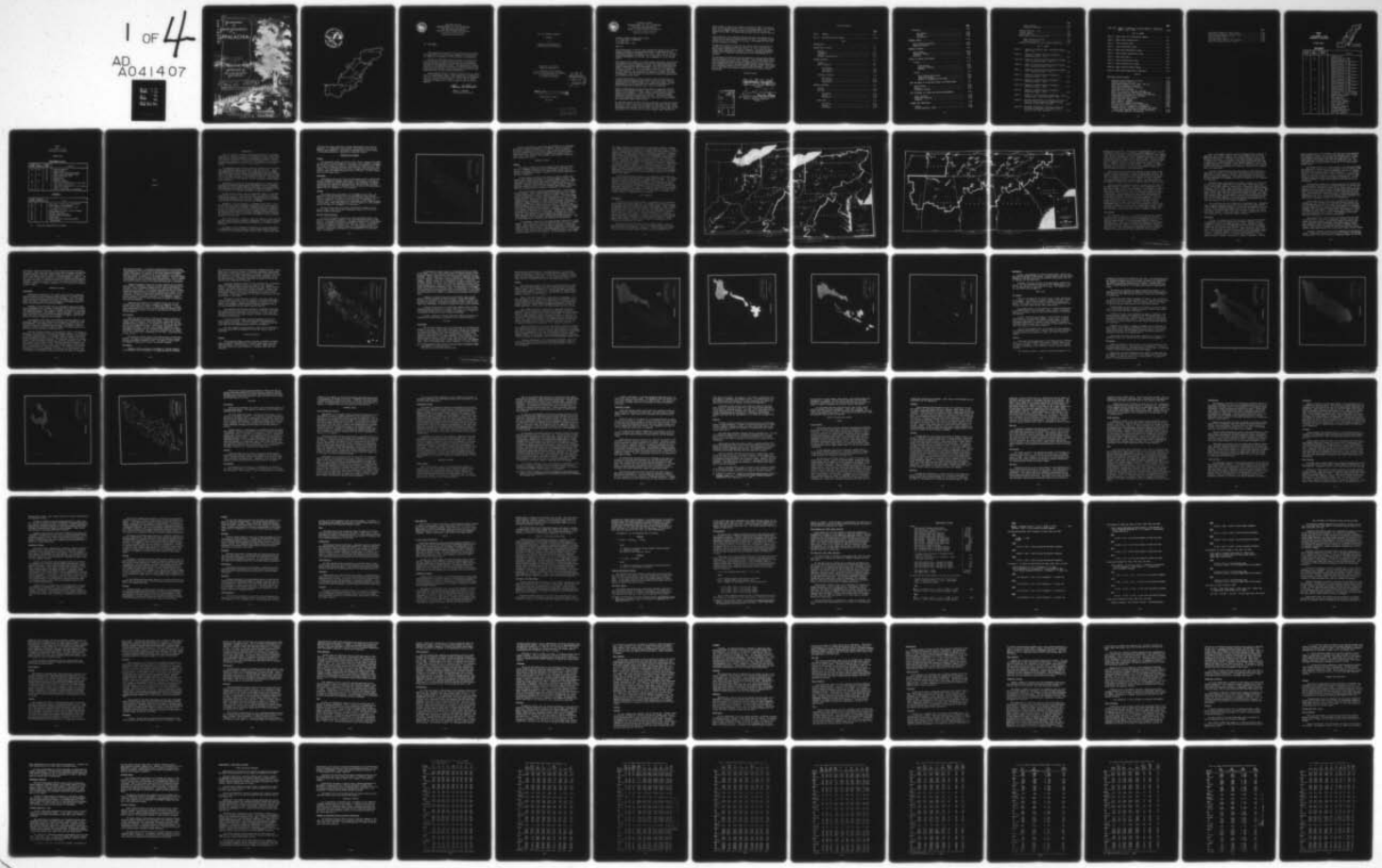
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Development of WATER RESOURCES in APPALACHIA.

Volume 22.

APPENDIX G.
FISH AND WILDLIFE RESOURCES.

JUL 11 1977

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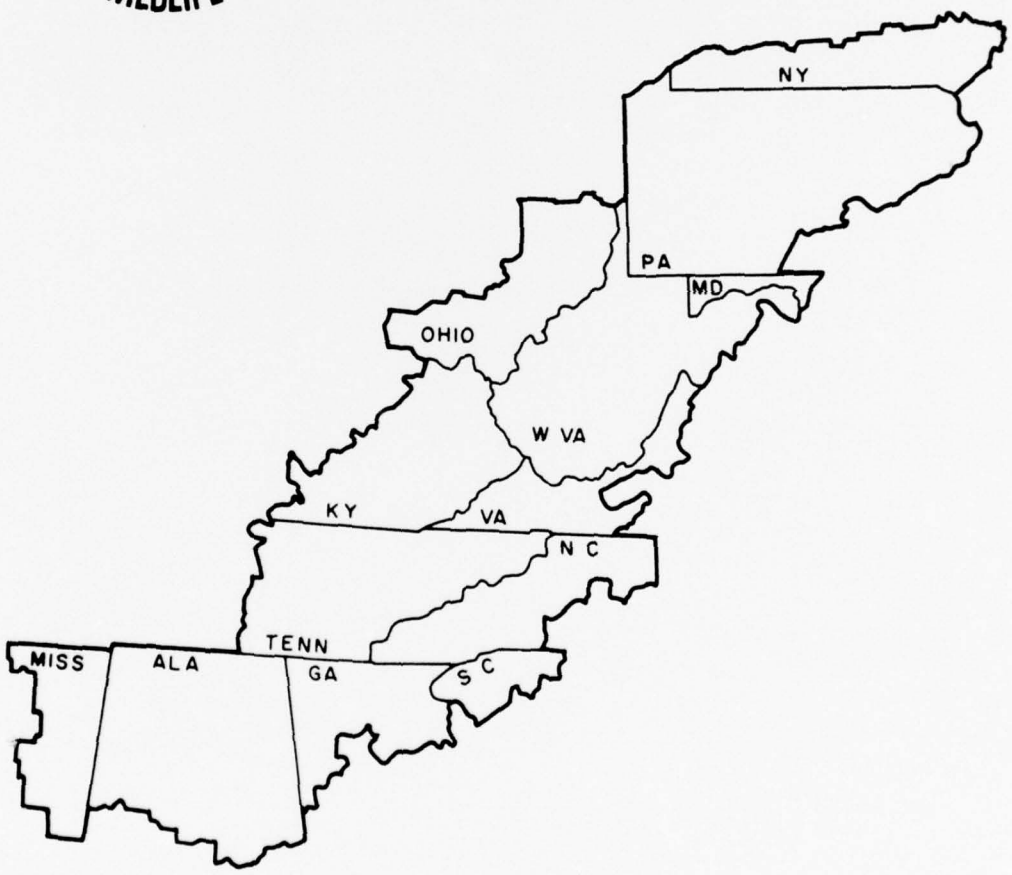
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UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

TO: THE READER

This appendix, designated as "G" and titled "Fish and Wildlife Resources" is one of the basic components that constitute the "Report for Development of Water Resources in Appalachia."

This document includes

Included in this appendix are discussions of the fish and wildlife resources, resource problems, status of fishing and hunting, and ways and means of satisfying the fishing and hunting needs of the Appalachian Region. The appendix also includes detailed fish and wildlife discussions of selected reservoir and local protection projects that are proposed for inclusion in the Appalachian Plan for Water Resource Development.

The Main Report (Volume I) should be consulted for an overall view of the Appalachian Region. Eight appendices, in addition to this one, treat specific subjects and contain detailed information required to support the Main Report. An index for the report components and appendices is shown on pages vi and vii of this appendix.

Thomas A. Schrader

THOMAS A. SCHRADER
Acting Regional Director

(1)

FISH AND WILDLIFE RESOURCES

APPENDIX C

To

REPORT FOR DEVELOPMENT OF
WATER RESOURCES IN APPALACHIA

Prepared by and Printed
under the Direction of

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Sport Fisheries and Wildlife
in cooperation with the
U.S. Corps of Engineers

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ORIGINAL CONTAINS COLOR PLATES: ALL DDC
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Administrative Report

May 1969

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DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

Director, Office of Appalachian Studies
U. S. Army Corps of Engineers
P. O. Box 1159
Cincinnati, Ohio 45201

Dear Sir:

This is the report of the U.S. Fish and Wildlife Service on the fish and wildlife resources in the Appalachian Region, as authorized by the "Appalachian Regional Development Act of 1965", (Sec. 206 (e), PL 89-4). It has been prepared in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; 16 U.S.C. 661-666 incl.).

The purpose of this report is to relate present and future fish and wildlife resources to the availability of the sport fishing and hunting opportunities, including commercial fishing. The report identifies those areas in Appalachia for which enhancement of the fish and wildlife resources is a necessity, if the sportsmen's needs are to be satisfied or even maintained. It includes projections for the years 1980, 2000, and 2020, based on expected population growth and economic development in Appalachia. Ways and means for meeting the fishing and hunting needs are included in this report.

In 1964, approximately 3.2 million anglers fished 53 million days on 1,040,000 acres of reservoirs and lakes; 154,000 acres of ponds; and 192,000 acres of fishable streams in the Appalachian Region. Hunting activities of 29 million man-days were exerted by approximately 2.3 million hunters on 115 million acres of land in the Region.

There are approximately 892,000 surface acres of commercial fisheries habitat in the Appalachian Region, capable of producing 43.8 million pounds of fish annually. In 1966, however, only 4.9 million pounds of finfish were harvested at a value of $705,900. Shellfish landings amounted to 5.2 million pounds worth $511,000. The apparent limited use of the commercial fisheries resource is the result of many problems which presently confront this industry.

The projected demand for sport fishing is expected to increase 21 percent by 1980, 39 percent by 2000, and 61 percent by 2020 over the 1964 actual Region use. Only in 1980 will the demands for the Region be met. During the remaining two periods, 2000 and 2020, the sport fishing needs for the Region will be 7.7 million and 19.1 million angler days, respectively.

Hunter demand is expected to increase 20 percent by 1980, 60 percent by 2000, and 119 percent by 2020, over the 1964 actual Region use. Hunting needs for the Region during the above three periods are 5.6 million hunter days by 1980; 17.3 million days by 2000; and 34.4 million days by 2020.

Future demands on the commercial fisheries resources are expected to increase with the advent of industrial uses for fish. The primary processing will be for the production of fish meal. The demands for food fish are also expected to increase.

Throughout the report, in both text and tables, many of the numbers resulting from calculations were not rounded. It is not intended that these figures represent this degree of accuracy. The actual calculated numbers were listed merely to provide a means for checking mathematical accuracy and to supply the necessary data by which methodology can be followed.

The cooperation of state fish and game agencies in the Appalachian Region made the completion of this report possible. Other Federal agencies also contributed data during the study, including the Bureau of Outdoor Recreation, Federal Water Pollution Control Administration, Forest Service, Soil Conservation Service, Economic Research Service, Federal Power Commission, Geological Survey, and the Tennessee Valley Authority. The cooperation of your office for overall direction during the study is greatly appreciated.

Sincerely yours,

Richard E. Griffith

Richard E. Griffith, Regional Director
Bureau of Sport Fisheries and Wildlife
Region 5

Ernest B. Prince Deputy Regional Director

for William F. Carbine, Regional Director
Bureau of Commercial Fisheries
Region 4

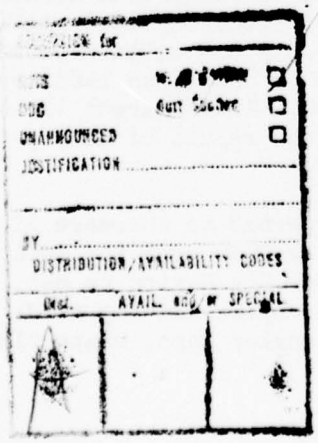


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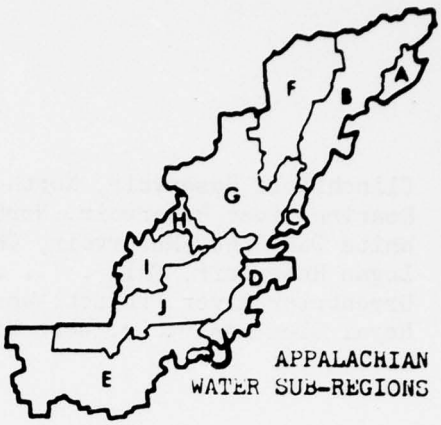
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REPORT
For
DEVELOPMENT OF WATER
RESOURCES IN APPALACHIA



APPALACHIAN
WATER SUB-REGIONS

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REPORT
For
DEVELOPMENT OF WATER
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VOLUME INDEX

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14	V	-	State Water Supplements: O., Pa., S.Car., Tenn., Va., W.Va.
15	VI	-	History, Coordination & Cooperation

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17	B	Power Supply and Requirements
18	C	The Incidence and Formation of Mine Drainage Pollution
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20	E	Economic Base Study
21	F	Recreation and Aesthetics
22	G	Fish and Wildlife Resources
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PART I

GENERAL

INTRODUCTION

This is a report on the fish and wildlife resources in the Appalachian Region. Emphasis is placed on the present and future needs of the sportsmen and commercial fishermen in Appalachia, including recommendations for the enhancement of the fish and wildlife resources. The report has been prepared in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; 16 U.S.C. 661-666 incl.).

The Appalachian Water Resource Survey was authorized by the "Appalachian Regional Development Act of 1965", (Sec. 206, PL 89-4). Under this authorization, the Secretary of the Army was directed to prepare a comprehensive plan for the development and efficient utilization of the water and related resources of the Appalachian Region with special attention to the needs for expanding the economy of the area. This plan will be an integral part of the regional economic development program authorized by the Act.

Specifically, the plan may recommend measures for: flood control, municipal and industrial water supply, hydroelectric power development, water quality control, development and enhancement of fish and wildlife and other outdoor recreation, improvement of rivers for navigation, and the conservation and efficient utilization of the land resource.

For the purpose of this study, the Appalachian Region is that area as designated in the Act (Sec. 403, PL 89-4). It includes the entire state of West Virginia, a major portion of Pennsylvania and small parts of Maryland, Mississippi, New York, Ohio, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, and Alabama.

Appendix G - Fish and Wildlife - is composed of two parts. Part I may be defined as a Type 1 (Framework) study while the second part is a Type 3 or individual project survey. Framework studies are preliminary in scope and are designed to provide broad-scaled analyses of water and related land resource problems as well as furnish general appraisals of the probable nature, extent, and timing of measures for their solutions. The studies are concerned only with the intra-regional water and related resources and their uses.

Much of the data and information which was needed to prepare this report was provided by the conservation departments of the states concerned. Federal agencies furnished additional information and assistance during the study.

The Bureau of Sport Fisheries and Wildlife has issued approximately 475 administrative reports relative to the fish and wildlife resources of portions of the Appalachian Region prior to 1964. These reports were

concerned with water development projects administered by the Corps of Engineers, U.S. Department of Agriculture, or projects licensed by the Federal Power Commission. They range in complexity from survey reports on individual projects to comprehensive basin-wide reports.

DESCRIPTION OF REGION

General

The Appalachian Region consisting of 397 counties, extends from southern New York to central Alabama and Mississippi, and in addition, comprises all of West Virginia and portions of the State of Pennsylvania, Ohio, Maryland, Kentucky, Virginia, Tennessee, North Carolina, South Carolina, and Georgia. It is approximately 2,700 miles in length and averages about 500 miles in width, the width varying from 300 to 750 miles. Its area covers about 195,000 square miles.

Topography

Physiographic provinces include the Blue Ridge Province, Valley Ridge Province, Appalachian Plateau, small areas of the Piedmont, Gulf Plains, Central Lowlands, and Interior Low Plateaus. The topography is generally mountainous, with elevations ranging from 100 feet above mean sea level near Tuscaloosa, Alabama to 6,684 feet above sea level at the Appalachian's highest peak, Mt. Mitchell, in North Carolina.

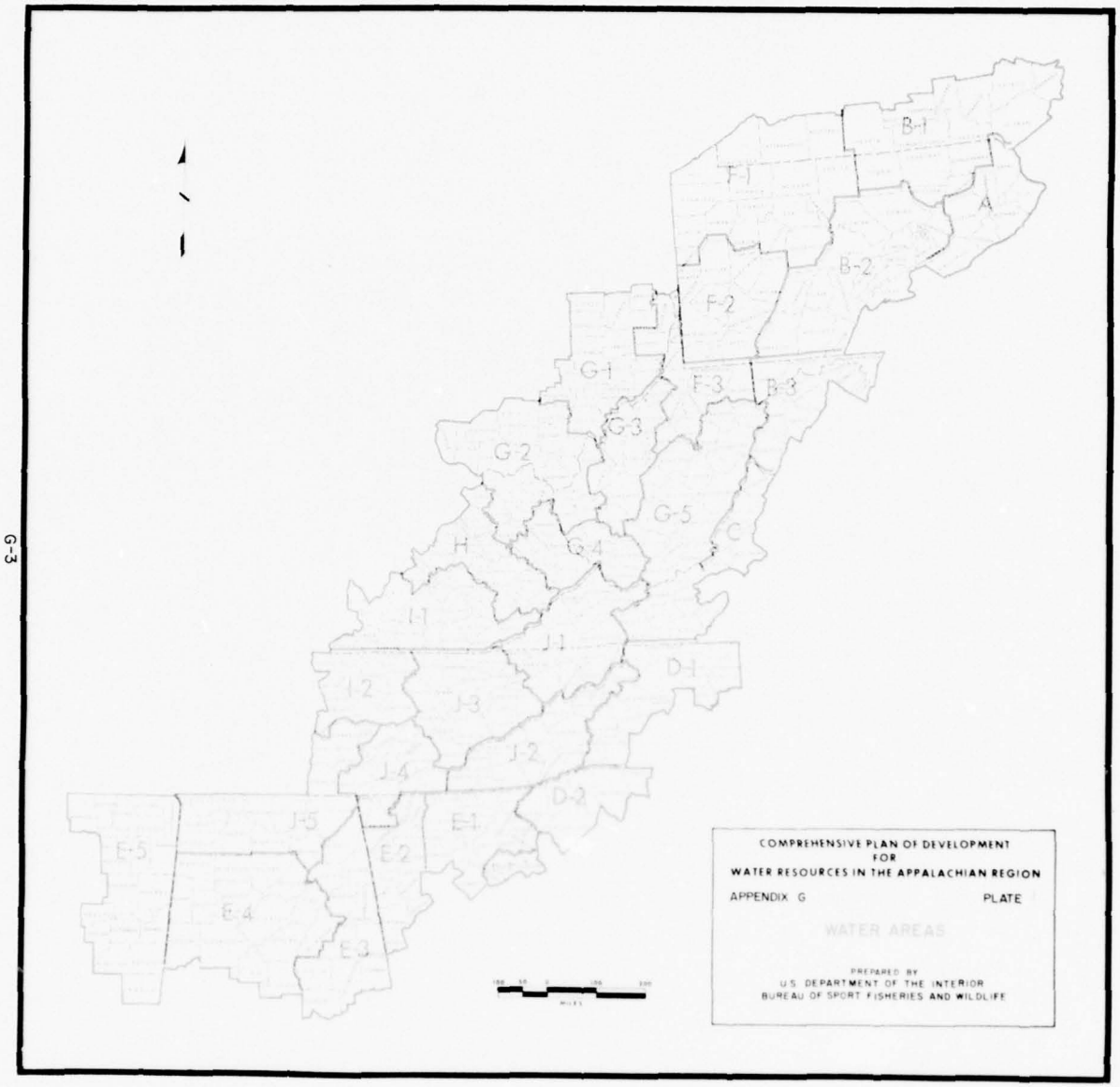
Climate

The average annual precipitation for the Region is 47 inches. It varies from about 35 inches in the north to almost 80 inches in North Carolina. More than 100 inches of snow falls in higher elevations in the north as compared to 3 inches or less in the south. Occasionally, 20 inches or more of snow have fallen in Pennsylvania and West Virginia during a single storm. Mean temperatures vary from 70 degrees F. in the northern part of the Region to 75 degrees F. in the south.

Tropical storms which move inland from the Gulf of Mexico and the Atlantic Ocean, lose much of their destructive force and do not pose a serious threat to the Region.

Economic Characteristics

In 1960, 17.7 million people lived in the Appalachian Region - ten percent of the national population. Six cities had populations more than 100,000 - Pittsburgh, Pennsylvania; Birmingham, Alabama; Erie, Pennsylvania; Chattanooga, Tennessee; Knoxville, Tennessee; and Scranton, Pennsylvania. Of these, Pittsburgh led with 600,000. Two other cities, Atlanta and Cincinnati, within easy commuting distance of the Appalachian Region are expected to make heavy contributions to the recreation use of the facilities of the Region.


