, but forests that exist primarily for cutting pulp or timber call for a control program that is different from that of a tract used mainly for hunting or esthetic purposes.

The esthetic use of forest land would commonly include its employment either as a "green belt," providing a break in cultural uses or a buffer zone between incompatible developments, or as an acreage that exists as a remnant of the natural vegetation. Each of these practices should provide opportunities for hiking, camping and nature study. Special activities such as Boy Scout camps, churches or schools could occupy green belt space as could very low density (five-to-ten acre) homesites.

FUNCTIONAL MAP LEGEND

Proposed Cross-Florida Barge Canal
Boundary of Study Area
Electric Power Line
Paved Roads
Dirt Roads

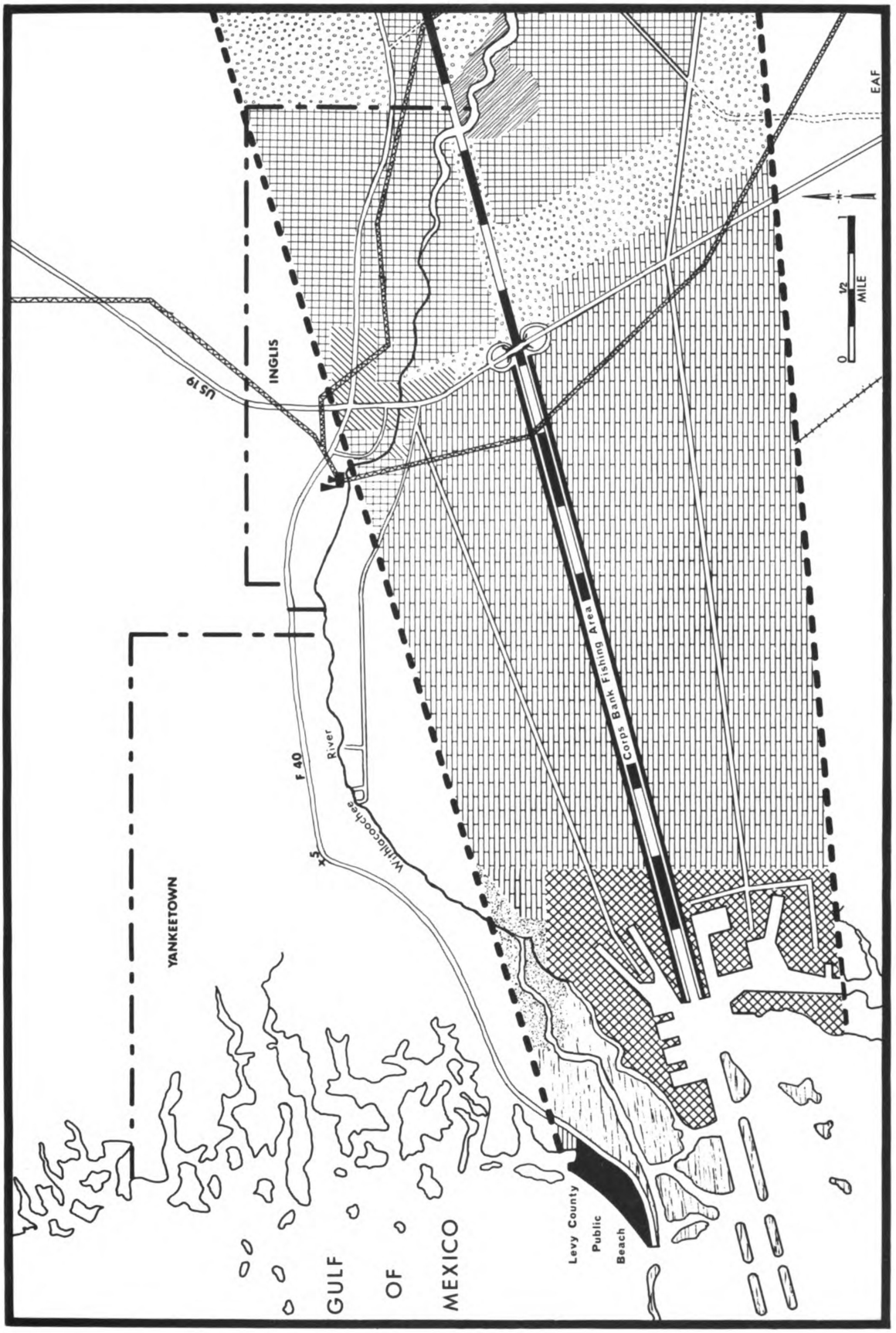
LAND IN NATURAL VEGETATION

Dry Sand Scrub
Pine Flatwood
Coastal Salt Water Marsh
Swamp Forest
Upland Pine and Oak
Hardwood Hammock
Hardwood Forest

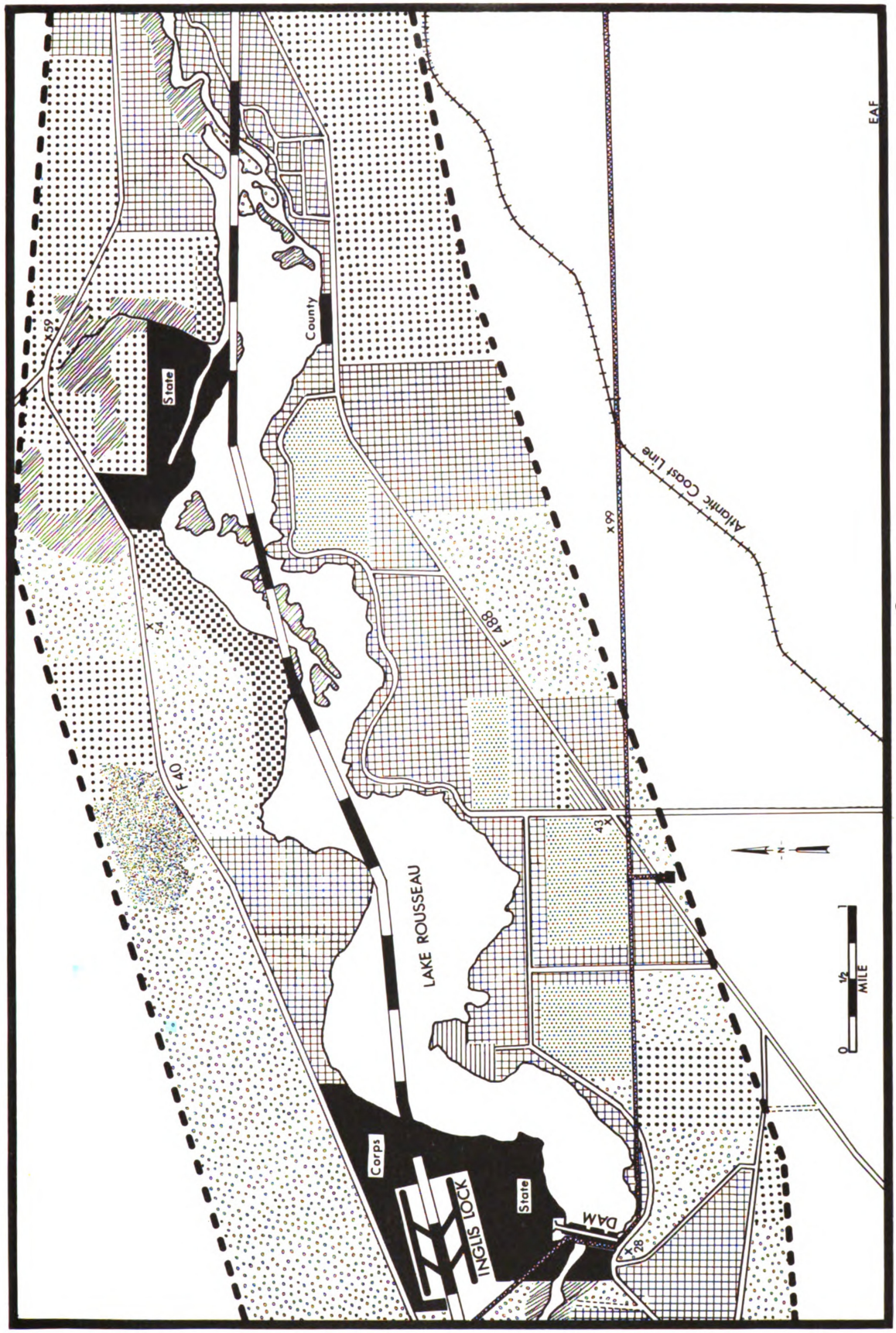
CULTURAL LAND USES

Major Residential
Improved Pasture
Commercial
Planted Pine
Industry
Citrus
Port Area
Cottage and Camp Sites
Marina
Corps Recreation Site
(Agency responsible for development)
CORPS....U.S. Corps of Engineers
STATE
COUNTY
USFS.....U.S. Forest Service

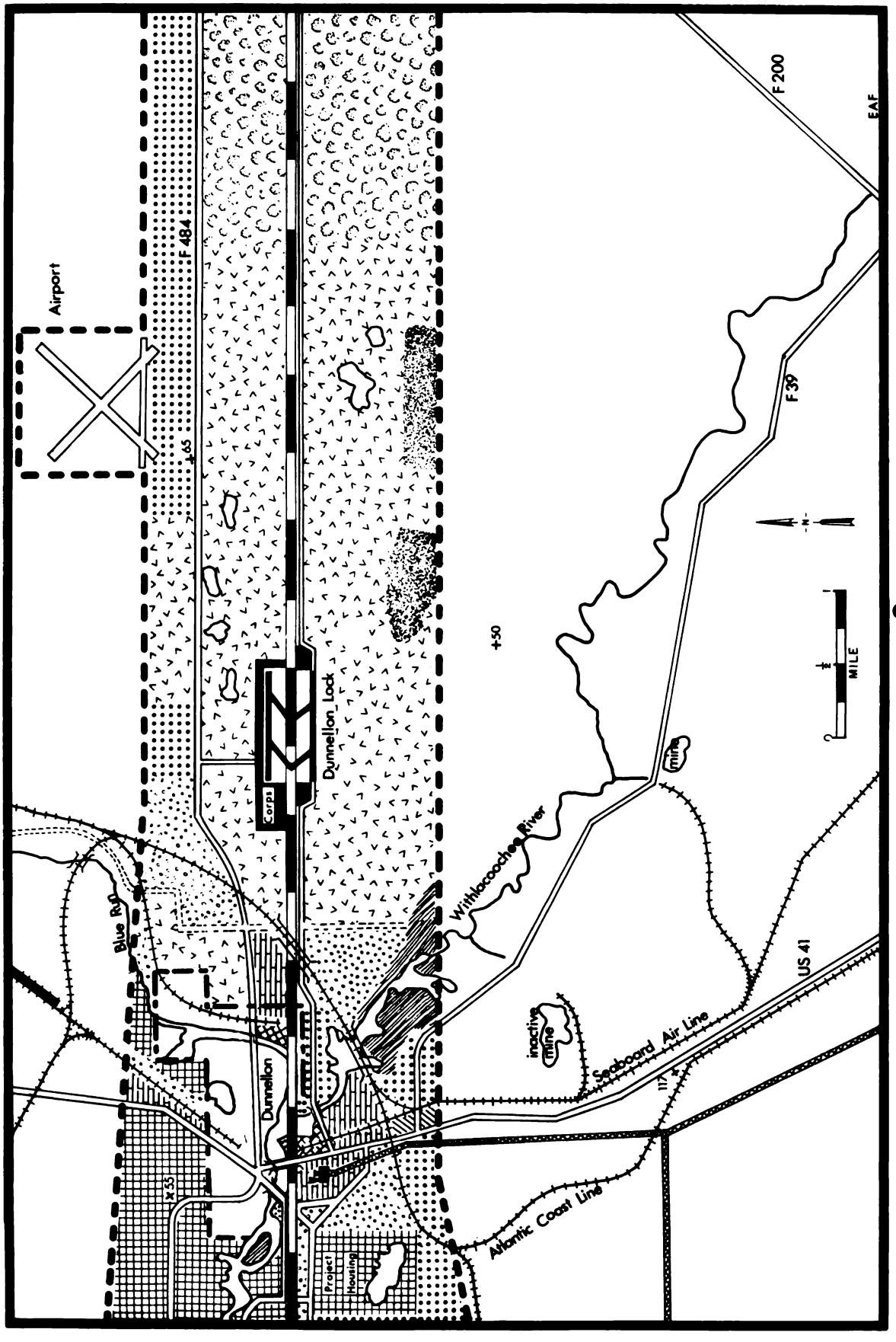
▲ Camp Site
Cemetery
Gas Pipeline
X_{117} Elevation Point
TP Trailer Park
Power Relay Station
Corps of Engineers Headquarters


US 19
INGLIS
EAF
½ MILE
0
F 40
River
Withlacoochee
Corps Bank Fishing Area
YANKEETOWN
GULF OF MEXICO
Levy County Public Beach

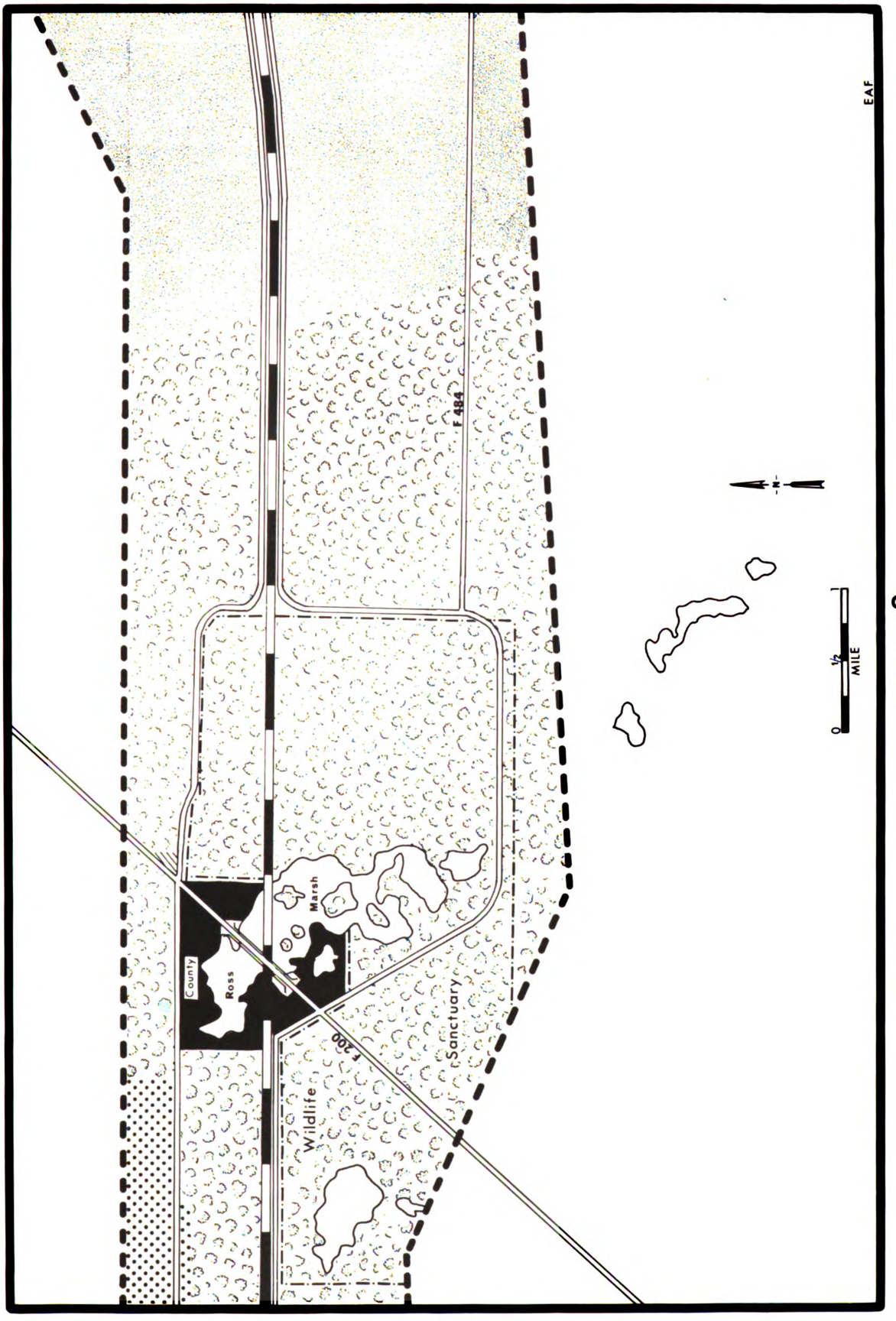
MAP A3


State
County
X59
X54
F40
F486
X66
Atlantic Coast Line
EAF
LAKE ROUSSEAU
X43
Corps
INGLIS LOCK
State
DAM
X28
N
0
½
MILE

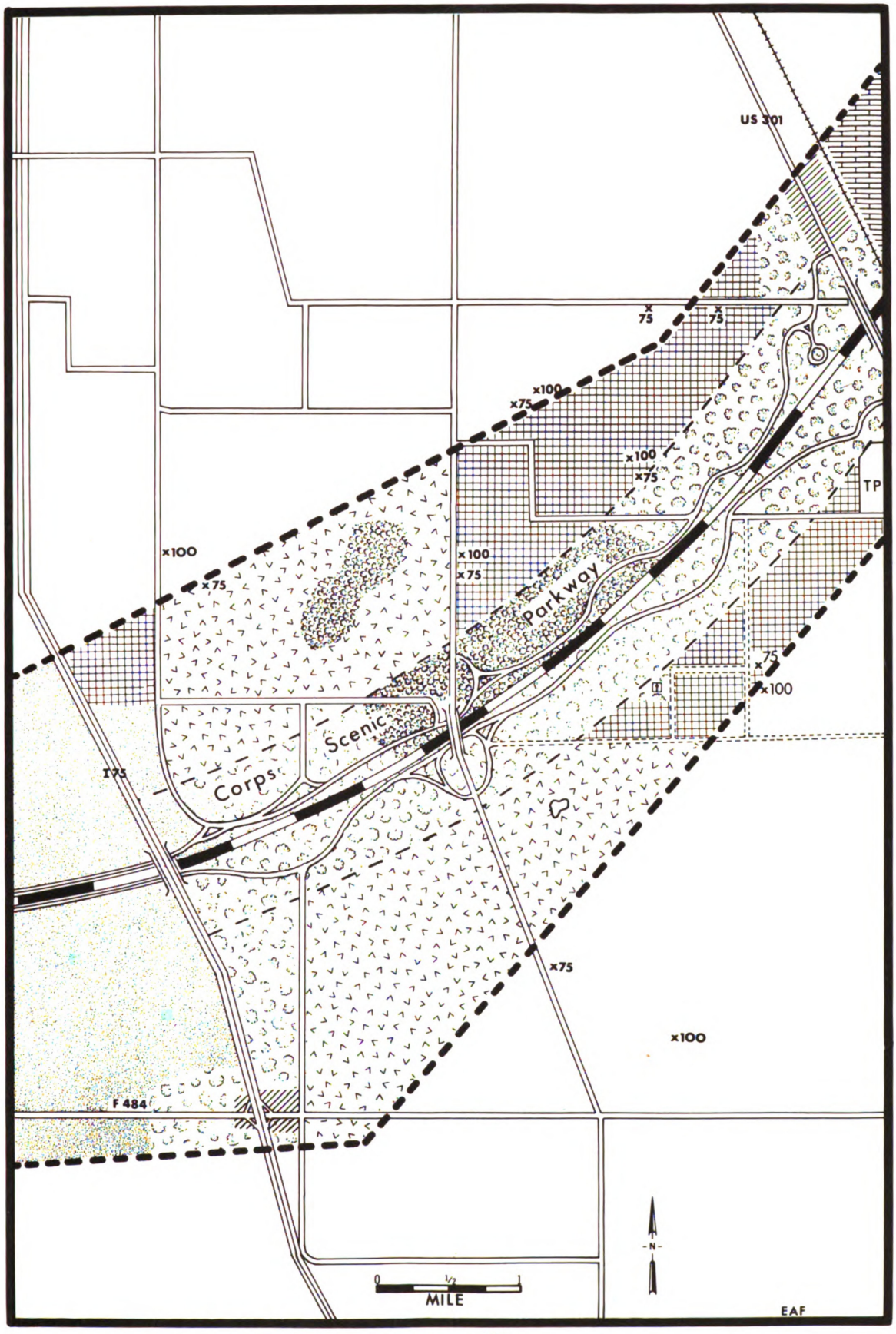
MAP B3


Airport
F 484
+65
Dunnellon Lock
Corps
Withlacoochee River
F 200
EAF
F 39
+50
mine
MILE
Blue Rd
Dunnellon
inactive mine
Seaboard Air Line
US 41
117
Atlantic Coast Line
Project Housing
+33