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COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
APPENDIX G
PLATE
WATER AREAS
PREPARED BY
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE

Mining, manufacturing, agriculture and forestry are the principal activities of economic importance in the Region. About two-thirds of the nation's bituminous and anthracite coal is mined in Appalachia. Principal manufactured products include primary and fabricated metals, machinery textiles, wearing apparel, chemicals and allied products, stone, clay, glass products, food products, paper products, lumber and wood products, and others.

FISHERY RESOURCES

General

The aquatic habitat and fishery resources within Appalachia vary with the topography, glaciation and the development of the water resources. In general, there are three Regions where certain types of habitat are predominant, however, transition zones between these Regions are often indefinite.

In the glaciated sections of New York and northern Pennsylvania natural lakes comprise 67 percent of the total acreage of water. Only three percent of the natural lakes in Appalachia fall outside this designated area, and most of these are located in adjacent portions of Pennsylvania. Normally, water quality in these lakes is high and many of them are suitable for trout and other desirable sport fishes. There has been only a limited amount of reservoir construction in this Region.

The more mountainous sections of Appalachia form a second environmental variation. Major mountain ranges of the Region are the Catskills of south central New York and the Appalachians which extend from northeastern Pennsylvania to northern Georgia and Alabama. Subsidiary ranges include the Great Smoky Mountains, the Alleghany Mountains, and the Blue Ridge Mountains. Development of large reservoirs in this region is often limited by rugged topography and actual needs of adjacent communities. Therefore, streams and rivers account for more than fifty percent of the water acreage in most of these mountainous sectors. The mild summer climate at these higher elevations results in water temperatures suitable for trout and smallmouth bass production or survival. Most of the natural trout streams in Appalachia are located in the region which overlaps the glaciated area in New York and Pennsylvania. All Appalachian states except Ohio are represented in this mountainous habitat type. The normally high water quality of these headwater and tributary streams is often affected by acid drainage or sediment from mining operations. This is particularly true in Kentucky, West Virginia and Pennsylvania.

The remainder of Appalachia, although generally mountainous, is less rugged. Most of this area is located south and west of the major mountain ranges. Large reservoirs on major tributaries and rivers dominate the surface water in these sections. The Corps of Engineers and Tennessee Valley Authority are the primary development agencies west and south of the mountains, while private power companies become more active in the densely populated regions east of the mountains. As the tributary streams merge

into major drainages, industrialization and population densities increase. As a result, the need for more intensive water management becomes a necessity and multiple-purpose reservoir construction has been undertaken. Flood control, hydroelectric power production, recreation, navigation, domestic water supply, and satisfying industrial water requirements are primary benefits of reservoir development. At these lower elevations water temperatures tend to exceed the limits tolerated by trout and other coldwater fishes. Largemouth bass, catfish and panfish are the common game species; and, the percentage of non-game fishes becomes proportionally larger than in the cooler tributary streams. If water quality continues to decline due to pollution, water fluctuations, and chemical composition, the sport or game fish populations suffer and the value of the fisheries is further reduced. Through cooperative efforts water quality can be improved in the tailwater of many reservoirs allowing the creation of high value fisheries. Developments of this type have become increasingly important to the fisheries of this Region.

The commercial fishery resources occur primarily in the larger reservoirs and a few of the major river systems within the Region. The finfish resource consists almost entirely of non-game species of fish. All of the important shellfish resources are harvested in the southern part of the Region. In general, the commercial fishing industry has been limited by poor markets and restrictive legislation and as a result, the resource has never been fully utilized. Most of the fishing occurs primarily on Tennessee River impoundments in Alabama and eastern Tennessee and on that portion of Lake Erie which borders the Region. In other areas of Appalachia commercial fishing is insignificant or non-existent.

Sport Fisheries

The Habitat

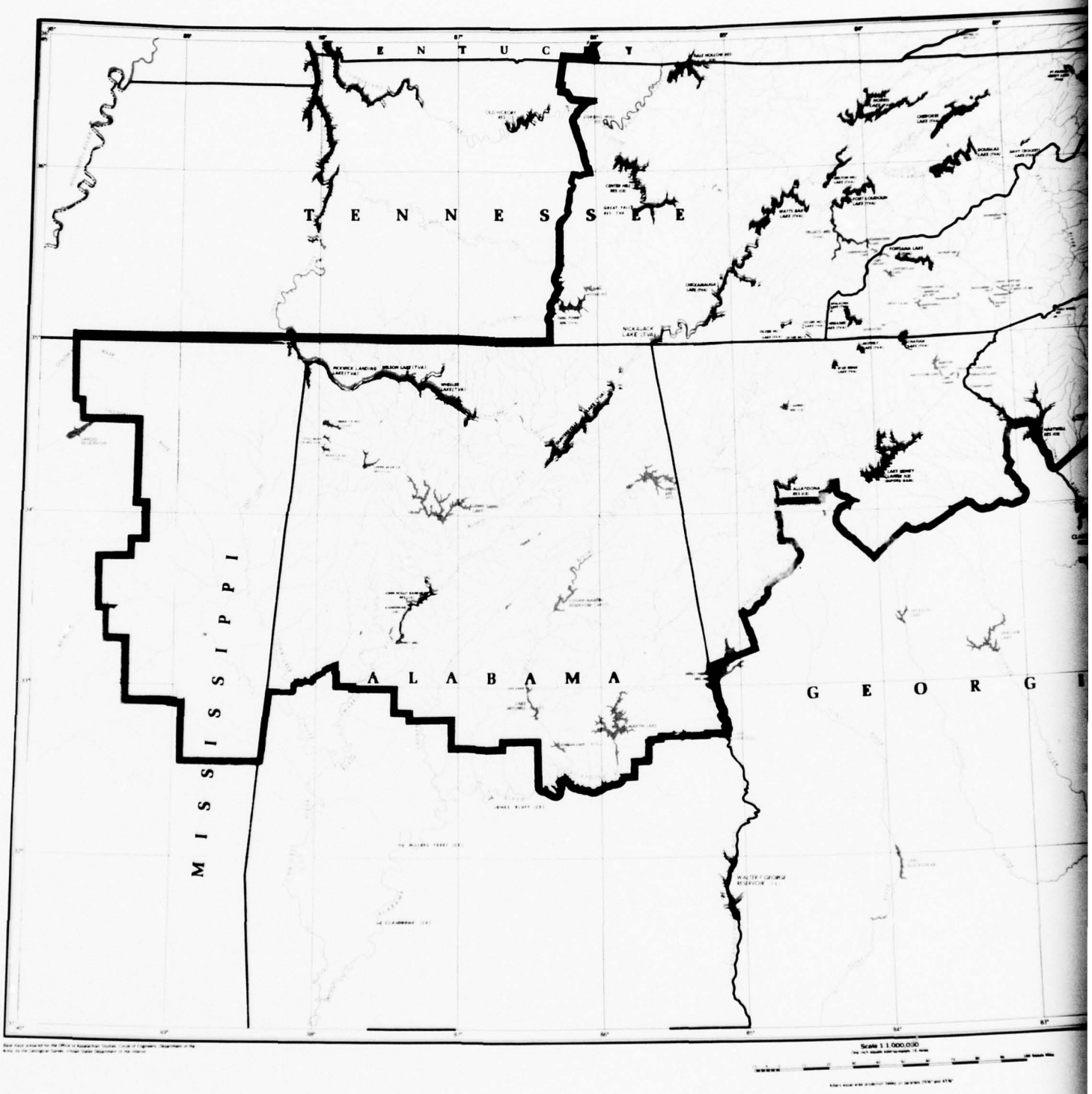
The 48,100 miles of fishing streams in Appalachia, when converted to acres at the rate of four acres per mile, represents approximately 14 percent (192,000 acres) of the Region's total surface water. Streams comprise a high percentage of the total water area in West Virginia, Virginia, eastern Kentucky and portions of North Carolina. At higher elevations, the streams are small compared to the major rivers and tributaries located at lower elevations. Where trout can survive, fisherman-use is generally high but productivity is limited. Pollution from acid mine drainage, coal-washing operations, industrial, and domestic sources reduces water quality and, in turn, affects production of large sections of habitat. Severe water level fluctuations resulting from critical low-water periods and flooding also reduce fish production.

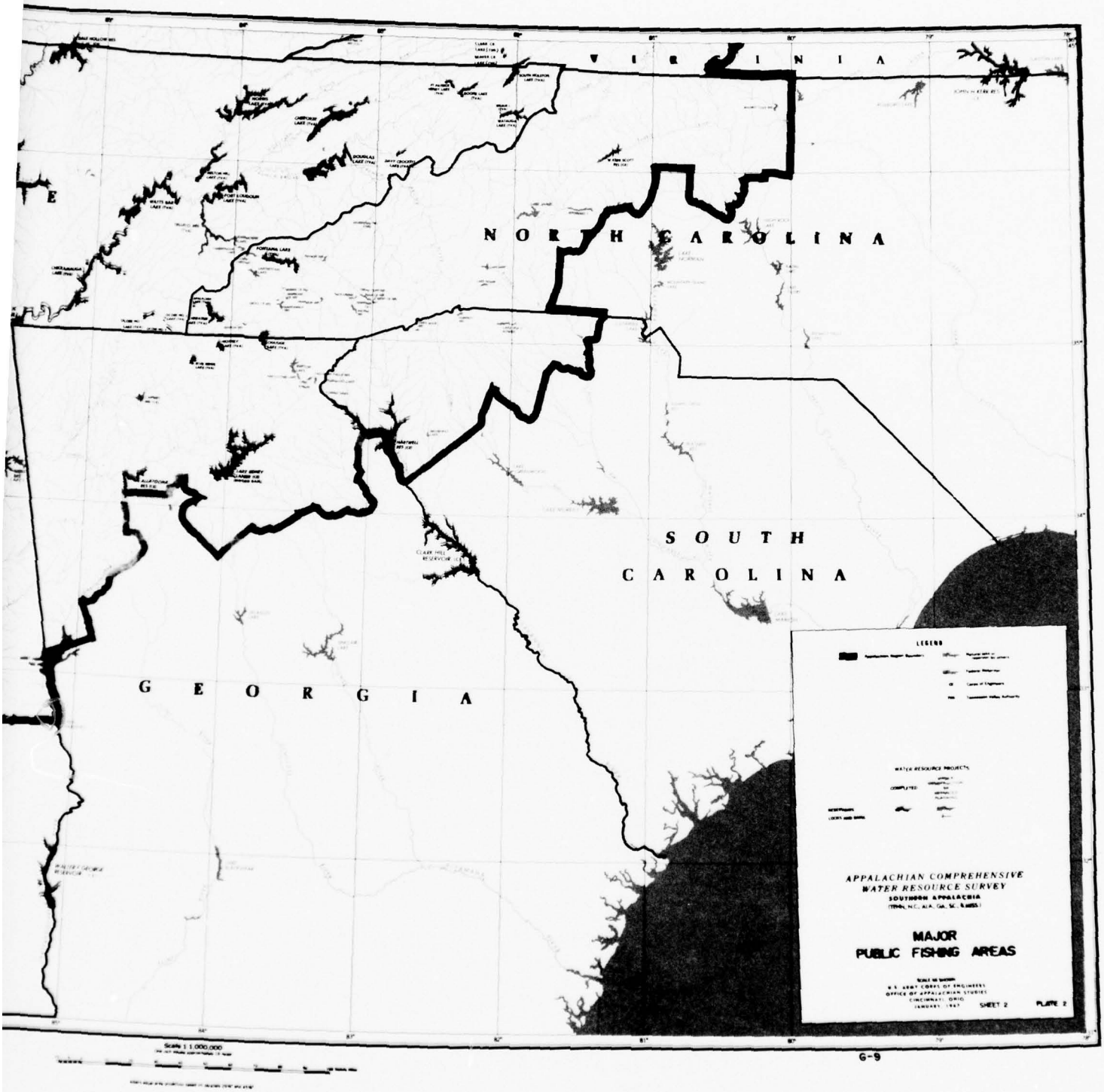
Reservoir storage constitutes about 67 percent (924,500 acres) of the water acreage in Appalachia. Most of the larger projects are located west and south of the Appalachian mountains. Primary construction agencies include the Tennessee Valley Authority, Corps of Engineers, and


MICHIGAN
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INDIANA
OHIO
PENNSY
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KENTUCKY
TENNESSEE
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NEW YORK
PENNSYLVANIA
NEW JERSEY
MARYLAND
DELAWARE
WEST VIRGINIA
VIRGINIA
NORTH CAROLINA
LEGEND
WATER RESOURCE PROJECTS
COMPLETED
APPALACHIAN COMPREHENSIVE
WATER RESOURCE SURVEY
NORTHERN APPALACHIA
(N.Y., PA., OHIO, W. VA., MD., KY., & VA.)
MAJOR
PUBLIC FISHING AREAS
U.S. ARMY CORPS OF ENGINEERS
OFFICE OF APPALACHIAN STUDIES
CINCINNATI, OHIO
JANUARY 1967
SHEET 1
PLATE 2
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E N T U C K Y
T E N N E S S E E
M I S S I S S I P P I
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private power companies. State Game and Fish Departments, the U.S. Soil Conservation Service, local governments, private organizations, and industry are also involved in upstream reservoir construction, of a smaller size. Multiple-use reservoirs include hydroelectric power, flood control, industrial and domestic water supply, navigation, water quality control, fish and wildlife and recreation as project purposes. Topography limits dam site selection as well as storage capacity in the mountainous regions. Therefore, most of the larger projects are located in areas having low stream gradient and broad valleys. Industrial and urban development along major water courses and transportation centers have often dictated the areas of water development.

Natural lakes make up about eight percent (115,900 acres) of the acreage of water in Appalachia with the majority being located in New York and northern Pennsylvania. Generally, these lakes are deep, cool, clear and relatively unproductive when compared with the large reservoirs of southern Appalachia. Total production is often limited by cool water temperatures and the basin contour. The establishment of high quality fisheries has partially offset the lack of high production.

Farm-pond habitat represents almost 11 percent (153,700 acres) of the water acreage in Appalachia. Most of it is concentrated in the agricultural areas, and to a lesser degree, in the foothills or transition zones. Steep gradients, inaccessibility, and limited need for water storage deter pond construction in the more mountainous sections of Appalachia. As topography becomes less severe, agricultural use of the land is greater, increasing the need for soil stabilization, land treatment measures and better watershed management. Farm ponds in this intermediate zone are constructed primarily for livestock water, while erosion control and fishing are secondary functions. Recent trends have placed a higher priority on fish and wildlife developments made in conjunction with pond construction. Most of the ponds are constructed on private lands, ranging from a quarter to five surface-acres in size, and are less than twelve feet in depth. Habitat composition of each Appalachian state is presented in table II.

Fish Species

The headwater portion of many coldwater streams maintain populations of brook and brown trout. Rainbow trout are often stocked. Smallmouth bass and walleyes inhabit the intermediate sections of the many cool water streams. In the downstream sections of the major tributaries and in the main rivers where the gradient lessens and maximum temperatures are higher, largemouth bass, bluegills, crappies, sunfishes, and catfish are the common game species. Public lands are often located on the intermediate and headwater sectors of streams, therefore, these sections are often available to the fisherman.

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Most of the larger reservoirs support warm-water fish populations of largemouth bass, catfish, crappie, white bass, gluegills, and sunfishes. Where water quality and temperature are suitable, walleyes become a more important game species. A few states have made successful introductions of striped bass. Fishery development, along with other recreational uses of reservoirs is often dependent on water quality relating to soils in the upstream watershed. The chemical composition of the water and the contour of the reservoir basin generally are indicative of the productive capabilities of an impoundment.

The lack of shallow water limits productivity in some reservoirs. Water level fluctuations can alter both total production and the ratio of game fishes to other species. Tailwater fisheries are an important outgrowth of reservoir development. Inter-agency cooperation is essential for the development and management of potential fisheries of both reservoir and tailwaters.

Smallmouth bass, largemouth bass, bluegill, crappie, and sunfish are the most common game fishes taken in natural lakes. Brook trout, brown trout, rainbow trout, walleye, northern pike, pickerel and muskellunge are present in specific areas. Lake Chautauqua in southwestern New York State, for example, is one of the better known lakes managed for muskellunge. Lake trout, kokanee, and splake have been experimentally introduced in selected waters of this area. With the exception of a number of access sites that are purchased, leased, and maintained by game and fish departments or other public recreational interests, most of the lands adjoining these natural lakes are in private ownership. The state game and fish departments, however, are responsible for the fisheries management.

Fish production per acre of farm ponds is generally high. Largemouth bass, bluegills, sunfish and bullheads are the most common fish species. Poor management frequently results in unbalanced fish populations and poor returns. Ponds constructed fundamentally for fish production have become more popular especially where trout can be stocked. In many such cases a user fee is charged. Ponds in the southern part of Appalachia tend to be more productive, due to moderate climatic conditions.

Utilization

In 1964, an estimated 52,800,000 man-days of angling were expended on Appalachia's 1,386,000 surface acres of fishable habitat, which is equivalent to about 38 man-days per surface acre. However, an overall average use rate per acre for Appalachia or for each of the Appalachian states does not provide a valid base which can be applied to any habitat type or specific area within the Region. There are several reasons for this. The productive capacities of reservoirs, ponds, and streams differ as well as comparable habitats of the same general classification. In addition, average use rates do not account for variations in license sales, population density, accessibility, degree of management, species

species composition of the fisheries, and other local characteristics that influence fishing. Also, much of the available census information represents estimates of fishermen-use on specialized or heavily fished waters such as state-owned lakes and large reservoirs with only fragmentary information available for streams and ponds. This information could not be adjusted to cover any of the three general habitat types.

The average use rates per acre for each of the Appalachian states does provide an indication as to the predominant type of habitat in any particular state. Due to productive potential, use rates on streams and ponds are considerably higher than on reservoirs. If a large percentage of the available habitat consists of ponds or streams in any state, per acre use is high in comparison to lower per acre use rates for states dominated by reservoir or large lake fisheries. In each instance, fishing is closely representative of the productivity of the habitat.

The Appalachian average of 38 man-days per acre was derived from total man-days and existing water acreages composed of 75 percent reservoirs and lakes, 14 percent streams, and 11 percent ponds. For the purposes of the following discussion, average values representing man-days per total water surface acreages for each Appalachian state are used. These values are considered in light of actual habitat types available in each state. Total fishing use in Appalachia during 1964 ranged from a low of 23.5 man-days per surface acre in Tennessee to a high of 102.2 man-days per surface acre in Pennsylvania.

Other states having low fishing use include Alabama with 23.9 man-days per acre, Kentucky with 30 man-days per acre, Georgia with 32.5 man-days per acre, and Mississippi with 38.3 man-days per acre. Since the water habitat in all of these states tends to be dominated by large reservoirs, this represents higher actual use of the habitat potential. In these states, increased use is attributable to population densities that tend to be below average while fishing license sales are considerably above average. Non-resident license sales also add substantially to the use in these states.

The states of Ohio, West Virginia, and Pennsylvania have high use values of 83.1, 97.5 and 102.2 man-days per acre, respectively. Streams and ponds, having a comparatively greater productive potential, constitute higher percentages of the total fishable habitat. High estimated use does not necessarily result in extreme overuse, however. High population density and low license sales are considered as factors which reduce total fishing use in these northern states.

Moderate fisherman-use exists in the remaining five Appalachian states. Variations in habitat potential tend to buffer both high and low use values. This can be seen in a comparison between the per acre

use rates of New York and Virginia. Large natural lakes and reservoirs, which have a lower productive potential than stream acreages, dominate the fisheries habitat in New York, while streams with the higher productive capabilities make up about 60 percent of fishing habitat in Virginia. The low use rates in New York correspond to the lower habitat potential while the higher use rates in Virginia are absorbed by habitat having higher use potential. Since the per acre use rate of each state is directly proportional to the habitat potential, moderation of both high and low valuations per acre result.

Commercial Fishery

The Habitat

There are approximately 892,000 surface acres of usable commercial fisheries habitat in the Appalachian Region (Table XIII), capable of providing 43,860,000 pounds of commercial fish annually. With a few exceptions, this includes reservoirs and lakes 1,000 surface acres and larger within the Region. Lake Erie is not included in the acreage figures because it lies outside of the Appalachian Region.

Basically, all waters that have fish populations have species that are of commercial value. However, a water area must be capable of producing large quantities of fish, either in numbers or pounds if it is to support commercial fishing. This demand on the habitat limits by size waters which are considered to have commercial fishing potential. Generally, all areas under 1,000 surface acres are considered too small to meet the demands of commercial fishing and were excluded.

For purposes of this study, the commercial fisheries habitat in the Appalachian Region has been divided into two sections, northern and southern Appalachia. The dividing line is the boundary between the states of Kentucky-Tennessee and Virginia-North Carolina. The habitat of the two sections, as well as within each section, differs in varying degrees, both physically and biologically, as discussed below.

Southern Appalachia includes the Appalachian portion of the states of Tennessee, North Carolina, South Carolina, Georgia, Alabama, and Mississippi. The habitat consists mainly of the Tennessee Valley Authority impoundments in the Tennessee River Basin. In addition, there are several Corps of Engineers and private power reservoirs. The reservoirs are large and closely grouped. Many are directly connected by a system of navigation locks. The mild climate in the southern section makes the reservoirs available to the fishermen for longer periods of time. Productivity studies indicate that many of the reservoirs in this section have a high percent of the fish population available to the commercial fisherman. It is estimated that the impoundments on the Tennessee River, Coosa River, and Black Warrior River in the states of Tennessee and Alabama can provide 75 pounds of commercial

fish per acre annually. The remaining reservoirs have more restricted fish populations and could produce an annual yield of 15 pounds per acre. Several reservoirs in the southern section were discounted altogether because of extremely low productivity or the majority of the species were game fishes. In addition to the finfish resources, southern Appalachia contains all of the important shellfish resources. About 10 species of fresh-water mussels are commercially valuable and much of the available world's supply is found in the Tennessee River area of Appalachia.

Northern Appalachia includes all of West Virginia and the Appalachian portions of Kentucky, Virginia, Maryland, Ohio, Pennsylvania, and New York. Corps of Engineers reservoirs and a few natural lakes are included in this section. The reservoirs are smaller than the southern Appalachian impoundments and are widely scattered. The climate is more severe and fishing is limited during the winter months because of ice conditions. In addition, fewer fish species are available to the commercial fisherman in northern Appalachia. It is estimated, however, that these 108,000 acres of water could supply 15 pounds of commercial fish per acre annually.

Commercial fish habitat in the northern section has also been affected by pollution from mining, industry, and domestic sources. The Ohio River within the region is a significant example. It represents approximately 80,000 surface acres of potential commercial fish habitat which could provide 50 pounds of fish per acre if water quality was suitable.

Fish Species

There are several species of finfish and shellfish harvested by commercial fishermen in the Appalachian Region. Legal restrictions, however, limit the taking to only those finfish species that are not considered sport or game fish. One exception to this is the Lake Erie portion of the Region where smelt, yellow perch, and walleye are the main species harvested. Buffalo, carp, catfish, paddlefish, drum, carpsucker and gizzard shad are principal fishes caught in the remaining portion of Appalachia. All of the above species, with the exception of the gizzard shad, are marketed as food fish. The gizzard shad is sold as bait.

The shellfish harvest consists of several species of fresh-water mussels. The pigtoe and blackhead mussels are the preferred species and have the greatest commercial value. The shells of these mussels are shipped to Japan and are used in the culture of pearls.

Utilization

Commercial fishing activity in the Region is limited primarily to the Tennessee River impoundments of Alabama and eastern Tennessee

and the counties of New York and Pennsylvania bordering Lake Erie. Other areas open to commercial fishing but producing relatively insignificant quantities of fish include that portion of the Ohio River within the Region upstream to the West Virginia-Kentucky border; a portion of the middle reaches of the Licking, Big Sandy, Kentucky and Cumberland Rivers; and four reservoirs - Herrington, Cumberland and Dewey in Kentucky and Dale Hollow in Tennessee and Kentucky.

Commercial fishery production in the Tennessee River impoundments within the Region amounted to 3,835,374 pounds in 1966, valued at $559,038. Principal species landed were buffalo, carp, catfish and paddlefish, with drum and carpsucker of lesser importance. Gizzard shad landings amounted to 172,187 pounds valued at $6,888. The latter figures include production from only three reservoirs, Pickwick, Wilson and Wheeler. No data are available on the catch of this species at other impoundments in the system.

Utilization of the Cumberland, Kentucky, Big Sandy, Barren and Licking Rivers is believed to occur primarily in the downstream reaches outside of the Region. However, approximately 25 percent of the commercial fish landings in these streams occurred in Appalachia and in 1966 this amounted to 110,250 pounds valued at $12,553.

The commercial fish landings recorded in Pennsylvania from Lake Erie amounted to 573,000 pounds in 1966 valued at $70,656. The principal species harvested were smelt and yellow perch. In New York, the recorded catch was 419,000 pounds valued at $56,818, with yellow perch and walleye predominating.

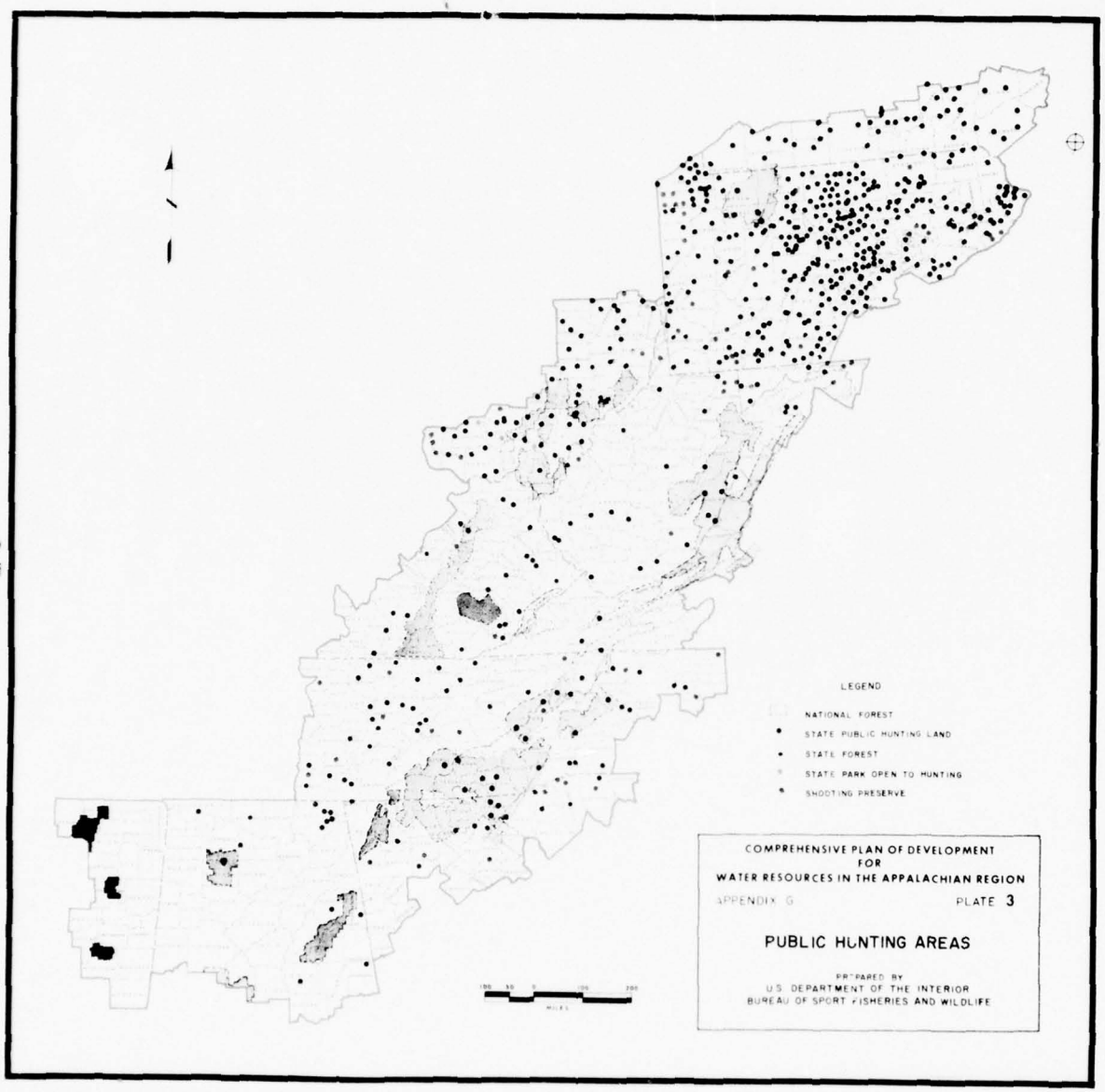
In 1966, the mussel shell harvest was estimated at 5,468,000 pounds valued at $577,161. These are Tennessee River figures and include Kentucky Lake which is out of the Region. A small quantity was also taken from the Cumberland River outside of the Region.

The total commercial fish landings of both fish and shellfish in Appalachia during 1966 is estimated at 10,377,811 pounds, valued at $1,283,114.

WILDLIFE RESOURCES

General

The Appalachian Region supports a variety of wildlife resources, which provide many opportunities for hunting, nature study, and other related pursuits. For the purposes of this report, these resources have been divided into three categories - big game, small game, and waterfowl.


LEGEND
NATIONAL FOREST
STATE PUBLIC HUNTING LAND
STATE FOREST
STATE PARK OPEN TO HUNTING
SHOOTING PRESERVE
COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
APPENDIX G
PLATE 3
PUBLIC HUNTING AREAS
PREPARED BY
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE

An estimated 115 million acres 1/ of wildlife habitat are found in the Region. Of this total acreage, about 60 percent consists of forest and woodlands, while cropland, pasture, and other land make up the remainder. About 10 percent of this is under public ownership, and open to public hunting. State parks closed to hunting are excluded from these figures. Another one percent in Pennsylvania is under a cooperative agreement program, whereby the land remains in private ownership but open to public hunting. In return, the State Game Commission provides technical assistance and a supply of placards for the posting of safety zones around the cooperator's residential area. The importance of the remaining 89 percent in private ownership cannot be overstressed, as the future of hunting depends upon keeping the bulk of this land open to public hunting, and improving the habitat to accommodate more abundant game populations.

Presently the wildlife resources of the Region supply approximately 29 million man-days of hunting annually. Small game hunting accounts for 85 percent of the total man-days; big game 14 percent; and waterfowl one percent. Approximately 92 percent of the hunters in the Region hunt small game; 47 percent big game; and three percent waterfowl.

Wildlife resources have an unmeasurable esthetic value, and are enjoyed annually by thousands of people. Many, who do not hunt, derive considerable pleasure from bird observation, photography, or merely enjoy viewing the wildlife in their natural surroundings.

A summary analysis of wildlife resources, their utilization, and significance by major groups is presented in the following sections.

Big Game

The Habitat

All of the wildlife habitat in the Region may be considered as important to big game. However, the forests and woodlands are considered as the primary habitat with cropland and pasture of secondary importance. The forests and woodland tracts are composed mainly of second growth stands of mixed hardwoods with some interspersion of evergreens. The majority of this land is in private ownership. Public lands are in the form of National Forests, National Parks, National Wildlife Refuges, State Forests, State-owned public hunting areas, and other State-managed land. Some of the managed areas consist primarily of big game habitat,

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1/ U.S. Department of Agriculture's "Soil and Water Conservation Needs Inventories" of Appalachian States.
Does not include urban and built-up areas.

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and provide controlled hunting. Controlled hunting, or in some areas called managed hunts, differs from unrestricted public hunting in that hunting is restricted by permit and special season. Because of the special protection given managed areas, as well as special habitat improvements, hunting is usually better than on the other public lands.

Species

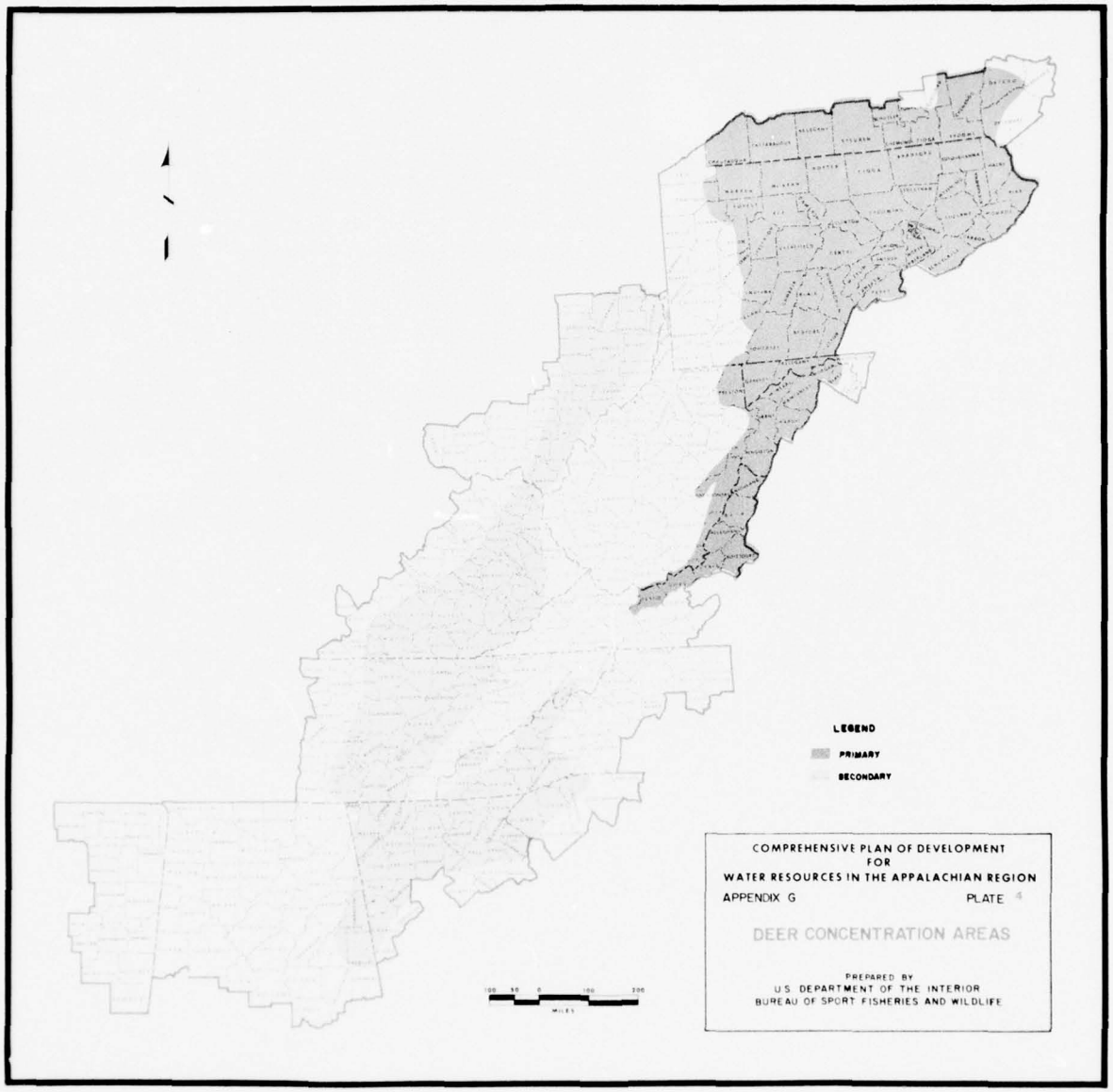
Big game species found in the Region are white-tailed deer, black bear, wild turkey and European wild boar. Excluding wild boar, these species supply a good percentage of the hunting opportunity especially in the northern portion of the Region. Approximately 22 percent of the total hunting effort is expended on big game in New York, Pennsylvania, Maryland, Virginia, and West Virginia.

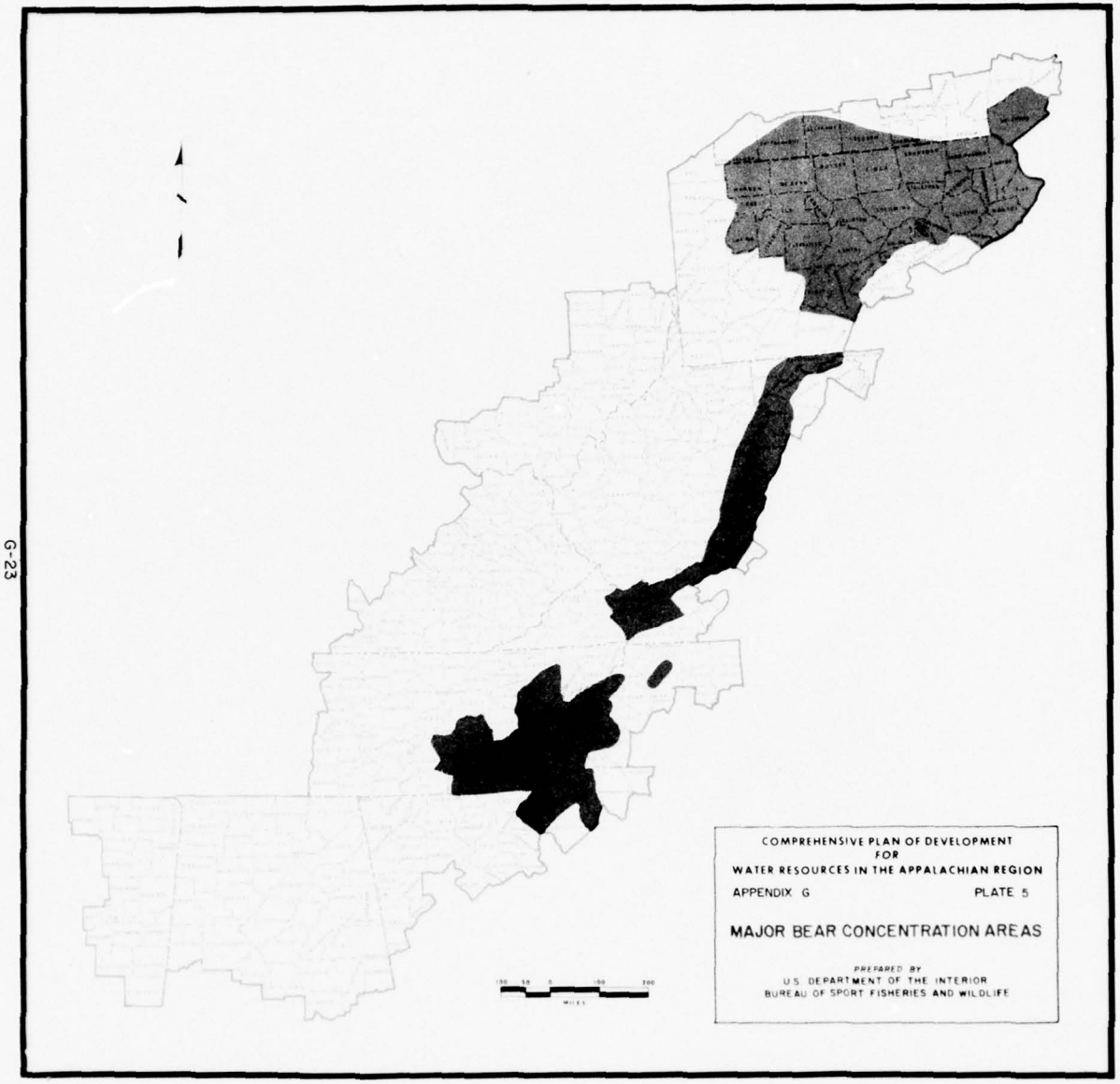
Deer is the most important big game species in Appalachia. The deer population in most of the Region reached its peak following the cutting and burning of the forest in the early 1900's. Population trends at the present time vary throughout Appalachia depending on timber management practices. Modern forest management practices can provide improved deer habitat to benefit of both the landowner and the sportsman.

Wild turkeys are found in each state of the Region with major concentrations in Pennsylvania, Virginia, West Virginia, New York and Maryland. Recently several states have re-established the turkey, namely, North and South Carolina, Georgia, Kentucky, and Ohio. As habitat improves, turkey populations should increase and expand into new areas in the states. Wild turkey furnishes a high quality type of hunting in most areas. Many states are providing for a greater utilization of this resource by permitting spring gobbler hunting. This type of hunting can be permitted without being detrimental to low density populations.

Black bear are found in New York, Pennsylvania, Maryland, Virginia, West Virginia, Tennessee, North Carolina, and South Carolina. This animal provides only a small portion of the big game hunting effort in Appalachia, but is considered to be a high quality type of hunting. Usually bear hunting requires the use of dogs, and is performed in the more remote timbered sections of the Region. The bear population appears stable and little fluctuation is anticipated unless major environmental changes occur.

Wild boar are hunted in North Carolina and Tennessee. This species is of little significance in total man-days expended, however, it is important locally and provides very high quality hunting for those who participate.