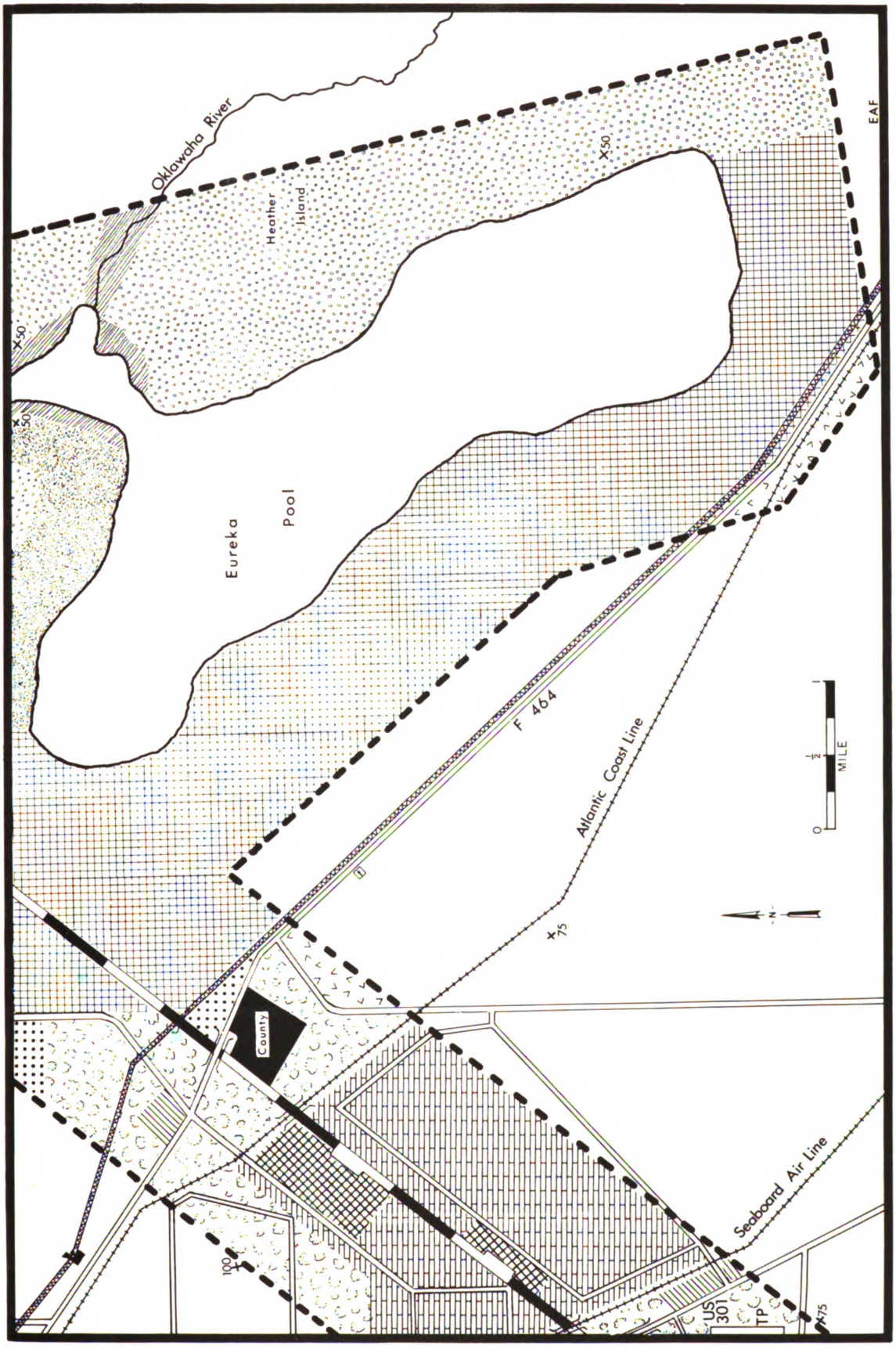
MAP C3



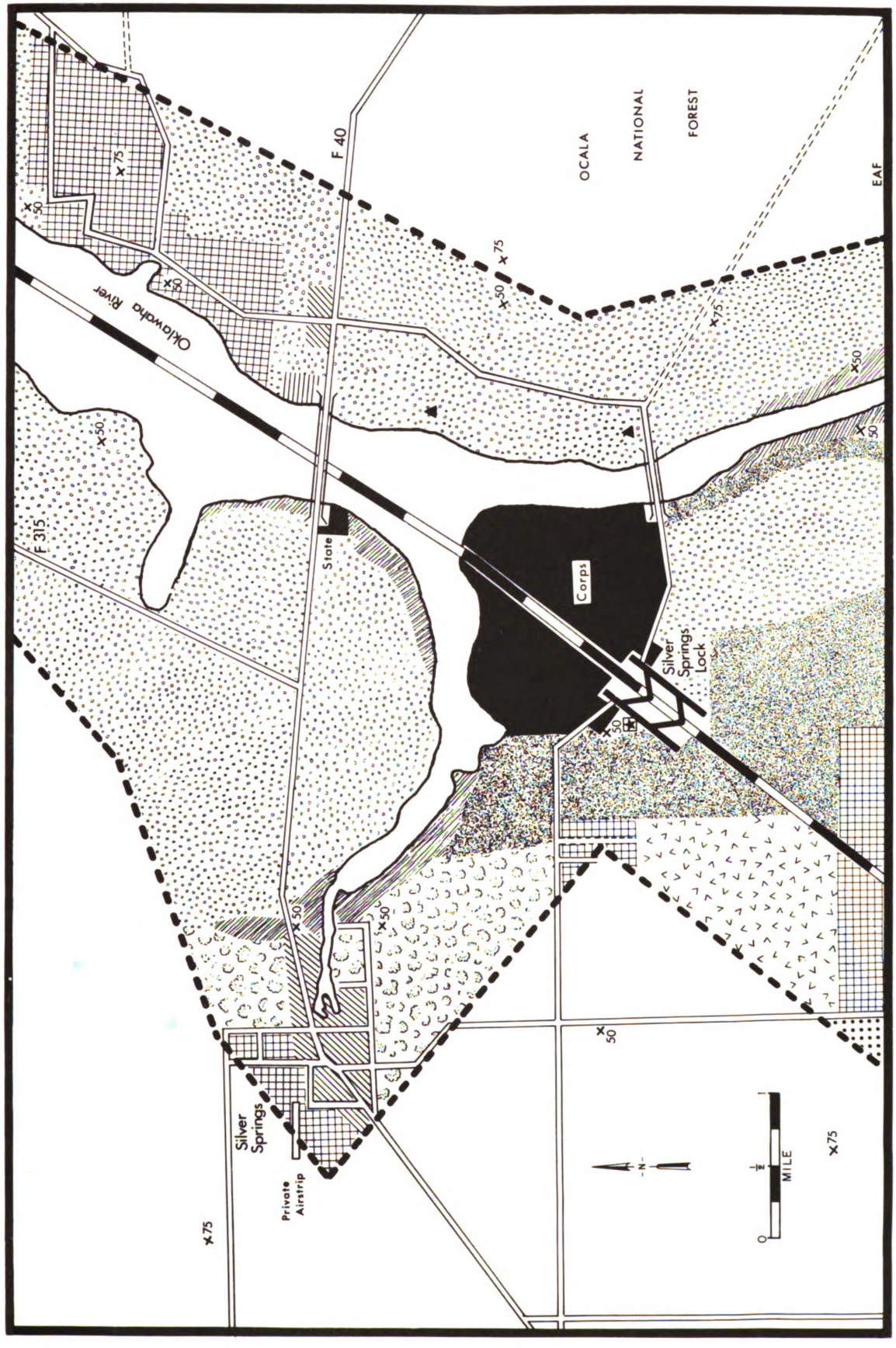
MAP D3


US 301
x100
x75
x100
x75
x100
x75
TP
x100
x75
Parkway
Scenic
Corps
I75
x75
x100
F 484
0
½
MILE
N
EAF

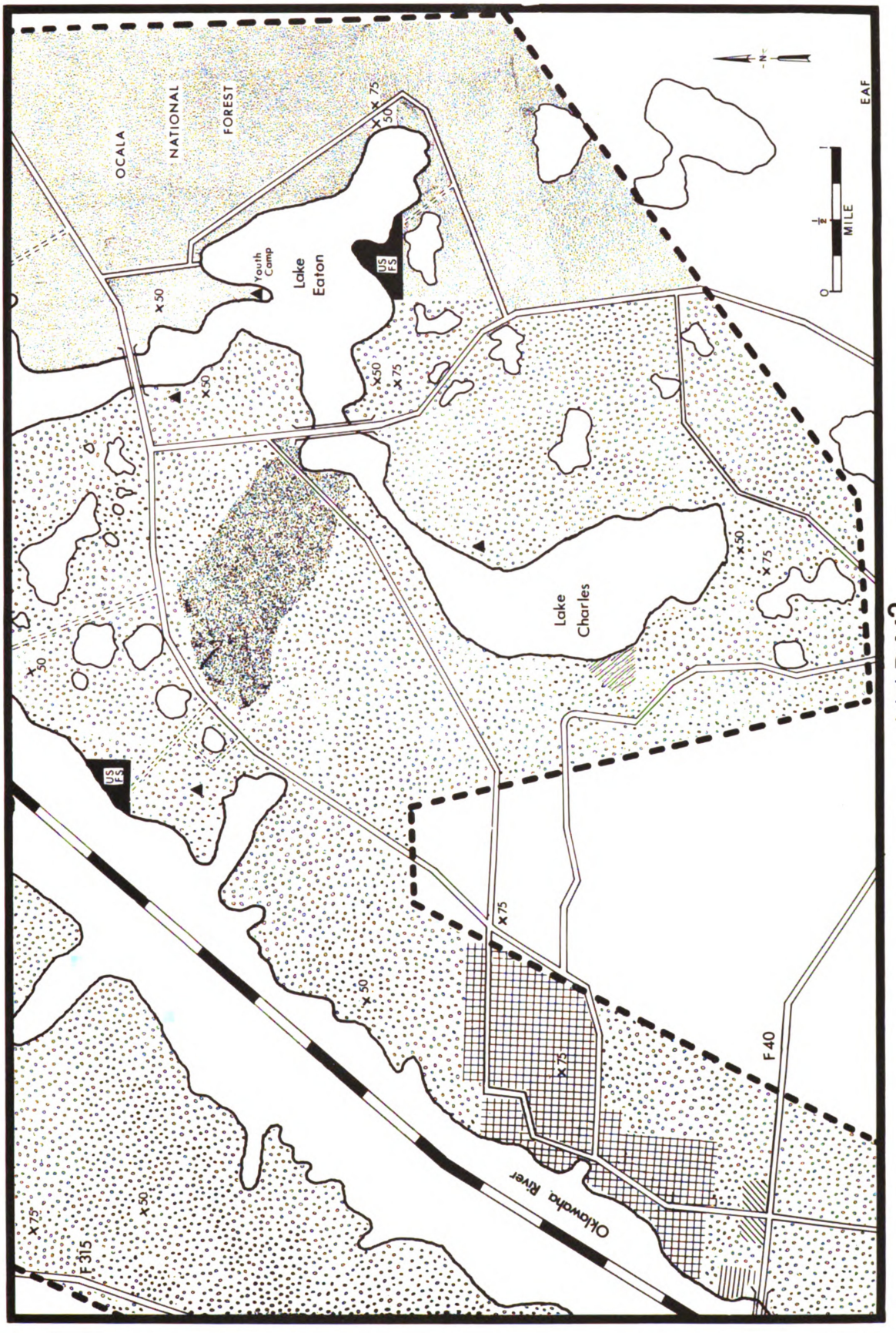
MAP E3


Oklawaha River
Heather Island
Eureka Pool
X50
EAF
F 464
Atlantic Coast Line
X75
County
100
Seaboard Air Line
US 301
TP
0
1/2
MILE
N

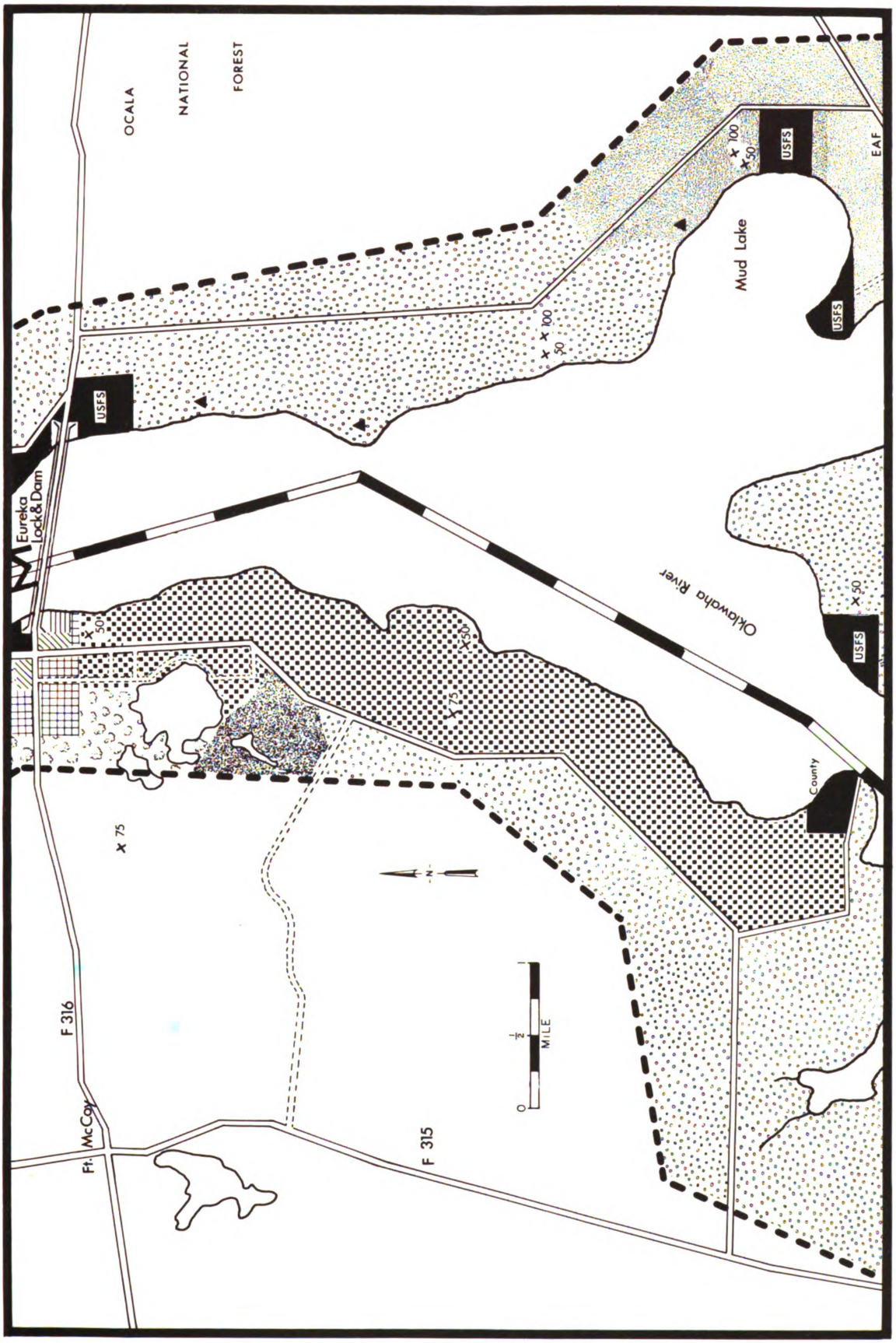
MAP F3


OCALA
NATIONAL
FOREST
EAF
F 40
F 315
Oklawaha River
State
Corps
Silver Springs Lock
Silver Springs
Private Airstrip
N
0
½
MILE
×50
×75

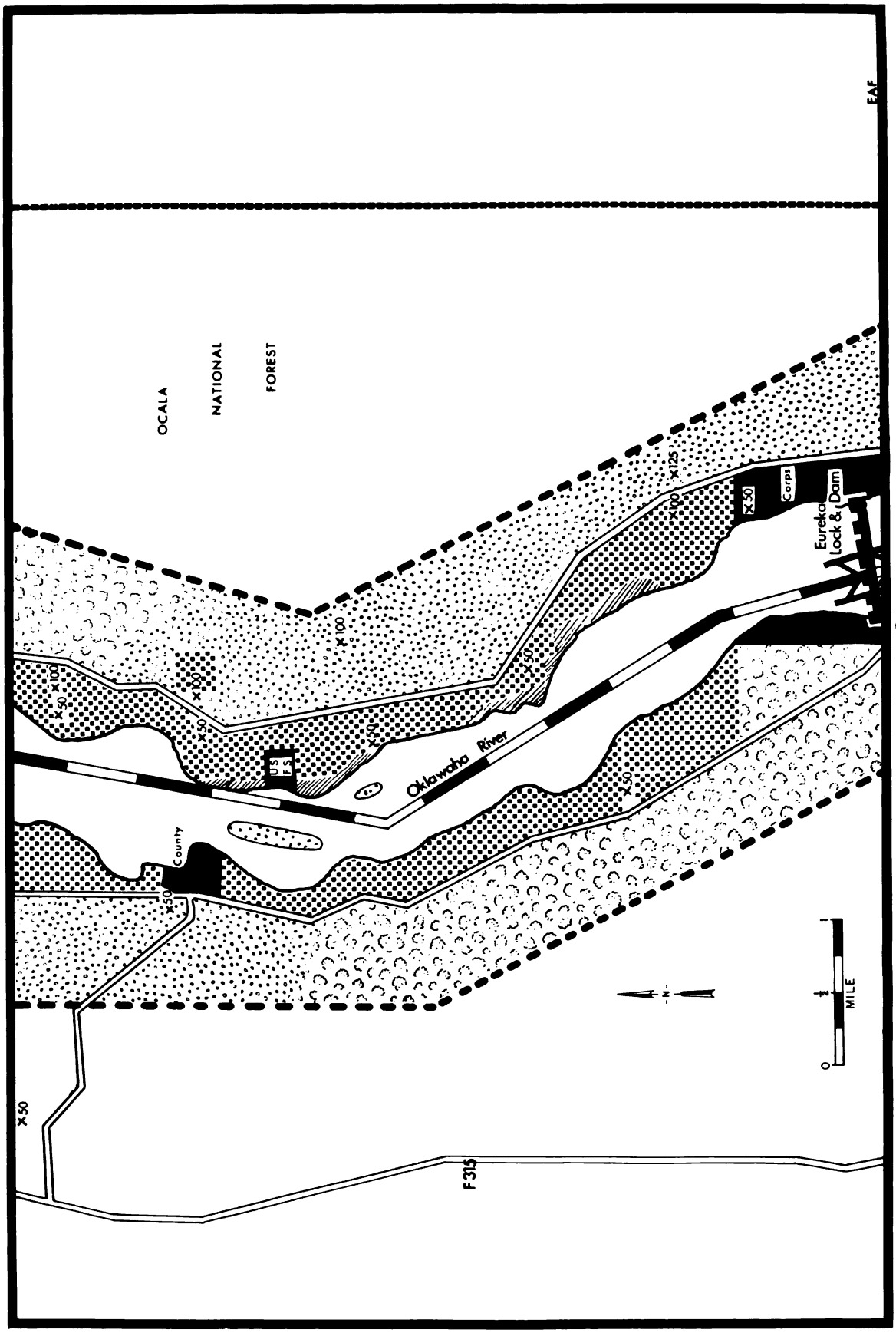
MAP G3


OCALA
NATIONAL
FOREST
Youth Camp
Lake Eaton
Lake Charles
Oklawaha River
F 315
F 40
US FS
MILE
EAF

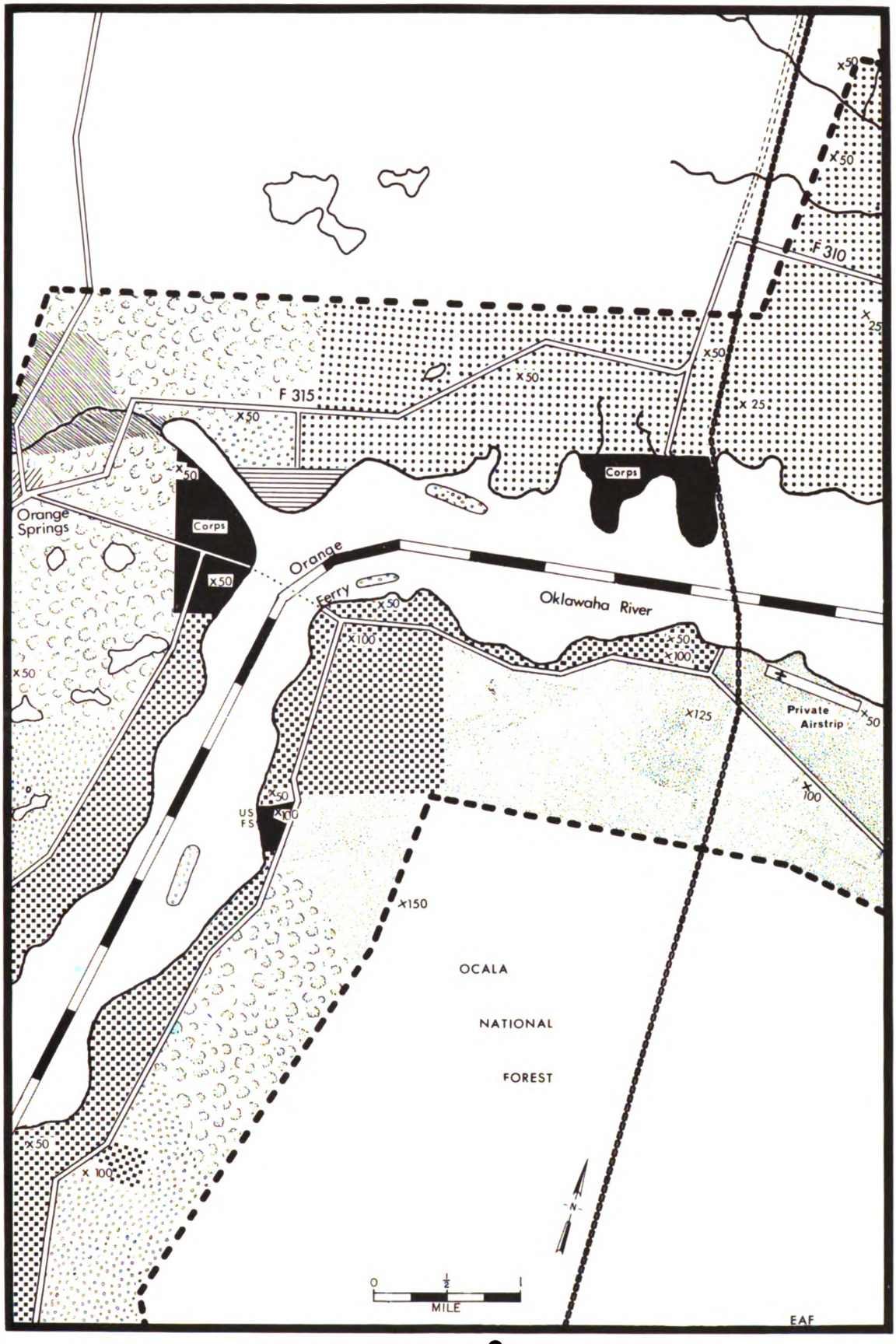
MAP H3


OCALA
NATIONAL
FOREST
Eureka Lock&Dam
USFS
Mud Lake
Oklawaha River
County
F 316
F 315
Ft. McCoy
MILE
N