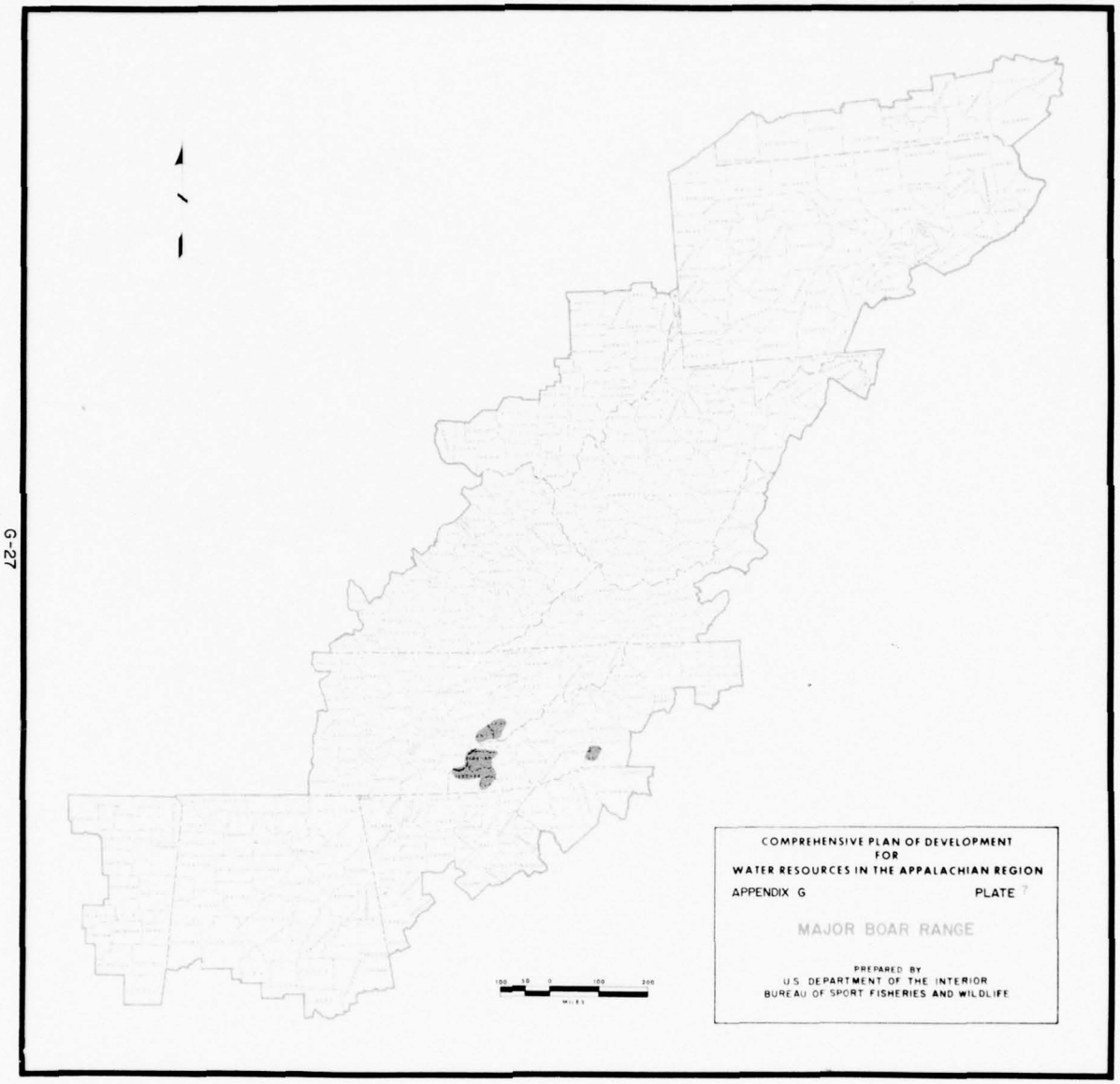

LEGEND
PRIMARY
SECONDARY
COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
APPENDIX G
PLATE 4
DEER CONCENTRATION AREAS
PREPARED BY
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE



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Utilization

In 1964, approximately one million hunters spent 4 million man-days hunting big game in Appalachia. The participation rate per hunter averaged 3.8 man-days, while the 1965 national participation rate was 6.7 man-days per big game hunter.

Estimates of hunting pressure on big game habitat ranged from a high of .205 days per acre in Water Area F-2 in Pennsylvania to a low of .004 days per acre in Water Area G-1 in Ohio. The Regional mean was .047 hunter days use per acre.

Small Game

The Habitat

There are approximately 113 million acres of small game habitat in the Region. It consists of cropland, pasture, idle land, forests, and woodlands. Most of this habitat is interwoven throughout the Region. The lowlands provide food and cover for farm game while the mountains and hilly areas sustain forest game species.

The greater portion of this habitat is in private ownership and is sometimes closed to public hunting. Quail, rabbit, and pheasant hunting is affected in this way more than the hunting of other small game species.

In 1964, there were approximately 11,800,000 acres of public hunting lands in the Appalachian Region. Of the total, 48 percent were in national forests; 4 percent other federal lands; 9 percent farm-game cooperatives; 21 percent in state forests; 17 percent in State-owned fish and game lands; one percent in state parks; and less than one percent in county parks (Plate 3).

Some of the management areas in the Region are used primarily for controlled small game hunts. Several private shooting preserves, operated primarily for pheasants or quail, are located within the Region.

Species

Small game species significant to the Region are the cottontail rabbit, fox and gray squirrel, ruffed grouse, bobwhite quail, mourning dove and pheasant. Other species which contribute considerably to hunting opportunity are the woodchuck, red fox, snowshoe hare and raccoon.

The cottontail rabbit is present throughout the Region and is

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primarily associated with cropland and idle land. Food farming practices are generally advantageous to this species, although cover requirements are sometimes lacking. However, much has been done in many states to improve the habitat associated with this species. Snowshoe hares are found in higher elevations of the Region particularly in spruce-forest areas.

Two species of squirrels are common throughout the Region. Gray squirrels are found typically in forested areas, while fox squirrels are more common in rural agricultural districts on farm wood lots bordered by cleared land.

Ruffed grouse are present throughout the Region. Good populations are found as far south as North Carolina, which is near the southern edge of the range for this species. This bird prefers deciduous and mixed deciduous-coniferous forest margins and second growth habitat.

Bobwhite quail are found in most of the Region, but are more numerous in the southern portion. Habitat consisting of mixed brush, grassland, cropland and idle land is preferred.

Mourning doves also occur throughout the Region. Generally, they inhabit northern portions for nesting and use the southern portion for both nesting and wintering. Only two states, New York and Ohio, do not recognize the dove as a game species. Through research and liberalization of laws in several states this species should become more important as a game bird.

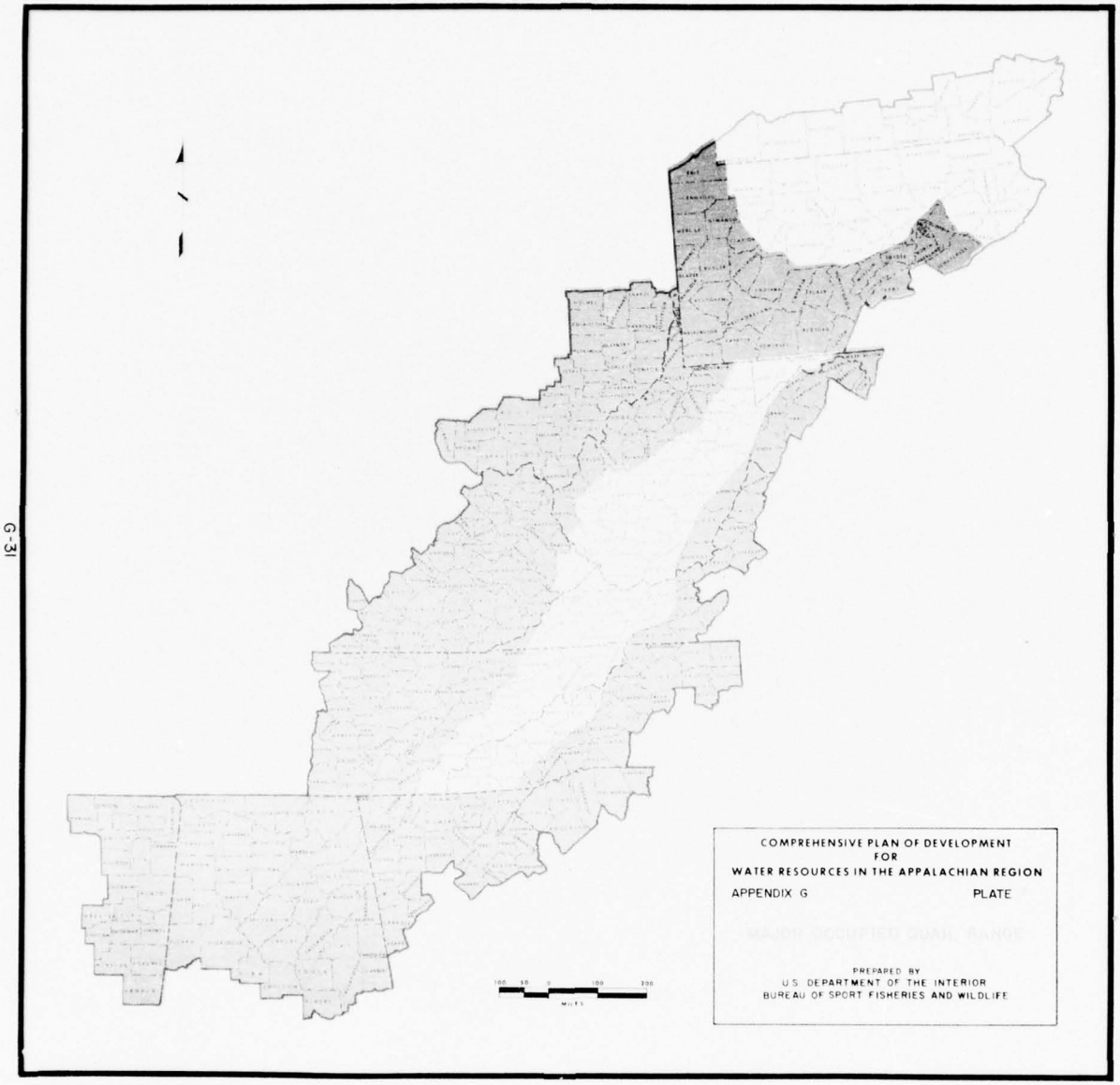
Pheasants are present in huntable populations in the northern one-third portion of the Region, specifically in the state of Ohio, Pennsylvania, and New York. Although natural production exists, a stocking of artificially-reared birds to augment huntable natural populations is carried out each year by the above states.

Other animals and birds hunted less frequently in the Region, but important locally, are woodcock, opossum, crows, and red squirrels.

Utilization

Small game species sustain the bulk of the hunting pressure in most of the Appalachian states. Percentage-wise, approximately 85 percent of the total hunting effort in 1964 was expended on small game. An estimated 2 million hunters participated in small game hunting.

Region-wide, the annual hunting pressure exerted in small game hunting, ranges from a low of .09 days per acre in Water Area D-2 in Georgia to a high of .55 days per acre in F-2 in Pennsylvania. The Region's mean is .22 hunter-days use per acre.


COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
APPENDIX G
PLATE
PREPARED BY
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE



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The amount of hunting pressure exerted on some of the more important small game species varies with latitude. Basically, rabbits, pheasants, and ruffed grouse are hunted more extensively in the northern Appalachian states while squirrels, quail and doves receive higher hunting pressure in the south.

Waterfowl

The Habitat

There are approximately two million acres of waterfowl habitat in the Appalachian Region. This habitat is composed of both wetlands and permanent water areas.

Two major waterfowl flyways - Atlantic and Mississippi - cross portions of the Region (Plate 11). The Atlantic cuts an extensive pattern across the western half of Pennsylvania and southwest New York and only to a minor degree across West Virginia, Virginia, Ohio, North Carolina, Kentucky, and Tennessee. The Mississippi Flyway enters the Region in southern Ohio; and then proceeds south through parts of Kentucky, Tennessee, Alabama, and Mississippi to the Gulf wintering grounds.

Although there is some migration of waterfowl through the Appalachian Region, the area is considered poor for the rearing or wintering of waterfowl. Much of the Region is mountainous or hilly, with narrow valleys that are not conducive to the natural formation of extensive marshy area or shallow lakes. The southern part of the Region has considerable acreages of water in large impoundments that are receiving some wintering use. It is possible that as traditional migration patterns are extended to include these lakes, some of them may well become important wintering areas for waterfowl. Most of the impoundments are deep, with relatively little shallow water, which results in a shortage of feeding areas, especially for puddle ducks.

Species

There have been over 25 species of ducks and geese observed throughout the Appalachian Region during migration and wintering periods. Principal species utilizing the Region are the mallard, black duck, wood duck, and Canada goose. Essentially, only the black duck, mallard, and wood ducks nest and rear their young in the Region.

Utilization

An estimated 370,000 man-days or approximately one percent of the total hunting effort was expended on waterfowl hunting in the Region during 1964. Many species of ducks are represented in the harvest

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figures for the Region, but the three previously mentioned species make up approximately 80 percent of the kill. Estimates of hunting pressure on waterfowl habitat ranged from a high of 1.046 days per acre in Water Area F-2 in Pennsylvania to a low of .022 per acre in Water Area G-1 in Georgia. The Region's mean was .206 hunter days use per acre.

ECONOMIC IMPACT

Sport Fishing and Hunting

Measurement of the economic benefits derived from hunting and fishing generally includes a monetary assessment of each activity and an estimate of jobs or businesses created or partially supported. Although many methods of evaluation have been suggested, no standard has been established by which results may be compared. The average annual expenditure per fisherman and hunter listed in the National Survey of Fishing and Hunting (1965) was used to compute total expenditures per fisherman and hunter listed in the National Survey in the Appalachian Region (tables XI and XII). Attempts to determine and convert monetary spending by hunters and fishermen to jobs created are extremely difficult, due to variations in locally retained monies and profit requirements in relation to job creation.

Very few full-time businesses are directly supported by hunting or fishing, but many profit, to some degree, from expenditures on these two activities. A large percentage of expenditures by hunters and fishermen are for food, lodging, transportation, basic equipment and supplies. Directly related jobs such as bait dealers, hunting and fishing guides, sporting goods stores specializing in sales of hunting and fishing supplies, and collectors of user-fees represent specific allocations, but tend to be seasonal in nature and often result in additions to income rather than total income. License fees support state game and fish departments, while taxes on sporting goods provide monies for federal aid to the states for fish and wildlife programs.

Improvement of local opportunities and facilities for fishing results in greater total expenditures by those wishing to participate. Higher profits may allow entry of sub-marginal operations or new investments. If the supply of goods and services provided to fishermen exceeds the demand, marginal operators are forced out of business through a competitive reduction in profits and new investment is curtailed. In many instances, fluctuations in expenditures by an isolated group representing a small percentage of the total available profit, affects marginal operations and in turn, those which have dependency on that group. A decline or rise in expenditures by fishermen is likely to affect a service station which also sells bait and rents boats more than another station which competes satisfactorily without these supplements.

All of these monetary valuations do not consider the aesthetic or intangible benefits to the participant except in his willingness to pay for the desired experiences.

Commercial Fishing

The effects of commercial fishing on the economy are more easily identifiable in comparison to sport fishing or hunting because the commercial fishing unit can be treated as any other business operation. However, because of the common property nature of the resource, legal restrictions, and poor markets for some species, the contribution of commercial fishing to the Region has been limited. Even in the comparatively intensive fisheries of Lake Erie and the Tennessee River, the industry is characteristically one of a large number of fishermen operating seasonally with little capitalization and utilizing the traditional fishing gear suitable for a low volume and high unit value type of production. Many of the operations are marginal in the sense that they move in and out of the industry with fluctuations of other local employment opportunities. Others fish only as a sideline or hobby. Often, the fish are sold in the round to dealers for transport and processing out of the Region, which limits any additional local spending or employment.

In general, the economy of the industry is exemplified from data on fisherman catch and income in the Tennessee River area. In 1965, there were 1,180 licensed fishermen with an average gross income of $1,053 on landings, averaging 5,699 pounds per fisherman in this area. The total commercial fishery landings of both fish and shellfish in Appalachia during 1966 is estimated at 10,377,811 pounds valued at $1,283,114. Although these figures indicate that the commercial fishery industry is not a major contributor to the Regional economy, it should be realized that the resource is virtually untapped and that it has the potential to become a significantly important feature of the Appalachian economy. Possible ways for stimulating this industry are discussed in the "Status of Fishing and Hunting" section of this report.

RESOURCE PROBLEMS

Sport Fishery

Many of the current problems confronting fishery managers in Appalachia are due to conflicting uses of water and adjacent lands. Water pollution from an expanding number of sources ranging from acid mine wastes to pesticides has recently reached critical proportions and correctional efforts have been intensified. The economy of large sections of Appalachia is dependent on the coal industry which has been a chief source of water pollution.

Much of the existing mine pollution can be traced to past mining practices and operations. Major pollutants include acids from deep mines and both acid and eroded sediment from strip mined areas. Correctional measures are expensive and for many years they have been considered uneconomical. The original mining operations, long since abandoned, were conducted in accordance with accepted practices of the time and it is difficult to assign rehabilitation costs. State and federal government cost-sharing programs are now being proposed to assist in alleviating mine pollution.

In 1963, 2/, approximately 4,600 miles of streams and about 13,800 acres of ponded water in Appalachia were adversely affected by acid mine pollution. Pennsylvania and West Virginia account for more than 80 percent of the Appalachian total. Domestic pollution is common in the rural and small communities of Appalachia, while industrial pollution becomes a major factor in the main streams and tributaries. Fishery resource managers of the larger rivers are confronted with the cumulative results of this mis-used water. State and federal agencies are presently engaged in establishing water quality standards, which will aid in the management of the fish habitat.

As the demand on fisheries resources increases, location and access play more important roles in determining use. Productive waters located near population centers which have ample public access are the most efficiently used. Construction of the Appalachian Highway Corridor system will generally improve access to existing water developments, and make secondary access construction more feasible for state agencies. In many instances, new water resource development will be located near regions of potential population growth and accessible by means of the new highway network. Many Appalachian states are actively participating in programs to acquire access to the better trout and smallmouth bass streams. Improved access routes from population centers to under-used reservoirs are cooperative ventures between state and federal agencies. The end product of these efforts should result in a better and more effective distribution of existing pressure. Many small reservoirs, lakes, and farm ponds are presently inaccessible and poorly maintained. Such areas through owner education, access development and improved management are capable of providing a substantial number of additional man-days fishing.

Other resource problems include the following: destruction of fish habitat; conflicting interests of differing water oriented recreation activities; inadequate funding of state fisheries programs; and the need for improving exchanges between research and management.

2/ Kinney, Edward C, Extent of Acid Mine Pollution in the United States Affecting Fish and Wildlife, Fish and Wildlife Circular 191, Washington, D. C., 1964, p.2.

Finally, advancement in fisheries management aided greatly by research will occur in future years. The degree and rate are unknown, and we can only speculate on the success of these efforts. For purposes of this report no future needs will be satisfied by improved management techniques.

Commercial Fishery

There are several problems which affect the commercial fisheries resource and its utilization in Appalachia. The major factors include market conditions, legal restriction, equipment and methods and water quality.

Demand for many of the commercial fish species abundant in Appalachia has been limited by a number of factors including poor water quality in some Ohio River waters producing off-flavors in fish, the lack of modern processing and packaging facilities that would enable fishery products to compete with other food products, and a generally low level of product development work within the industry.

For other species produced commercially in Appalachia, including catfish, paddlefish and buffalo, markets are readily available and production has been limited primarily by water quality, and the available supply.

Legal restrictions are a big factor in limiting the harvest of the commercial fisheries resource throughout the Region. Commercial fishermen are regulated in varying degrees to the species, seasons and methods where fishing is permitted. Many of the lakes and reservoirs are completely closed to commercial fishing. The commercial fishery landings, as previously discussed in the report, indicate that commercial fishing occurs mostly in the Tennessee River area and Lake Erie. Throughout the remainder of Appalachia, legal restrictions are the major factor limiting commercial fishing. There is considerable variation in the restrictions from state to state.

The fishing gear and methods used by fishermen in the Region are suitable only for low volume production of fish with relatively high unit value. Traditionally, there have been few innovations in gear design and operation that would permit efficient production on a volume basis. At the same time, most fishermen have been limited in their ability to modify existing methods by a lack of available capital for investment and severe limitations caused by legal restrictions.

Pollution from various sources has reduced the water quality in some areas of Appalachia to the point where the commercial fisheries resource has been affected. Acid mine drainage has directly influenced the fish populations of some reservoirs in northern Appalachia. However, the most important pollution problem exists in that portion of the Ohio

River within the Region. This section of the River is polluted in varying degrees by industrial and domestic sources. The general affects of this pollution are not directly on the fish population, but rather the flesh of the fish which is tainted, yielding them unpalatable.