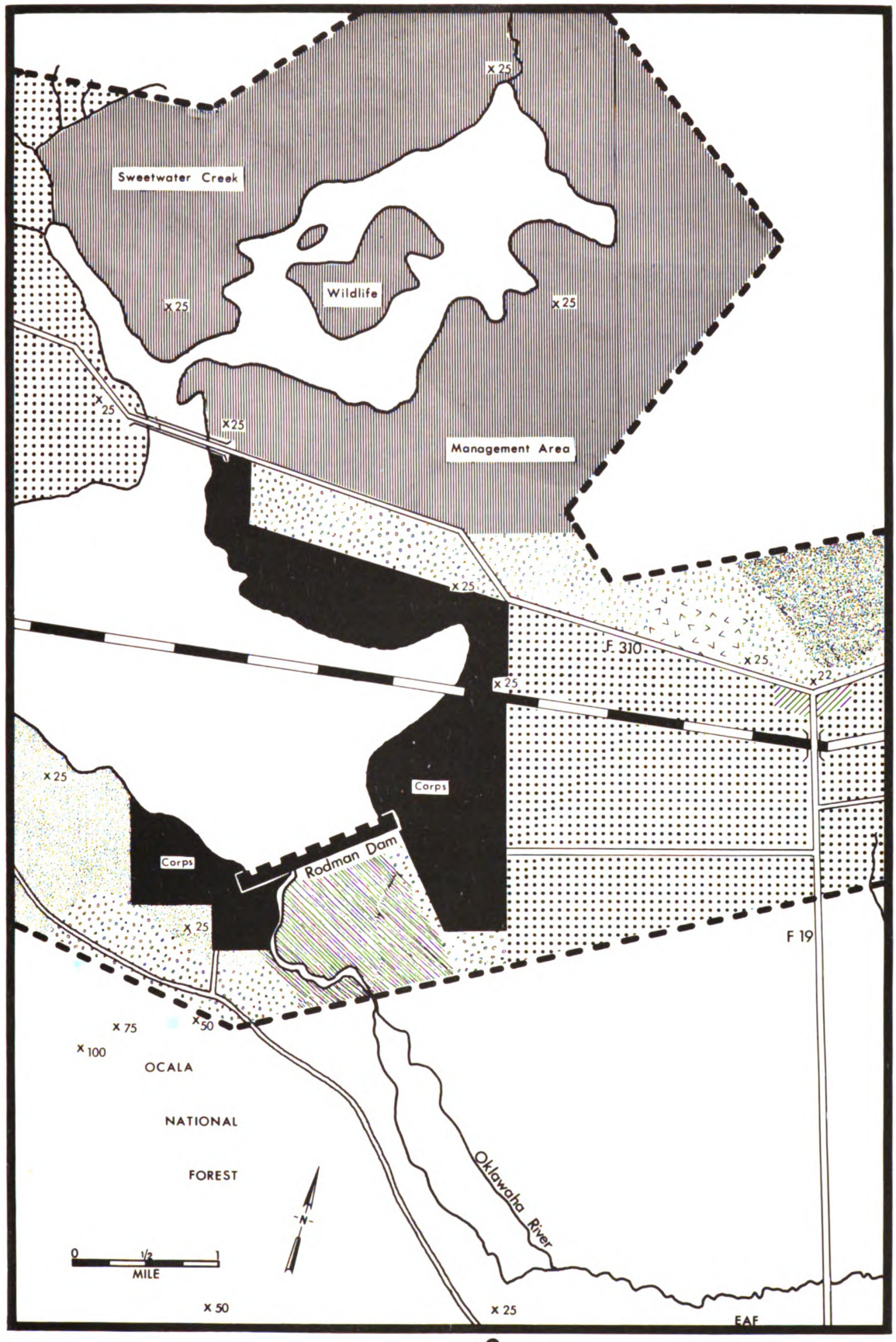
MAP 13


OCALA
NATIONAL
FOREST
FAF
Eureka Lock & Dam
Corps
Oklawaha River
US FS
County
F315
MILE
0
½
N

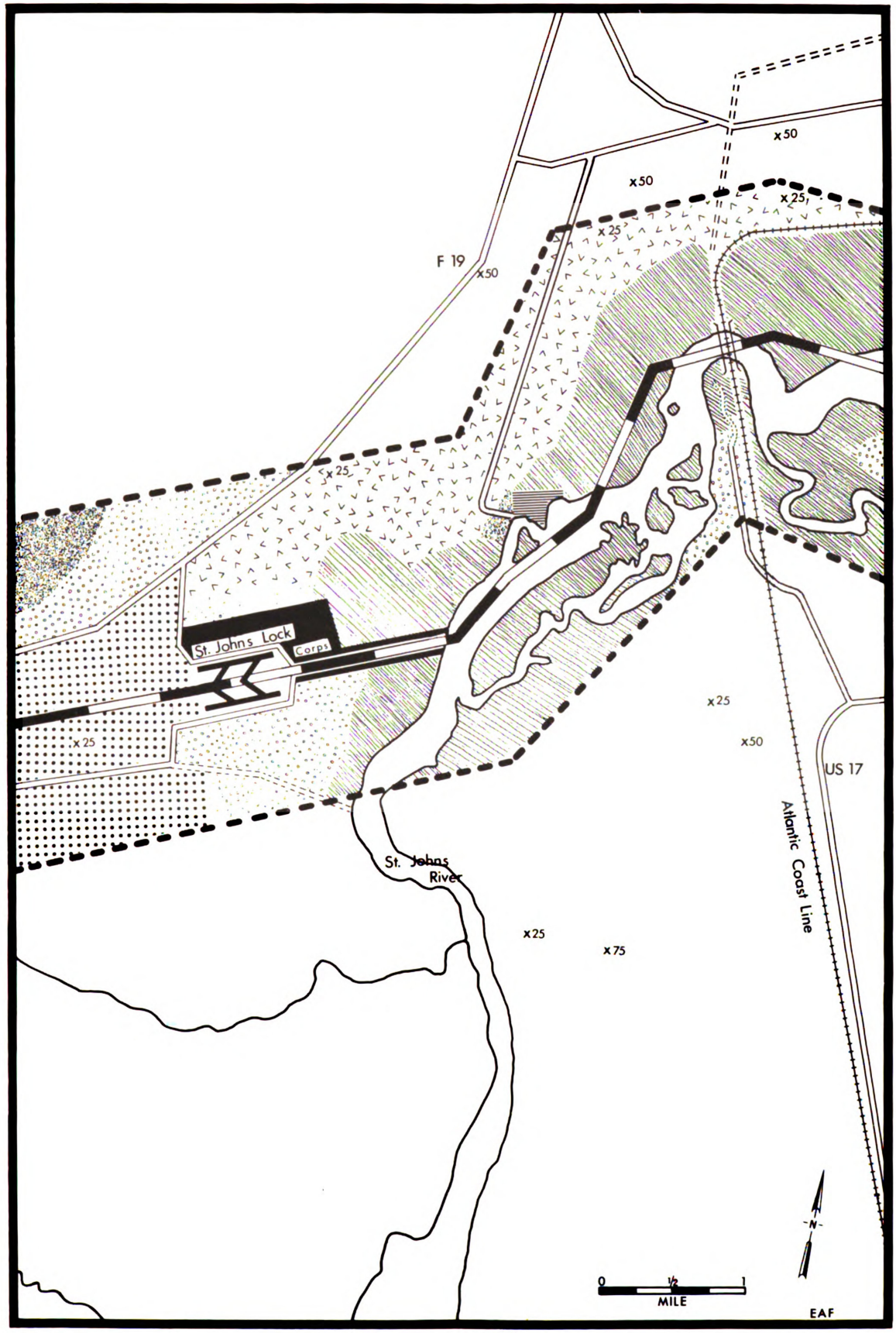
MAP J3


F 310
F 315
Corps
Corps
Corps
Orange Springs
Orange Ferry
Oklawaha River
Private Airstrip
US FS
OCALA
NATIONAL
FOREST
0
1/2
1
MILE
EAF

MAP K3


x 25
Sweetwater Creek
Wildlife
x 25
x 25
x 25
x25
Management Area
x 25
F 310
x 25
x 25
x22
x 25
Corps
Corps
Rodman Dam
x 25
F 19
x 75
x50
x 100
OCALA
NATIONAL
FOREST
Oklawaha River
N
0
1/2
1
MILE
x 50
x 25
EAF

MAP L3


x50
x50
x25
x25
F 19
x50
x25
St. Johns Lock
Corps
x25
x25
x50
US 17
Atlantic Coast Line
St. Johns River
x25
x75
N
0
½
1
MILE
EAF

MAP M3

Recognizing the evident lack of planning for commercial development in past years, the functional maps identify certain areas for this use because the design will provide order to the landscape, will afford more convenient commercial activity, and will allow better regulation of the resultant traffic. Also, special zones for persons who want to purchase small lots for modest dwellings, including cottages, cabins and trailers, or campsites are designated. Occupancy here would probably be temporary, such as during weekends or vacations, but zoning needs to be established to keep out blight conditions. No special differentiation or planning is identified in regard either to the density of residential development or to the building codes needed to control new construction. That type of designing would necessarily be done at a different scale from the one used in this study, and it would more naturally be the responsibility of the urban planner.[1] Zoning and building codes must be developed in line with the criteria discussed in Chapter Five.

Commercial development in respect to location, size, and kind of stores should reflect the type of area it serves. Most needed in the study area will be small shopping centers to provide convenience goods and personal services for the resident, the traveler, and the temporary visitor such as

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[1]Interview with Edward McClure, Head of the Urban Planning Department of the Florida State University, Tallahassee, March 10, 1967.

the sportsman. A neighborhood center having approximately ten shops, including a large grocery and a drugstore, would require one-thousand families in its trade area.[2] The locations at the crossroads south of Lake Rousseau (Map B3) and west of Eureka Pool (Map F3) are suggested as the only ones that will meet this criterion.

Recreation sites along the canal will be of several types. While specific characteristics will be discussed later with the individual maps, several general statements can be made at this time. For each development a responsible body or governmental level is identified as a funding source for site improvement in cooperation with the Corps of Engineers. The primary agency, of course, is the Corps itself which will promote the various areas as a part of the waterway project. The larger parks will include playgrounds, beaches, camping and picnic areas, hiking and nature trails, boating facilities and designated places for water skiing. Those locations at the locks and dams will include parking and overlook spaces for automobiles and sightseeing tours. The scenic parkway and the wildlife reserves will be discussed with the map on which they appear. A commercial outdoor-oriented enterprise is the marina. Each of these firms should provide launching and beaching accommodations, and the necessities for boating and fishing, repair and storage

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[2]Mary McLean (ed.), Local Planning Administration (Chicago: The International City Manager's Association, 1959), p. 136.

services, and possibly a restaurant and motel. The other special land uses will be discussed in relation to their specific location, and any important deviation from the above generalizations will be noted in the paragraphs that follow.

Optimum Land Use in the Withlacoochee Valley Area

Map A3 is characterized by the port and industrial sites at the Gulf terminus of the waterway. As indicated in Chapter Five, this is the primary area identified by representatives of barge companies for creation of a port. The design shown on this map provides for loading and unloading spaces on both sides of the canal entrance. A major marshalling yard for waiting vessels or for large tow make-up is located in the northwest part of the installation. The configuration of the facilities takes advantage of the natural shape of the coastline. Use is made of the rock and fill dirt dredged from the water. Protection is provided by offshore islands.

Because of the cost involved in the construction of the port, public ownership by Citrus County is recommended. The facility will also need utility and access services, of which the provision of fresh water would cause a problem. The county could build and lease warehouse and office space to interested companies and rent to users space and equipment for general loading requirements. Although highway access is good, the section north of the canal will not have rail connections unless either the Withlacoochee on the north

or the canal on the south are bridged and a spur line laid. Otherwise, the operation that requires rail transportation must locate on the south side of the harbor.

Industrial zoning is shown between the port and a line just east of Highway U.S. 19. This area can accommodate the various types of industry described in Chapter Five, and is large enough to allow for on-site mining of magnesium dolomite if the chemical company that owns much of this acreage so desires. Both north and south of the canal the orientation must be toward the central access road and to the water or U.S. 19 rather than to the canal. The reason for this restriction is the bank fishing area that has been established by the Corps of Engineers. No breaks will be permitted through this recreation development.

Because of the thin lens of fresh ground water in this area, this writer suggests that a water system be developed by Citrus County. Selective pumping of several wells that penetrate the artesian aquifer inland of the ten-foot level of the piezometric surface[3] could provide a great amount of potable water. The exact location of this ten-foot contour is not known, but it is somewhere west of U.S. 19.

Recreation is provided at the public beach; fishing is possible in both the Withlacoochee River and the canal and around the offshore islands. The marina north of the

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[3]An imaginary surface which coincides with the static level of ground water in an aquifer.

public beach will be developed by Levy County and leased to a major oil company.[4]

The town of Inglis should benefit from industrial development, from continued growth of retirement and tourist trade, and from an increase in highway-oriented trade. The new connecting road between the industrial area and Highway 488, and the shopping center on that road (Map B3) will tend to unite this northwest corner of Citrus County.

Map B3 exemplifies expected local trends in population, recreation, forestry and agriculture. As the population increases, residential uses will continue to occupy and fill in the land on the lake and around the citrus groves. Eventually, as in south Florida, the groves, too, will be subdivided for residential development. South of Highway 488 the areas laid out for housing before 1966 will show increased growth.

Recreation will serve to draw both tourists and Floridians to the area. Sightseeing, boating, fishing, camping, and picnic facilities will be highly developed in the Corps and state parks. The bridge over the dam will provide access to the area previously designated as a wildlife management area. Opening two areas on the north bank of the lake to cabins and campsites could serve to meet the demands of weekend and holiday vacationers who like the outdoors.

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[4]Interview with Buren Brice, Chairman of the Levy County Port Authority, Bronson, Florida, March 2, 1967.

Zoning will be important here to serve as a bulwark against the possibilities of dumps, abandoned automobiles, shacks, and other undesirable items.

Studies of the fish habitat and the nature of the bottom of the lake will determine where spoil will be placed. Little dredging will be needed in much of the lake reach and most of the small amount of spoil will be placed on the bottom. Some of this material will be used, however, to build up existing islands which can be planted in pine. Care must be taken not to eliminate all of the swamp forest areas.

Under management the second growth forests north of Lake Rousseau can be maintained as continuously productive woods and can support turkey, deer, and small game for the hunter. To a limited extent, this sports use can be made of the pine flatwoods south of the lake, but the denser human occupancy will tend to restrict activities other than forestry. Planted pine is encouraged on most lands that are now devoted to unimproved pasture, watermelon, and peaches. Pulpwood production is the long-term goal, but if population growth is greater than expected, the trees will make the acreage more valuable as residential land.

Isolated commercial development such as a general store and fish camps will continue to exist on the north shore, and the Citrus County area will be sufficiently populated to support a neighborhood shopping center. The location indicated is desirable because it is central, not

only to the residential areas in the study area, but to Citronell, three miles directly south. Another commercial change is the elimination of the dolomite pit west of the dam. This activity will be moved by 1975 and, by leveling the overburden and the creation of ponds as needed, the land can be reclaimed for residential use.

Paved roads around the lake, in residential areas, across the dam, and to the marina will stimulate growth. As mentioned previously, zoning and building codes will be important to a healthy development of this land, but also desirable is a publicity program which will advertise the assets of the region.

An example of a land use that would be detrimental would be the development of a phosphate loading facility on the north shore of Lake Rousseau. Dust in the air and phosphate in the water would have an adverse effect on both recreational and residential land use, and such an operation would not be desirable from the transportation viewpoint because it would involve bringing empty barges through the Inglis lock to the loading site.

Map C3 presents a reasonable location for the transhipment of goods. The convergence of railroad, highway, and canal routes will support the development of two small port facilities and industrial parks, one each in Marion and Citrus Counties. Advantage can be taken of natural features in both cases, yet in each there is a problem to overcome.

In Marion County the docks and commercial area will have to be built where a sand ridge that reaches over fifty feet in elevation now exists. The port facility on Blue Run is a good location and will not require extensive earth moving, but the construction of an industrial complex will. Also, it will be necessary to install a spur rail line because the incline to the main railroad bridge must start nearly a mile north of the canal to meet the minimum clearance requirement of sixty-five feet above the waterway.

In Citrus County the principal problem in port and industrial park development will be the filling in of swamp forest areas. An advantage of this site is that the barge basins can utilize old phosphate pits that are in excess of twelve feet deep and are located in the Withlacoochee River just south of the canal.

Major transportation route changes can be seen on Map C3 when compared with Map C1. No particular problems are present in this connection, although the bridges to provide a sixty-five foot clearance are costly. The old automobile span southwest of Dunnellon must be maintained to provide access to the residents on the island that will be created between the canal and the river in that area. Access will also have to be provided for the people who live south of the waterway east of Dunnellon (Map C2). This writer suggests that instead of the proposed new county road one-half mile south of the canal from Highway 200 (Map D3) to U.S. 41, the Corps of Engineers should build a scenic drive

on the canal right-of-way, which would extend from Dunnellon to Highway 301 south of Ocala (Map E3). This road could go under the railroad bridge and cross the Withlacoochee over the old Seaboard Railroad overpass right-of-way as shown on Map C3. An additional means of access to the general area would be gained by reopening the Dunnellon airport. The major traffic would be private tourist flights, however, rather than commercial or executive craft as some suppose.

Little change is recommended in forestry and agricultural land use. Some of the present extensively farmed pasture land should be planted in pine, although more intensive development as grazing land is also reasonable.

Residential use will extend primarily to the north of Dunnellon and toward Lake Rousseau. In the north it is desirable to reclaim the phosphate lands, by leveling overburden and the creation of ponds, for attractive housing development. This has been done successfully elsewhere, for example in Polk County. A possible alternative for housing would be the area just southwest of the lock, east of the new railroad overpass. The land shown as pine flatwood and improved pasture could provide homesites if the new road is placed as indicated on the map and advised above.

A major problem could arise because of the relocation of approximately fifty Negro families whose situation was discussed in Chapter Five. This writer suggests that a federal housing project (Map C3) be built in sufficient time to allow

for an orderly move. This settlement in the designated location would improve the living conditions of these citizens, would provide a residential site near their original homes and would furnish quarters which they could afford.

Optimum Land Use in the Ridge Section

Less intensive use of land is characteristic of Map D3. The upland pine and oak vegetation on the very sandy dry soils could best be used by developing a wildlife sanctuary in conjunction with the county park on Ross Marsh. The Florida Game and Fresh Water Fish Commission would be responsible for this project. The Canal Authority presently owns land to a point one-half mile back from the canal centerline, and by trading some acreage and purchasing the rest, this wildlife area could add to the outdoor recreation potential of the study region.[5] A special factor would be the lack of hunting in the reserve because of its relatively small size and because of the need for animal protection around the marsh.

Engineering studies should be made to establish the feasibility of placing a low level dam parallel to each side of the canal to maintain the normal water level in the bog. At present the floor of the wet area is approximately fifty feet above sea level. If the average level of the surface

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[5]Interview with H. E. Wallace, Assistant Director, Florida Game and Fresh Water Fish Commission, Tallanassee, February 28, 1967.

of the waterway is lower than that height, and it is sure to be, the karst feature will be drained. To explore this problem the procedure then, would be to check to see whether the organic layer on the floor of the marsh, the limestone supporting it, and the local water table would hold the present quantity of water if impounding structures were installed.

Additional changes contemplated in land use on Map D3 include some more planted pine and a small service space for travel, tourist, and recreation needs. All agricultural use of this area should disappear, although some of the woodland will serve as limited acreage residence sites. The extension of the scenic drive from Dunnellon to Highway U.S. 301 follows along the canal and through the wildlife sanctuary.