Fresh-water mussel resources are primarily limited in two ways. There are only a few species that are of high value and the availability of these is declining rapidly. One study on the fresh-water mussels in the Tennessee River 3/ indicated that survival of young mussels is a problem in maintaining the populations. Unfavorable environmental changes resulting from the impoundments on the River are a possible reason.

Wildlife

The most critical problem facing wildlife today is the decreasing amount of existing habitat. Acreage is continuously being lost to urbanization, highways, industrial sites, and other specialized uses by man. For all practical purposes this acreage is fixed and there is no way to replace this loss.

The three major problems limiting hunting opportunity are: (1) land not available to hunting due to incompatible alternate uses; (2) land that is open to hunting, but is not producing wildlife to its fullest potential; and (3) land not available to hunting due to posting or inaccessibility.

The closing of land by posting is mainly a landowner-hunter relations problem and will have to be solved in most cases at the local level. Reasons for posting land are varied. They include protection of crops, livestock, fences, equipment and buildings; poor manners of hunters; protection of wildlife; liability laws; and desire for privacy.

Land not available through inaccessibility, in many cases, is due to lack of roads in the area. Geographic features, such as swamps and cliffs may limit the feasibility of road construction. In other instances, the economics involved prohibit the building of roads. However, from the standpoint of wildlife per se, the presence of inaccessible areas may be desirable. This factor should be considered in the future as the intensity of land-use increases.

Much of the land that is open to hunting is not producing wildlife at its maximum potential. Landowners who rely on their land as a source of income usually manage the land for the greatest economic benefits.

3/ Scruggs, D. George, Jr., Status of Fresh-Water Mussel Stocks in the Tennessee River, Dept. of the Interior Special Scientific Report-Fisheries No. 370, Washington, D. C., 1960.

The practices of clean farming, weed control, and woodland grazing are detrimental to wildlife, for they remove necessary cover and food. Ecological requirements vary for each species, and for this reason research is needed to establish more precise species requirements.

In some areas there are limiting factors that further complicate the problem of habitat management. Feral dogs, poaching, and forest fires are examples that limit production and management, particularly on the Region's deer ranges. These factors vary from area to area and different solutions may be required.

STATUS OF FISHING AND HUNTING

Current

Sport Fishing

The current status of sport fishing in Appalachia was evaluated by using water areas established by the Corps of Engineers as units of comparison. Since the water areas overlap state boundaries, a total of 40 units was used for comparing mean and median values for sport fishing opportunity and current demand. These values were determined by using 1964 fishing license sales, 1960 population data, and the Appalachian water inventory, which includes natural waters and water development projects completed prior to 1965. Large variations in population and available fish habitat tend to skew the mean values for the 40 water areas toward regions of intense use per acre, while the Appalachian mean is skewed toward regions of low use and abundant opportunity.

In the following state-by-state analysis, median values of 10.76 percent fishing license sales, .058 acres of water per capita, 56 man-days use per surface acre, and expected water needs are employed as guides for evaluating individual units.

The existing fish habitat (table II, column 9) includes four habitat types, namely: reservoirs, natural lakes, streams and ponds. Stream mileage was converted to surface acreage at an average of four acres per mile. Each water type is discussed as a percentage of the state's total fish habitat. Special emphasis was placed on high quality waters. Both population density and square-miles of individual Appalachian Water Area units were considered where extreme conditions occur. Actual use deviates from calculated use when egress of fishermen from a water area differs substantially from those entering that area to participate, or vice versa. Differential in productive potential, fishing season, and degree of management cannot be accurately weighed at this study level and therefore have not been used in the calculations. Conditions in adjacent water areas and states are con-

sidered when variations are extreme. Water areas of near average use and opportunity are not emphasized.

Alabama:

Large reservoirs and waterways account for 92 percent of the surface water in the Appalachian portion of Alabama. Water areas J-5 and E-3 have a comparative surplus of water, mainly in large, well-distributed reservoirs. This condition is reflected in high license sales and low use per acre. Both areas have sufficient fish habitat to fill the current demand. The increased population density in water area E-4 can be partially attributed to Jefferson County and metropolitan Birmingham. This results in a decline in comparative values, but only license sales drop slightly below the Appalachian median. The existing fish habitat exceeds the current demand, but without additional water developments, needs will arise by 1980. Isolated local needs within the water area exist primarily in Jefferson County. Climatic conditions which tend to allow increased productive potential and an intensive pond management program assist in maintaining the status of sport fishing in Alabama.

Georgia:

Fishing waters in the Appalachian portion of Georgia consist of 70 percent reservoirs, 19 percent ponds, and 11 percent streams. Water area E-1 has a surplus of aquatic habitat which is reflected in high fishing license sales and low per acre use. Near median values in water area E-2 result in a slight need for additional water development. The portions of water areas D-2 and J-4 in Georgia are small in size and comparative population. Median conditions prevail in D-2, but acres per capita and license sales drop below those guiding values in water area J-4. Although low opportunity in water area J-4 is reflected in extremely low fishing license sales, it is suspected that many anglers purchase non-resident licenses in the adjoining states of Alabama and Tennessee, where greater opportunity exists. A population approaching that of the Appalachian portion of Georgia reside in Fulton County, which includes part of metropolitan Atlanta. This densely populated area is bordered on three sides by the Appalachian region. It is highly probable that a much larger number of anglers enter than leave the Appalachian area of Georgia, to participate. The extent of this influx would determine the degree of increased use on the waters of northern Georgia. There appears to be no critical current needs in the Appalachian portion of Georgia.

Kentucky:

Although the composition of fishable habitat in the Appalachian portion of Kentucky is well-balanced, with 62 percent reservoirs, 14 percent ponds, and 24 percent streams, the distribution of reservoirs and ponds is concentrated in the southern and western regions. Lake

Cumberland, located in water area I-1, accounts for about 50 percent of the total surface acreage in the Appalachian portion of Kentucky. Calculated use in water area I-1 indicates a surplus of opportunity. However, a large number of non-resident anglers and resident anglers from outside the water area suggests that actual use may be much higher. Near median conditions prevail in water area H, but a high concentration of farm ponds boosts existing opportunity above the current demand. Stream habitat dominates the fishing waters in the Kentucky portions of water areas G-4 and G-2. Current opportunity in both regions is substantially below the Appalachian median. License sales in water area G-4 are well below the Appalachian median at 7.4 percent. Both areas have a moderate need for reservoir type water developments. Pollution from coal mining operations further reduces the quality and productive potential of the existing stream fishery. Adjoining states of Ohio and West Virginia provide little means of satisfying the current demand.

Maryland:

A population averaging 126 persons per square mile reside in the three Appalachian counties of western Maryland. This is one of the few areas where high density does not result in low license sales and high use of the available fisheries resources. Non-resident anglers are a factor which keep the total license sales above the Appalachian median. This also indicates that suitable opportunity currently exists. Streams and reservoirs make up a large percentage of the total habitat that fulfills 96 percent of the current demand. Large eastern metropolitan centers exhibiting extreme population densities exert additional undetermined pressures on the accessible fisheries resources of this tri-county area.

Mississippi:

All twenty counties of the Appalachian portion of Mississippi are included in water area E-5. The percent of license sales is slightly above the median for the Region, and the acres of water available per capita is high. Ponds consist of 59 percent of the surface water with reservoirs and streams accounting for 29 and 12 percent respectively. The current habitat exceeds the present demand.

New York:

Seventy-six percent of the surface waters in the Appalachian portion of New York are classified as natural lakes. With the exception of Pennsylvania, this type of habitat is negligible in the remainder of Appalachia. These natural basins are generally characterized by high water quality and stable water levels in contrast to the fluctuations in many multiple purpose reservoirs. High value sport fishes and desirable population characteristics frequently offset the low productive

capacity in these natural basins. Cold and cool water streams, ponds and reservoirs suitable for sustaining trout, smallmouth bass, walleyed pike, muskellunges and yellow perch are common to this section of New York.

Current demands are fulfilled in water area B-1, but a substantial need is indicated in the western section of water area F-1. The addition of the adjacent portion of Lake Erie to the available fisheries habitat of this region would reduce this current need. Large natural lakes to the north and east can further reduce the existing needs. Overall, the New York portion of Appalachia is not considered as a critical area in need of fishing waters.

North Carolina:

Nearly 80 percent of the fish habitat in the Appalachian portion of North Carolina is impounded water, while streams account for about 11 percent of the total. Some of the better natural trout streams in Appalachia are found in water area J-2. Here opportunity and license sales are considerably above the Appalachian median and existing use below the corresponding median. Several Tennessee Valley Authority (TVA) reservoirs add to the fisheries habitat of this region and thereby create a surplus in this water area. Private power reservoirs dominate the fisheries of the more densely populated water area D-1, but opportunity and license sales drop below the guiding values. Current use is also below the Appalachian median. Low license sales indicate a slight need exists in this water area. Several large reservoirs just across the Appalachian boundary and the existing surplus in water area J-1 can supply the opportunity for the small unsatisfied demand in water area D-1.

Ohio:

All three water areas represented in Ohio show a substantial need for fishing waters, water areas F-3 and G-2 being the most critical. Reservoirs account for approximately 55 percent of the state's fish habitat. Many of these impoundments are controlled by the Muskingum Conservancy District and located in water area G-1. Fishing license sales in water area G-1 are well above the Appalachian median resulting in a corresponding need. Water area F-3 is small but densely populated and only 21 percent of the current demand is fulfilled. Adjacent regions have similar problems of unsatisfied demands and have no surplus habitat to assist in supplying the needed opportunity. Since water area G-2 has only one large reservoir, streams and ponds become more important to the fisheries of this region. Metropolitan Cincinnati places additional undetermined pressures on the western portion of this water area. Actual needs and use per acre are probably more intense than the calculated values presented in table II. Fishing license sales are below the Appalachian median in water areas F-3 and G-2. Polluted water from coal mining operations and industrial sources are continuing to reduce the quality of the aquatic habitat in Ohio which compounds the problem of creating additional fishing waters.

Pennsylvania:

Approximately one-third of the Appalachian population resides in the State of Pennsylvania, which covers approximately one fifth of the Appalachian land area. Most of this population is concentrated around Pittsburgh, a major industrial and metropolitan center. These conditions result in extreme comparative values occurring in the Pennsylvania portion of water area F-2 and exert considerable influence on the remainder of Appalachia. Current fishery needs exist in all five water areas with the degree of need ranging from about 17 percent fulfilled in water area F-2 to 84 percent fulfilled in the Pennsylvania portion of water area B-1.

Natural lakes account for about 31 percent of the state's aquatic habitat with the remainder being more equally distributed between reservoirs, ponds and streams. The majority of the natural basins are located in the northern and eastern part of the state. This general area also contains most of the state's trout streams.

Pollution from abandoned coal mines, strip-mine operations, industrial wastes, abandoned and improperly sealed oil wells, and domestic sources limits the fisheries in many streams and several reservoirs of the state. This condition reduces the fishery potentials of many proposed and planned water development projects. Primary areas of pollution occur in water areas F-1, F-2, A, and along the margins of B-2.

Water area F-2 represents the most severe need throughout Appalachia. Available fishing opportunity is represented by .003 acres per capita which is currently utilized at a calculated rate of 319 man-days per acre. Fishing license sales at 3.3 percent also represent an Appalachian low, but it is not realistic to expect median sales in a region where density reaches 431 persons per square mile. Water area A and B-2 also have comparatively high needs while F-1 and B-1 are classed as having moderate current needs.

South Carolina:

The Appalachian portion of South Carolina consists of six counties, all included in water area D-2. A population density of 148 persons per square mile results in fishing license sales dropping below the Appalachian median, but present opportunity and use per acre compare favorably with median values. Reservoirs account for about 76 percent of the fish habitat with Hartwell Reservoir being the major contributor. The current demand is well satisfied in the Appalachian portion of South Carolina. Reservoir development in the adjoining states and non-Appalachian sections of the state could supply additional opportunity.

Tennessee:

Nearly 94 percent of the fishable habitat in the Appalachian portion of Tennessee is impounded water. This results in angling opportunity considerably above and existing use well below median values established for Appalachia. Water area I-2, J-3, and J-4 have the largest water surplus. This is reflected in extremely high license sales. Much of this surplus water can be attributed to the TVA reservoirs of the Tennessee River Basin. This abundant opportunity draws a high percentage of non-resident fishermen, and a large number of resident anglers from other water areas and regions of Tennessee outside of Appalachia. The Tennessee portions of water areas J-1 and J-5 show an unsatisfied demand within their boundaries. Moderately high license sales with much of the actual use in adjacent water areas account for this localized need. Due to this extensive reservoir development, the State of Tennessee has the largest surplus of water acreage in Appalachia.

Virginia:

Streams dominate the fisheries habitat in the Appalachian portion of Virginia. All three water areas represented show an unsatisfied demand even though opportunity is above the Appalachian median in water areas C and G-5.

License sales in these two areas are substantially above the Appalachian median resulting in higher use per acre and a corresponding need for additional opportunity. Moderate needs in C and G-5 are exceeded by those in J-1 where only about 55 percent of the current demand is satisfied. Stream pollution also reduces quality of the habitat in this section of Virginia. Although opportunity in water area J-1 is low, license sales have remained at comparatively high levels. Since adjacent water areas have very little opportunity, needs are considered critical. Therefore, any water developments in Virginia would supply needed additional opportunity.

West Virginia:

The entire state of West Virginia lies within the Appalachian boundary and is divided into six water areas. Varying degrees of need exist in all six divisions. Conditions in G-2, F-3, G-3 and G-4 are the most critical.

Streams and rivers account for about 72 percent of the fish habitat in West Virginia. High value trout and smallmouth bass streams are located primarily in water areas B-3 and G-5. These two areas support much of the state's non-resident angling. This is reflected in fishing license sales which are above the Appalachian median. Only minor current needs exist in these two sparsely populated sub-divisions. In the remaining four water areas, population density exceeds 100 persons per square mile. Opportunity is far below the Appalachian median with a corresponding drop in

fishing license sales. Only in water area G-3 do license sales approach the Appalachian median.

Pollution, generally from coal mining operations in water areas F-3, G-2, and G-4 reduces or limits the quality of existing habitat and also curtails fisheries potentials in proposed or planned impoundments. Expensive land treatment measures and long recovery periods are often necessary to improve water quality in many drainages. Major efforts are now aimed at preventing additional pollution.

Reservoir development at sites with acceptable water quality and conservation storage not only will assist in providing needed fishing opportunity, but will also create a more balanced distribution of fish habitat throughout the state. West Virginia along with designated portions of Pennsylvania and Ohio currently have the greatest need for additional fishing opportunity.

Commercial Fishing

The current needs confronting the commercial fisheries industry in Appalachia are allied with the problems that have been previously discussed. These included market conditions, restrictive legislation, methods and equipment, and water quality. With the exception of water quality, all of these deal basically with the utilization of the resource. Solutions to these problems are considered the major needs for the commercial fishery.

Markets for both edible and industrial finfish species need to be developed. For instance, national figures indicate that the per capita consumption of fish, including edible and industrial domestic fish is 27.9 pounds. Of the total national fish production, 1.5 percent originates from inland waters, exclusive of the Great Lakes. Based on these figures, the demand for fish in Appalachia in 1966 was estimated at 7.5 million pounds of which approximately 4.9 million pounds were produced in the Region. This included the Lake Erie landings in Appalachia. A deficit of 2.6 million pounds occurred, but it can be assumed that it was supplied from out of the Region. The need for improved markets is also evidenced by comparing the 1966 catch of 4.9 million pounds to the potential Appalachian supply of over 43.8 million pounds annually.

Liberalization of regulations which presently restrict commercial fishing is a primary need. Many of the regulations in Appalachia are outmoded and place unnecessary limitations on species, seasons, and methods. In some areas there is a complete prohibition of commercial fishing. The development of more realistic regulations would be a major step towards improving the commercial fishing industry.

The need for improved water quality in relation to the commercial fisheries resources is limited to that portion of the Ohio River in the Region. A few reservoirs are affected by mine pollution, but their potential contribution to the resource is insignificant. The Ohio River, however, represents about 80,000 surface areas of contiguous habitat of considerable potential. The river is presently influenced by industrial and domestic pollution which imparts undesirable tastes and odors to the fish. The Ohio River in the Region could provide 4 million pounds of fish yearly to the commercial fishery if the water quality were improved.

The status of the fresh-water mussels as a commercial fisheries resource is questionable. The demand for certain species is high and will probably remain so. However, the species that are of commercial value are declining in numbers which, in turn, will limit the future of the resource. For example, in 1967, the demand for mussel shells decreased 30 percent from 1966, which was the peak year of production. In part, the reduced demand resulted from the harvest of many poor quality shells in 1966 which the Japanese pearl growers no longer will accept. More research is needed on the fresh-water mussels to determine if this resource can be managed to provide a continuing supply of high quality shells.

Hunting

The percent of population buying hunting licenses and the amount of land available to the 1964 licensed hunter (table VI, Columns 14 and 20), were the two factors employed for determining the current hunting demand in Appalachia. In both instances, the water area medians were used for comparing intra-region wildlife resources. The water area median for 1964 license sales per capita was 10.7 percent, ranging from a high of 20.7 percent in water area C, Virginia, to a low of 6.3 percent in water area F-2, Pennsylvania. The amount of land available per licensed hunter in 1964 ranged from a high of 153.6 acres in water area H, Kentucky, to a low of 20.8 acres in water area F-2, Pennsylvania, with a median of 70.8 acres.

In the following state-by-state analysis it should be noted that the figures used are for that part of the state which lies within the boundaries of the Appalachian area.

Alabama:

Although Alabama is slightly below the median in the percentage of the population buying hunting licenses, the state as a whole exceeded the 1964 median water area ratio of acres per licensed hunter. Small game hunting is the most popular of the three major hunting activities. Approximately 98 percent hunt small game, while 9 percent and 4 percent of the total hunters pursue big game and waterfowl, respectively.

Georgia:

All the water areas were above the 1964 water area median in the amount of land per licensed hunter. This amount varied from 87.1 to 124.8 acres among the areas. License sales per capita were slightly below the median. Sales varied from 6.6 to 10.6 percent in the water areas. Almost three fourths of the public hunting areas in the Appalachian portion of Georgia are on U.S. Forest Service and other Federal lands.

Kentucky:

Kentucky ranked highest in acres per licensee exceeding the water area median by over 100 percent. Ironically, the state fell well below the Regional median in hunting license sales per capita. The reason for the high opportunity and low license sales has not been determined. However, it is suspected that limited access and low big game populations are probably factors restricting the resident hunting activities in this part of the state.

Maryland:

Although the percent of license sales per capita was above the 1964 water area median, the land available per licensee fell far below the median established by the study. The small portion of Maryland lying within Appalachia as well as its high population density per square mile probably accounts for the limited hunting opportunity.

Mississippi:

Mississippi statistics did not indicate a comparative need for additional hunting opportunity, since water area E-5 was above the Region medians in acres per hunter and percent of licensed hunters per capita.

New York:

Hunting opportunity in the Appalachian portion of New York was slightly below the established median for amount of land per hunter - the opportunity in water area F-1 being slightly lower than area F-1. A high interest in both big and small game hunting was indicated by the percentage of license sales per capita. The participation rate was the lowest of the states in Appalachia which resulted in a relatively light use in man-days per acre.

North Carolina:

North Carolina statistics indicate that the 1964 hunting acreages per licensee were slightly below the Appalachian Region comparative standard. This is probably due to the popularity of small game

hunting on the game management areas within the Region. The effects of this pressure are apparent in water area J-2 where license sales are significantly above the established Regional median.

Ohio:

Only water area F-3 was excessively below the median for license sales per capita and amount of land per capita. Water areas G-1 and G-2 approached the Region's comparative medians. The high population density and urbanized character of the relatively small size of F-3 reflects the lack of hunting opportunity in this area.

Pennsylvania:

Pennsylvania statistics reflected a comparative need for additional hunting opportunity in all water areas except B-1. There was considerable variation, however, among water areas in the percent of population buying licenses. The low ranged from 6.3 percent in water area F-2, which includes the highly populated Pittsburgh area, to a high of 17.9 percent in water area B-1. Although a large amount of public hunting lands is available in the areas of need, the statistical study indicates that these lands probably are approaching their full hunting potential.

South Carolina:

The 1964 hunting acreages available per licensed hunter in South Carolina were well below the established median as well as the percentage of license sales per capita. The unusually high population density reflects the need for hunting opportunity in the six-county water area.