The Corps of Engineer's Scenic Parkway dominates Map E3. This use was designated by the Corps as desirable rather than an alternate one of reselling the land to the public for residential, agricultural, or industrial use. Three factors influenced this decision. First, the Engineers desire reasonable control over the land use in the Summit Pool reach. Secondly, they could complete a program that would keep the area in public use and fit it into the overall recreation development. Finally, the elevation at this point is between thirty to fifty feet above the level of the canal surface, and the federal agency would be most able to

utilize the overburden to create a scenic parkway of nature trails, overlooks, bridle paths, and picnic areas.[6]

No commercial traffic or business enterprise will be allowed in the parkway. It is an interesting fact that the intersection of Interstate 75 and the canal will not produce a major land use change. This is explained by the relative location of the Interstate away from utilities, other means of transportation, and from the urban area. For travelers leaving the Interstate to visit the parkway a small commercial area will develop.

Population pressure will create a demand for the residential areas noted and may, in time, impinge on the pastures for thoroughbreds shown on the good soils of this area. The Fishburn Cemetery has been relocated about one-half mile south of its original site. The land in the northeast corner of the study space will develop highway and service oriented business and an industrial park which is primarily on Map F3.

Indicated land use change in the area between the railroads on Map F3 is from residential and agricultural to industrial. This modification is an extension of the present zoning plans of Marion County as well as an influence of the

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[6]Interview with Ard L. Eulenfeld, Project Planner, Corps of Engineers, Jacksonville, December 22, 1966.

barge canal.[7] All of the factors needed by industry are present at this location. Because of the problems related to maintaining a minimum water level in the Summit Pool, the harbor slips will necessarily have to be small. The larger port area behind the docking space north of the waterway indicates public warehousing and storage units. As in each industrial complex noted in the study, not all of the plants will be oriented toward the canal. In fact, most of them may not be, particularly at this site. Additional highway and rail access can be developed within the park as needed.

Highway and service oriented businesses will develop on U.S. 301, and a neighborhood shopping center will be build on Highway 464 to meet the needs of the residential growth both toward Ocala and along the Eureka Pool. These same people will be served by the county park on the canal. Also to be noted is the relocation of the Capulet cemetery from the canal right-of-way.

Optimum Land Use In the Oklawaha Valley Area

The large private housing area on the Eureka Pool will tend to be a highly developed and advertised retirement haven with the possible creation of parks and a small beach. The special character of this pool is important. Its average

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[7]Interview with John Hastings, Marion County Planner, Ocala, January 12, 1967.

depth could well be less than three feet, and on occasions the water's edge may recede one-hundred feet or more in relatively level areas. A minimum level, not as yet determined, will be maintained by regulating the outflow at the Eureka Dam.

A major use of this water feature will be fishing. There may be hunting on the privately owned north and east banks. A possible health problem to the new residents could be the existence of encephalitis-carrying mosquitoes. The cattle operation that has existed here before flooding could be moved to leased land across Highway 464.

Map G3 represents an extension of the present multi-use character of the land without change in the cover of natural vegetation in much of the area. It shows an expansion or intensification of previous activities, such as the residential and commercial uses north of Highway 40 east of the river, and an addition of the canal and park facilities. The residential section on the south border is an extension of the retirement development shown on Map F3. The Cross-Florida Barge Canal Headquarters building is shown at the location of the Silver Springs lock.

Cooperation among the private land owners, the forest services, the Florida Game and Fresh Water Fish Commission, and the Corps of Engineers is vital to optimum use of this area. Coordination will eliminate needless duplication of activities, will provide the best location for camping and

sites for water sports, and will regulate hunting effectively. Timber production and more fire protection will continue to be an integral part of the activities here.

Access to the land on the east side of the lock will not be adequate without the addition of the bridge shown on the map. This structure is necessary especially to forestry and recreational uses. The road leading to it from Highway 40 should be paved.

The enlarging of Silver Run might be capitalized upon by Silver Springs Incorporated by the addition of some attractions along the banks that fit into the natural setting. These sites then could be serviced by a conveyance such as a type of sky-ride or monorail. Except for these possibilities, the Silver Springs enterprise will be unaffected by the canal.

Land use change on the Eureka and Rodman Pools, on Map H3 through L3, points out the accelerating effect the canal project will have on the area. The present major uses--recreation, retirement and non-permanent residential, privately owned forests, and general land improvement in the Ocala National Forest--will be more intensively developed. The major reasons for the various trends are: the additional water surface and waterfront property, the promotion of better access, population growth, and a coordinated development program largely backed by federal funds.

U. S. Forest Service recreation sites for camping, hiking, picnicing, and nature study will be built with

running water, restroom, and cooking facilities. The dirt roads and the relatively isolated locations of some of these spots reflect the open, back-to-nature, non-commercial character of this program. It will be necessary for the Youth Camp to move its waterfront development, but the cost of relocation will be borne by the Canal Authority, and the conservation work will not suffer (Map H3). This report retains the lake names and the Oklawaha designation and predicts that they will not disappear.

Private cabins and campsite locations indicated on Map I3 will provide a small lot for the weekend vacationer, or for the visitor wanting to stay for a longer period. Some persons might wish to make this area a permanent residence, but usually the stay will be temporary. The hamlet of Eureka should show some growth as a housing area for wildlife officers, retired persons and personnel who work at the lock and dam or in the marina. National Forest regulations will prohibit residential land use from developing on the east bank of the reservoir on this map.

Maps J3 and K3 show a continuation of the same utilization pattern. It is significant that this is entirely compatible with previous uses and that it fits into the recreation program of the navigation project. On each map several spoil islands have been drawn in to denote the probability that a few such islands will be created. The Corps, as indicated in Chapter Five, will plant these features

in natural vegetation. Two other uses for spoil will be to improve shorelines and to build beaches at the recreation sites.

The marina on Map K3 should be a large enterprise that would include boat and motor repair and sales, services for the sports needs of the area, a restaurant, and motel. It is possible that the facility might be closer to the park across the inlet, but the location shown is better in regard to water access, and there is an excellent view both up and down river. The Orange Ferry operation permit will be leased from the Corps of Engineers. Private ownership of the land at the east end of the ferry will prohibit the development of a public park at that point.

Planted pine land will make optimum use of the sandy soils located along the north shore, east of the marina and to the east of Rodman Dam (Maps K3 and L3). It is important to note that the small trees would be planted in an existing but very poor quality pine flatwood. It is between Orange Springs and the St. Johns River that the land has been severely overcut, and a well-managed reforestation program has not been implemented. The present limited use for sheep and cattle grazing will expand only slightly, remaining essentially unchanged.

Large, well-developed recreation areas by the Corps of Engineers and the wildlife management area dominate Map L3. A good publicity program will bring many people to the canal

area. The St. Johns Lock, the Rodman Dam, and these facilities for outdoor activities would be the first stops on the canal for the visitors coming from northeast Florida. The commercial activity at the junction of Highways 19 and 310, though, being primarily highway-oriented, could contain a motel-hunting lodge complex. The Sweetwater Creek Wildlife Management Area would grow and protect a good habitat for fowl and small game. Hunting and fishing conditions would be excellent in this area.

Map M3 is characterized by the St. Johns River and its relatively unchanged banks of swamp forest vegetation. The completion of the canal will necessitate that the lock and the adjoining park and fishing banks be developed by the Corps of Engineers. Optimum land use will call for planted pine on the cutover lands and an enlargement of the pastured area on Highway 19. The marina is merely an expansion of the fishing camp that is presently located there, and its growth will be due to a normal population increase rather than to the existence of the waterway project.

Industrial, residential, and other more intensive uses of the land will not develop at this end of the canal, partly because of the lack of major highway and railroad access and of utility services. One or more of these factors hurt both the canal and the St. Johns development potential. More significant, the proximity to Palatka where these and other criteria can be better met, plus the cost of preparing

swamp forest land for heavy use, and the modest market area, are factors that will tend to influence business and industry to locate to the north between Palatka and Jacksonville. The advent of the St. Johns-Indian River Canal, however, would probably provide impetus for the construction of a small marshalling yard at the juncture of the barge canal and the St. Johns River.

Linear Land Use Changes

A linear measurement of the major land uses on both sides of the waterway before construction of the waterway, as compared to a similar assessment of the suggested uses described in this chapter, provides an idea of the most significant changes in the utilization of the space (Table 5). The use as natural forest loses the largest amount of frontage, about seventy-five miles in all. The figures given in Table 5 were gained by gauging, according to the categories provided, the linear mileage on both banks of the dry land cuts and the shoreline before and after completion of the reservoirs.

Of the natural vegetation areas the swamp forest lost the most frontage because it occupied the areas of lowest elevation. Some of this land and other locations in natural forest will not disappear actually, but were placed in a different category because of a change in the major emphasis of the utilization of space. For example, the land on Map D3 will stay in upland pine and oak, yet the major objective

TABLE 5

MAJOR CHANGES IN LAND USE BETWEEN THE INVENTORY AND FUNCTIONAL MAP

Major Land Use	Linear Miles		Net Miles	
	Before Canal	After Canal	Gain	Loss
Swamp Forest	71.5	14.2	--	57.3
Unimproved Pasture	18.1	--	--	18.1
Pine Flatwood	29.4	21.5	--	7.9
Upland Pine and Oak	21.0	14.7	--	6.3
Hardwood Hammock	7.4	2.9	--	4.5
Cottage and Campsite	0	27.4	27.4	--
Recreation Sites	0	22.7	22.7	--
Planted Pine	0	13.2	13.2	--
Scenic Parkway	0	13.0	13.0	--
Industrial	0	11.2	11.2	--
Residential	15.0	20.5	5.5	--
Wildlife Sanctuary	0	5.3	5.3	--
Dry Sand Scrub	4.8	9.3	4.5	--
Ports	0	4.4	4.4	--

for that space will be to serve as a wildlife sanctuary. The other major loss, that in unimproved pasture, is caused by the need to make better economic use of that acreage as explained earlier in this chapter.

Major gains are in land uses that are new in the immediate canal area. As seen in Table 5, seven of the nine categories are different from before, and they substantiate the notation that growth on the waterway will be largely recreational, residential and industrial (including port facilities). Other changes, such as for marinas or in coastal marsh, were less than two miles and were not included

in the table. Improved pasture, which did change in certain locations, balanced with equal gain and loss, a linear distance of 7.2 miles.

Since the pool areas did not exist prior to flooding behind the dams, there is no way to compare the land use on the shoreline before flooding. Most of the land inundated was swamp forest, as noted on the inventory maps, the major exception being the improved pasture on Map F. This topic was discussed in Chapter Five. After completion of the project the vegetation or land use on the banks of the reservoirs will be pine flatwood, nineteen miles; wildlife management area, 11.6 miles; residential, 7.6 miles; sand pine, 7.2 miles; swamp forest, 6.9 miles; and recreation sites, 6.5 miles. Several other types of utilization can be noted on Maps F3-L3.