Tennessee:

Tennessee was well above the water area median in hunting license sales per capita, and yet the land per licensee was below the 1964 median established for the study. Only water area I-2 showed a greater amount of land available per licensed hunter by comparative standards. A very low population density and high hunting opportunity probably were responsible for the high percentage of license sales in this latter water area.

Virginia:

Hunting opportunities in water areas C, J-1, and G-5 in Virginia appear adequate in amount and quality. With the exception of water area J-1, the remaining two areas are significantly above the 1964 median water area ratio of acres per licensed hunter. Water area J-1 was near the median, however.

West Virginia:

Water areas B-3 and G-5 were above the 1964 Regional median in amount of land per licensed hunter, while water areas G-2, G-3, G-4, and F-3 were below the comparative average. Water areas B-3, G-3, and G-5 were significantly above the established median for license sales per capita, while water areas G-2 and G-4 were exceedingly low by the comparative standards. However, water area F-3 was close to the Region median.

Future

Sport Fishing and Hunting

The future demands for sport fishing and hunting opportunities in Appalachia will be influenced mainly by the tremendous increase in population that is expected to occur following full development of the natural and economic resources of the Region. Projections indicate that fishing use will have increased 21 percent by 1980, 39 percent by 2000, and 61 percent by 2020. The 1964 Region-hunter use will have increased 20 percent by 1980, 60 percent by 2000, and 119 percent by 2020. These represent a 1964 - 2020 increase of 32,100,000 angler days and 34,400,000 hunter days.

In 2020, the fishing demand will have been the greatest in water area E-4, Alabama, with a pressure of nearly 6 million angler days. The least demand for the same period will have been in water area D-2, Georgia, with a 230,000 man-day exertion. Statistics indicate that water area B-2 in Pennsylvania will have had the greatest hunting demand of 4,700,000 man-days by 2020, while water area D-2 in Georgia will have had the least demand of 82,000 man-days over the same period.

Commercial Fishing

Current and future needs of the commercial fishing industry, which include development of potential markets, liberalization of regulations, and modernization of methods and equipment, are actually synonymous. If these necessities are met as current needs, then future needs simply entail improvement and refinement of the systems, regulations, methods, and equipment developed.

The demands for more fish, both for food and industrial purposes, are expected to become greater as the population increases. In the years 1980, 2000, and 2020 the Regional demands for fish will be 9.3, 13.1, and 18.4 millions of pounds, respectively (based on per capita consumption of 27.9 lbs., with 1.5 percent being supplied by inland waters, exclusive of the Great Lakes). However, the potential supply in 1960 of 43.8 million pounds far exceeds the projected maximum food fish demands for the year 2020. Continued reservoir construction especially in northern Appalachia, will add an estimated 168,557

surface acres of habitat to the resource base by 1980. This new habitat would provide 3.4 million pounds of fish per year and would raise the annual Regional potential production to 47.3 million pounds. It is expected that additional habitat will be created beyond 1980, but it has not been projected in this study.

The future needs for the fresh-water mussels will depend on whether techniques can be developed to manage this resource to provide a constant supply. If this can be accomplished, then future needs would be a continuation of efforts to further improve management of the resource.

Methods of Estimating Future Needs

Besides habitat, three additional parameters, population, license sales, and participation rate required predictions before supply and demand characteristics for 1980, 2000, and 2020 could be related to the 40 Appalachian water areas. Population projections, adjusted to include the impact of the entire Appalachian Program were furnished by the Office of Appalachian Studies, Corps of Engineers. These population projections (assessed according to the 1960 census) reveal cumulative increases of 26 percent by 1980, 77 percent by 2000, and 148 percent by 2020. This increase is considerably higher than estimations based on established historical trends without implementation of the Appalachian Program. Differentials between these projections must be considered since license sales and use resulting in estimated demands are, to some degree, directly dependent on population. Besides population relationships both fishing and hunting license sales are also dependent on opportunity, which includes available habitat or existing facilities. Actual resident fishing license sales correlated directly with current opportunity measured in surface acres of fishable habitat per capita and inversely with 1960 population density at the one percent level of significance. With respect to hunting, correlation of resident license sales was checked with the variables, 1960 population density and acres of hunting land per capita, both singly and in combination. Acres of hunting land per capita (squared) showed the highest correlation and was chosen for projection purposes.

Licensed - Resident Demand

The 1964 resident and non-resident fishing license and hunting license sales were totaled for each county within a water area. License sales per capita for each water area were computed by dividing the 1964 license sales by the 1960 total population of the water area. Acres of habitat (waters for fishing, land for hunting) per capita for each water area were determined by dividing the total acres of habitat by the total 1960 population of the water area.

Projected resident fishing license sales were determined for each of the 40 water areas by substituting population density and surface acres of water per capita in a multiple regression equation to obtain the percent

of population buying fishing licenses. In the same manner, the projected hunting license sales were determined by substituting acres of hunting land per capita in a single regression equation to obtain the percent of population purchasing hunting licenses. The calculated resident license sales for each area were then divided into the actual sales for 1964, resulting in a corrective factor for each area. The correction factor was then applied to 1980, 2000, and 2020 determinations.

The equations for the regressions are as follows:

Fishing

$$Y = 0.0940 - 0.000134X_1 + 0.355X_2$$

Where

Y = Percent of population buying resident fishing licenses.
X_1 = Population density.
X_2 = Acres of total water per capita.

Hunting

$$Y = 0.0885 + 0.00028X_1^2$$

Where

Y = Percent of population buying resident hunting licenses.
X_1 = Acres of hunting land per capita.

Licensed Non-Resident Demand

Non-resident hunting and fishing license sales were derived from the 1964 ratio of non-resident to resident license sales for each water area, i.e. the 1964 non-resident sales were divided by the resident sales. It was assumed that this ratio would remain constant in future years. The projected resident and non-resident license sales were then totaled to obtain total license sales.

Unlicensed Demand

Unlicensed participation was derived from statistics developed in the 1965 National Survey of Fishing and Hunting. 4/ The survey indicated that approximately 33.7 percent of all fresh-water fishermen and 16.3 percent of all hunters in the United States were not licensed.

4/ Dept. of the Interior, Fish and Wildlife Service, 1965 National Survey of Hunting and Fishing, Resource Publication 27, Washington, D. C. 1966, pp. 57, 71.

It was assumed that these percentages will remain constant during the projection years 1980, 2000, and 2020. Participants who are exempted in some states from paying some kind of fee include land owners, people over or under a set age, active servicemen, etc. This figure could be affected by changes in legislation.

Participation

The annual rate of angler participation is an often neglected statistic possibly because it exhibits a high variability within established geographical boundaries. Reports from several Appalachian states indicate that these fluctuations resulted partially from differences in population density and available habitat or opportunity. Secondary relationships exist between the rate of participation and license sales, type of habitat and other characteristics of the study area. No method of isolating the Appalachian portion of the state or water areas within the state could be justified. Only in one state did Regional data coincide with Appalachian boundaries and here the rate was commensurate with the national average of 18.4 man-days reported in the 1965 National Survey of Fishing and Hunting.

Nationally, it has been estimated that about 15 percent of the anglers would vary their rate of participation according to the availability of facilities 5/. The participation rate of the remaining 85 percent of the nation's anglers would remain constant. Acres of surface water per licensed angler were considered the best measure of available opportunity within each work unit. These two factors are combined in deriving the following formula for determining participation rate for the 40 water areas in Appalachia:

4.65 x acres water/licensed angler + 15.64 = 18.4

Where

18.4 = National average participation rate (1965)
15.64 = Constant (85% of participation rate)
4.65 = Constant for determining 15% of participation rate.

. . 4.65 (.594) + 15.64 = 18.4 man-days (1965)
4.65 (.636) + 15.64 = 18.6 man-days (1980)
4.65 (.557) + 15.64 = 18.2 man-days (2000)
4.65 (.481) + 15.64 = 17.9 man-days (2020)

Since a direct relation between the rate of participation and available habitat is established in this determination, correlation of these

5/ Mueller, Eva and Gurin, Gerald, Participation in Outdoor Recreation: Factors Affecting Demand Among American Adults. ORRRC Study Report 20, Washington, D. C., 1962, p. 7.

factors is evident. Projected rates of participation calculated by correlated regression vary only slightly from these original calculations and correctional adjustments are small.

Gross Demands for 1980, 2000, and 2020

Gross demand for the three periods of study was determined by multiplying the number of total anglers of each water area by the participation rate determined by the previously mentioned formula. The participation rate was multiplied by a correction factor to account for anglers who purchased short-term licenses. In like manner, the total hunters of each area were multiplied by the established participation rate. Gross region fishing demand will increase from 52.8 million angler days in 1964 to 64.0 million in 1980, 73.5 million in 2000, and ultimately 84.8 million angler days in 2020. Projected gross hunting demand figures for 1980, 2000, and 2020 are 34.7, 46.4, and 63.4 million hunter days, respectively.

Net Needs for 1980, 2000, and 2020

Net fishing needs or surpluses for the years 1980, 2000, and 2020 were derived by comparing the supply and demand in man-days for each water area.

The man-day supply of fishing was calculated by multiplying the current and 1980 total habitat consisting of reservoirs, lakes, ponds, and streams by the respective man-day per acre use. Estimates of water development and its distribution beyond 1980 could not be justified; therefore, the available use for 2000 and 2020 are based on 1980 opportunities. Any specific water development projects constructed after 1980 would influence values established for both the demand, measured in man-days expended and the supply measured in man-days available, for any particular water area. If all water development projects planned for the period 1964 to 1980 are completed, it is estimated that the 1980 sport fisheries habitat will be capable of supporting about 13.1 million more man-days of fishing than in 1964.

Hunting needs, however, could not be determined by comparing the supply and demand. Unlike fishery habitat, land habitat cannot be created (except improved by management) but is being continuously destroyed. Therefore, to determine hunting needs for the periods 1980, 2000, and 2020, the gross demands of each of the three periods were compared with 1964 demand. Projected net hunting needs of the region for 1980, 2000, and 2020 will amount to 5.6, 17.3, and 34.4 million hunter days respectively.

The following example is presented to explain the procedures used for projecting gross fishing demands and net needs for a typical water area:

Water Area G-2, Ohio

Given:

1964 Resident Fishing License Sales	=	40,262
1964 Non-Resident Fishing License Sales	=	1,332
1960 Water Area Population	=	441,400
1980 Projected Water Area Population	=	476,700
2000 Projected Water Area Population	=	665,100
2020 Projected Water Area Population	=	987,800
1960 Density - Population per Square Mile	=	79.0
1980 Density - Population per Square Mile	=	85.3
2000 Density - Population per Square Mile	=	119.1
2020 Density - Population per Square Mile	=	176.9
1964 Acres of Fisheries Habitat	=	12,389
1980 Estimated Acres of Fisheries Habitat	=	22,562
2000 Estimated Acres of Fisheries Habitat	=	22,562
2020 Estimated Acres of Fisheries Habitat	=	22,562
Correction Factor (Percent of Population with Resident Licenses)	=	97.5
Correction Factor (Percent of Population - 1964 Short-term Licenses)	=	99.2
1964 Participation Rate - Man-days per Angler	=	17.0
1980 Participation Rate - Man-days per Angler	=	17.8
2000 Participation Rate - Man-days per Angler	=	17.4
2020 Participation Rate - Man-days per Angler	=	17.0
1964 Angler Days - Supply	=	654,763
1980 Angler Days - Supply	=	1,155,182

Licensed Resident Sport Fishermen for 1980, 2000, and 2020:

Resident Fishing Licenses (Percent of Population) = .0940 - (.000134 X Density) + (.355 X acres water/Capita) X (Correction Factor)

1980

$[.0940 - (.000134 \times 85.3) + (.355 \times .047)] \times (.975) = .0968$

476,700 X 0.0968 = 46,141 Licensed Resident Anglers

2000

$[.0940 - (.000134 \times 119.1) + (.355 \times .034)] \times (.975) = .0878$

665,100 X .0878 = 58,392 Licensed Resident Anglers

2020

$$\left[.0940 - (.000134 \times 176.9) + (.355 \times .023)\right] \times (.975) = .0765$$

987,800 X .0765 = 75,564 Licensed Resident Anglers

Licensed Non-Resident Sport Fishermen for 1980, 2000, and 2020:

1964

$$\frac{1,332}{40,262} = 3.31\%$$

1980

46,141 X .0331 = 1,527 Licensed Non-Resident Fishermen

2000

58,392 X .0331 = 1,933 Licensed Non-Resident Fishermen

2020

75,564 X .0331 = 2,501 Licensed Non-Resident Fishermen

Fishermen 9 - 11 years old (unlicensed) for 1960, 1980, 2000, and 2020:

6.2% of Population of U.S. = Youngsters 9 - 11 years
.062 (Population) X (% Youngsters 9 - 11 who fished in East North Central Geographic Division) = Fishermen 9 - 11 years old

1964

.062 (441,400) X .249 = 6,815 Fishermen 9 - 11 years old

1980

.062 (476,700) X .249 = 7,360 Fishermen 9 - 11 years old

2000

.062 (665,100) X .249 = 10,267 Fishermen 9 - 11 years old

2020

.062 (987,800) X .249 = 15,249 Fishermen 9 - 11 years old

Total Anglers 12 years and older for 1960, 1980, 2000, and 2020:

Total licensed (Resident and Non-Resident) ÷ .663 (Percent of total Freshwater fishermen in U. S. Licensed) = Total anglers 12 years and older

1964

41,594 ÷ .663 = 62,736 Total Anglers 12 years and older

1980

47,668 ÷ .663 = 71,897 Total Anglers 12 years and older

2000

60,325 ÷ .663 = 90,988 Total Anglers 12 years and older

2020

78,065 ÷ .663 = 117,745 Total Anglers 12 years and older

Unlicensed Fishermen for 1960, 1980, 2000, and 2020:

(Total Anglers - 12 years and older) - (Resident & Non-Resident Licensed Fishermen) + (Total Anglers 9 - 11 years old) = Total Unlicensed Fishermen

1964

62,736 - 41,594 + 6,815 = 27,957 Total unlicensed fishermen

1980

71,897 - 47,668 + 7,360 = 31,589 Total unlicensed fishermen

2000

90,988 - 60,325 + 10,267 = 40,930 Total unlicensed fishermen

2020

117,745 - 78,065 + 15,249 = 54,929 Total unlicensed fishermen

Total Sport Fishermen for 1960, 1980, 2000, and 2020:

Resident licenses + Non-resident licenses + Unlicensed anglers

1964

40,262 + 1,332 + 27,957 = 69,551 Actual fishermen

1980

46,141 + 1,527 + 31,589 = 79,257 Projected fishermen

2000

58,392 + 1,933 + 40,930 = 101,255 Projected fishermen

2020

75,564 + 2,501 + 54,929 = 132,994 Projected fishermen

Gross Demand for Sport Fishing in 1980, 2000, and 2020:

Total Anglers x Computed Participation = Angler days
Angler days x corrected factor for short term licenses =
Angler days (Gross Demand)

1980

79,257 x 17.83 = 1,413,152 Angler days
1,413,152 x 99.2% = 1,401,847 Angler days (Gross Demand)

2000

101,255 x 17.36 = 1,757,787 Angler Days
1,757,787 x 99.2% = 1,743,725 Angler Days (Gross Demand)

2020

132,994 x 16.99 = 2,259,568 Angler Days
2,259,568 x 99.2% = 2,241,491 Angler Days (Gross Demand)

Net Needs for Sport Fishing in 1980:

Net Needs = 1980 Gross Demand - (1964 Actual Use + Angler Days of Opportunity Created from 1964 to 1980)

1,401,800 - (654,800 + 500,400) = 246,600 Angler Days (Net Needs)

WAYS AND MEANS OF SATISFYING FISHING AND HUNTING NEEDS

The following remedial measures are presented as a general guideline for meeting some of the Region's fishing and hunting needs for the years 1980, 2000, and 2020.

Projected sport fishing needs can be satisfied by using one or more of the following corrective actions: (a) creation of impoundments through the construction programs of the Corps of Engineers, Tennessee Valley Authority, U.S.D.A.'s Soil Conservation Service and Forest Service, private power companies, and various state agencies; (b) acquisition of additional public access downstream from currently operating reservoirs or along other streams and impoundments; (c) pollution abatement of contaminated streams and reservoirs; (d) provision of adequate minimum flows and reduction of maximums; (e) fish rearing and stocking; and (f) applying improved techniques of fisheries management developed by a continuing research program.

Basically, there are two major factors that need consideration if future hunting demands are to be met. One is concerned with the hunter and is largely an access problem. If land is not available for hunting, it will have little value in meeting the demand. The second factor is concerned with the game animal. If land open to hunting has little or no game present, it has little or no value in supplying man-days. Therefore, the increased demand will have to be met by opening as much land as possible to public hunting and managing the land for optimum game production.

Access can be improved in several different ways: First, improved highways, such as interstates, can cut traveling time and make trips to more distant areas feasible. Secondly, access roads on large blocks of land would help distribute hunting pressure similar to trails on smaller blocks of land. Thirdly, cooperative agreements with land-owners could provide hunting on private lands. Finally, placing lands into public ownership or leasing private lands that are suitable for hunting.

Habitat improvements on private lands are also associated with economic problems. Property owners who are dependent on their land for their livelihood cannot be expected to install practices that will lower their income. However, many good agricultural practices can also be beneficial to wildlife. In areas of intensive farming, some form of reimbursement to the landowners may become necessary if wildlife is to be retained in the area. Landowner-hunter relations are very important, and any program that would improve these relations should be encouraged.

Other factors that could improve hunting opportunity and thereby supply additional man-days are (1) Archery hunting, which is gradually gaining in popularity, can be performed safely on smaller areas than is

needed for rifle hunting. (2) The introduction of exotic species into areas that have low populations or no native species present. (3) The re-introduction of native species into areas where they have disappeared. The successful re-introduction of the wild turkeys in several states is a good example of this possibility. (4) Private shooting preserves supply additional opportunity, especially near high population centers. Use of these areas is expensive, however, and thus restricts the number of people who can afford to participate. (5) Public shooting areas containing pen-reared birds often increase hunting opportunity. This means is costly, too, and a way of financing this type operation would be necessary if used on extensive areas.

In the following state-by-state analysis, future demands are quantified and possible remedial programs are presented for meeting the fishing and hunting needs.

Sport Fishing

Alabama:

The computed 45 percent water surplus existing in Alabama in 1964 is reduced during each 20 year reporting period, reaching a low of 5 percent by the year 2020. Needs for additional fishing water arise in water sub area E-4 in 1980 and continue to increase by 2020. Northport Reservoir and three U.S.D.A. upstream watershed projects being studied under the Appalachian Water Resources Program would assist in meeting the need in this portion of the state. Although resident license sales show a decline from 13 percent in 1964 to 11.5 percent in 1980; 8.8 percent in 2000; and 7.4 percent in 2020, the computed number of resident licensed anglers increases during each reporting period and results in a 66 percent increase or 167,400 individuals by 2020. Normal water development operations between 1980 and 2020 should result in ample angling opportunity in the Appalachian portion of Alabama.

Georgia:

Like Alabama, the values in the Appalachian portion of Georgia indicate a substantial surplus of fishing opportunity in 1964. Scheduled water development projects add slightly to this surplus by 1980. The overall surplus is reduced by 2000 and becomes a small need by 2020. Current needs existing in water area E-2 increase during each reporting period and accounts for most of the overall needs by 2020. Of the two water development projects currently being studied under the Appalachian Program, the Conasauga River Reservoir project and one U.S.D.A. upstream watershed project located in water area E-2 will reduce the needs of this region by 27 percent. Two U.S.D.A. upstream watershed projects planned for J-4 is expected to meet this

need by 2020. Although the Curry Creek site is located in water area D-2 which shows no need for water development, its location on the southern boundary of Appalachia, near heavily populated regions, will draw substantial numbers of anglers from outside Appalachia. Resident state license sales dropped from 17 percent in 1964 to 16 percent in 1980, 13.5 percent in 2000, and 12 percent by 2020. This rate of decline is not as large as the projected population increases; therefore, the actual number of licensed resident anglers increases nearly 80 percent by 2020. Moderate water development from 1980 through 2020 should provide adequate fishing opportunity in Georgia throughout the span of this study.

Kentucky:

Needs existing in two of Kentucky's four water sub-divisions in 1964 will be satisfied through reservoir construction by 1980. In the remaining two areas, water surpluses will be maintained or increased. Without the creation of additional opportunity beyond 1980 water areas G-2 and G-4 will develop needs for additional fishing opportunity. Surplus opportunity in water areas H and I-1 provide Kentucky with an estimated surplus of 21 percent by 2020. This overall value represents the largest surplus among the twelve Appalachian states. Resident license sales per capita increased from 1964 to 1980 and declined slightly by 2000. The per capita sales will fall below the 1964 level by 2020. The number of resident license purchasers increases from 83,754 in 1964 to an estimated 141,052 in the year 2020. This 68 percent increase in individuals is directly related to the decline in surplus opportunity. This slow decline can be partially attributed to reservoir construction and a comparatively slow rate of population increase. Moderate needs are expected to occur in water area G-2 and a slight need in water area G-4 by 2020. Surplus opportunity in water areas H and I-1 can provide the necessary opportunity if available east to west access can be provided and maintained. Two U.S.D.A. upstream watershed projects planned for G-2 will reduce the need 4 percent by 2020.

The majority of the water development projects being considered under the Appalachian Water Resource Program for Kentucky, including Parker Branch, Devils Jumps, and Celina are located in regions of surplus opportunity. Therefore, much of the expected use on these reservoirs must be treated as redistribution of use, or use from outside the study unit from other states. Royalton Reservoir and three U.S.D.A. upstream reservoirs will provide fishing opportunity in water area G-4 and will reduce the need by 32 percent.

Maryland:

In 1964, a slight need for angling opportunity existed in the three counties that form the Appalachian portion of Maryland. During

periods of 1980, 2000, and 2020 this need becomes progressively larger and reaches a maximum in 2020. Only 67 percent of the demand will be fulfilled. Resident license sales decline slowly from 11 percent in 1964 to 9.2 percent in 2000, and then rather sharply to 7.7 percent by 2020. The number of resident license purchasers increases about 59 percent over the eighty-year period of study. Three U.S.D.A. upstream watersheds considered under the Appalachian Program will increase the opportunity, but will not reduce the need substantially due to their small sizes. The overall need for fishing opportunity in the Appalachian portion of Maryland is estimated as moderate to high after 1980. Normal operations of construction agencies are expected to reduce the need during this same period but no surpluses are expected to develop.

Mississippi:

The substantial surplus of fishing opportunity that existed in the Appalachian portion of Mississippi in 1964 will be reduced to where the habitat and demand will be approximately in balance by 1980. During this period, five U.S.D.A. upstream watershed projects will provide an additional contribution to the habitat base. Beyond 1980, needs will arise when considering the hypothetical situation of no further water development. Only 81 and 68 percent of the respective needs will be met in Mississippi by the years 2000 and 2020.

New York:

Through scheduled reservoir construction the slight overall 1964 surplus of opportunity is improved and increases 19 percent in 1980. Current needs in water area F-1 are expected to be satisfied by 1980. Beyond 1980 the lack of water development results in a reoccurrence of the need in this region, but the overall opportunity remains satisfactory. A continuation of these hypothetical conditions results in an overall slight need which is nearly equally divided by the two water areas in New York in the year 2020. Sales of resident fishing licenses decline slowly from 11 percent in 1964 to 7.7 percent in 2020. The number of license purchasers increases from 108,000 in 1964 to 187,000 in 2020. This 73 percent increase in license holders corresponds to a 149 percent increase in population as well as a rise in density from 87 persons per square mile in 1964 to 217 persons per square mile in 2020.

Five reservoir sites and four U.S.D.A. upstream watershed projects are currently being studied under the Appalachian Water Resources Program. Davenport Center Reservoir is located in water area B-1. Stannard, Otto, Zoar Reservoirs and an alternate site at Springville are located in water area F-1. The establishment of fisheries at these

sites along with normal water development activities by the construction agencies could satisfy about 75 percent of the needs that arise in the New York portion of Appalachia. Additional pressures from population centers to the north and east and from sections of northern Pennsylvania where development potential is limited can be expected.

North Carolina:

Current needs for additional fishing opportunity exist in water area D-1. A surplus in water area J-2 provides a small overall surplus for the Appalachian portion of North Carolina. Planned water development by the Tennessee Valley Authority will increase the surplus in water sub-area J-2, and thereby raise the overall surplus slightly higher in 1980. Due to the lack of additional opportunity after 1980, needs develop rather sharply because of the rapid population increase. Only 71 percent of the need will be fulfilled in 2020. Although both work units show needs in 2020, the needs in water area D-1 are most severe. Resident license sales percentages drop rapidly after 1980 because no newly created waters are considered to counteract a rapid overall population growth of 221 percent during the eighty-year study interval. Although sales decline from 9.5 percent in 1964 to 5.7 percent in 2020, the number of purchasers nearly double during this same period.

Five reservoir projects and three upstream watershed projects are being studied under the Appalachian Water Resource Program. Upper Donaha, Reddies, Clinchfield, Roaring River, and Fisher River reservoir sites fall in water area D-1, where the greatest need is expected to occur. Construction of these sites could reduce the need in D-1 by 54 percent. Slight needs in J-2 by 2020 should be met through normal activities of construction agencies. No substantial needs are expected to occur in the Appalachian portion of North Carolina if the Appalachian projects are approved and fisheries potentials developed.

Ohio:

In 1964, the Appalachian portion of Ohio had a severe need for additional fishing opportunity. Only 53 percent of the demand was fulfilled. Anticipated reservoir and pond construction prior to 1980, primarily in water area G-2 will decrease the overall need fulfillment from 53.3 percent to 63.4 percent in 1980. Without further water development the greatest need occurs in water area F-3. Per capita resident license sales improve slightly from 1964 to 1980, but declines to a low of .078 by 2020. During this same interval the number of license buyers is expected to increase 78 percent if no new water developments are considered after 1980. A moderate rate of population increase in Ohio corresponds with a more gradual decline in the per capita license sales. Four U.S.D.A. upstream watershed projects and one reservoir

project - White Oak in water area G-2 is being considered under the Appalachian Program. The five projects have potential to assist in reducing the excessive demand by 5 percent but severe future needs are still expected to be present in the Appalachian portion of Ohio.

South Carolina:

The six counties that comprise the Appalachian portion of South Carolina had an estimated 13 percent surplus of angling opportunity in 1964. An increase in the number of participants with a corresponding increase in fishing waters will result in a reduction of this surplus by 1980. Assuming that no water will be developed beyond 1980, a slight need arises by 2000 but is reduced by 2020 due to a reduction in the number of resident fishing license purchasers. Appalachia's most rapid rate of population increase occurs in South Carolina and results in a drastic decline in resident license sales between 2000 and 2020. Through established formulation, this population increase results in a per capita resident license sales drop from 5 percent in 2000 to 2.3 percent in 2020. Although the needs are not severe, the overall decline in the number of estimated resident anglers indicates that they are overcrowded, due to lack of opportunity and other undetermined factors that arise in metropolitan or densely populated regions. Four U.S.D.A. upstream watershed projects are planned for water area D-2 in South Carolina under the Appalachian Water Resource Program and are expected to meet the 48,500 man-day need in 2020.

Pennsylvania:

All five water areas in Pennsylvania lacked adequate fishing opportunity in 1964. Estimated needs are severe in water areas F-2, B-2, and A and only moderate in the northern water areas F-1 and B-1. The overall fulfilled need for the Appalachian portion rose from 44 percent fulfillment in 1964 to 55 percent in 1980. All water areas except B-1 continue to have substantial needs for additional fishing opportunity. Assuming that no water will be developed beyond 1980, the needs rise gradually, reaching 47 percent fulfillment by 2020. Resident license sales per capita decline from about 5.2 percent in 1964 to 2.8 percent in 2020. Established methodology was altered in the determination of resident license sales for water area F-2 between 2000 and 2020. Because of the high density and the lack of newly created opportunity in this water area, the computation of resident license sales resulted in negative sales in 2020. To project a more realistic valuation, per capita resident license sales calculated for 2000, were applied in the year 2020. This partially accounts for the reduction in the decline of projected resident license sales between 2000 and 2020. The projected number of resident license purchasers increases only 21 percent between 1964 and 2020, while the population shows an overall 125 percent increase. Two reservoir projects St. Petersburg and Prompton

located in water areas F-1 and A, respectively, are being considered under the Appalachian Program. In addition, eleven U.S.D.A. upstream watershed projects are planned for F-1, five for F-2, and two for B-2. All sites, if developed, are expected to receive heavy use, but overall need in Pennsylvania will be reduced only about 7 percent.

Although the need is severe, the number of licensed resident anglers remains constant. This is an additional indication of need, however, mainly in the more densely populated regions of the state. Many reservoir sites in Pennsylvania have limited fisheries potential due to poor water quality.

Tennessee:

Two of the five water areas in the Appalachian portion of Tennessee have a moderate need for additional angling opportunity. Surplus opportunity in the remaining three water areas results in a 33 percent statewide surplus in 1964 and declines to 2 percent by 2020. Size, low population, and sub-regional boundaries were considered in evaluating the need in water areas J-5 and J-1. In most instances large water acreages occur just across the water area boundaries where surplus opportunity exists. Access or availability is not curtailed by water area boundaries; therefore, actual needs in the state of Tennessee are considered minor. Normal water development beyond 1980 is expected to provide ample fishing opportunity in Tennessee. During the eighty-year study interval the population will have increased 178 percent, while the number of resident licensed anglers increased 65 percent. The resulting decline in license sales per capita is related to increased density and inherent lack of newly created opportunity in 1980. Fishing use of Devils Jumps Reservoir, which is being studied under the Appalachian Program, will be a re-distribution of fishermen rather than a creation of additional use due to the existing opportunity in this section of Tennessee. No substantial needs are expected to develop in Tennessee even though non-resident use, mainly from areas of low opportunity, will continue at a high rate.

Virginia:

Although the overall need for fishing opportunity in the Appalachian portion of Virginia increases slightly from 1964 to 1980, conditions in water area C are expected to improve due to water development. The 1980 needs in water area J-1 are rated high while those in G-5 are moderate. Without additional water development beyond 1980, excessive demands become severe in 2000 and 2020 for water areas J-1 and G-5 and moderate for water area C. Resident license sales decline from 12.1 percent in 1964 to 11.5 percent in 1980 and reach a low of 9.4 percent in 2020. A population increase of 155 percent over the eighty-year study interval coupled with a decline in the per capita resident license sales results

in a 98 percent increase in the number of resident license purchasers by 2020. Hipes reservoir site, which is being studied under the Appalachian Program, could satisfy about 50 percent of the projected need in water area C by 2020, but severe needs are expected to occur in water areas J-1 and G-5 in the years 2000 and 2020 even if normal development is assumed.

West Virginia:

Planned water developments in West Virginia will improve the overall fishing opportunity between 1964 and 1980, but only 58 percent of the total demand is expected to be fulfilled after this sixteen year period. During this interval severe needs remain constant in water areas G-3 and G-2, while moderate reductions in need occur in water areas G-4, G-5, and G-3. Without the creation of added opportunity beyond 1980 only 50 percent of expected demand will be satisfied in 2000 and 41 percent by 2020. Severe needs are expected to remain in all water areas except G-5, where normal construction activity may satisfy the projected demand after 1980. Per capita resident license sales in West Virginia decline slowly from 9.8 percent in 1964 to 7.5 percent in 2020. This is due to a comparatively low increase in population. The combination of these two factors results in a 60 percent increase in number of resident license purchasers by 2020. The degree of undetermined water development between 1980 and 2020 will tend to increase both the per capita and numerical values related to resident license sales. Four reservoir development projects, Greenbrier, Anthony Creek, North Mountain, and Royal Glenn are being considered under the water resources section of the Appalachian Act. In addition, ten U.S.D.A. upstream watershed projects are planned for water area F-3, one for G-2, two for G-5, and one for G-3. Two sites, Royal Glenn and North Mountain are located in water area B-3, which is expected to have the smallest comparable need. The Greenbrier site located in water area G-5, can be expected to receive maximum potential use due to large unfulfilled demand. The affect of water area boundaries is reduced in West Virginia due to the extreme overall need within the state and in most border sections of adjoining states.

Hunting

Alabama:

In 1964, Alabama had a moderate rate of hunting use. However, based on projected increases this use will increase at a faster rate than the other Appalachian states, with the exception of South Carolina. Land to be acquired by the U.S. Forest Service could supply about 2 percent of the estimated 861,000 additional man-days needed by 1980. Interstate Highways 20, 59, and 65 will criss-cross the area and will provide better access and shorter driving times for people in the larger cities. Habitat improvement and the control of feral dogs could increase game populations, especially the deer herds.

Georgia:

Currently, the hunting pressure in Georgia is relatively high. Hunting pressure is expected to increase at the projected median rate for Appalachia - an increase of 130 percent in man-days per acre by 2020. Land acquisition programs by the U.S. Forest Service could supply about 20 percent of the need for 1980. The remainder will have to be supplied by intensified management, cooperative programs, etc. Interstates 72, 85, and Appalachian Highway A will provide faster access to the Appalachian area from Atlanta and vicinity. This could increase hunting opportunity for Atlanta residents. Feral dogs are a problem in deer management, and a control program could increase the deer hunting opportunity appreciably. Several exotic species of game birds are being introduced experimentally and could increase hunting opportunity.

Kentucky:

The Appalachian portion of Kentucky has the lowest use rate of the states concerned. The projected rate of increase is also below the projected median rate for the states. Land acquisition programs by the U.S. Forest Service accompanied by increased game habitat improvement could fulfill the needs for 1980 and possibly for 2000. Interstates 72 and 64 and Appalachian Highways J, F, I, G, R, and B will greatly improve access into most of the area, and could provide hunting opportunity for people from western Kentucky and southern Ohio. Here again, feral dogs are a problem in some areas, especially to deer populations. Poaching in some areas may be an important factor in delaying the increase in turkey populations that have been established.

Maryland:

Maryland has a high use rate at the present time and future use is expected to increase at the projected median rate for the states. As with most states that already have high use rates, intensive management will be necessary if projected use is to be attained. Only a small portion of Appalachia is in Maryland. The small area could decrease the validity of the figures arrived at, due to the small sample. Interstate 70 and Appalachian Highway E will cross this area and probably will increase the number of hunters coming into the area.

Mississippi:

In 1964, Mississippi had a low hunting pressure. Projected increases in hunting pressures indicate a below median rate of increase - an increase of 75 percent versus a median of 130 percent for 2020. In view of the absence of major interstate highways in the area, access from outside the area is somewhat restricted. Deer herds are increasing, but are still below the carrying capacity. Poaching is an important factor, which re-

stricts the increase of turkey populations in some areas. This portion of Appalachia, with its present and projected low-use rates should be able to maintain favorable hunting conditions without intensive programs. Moderate programs of habitat improvement and better access which includes land acquisition programs by the U.S. Forest Service should supply hunting opportunity to the year 2020.

New York:

This area has relatively light use at the present time. Hunting pressure is expected to increase considerably by 1980 and continue to grow in the distant future. Statistics indicate that a 130 percent increase in the man-day use per acre will be necessary to meet the demand by 2020. This area supports good deer populations, and wild turkeys are on the increase. Both of these species require quite extensive tracts of forest type cover if they are to be maintained. Interstates 81 and 90 cross the area as well as Appalachian Highway T. This will increase the ease of access from the heavily populated eastern New York area, and could increase hunting pressure more than is indicated by the data.

North Carolina:

The Appalachian portion of North Carolina at present sustains a moderate hunting pressure. The projected intensity of use indicates an above normal increase in pressure - an increase of 190 percent versus a projected median of 130 percent for 2020. Land acquisition programs by the U.S. Forest Service could provide about 3 percent of the needs for 1980. Interstates 26, 40, and 77 and Appalachian Highways A, B, and K will cross the area, making access easier and possibly increasing hunting pressures more than anticipated. Big game management requires relatively large tracts of land and should be considered in highway planning and construction. Too much access, however, could lower or destroy the usefulness of an area to big game species.

Ohio:

Present hunting pressure for Ohio is moderate, with projected use increasing at a rate somewhat below the projected median for the states. Proposed land acquisition by the U.S. Forest Service could fulfill the increased demand by 1980. The establishment of a waterfowl refuge and waterfowl hunting area in connection with the proposed White Oak Reservoir could also help supply the needs for water area G-2. Interstates 70 and 77 and Appalachian Highways B, C, and D will cross the region. The proximity of heavy population centers to the north and west of the area may increase hunting pressure considerably.

Pennsylvania:

Hunting pressure is heavy in this state and will increase at a rate which is median (130 percent by 2020) for Appalachia. Land acquisition by the U.S. Forest Service will provide only about one percent of the needs for 1980. However, intensive game management practices could provide an additional percentage of the needs. Interstates 70, 79, 80, and 81 and Appalachian Highways M, N, O, P, and U will facilitate travel within the area and may cause some increased influx of hunters from the heavily populated eastern seaboard. Pennsylvania's game lands, forest lands, and sportsmen-landowner cooperative program provide considerable public hunting opportunity. The increasing pressures, however, will require above average efforts by the state to maintain this opportunity. Sunday hunting could also satisfy a percentage of the hunting need.

South Carolina:

South Carolina has a moderate rate of hunting pressure at the present time. However, this state shows the highest rate of increase in future hunting use of all the states in Appalachia. Interstates 26 and 85 will cross the Appalachian portion of the state. Proposed land acquisition by the U.S. Forest Service could supply about two percent of the demand by 1980. Intensive management will be necessary to maintain the present rate of hunting opportunity.

Tennessee:

Of five water areas in Tennessee, three will have a serious need by 1980. Water area J-3 will have the greatest need in the state. This need will be approximately 600,000 man-days. To approximate hunting opportunity as it existed in 1964, additional hunting sources will be needed in 1980. Proposed land acquisition by the U.S. Forest Service could provide for approximately seven percent of the increased needs for 1980. Appalachian Highways J, S, B, and K, and Interstates 24, 40, and 75 will expedite access in and through the area. An accelerated feral dog control program would increase deer herd populations in some areas and provide more big game hunting opportunity.

Virginia:

Virginia has a moderate rate of hunting at the present time. Projections indicate a slightly lower than median rate of increase in hunting pressures in the future. Proposed land acquisition by the U.S. Forest Service could meet the increased demands for 1980. Since there is a relatively large acreage of public land in the Appalachian portion of Virginia, access should not be a major problem. Game management practices can be instituted by agreement of the agencies involved. Interstates 64,

77, and 81 and Appalachian Highways B and Q will provide additional access to the area in future years. Demands for 2000 and 2020 should be able to be met by increased wildlife management practices. This area appears to be in a relatively good position to meet hunting needs for the future.

West Virginia:

Present use is near the projected median for the states. The rate of increase will be below the median for Appalachia. It is anticipated that the additional land acquired by the U.S. Forest Service will be able to supply about 55 percent of the 1980 needs. Access throughout the state will be improved by the completion of Interstate Highways 77, 79, and 64 and Appalachian Highways D, G, L, H, and E. Poaching and feral dogs are problems in some areas. Hunting opportunity could be increased if these hindrances were eliminated. Some management practices will also be necessary if the demand is to be met, although the need will not be as acute as in some of the other states.

Commercial Fishing

Several cooperative programs among the governmental agencies and the commercial fishing industry are presently working towards solutions to some of the needs that have been previously outlined.

The Bureau of Commercial Fisheries in cooperation with the industry is actively engaged in a program to increase consumer preference for fresh-water food fish. The research is aimed at improving methods of preparation and merchandising. They have already offered several publications to the public dealing with the preparation of fish. This coupled with more attractive merchandising is expected to stimulate the market for food fish.

The development of industrial operations within the Region for the production of animal food, fish meal and fish protein concentrate would provide a tremendous demand for the regional commercial fisheries resource. Demand for animal food and fish meal is good but to be competitive as a supply source, commercial fish must be consistently available in large volume and at prices of approximately two cents a pound for raw fish at the plant. To meet these conditions would require a massive restructuring of the regional commercial fishery together with major innovations in harvest techniques. It is the opinion of the Bureau of Commercial Fisheries that these requirements for full development of an industrial fishery are not likely to be met within a twenty year time frame. Thus, any fish meal and/or F.P.C. production evolving within Appalachia during this period will do so through utilization of waste by-products of the commercial food fishery and will be of limited volume. A precedent

of this type of operation now exists at one location in the Missouri Basin, where fish scraps from a food fishery are used to produce fish meal.

More realistic commercial fishing regulations will undoubtedly become a reality with the professional development of the commercial fishing industry. From a biological standpoint, much evidence is available which indicates that in most waters, a well regulated commercial fishery is not detrimental to the sport fisheries. Coordination and cooperation between the state conservation agencies and the commercial fishing industry along with a good public information program will help to eliminate unnecessary regulations.

Modernization of the commercial fishing methods and equipment would result in an efficient and economical utilization of the resource. Actually, two types of fishing operations need to be considered with respect to methods and equipment. One type of operation would occur on integrated systems of habitat such as the Tennessee River impoundments, Lake Erie, and the Ohio River. Here, a more sophisticated type of equipment could be used such as trawling vessels and transport barges that could continually utilize the resources throughout the system. The second type of operation would harvest the fishery resources in the scattered lakes and reservoirs of the region on an intermittent basis. To be efficient, this type of operation would need portable gear designed specifically for reservoir fishing.