Toward Optimum Land Use: A Summary

A trend toward optimum land use, while speeded up, will not result solely because of the opening of the barge canal. Normal population and economic growth, a need for public recreation land, property reevaluation and the accompanying pressure to put land to work are other factors that affect the utilization of space. Nevertheless, as the posture shown on the functional maps is achieved, as people move in, and as industry and other commercial development takes place, more service and construction jobs will be provided which will raise the per capita income and provide a

broader base for the economy. These paychecks will represent more money per capita because the positions require more skills, and the greater amount of full-time employment will lessen the insecurity of the laborer's present situation.

Although the new publicly owned lands in the study area will be taken off the tax rolls, the increase in value of the rest of the land will be substantial, enough to more than off-set the cost of needed utilities and services the growth will demand. As industry grows and trees are cut, these increased activities will also contribute to the county tax funds. The Corps of Engineers' Economic Evaluation states that, "Net land enhancement from provision of new waterfront is estimated on a front-foot basis at thirty dollars for reservoir upland, twenty dollars for reservoir low ground or swamp, and ten dollars for canal frontage."[8] These estimates are averages and their value is questionable except as they serve to point out a general agreement that the price of property will increase.

Before land use such as that presented on the functional maps can be achieved, man, i.e., landowners, government officials, bankers, and others, must be willing to plan. They must be able to set rational objectives and must study to find the best means of reaching them. They must appropriate time and money toward the attainment of common

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[8]U. S. Army Corps of Engineers, Economic Evaluation of Cross-Florida Barge Canal Project (Jacksonville: U. S. Army Engineer District).

goals. The representative of the Corps of Engineers, the State Legislator, the County Commissioner, the man from the Chamber of Commerce, the businessman, and the landowner must each do his part, but each must start by recognizing the cardinal principle that optimum utilization of space does not just happen: it must be paid for by cooperation, planning, concern for the public interest, work, and money.

In Chapter Seven, the conclusions and recommendations that have grown out of this study will be presented. These comments will consider the validity of the problem, the intellectual model, the procedures used, and the significance of the investigation.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

Geography as a discipline has much to contribute to the study of land use and land use change. The spatial approach, the use of maps as a tool for analysis and communication, and the provision of a structure for investigating many physical and cultural phenomena in one area, are all geographical aids man can utilize in his pursuit of optimum use of his habitat.

This study underscores the fact that the construction of the Cross-Florida Barge Canal will affect a complex set of natural and cultural phenomena, and that immediate land use change will result along much of the waterway's length. Besides the alterations caused by the actual building of the project, other modifications, such as the development of port facilities, recreation sites, and industrial areas are inevitable. Some changes, such as greater residential construction, more intense utilization of natural forest, and an increase in planted pine, are greatly affected by other factors besides the waterway project, i.e., the natural growth of the population and economy in central Florida, or by the tax re-evaluation programs that are in effect in each

county which it traverses. But even where the different use of land is not caused by the presence of the canal, the structure will tend to encourage development at a rate and to a degree that is not normal for that area.

It is important that the fact of land use change be recognized so that adequate study and planning can be done to provide a guide for the whole study area rather than to allow isolated, irrational change which leads to incompatible situations, duplication of activity, and waste. Those agencies responsible for the various types of planning on a larger, more detailed scale will be able to utilize this study as a pattern for the purpose of orientation. Lawmakers, business and professional men, county and state officials, and private landowners will all have special uses for the information and ideas it provides.

Optimum land use, as defined in Chapter One, is functional. It can be used to identify both the general needs and opportunities that will characterize the study area. Although it is impossible to predict an exact amount of increase in the per capita income, land values, production of the land, orderly residential development, employment, recreational opportunities, and concern for conservation of resources for this and future generations, each has been shown as expanding in its benefits to the public interest. This gain is identified or can be measured in several ways in the study--by using the maps, by extrapolation, and by logical argument.

The operational intellectual model, which provided the frame of reference for constructing the functional maps is entirely adequate. It is limited only by the availability of data and the ability of the researcher to include all relevant material and accurately judge its import. The importance of recognizing the existence of a land use problem is not as obvious as it might seem. The person who has doubts, however, needs only to look about him to see the many examples of a lack of planning, and read the newspapers to note the legal and economic problems that arise therefrom. Man must be made aware of the problem of designing land use, and help should be provided toward adequately defining it. This paper meets those needs in regard to the study area.

The input correctly calls for a survey of the history of land use in the study area and an analysis of the physical and cultural characteristics of the space. These prove valuable and provide a basis for the promotion of heavy recreational utilization of the land close to the canal. History shows that this focus is a logical extension of past economic activity and land use. The Cross-Florida Barge Canal project provides a means for planning and federal money for intensive development. The historical background also gives an explanation for the retirement and tourist character of the project space.

The analysis of the physical and cultural environment proves essential to constructing the functional maps.

For example, it explains the elimination of agriculture from the Lake Rousseau area, it furnishes the information necessary to judge the feasibility of constructing port facilities, and it supplies the basis on which to build a case for the present need for zoning legislation. To the input section the inventory maps and the overlay method of presentation were invaluable. The methods of investigation discussed in Chapter One were successful. Field observation and careful consideration of personal interviews were vital to gathering and interpreting data and to deciding on optimum land uses.

The identification of the intervening variables was dependent upon many factors. A careful examination of the requirements of the physical structure of the navigation project was necessary as was an understanding of the fact that the Corps of Engineers will operate and manage the canal project and must approve of all shoreline development. Planning and economic geography concepts regarding gross land use, utility and other service needs of various activities, and plant and port location requirements were important to this phase of the study and are necessarily recommended to persons who will use this study as an aid to specific planning. These ideas and criteria then must be specially fitted to the site and situation factors of any given land use.

An important variable which must be controlled when multiple uses, such as those presented here, are to be

successful, is pollution. The possible sources of water contamination are: domestic and industrial sewage; oil or other discharge from boats; refuse dumping by citizens, especially in areas of heavy recreational uses; and misuse of agricultural chemicals applied to adjoining lands. These, however, apply only to water. Effective control of dust, smoke, and excessive noise is also necessary to develop optimum utilization of land along the canal.

Interviews in the study area identified relatively little conflict of objectives in regard to optimum land use. The most important controversies are: a possible competition for port and industrial sites among the counties on the canal route; the desire to establish a phosphate landing terminal on the north bank of Lake Rousseau in an area that can best be developed for recreation; general lack of interest in the welfare of the persons located immediately south of Dunnellon who must leave their homes; the futile plan to use the land designated as scenic parkway south of Ocala for industrial development; and some opposition to county wide zoning regulations. This writer, whose suggestions are made in Chapter Six, believes that under the present organizational structure the citizens and the officials of the counties involved can study these conflicts and make rational decisions.

From the output phase of the model, the functional maps, it can be concluded that intensive development of every small area relative to jobs, income, or material production,

is not necessary to the optimum development of the whole study space or of the four counties in the project. As models, they show the benefits of wholistic planning, which in turn helps man identify land use generalizations, such as the existence of commercial development at points near bridges over the canal, or the location of recreation sites and marinas for public usage, or the need for additional access roads.

The maps may also be applied toward educating the public about the need for planning for optimum land use. Moreover, they may help people understand the goal of conservation as not only the protection of natural resources but also as their proper development and utilization toward meeting the needs of people. Finally, the functional diagrams should predict optimum land employment five to ten years after the canal is complete. In no case is there a suggestion made which will cause economic loss to the private landholder. In several cases, however, private land will have to be purchased by a governmental body in order to provide a practice that might otherwise be impossible. In such instances the purchase price should be set in the same manner as is customary for land bought for navigation right-of-way.

The model is successful in helping people establish and evaluate goals. This is desirable because too often people tend to claim excessive potential for available resources. It serves as a guide to identify the steps in land

use development, and it points out the need for multi-dimensional planning. Land uses, to be optimal, must be both vertically and horizontally compatible; that is, they must have continuity in time and be in harmony with neighboring utilization.

Specific Recommendations

As an outgrowth of this investigation, the writer has several special recommendations to make in regard to both the study itself and the implementation of the functional model. They are:

1. The optimum land use model presented here should be tested in 1970, 1975, and 1980, to determine the validity of the predictions made in the output section. If deviations are noted, care should be taken to identify the causes, whether they are the fault of the procedure used or of the existence of an unforeseen variable.
2. The structure of the intellectual model does not require that it be used only on land contiguous to transportation routes. Other studies using this method should be made to predict land use change (1) near where other types of new transportation routes may be constructed and, (2) where other groupings of variables are involved.
3. The structure of the model does not determine the scale at which it should be used. Other similar

studies should be made to test its applicability both at larger and smaller scales.

4. The Legislature of the State of Florida should enact legislation which will grant cities and counties in Florida the following powers: (a) to establish local planning commissions, (b) to prepare community development plans, and (c) to adopt zoning ordinances, subdivision standards, and construction codes. This could also be achieved through a new Constitution which would establish home rule.
5. The Legislature of the State of Florida should review existing anti-pollution statutes in order to provide effective legislation regarding the control of the pollutants of water and air (as well as excessive noise). Where the laws are adequate, the enforcing agencies must be provided with staff, money, and authority to uphold them.
6. The Corps of Engineers, in cooperation with the State Board of Health should conduct studies at the appropriate time to enable them to develop an adequate mosquito control program in the area of the barge canal.
7. The Legislature of the State of Florida should provide legislation which will enable the Canal Authority of the State of Florida to purchase land for the non-navigation purposes of recreation use

outside of the Corps of Engineers' Recreation Master Plan. These areas would be for the Wildlife Sanctuary and the Management Area.

8. The Corps of Engineers should extend their proposed scenic drive westward to Dunnellon as shown on the functional maps.
9. All of the public and private agencies interested in the use of land on the Cross-Florida Barge Canal, should consider the necessity for cooperation if optimum land use is to be attained. This should include setting compatible goals and working, where possible, together toward those objectives. An educational program on land use, a recreation and industrial publicity campaign, and the development of east-west tourist traffic flow, are only a few of the suggestions that will be more quickly and economically gained through common efforts.
10. A committee must be set up to solve the housing problem which will confront the persons who live immediately south of Dunnellon. These people should be represented in the discussion concerning their relocation opportunities.
11. This writer recommends the consideration of this study as a valid model of optimum land use after construction of the Cross-Florida Barge Canal, and as a report based on the use of scientific methods for the best interest of Florida's citizens.

Finally, with the completion of this investigation, the writer feels that strength is provided to the implication made by Friedmann when he said that perhaps it is in the geography and the economics of location that one can discover an adequate theoretical foundation for regional development and planning.[1] This study can be used as a model for land use development not only in the study area, but as a guide to the development of other regions.

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[1]John Friedmann, "Regional Planning as a Field of Study," in Regional Development and Planning (Cambridge, Mass,: The M.I.T. Press, 1964), p. 62.

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