Although there is information available concerning the overall fishery resources of the habitat in Appalachia, additional studies will be needed. The results of these studies can provide guides for managing the region's reservoirs in a manner compatible to both sport and commercial fisheries.

COST ESTIMATES OF SPORT FISHERIES AND WILDLIFE DEVELOPMENTS

Sport Fisheries

Projections of both fishing license sales and annual rates of participation indicate that the demand for fishing opportunity will increase by 10.5 million man-days by 1980. During this same period construction estimates by the Corps of Engineers are for about 102,000 surface acres of fishable habitat, 44,000 surface acres by the Tennessee Valley Authority, 13,000 acres under the U.S. Department of Agriculture's upstream watershed program, and 6,000 acres on U.S. Forest Service lands. This total of about 165,000 surface acres could support about one third the projected fishing demand. Costs of establishing and maintaining the fisheries at these proposed developments are estimated to range from $300,000 to $1,250,000 at the Corps of Engineers sites, $140,000 to

$540,000 at the Tennessee Valley Authority sites, $40,000 to $160,000 at the U.S.D.A. upstream watershed projects, and $186,000 at U.S. Forest sites. Approximately 115,000 surface acres of farm, ranch, or private ponds will be added to the fishing habitat by 1980. Costs of fisheries developments at these sites are considered insignificant. No estimates of pond or reservoir construction by states, municipal groups or private power agencies are included, but these would add considerably to the total fisheries cost for 1980. Many of the estimated water development projects are located in areas where surplus opportunity exists. Therefore, these acreages cannot be applied against the demand in areas where needs exist. No estimates of water development beyond 1980 could be justified due to the lack of specific projects that would allow assignment to water areas.

In order to satisfy needs that arise by 1980, 2000, and 2020, opportunity must be created in areas with definite needs rather than in units with adequate opportunity. An overall need or surplus cannot be applied to each or any of the individual water areas.

Commercial Fisheries

It is not significant to identify in this study, the costs of research programs which are designed to develop efficient and economical fishing techniques. The end result of these programs and how they will affect the commercial fisherman is important. Many of the other costs are vague, such as those associated with improving regulations.

The Bureau of Commercial Fisheries gear research program has provided some estimates on what it would cost a fisherman to operate a theoretical multi-method fishery for a system of reservoirs. The annual cost for such an operation is estimated at $36,000. This cost includes estimated depreciation of the original value, interest on the investment, miscellaneous fixed costs and costs of operation and maintenance.

Wildlife

Projected figures indicate that 5.7 million man-days of additional hunting opportunity will be needed by 1980. Loss of habitat due to urbanization will also result in a loss of 500,000 man-days of hunting opportunity.

By 1980 a total of 1.2 million man-days could be supplied by public developments that will be open to hunting.

This leaves an additional demand of 5.0 million man-days, which will need to be supplied. There are various ways that this projected demand could be met:

1. A 22 percent increase of hunting use on hunting acreages could supply the demand. This would mean that programs designed to open lands now closed to hunting would be needed. Also, better habitat management programs would be necessary on lands open at the present time.

2. If the additional demand is to be met by hunting on public lands, an additional 16.3 million acres under ownership or lease by public agencies would be required. Approximate costs for this program would be $5,500,000 annually. This amount would be necessary even though a large part of the use would be on multi-purpose public land, with part of the benefits accruing at little or no cost.

3. Liberalized hunting regulations, where biologically feasible, could supply additional man-days of opportunity. Improved highways could increase opportunity on under-utilized areas by lessening the time required to reach these areas. These additional man-days of opportunity could be provided at little or no cost to the game management agencies.

SUMMARY AND CONCLUSIONS

General

The Report for Development of Water Resources in Appalachia was authorized by the "Appalachian Regional Development Act of 1965". The Act directs the Secretary of the Army, in cooperation with the Secretaries of Agriculture; Commerce; Health, Education and Welfare; Interior; and the Tennessee Valley Authority and Federal Power Commission to prepare a comprehensive plan for the development and efficient utilization of the water and related resources of the Appalachian Region with special attention to the needs for expanding the economy of the area.

The Appalachian Region as designated for this study includes the entire state of West Virginia and portions of Pennsylvania, Maryland, Mississippi, New York, Ohio, Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, and Alabama. In 1960, the population of Appalachia was 17.7 million people.

Fishery Resources - 1964

Sport Fisheries

There are approximately 1.4 million surface acres of fishable waters in Appalachia. This represents 926,900 acres of reservoirs; 112,900 acres of lakes; 153,700 acres of ponds; and 192,000 acres of streams.

Species distribution varies throughout the Region with latitude and habitat. The warmwater species of fish most common are largemouth

bass, smallmouth bass, catfish, walleyes and panfishes. Coldwater species include brook trout, brown trout, and rainbow trout.

In 1964, approximately 52.8 million man-days of angling were expended in Appalachia. Average values representing man-days per total water surface acreages for each of the Appalachian states ranged from a low of 23.5 man-days per acre in Tennessee to a high of 102.2 man-days per surface acre in Pennsylvania.

Commercial Fisheries

There are approximately 892,000 surface acres of potentially usable commercial fisheries habitat in the Region capable of producing 43.8 million pounds of finfish annually. The bulk of this production consists of non-game fish species including buffalo, carp, catfish, paddlefish, drum, carpsucker, and gizzard shad. In addition, several species of fresh-water mussels are also important in parts of the Region.

In spite of high production potentials in the Region, commercial fishing is limited largely to the Tennessee River impoundments and Lake Erie bordering the Region. The primary reasons for the lack of commercial fishing activity are poor markets and unnecessary restrictions. In 1966, a total of 10.1 million pounds of commercial finfish and shellfish was harvested in Appalachia.

Wildlife Resources - 1964

In 1964, there were approximately 115 million acres of wildlife habitat in the Appalachian Region. Of this total 74 percent was classified as big game, 98 percent as small game, and 2 percent as waterfowl.

The availability and importance of the wildlife species varies throughout the Region. Big game species, commonly found, include white-tailed deer, black bear, and wild turkey. European wild boar have been introduced in some areas. Small game species of importance are the cottontail rabbit, fox and gray squirrel, ruffed grouse, bobwhite quail, mourning dove, and pheasant. Although many species of waterfowl are present in Appalachia, those of principal importance include the mallard, black duck, wood duck, and Canada goose.

The wildlife in Appalachia provided approximately 29 million man-days of hunting in 1964. Of this total effort, the various species of big game, small game, and waterfowl sustained 4 million, 24 million, and 370,000 man-days, respectively.

In addition to the use of wildlife by hunters, the presence of

the wild animals enhance other forms of general recreation such as sight-seeing, picnicing, camping, etc. However, it is difficult, if not impossible, to place a quantitative value on wildlife in these other forms of recreation. This report did not attempt to evaluate the role wildlife has in general recreation.

Economic Impact

The average annual expenditure per fisherman and hunter in 1965 was $88.71 and $82.54, respectively. These expenditures amount to millions of dollars when the total numbers of fishermen and hunters are considered. Most of the monies spent directly on fishing and hunting activities are distributed in such a manner that very few full-time businesses are directly supported by these activities. License fees support state game and fish departments. Federal taxes on sporting goods are also returned to the state to support fish and wildlife programs.

Poor markets and restrictive regulations are the primary deterrents to commercial fisheries development. The total value of the 1966 commercial fisheries catch in the Region was approximately $1.2 million. This resource has the potential of becoming a significant feature of the Appalachian economy.

Resource Problems

Sport fisheries habitat has been adversely affected in certain areas of the Region by acid mine drainage, industrial wastes, and domestic sewage. Other problems include lack of access, destruction of habitat such as dredging and channelization, conflicting uses of the water resources, and inadequate funding of state fisheries programs.

The major problems confronting the commercial fisheries industry relate to factors which limit the utilization of the resource. These include inadequate markets, unnecessary regulations, and inefficient methods and equipment. The shellfishery is limited primarily by the declining population of preferred species of fresh-water mussels. The shellfishery in Ohio is currently under study. The effect of harvest by the cultured pearl industry is being determined.

The most critical problem facing the wildlife resource is the decreasing amount of habitat. In addition, available habitat is being closed to public hunting at an increasing rate and modernized agricultural methods have reduced wildlife production on farm lands.

Future Needs - 1980, 2000, and 2020:

Sport Fishing and Hunting

Methodology for projecting sport fishing and hunting gross demands, net needs, and participation for the Region is presented in the text.

Fishing license sales correlated directly with current opportunity measured in surface acres of fishable habitat per capita and inversely with 1960 population density at the one percent level of significance. Hunting license sales showed the highest correlation with the variable acres of hunting land per capita.

Projected gross demand for sport fishing is estimated to increase 21 percent by 1980, 39 percent by 2000, and 61 percent by 2020, over the 1964 actual Region use.

Future gross demand for hunting is expected to increase 20 percent by 1980, 60 percent by 2000, and 119 percent by 2020, over the 1964 actual Region use.

Regardless of the amount of gross fishing demand that will be met by future going programs and Appalachian projects, unfulfilled needs for fishing opportunity will exist in 22 water areas by 1980, 28 water areas by 2000, and 31 of the 40 water areas by 2020. Regional needs are estimated to be fulfilled in 1980. Unfulfilled needs by the years 2000 and 2020 are estimated to be 7.7 million and 19.1 million angler days, respectively.

Projected sport fishing needs can be satisfied by using one or more of the following corrective actions: (a) creation of impoundments through the construction programs of the Corps of Engineers, Tennessee Valley Authority, U.S. Soil Conservation Service, U.S. Forest Services, private power developments, and various state agencies; (b) acquisition of additional public access downstream from currently operating reservoirs or along other streams and impoundments; (c) pollution abatement of contaminated streams and reservoirs; (d) determination of adequate minimum flows and reduction of maximums; (e) continued research to improve the techniques of fisheries management; (f) fish rearing and stocking; and (g) protection and improvement of habitat.

Unfulfilled Regional hunting needs above the 1964 supply will approach 5.6 million hunter days by 1980; 17.3 million hunter days by 2000; and 34.4 million hunter days by 2020.

Possible ways to meet future hunter needs are: (a) improve access to available hunting land by improvement of roads and trails and by cooperative agreements between sportsmen and land-owners; (b) habitat improvement on private and public lands; (c) introduction of

exotic species into areas of low native populations; (d) re-introduction of native species into areas in which they originally thrived, e.g. wild turkey; (e) development of public and private shooting preserves; and (f) land acquisition by public agencies.

Priorities for fulfilling future Region fishing and hunting needs are presented in table III, Column 18; table IV, Column 11; table V, Column 11; table VII, Column 7; table VIII, Column 7; and table IX, Column 7.

Expenditures necessary to provide public fishing opportunity for the Region's needs projected to 1980 are estimated to range from $300,000 to $1,250,000 at Corps of Engineers sites, $140,000 to $540,000 at Tennessee Valley Authority sites, and $40,000 to $160,000 in U.S. Department of Agricultures upstream watershed projects.

Approximate costs for providing sufficient region hunting habitat needed by 1980 would be about $5,500,000 annually.

Commercial Fishing

It is impossible to ascertain what the demands on the commercial fisheries resource will be in the future. No doubt the food fish requirements of the population will increase. Although that need will never approach the potential supply, modern harvesting techniques and processing facilities would be of great value in food fish production. The use of fish for industrial purposes is not viewed as likely for the short-term future.

Summary of Tabulated Fish and Wildlife Information

The following thirteen tables present a numerical summary of the fish and wildlife information of the Appalachian Region for the periods 1964, 1980, 2000, and 2020. The methodology used to compute these has been previously explained.

TABLE I SUMMARY OF POPULATION DATA - APPALACHIAN REGION - 1960-2020 1/

State and Water Area	Population(1,000's) 1 1960	2 1980	3 2000	4 2020	5 Area (Sq.Mi.)	Density(Pop. per sq. mi.) 6 1960	7 1980	8 2000	9 2020
Alabama									
J-5	453.6	733.8	1,188.0	1,824.4	6,251	72.6	117.4	190.1	291.9
E-3	407.5	562.6	744.9	1,081.0	6,886	59.2	81.7	112.5	157.0
E-4	1,085.1	1,442.8	1,982.5	2,747.2	10,168	106.7	139.9	195.0	270.2
STATE TOTAL	1,946.2	2,719.2	3,945.3	5,652.6	23,305	83.5	116.7	169.4	242.5
Georgia									
E-2	303.3	420.1	560.9	773.2	4,187	72.4	100.3	133.0	184.7
J-4	75.0	101.3	139.9	194.2	780	96.2	129.9	179.3	249.0
E-1	252.4	379.7	537.2	762.9	5,085	49.6	74.7	105.6	150.0
D-2	44.2	55.9	67.6	84.0	789	56.1	70.9	85.7	106.5
STATE TOTAL	674.9	957.0	1,305.6	1,814.3	10,841	62.3	88.3	120.2	167.4
Kentucky									
I-1	347.6	362.9	402.5	470.5	6,897	50.4	52.6	58.4	68.2
H	265.9	291.7	424.7	578.0	5,343	49.3	54.6	79.5	108.2
G-4	163.1	164.8	186.9	218.2	2,410	67.7	68.4	77.5	90.5
G-2	145.5	185.7	241.5	370.2	2,295	63.4	80.9	105.2	161.3
STATE TOTAL	922.1	1,005.1	1,255.6	1,636.9	16,945	54.4	59.3	74.1	96.6
Maryland									
B-3	195.8	240.7	328.0	485.2	1,550	126.3	155.3	211.6	313.1
STATE TOTAL	195.8	240.7	328.0	485.2	1,550	126.3	155.3	211.6	313.1
Mississippi									
E-5	406.2	597.0	852.0	1,112.0	10,304	39.4	57.9	82.7	107.9
STATE TOTAL	406.2	597.0	852.0	1,112.0	10,304	39.4	57.9	82.7	107.9
New York									
F-1	269.5	325.2	458.0	635.9	3,463	77.8	93.9	132.2	183.6
B-1	707.9	918.3	1,282.6	1,795.8	7,770	91.1	118.2	165.1	231.1
STATE TOTAL	977.4	1,243.5	1,740.6	2,431.7	11,233	87.0	110.7	155.0	216.5
North Carolina									
J-2	366.4	481.0	665.7	911.0	6,001	61.1	80.2	110.9	151.8
D-1	573.4	795.9	1,333.7	2,105.9	5,918	96.9	134.5	225.4	355.9
STATE TOTAL	939.8	1,276.9	1,999.4	3,016.9	11,919	78.8	107.1	167.7	253.1
Ohio									
G-1	495.1	622.5	992.8	1,159.1	7,167	69.1	86.9	128.8	161.7
F-3	183.1	193.0	280.5	386.6	946	193.5	204.0	296.5	408.7
G-2	441.4	476.7	665.1	987.8	5,585	79.0	85.3	119.1	176.9
STATE TOTAL	1,119.6	1,292.2	1,868.4	2,533.5	13,698	81.7	94.3	136.4	185.0
Pennsylvania									
F-1	966.1	1,282.9	1,785.0	2,333.7	10,565	91.4	121.4	169.0	220.9
F-2	2,883.7	3,350.7	4,450.2	6,183.0	6,697	430.6	500.3	664.5	923.2
B-2	1,048.8	1,357.1	1,866.8	2,551.2	10,967	95.6	123.7	170.2	232.6
B-1	147.7	178.5	224.3	288.7	4,007	36.9	44.5	56.0	72.0
A	884.4	1,006.3	1,420.0	1,999.0	4,433	199.5	227.0	320.3	450.9
STATE TOTAL	5,930.7	7,175.5	9,746.3	13,355.6	36,669	161.7	195.7	265.8	364.2
South Carolina									
D-2	586.5	866.1	1,426.2	2,241.3	3,959	148.1	218.8	360.2	566.1
STATE TOTAL	586.5	866.1	1,426.2	2,241.3	3,959	148.1	218.8	360.2	566.1
Tennessee									
I-2	147.9	171.7	236.3	341.2	4,029	36.7	42.6	58.6	84.7
J-5	92.4	140.5	216.7	323.6	2,050	45.1	68.5	105.7	157.8
J-4	377.8	510.1	704.3	978.3	3,498	108.0	145.8	201.4	297.9
J-3	654.2	945.3	1,385.0	2,010.0	6,716	97.4	140.7	206.2	299.3
J-1	326.8	417.6	576.7	800.3	2,932	111.5	142.4	196.7	272.9
STATE TOTAL	1,599.1	2,185.2	3,119.0	4,453.4	19,225	83.2		162.2	231.6
Virginia									
J-1	283.4	362.3	500.1	694.0	3,818	74.2	94.9	131.0	181.8
C	57.1	77.6	120.3	171.7	2,292	24.9	33.9	52.5	74.9
G-5	159.8	189.3	281.6	408.7	3,277	48.8	57.8	85.9	124.7
STATE TOTAL	500.3	629.2	902.0	1,274.4	9,387	53.3	67.0	96.1	135.8
West Virginia									
G-3	458.2	562.3	796.9	1,202.9	4,428	103.5	127.0	180.0	271.6
G-2	191.9	267.4	345.7	534.9	1,662	115.5	161.0	208.0	321.8
F-3	468.5	532.7	774.5	1,067.4	3,903	120.0	136.5	198.4	273.5
B-3	120.6	137.7	198.3	269.5	3,486	34.6	39.5	56.9	77.3
G-5	413.7	401.0	418.4	537.8	8,684	47.6	46.2	48.2	61.9
G-4	207.5	210.2	235.7	271.8	1,916	108.3	109.7	123.0	141.9
STATE TOTAL	1,860.4	2,111.3	2,769.5	3,884.3	24,079	77.3	87.7	115.0	161.3
REGION TOTAL	17,659.0	22,298.9	31,257.0	43,892.1	193,114	91.4	115.5	161.9	227.3

1/. Data based on memorandum, Office of Appalachian Studies, Corps of Engineers, dated May 15, 1967.

TABLE II. SUMMARY OF FISHERIES RESOURCE INFORMATION - APPALACHIAN REGION - 1964

	1 Licensed Resident Anglers	2 Licensed Non-Resident Anglers	3 Total Licensed Anglers	4 Un-Licensed Anglers	5 Total Anglers	6 Reservoirs and Lakes (Acres)	7 Ponds (Acres)	8 Streams (Acres)	9 Total Water (Acres)
Alabama									
J-5	81,972	10,616	92,588	53,165	145,753	194,855	2,774	3,688	201,317
E-3	60,594	6,898	67,492	39,788	107,280	84,560	10,190	6,312	101,062
E-4	111,095	1,381	112,476	71,769	184,245	62,032	18,801	7,524	88,357
STATE TOTAL	253,661	18,895	272,556	164,722	437,278	341,447	31,765	17,524	390,736
Georgia									
E-2	39,667	389	40,056	25,043	65,099	3,880	8,633	5,020	17,533
J-4	4,028	165	4,193	3,289	7,482	-	1,607	936	2,543
E-1	69,254	4,881	74,135	41,579	115,714	76,679	10,486	6,096	93,261
D-2	4,458	16	4,474	2,947	7,431	-	1,627	948	2,575
STATE TOTAL	117,407	5,451	122,858	72,868	195,726	80,559	22,353	13,000	115,912
Kentucky									
I-1	34,929	18,416	53,345	31,792	85,137	57,652	4,663	9,932	72,247
H	24,995	2,140	27,135	17,370	44,505	2,835	8,096	7,692	18,623
G-4	10,570	1,419	11,989	8,289	20,278	1,111	204	3,468	4,783
G-2	13,260	2,401	15,661	9,918	25,579	268	1,278	3,308	4,854
STATE TOTAL	83,754	24,376	108,130	67,369	175,499	61,866	14,241	24,400	100,507
Maryland									
B-3	21,058	4,707	25,765	16,119	41,884	5,691	313	8,752	14,756
STATE TOTAL	21,058	4,707	25,765	16,119	41,884	5,691	313	8,752	14,756
Mississippi									
E-5	50,792	9,249	60,041	35,984	96,025	11,708	23,359	4,732	39,799
STATE TOTAL	50,792	9,249	60,041	35,984	96,025	11,708	23,359	4,732	39,799
New York									
F-1	25,843	8,317	34,160	20,939	55,099	15,697	1,813	1,964	19,474
B-1	82,086	5,612	87,698	53,969	141,667	77,342	4,069	10,536	91,947
STATE TOTAL	107,929	13,929	121,858	74,908	196,766	93,039	5,882	12,500	111,421
N. Carolina									
J-2	44,977	16,294	61,271	36,800	98,071	31,186	2,858	2,060	36,104
D-1	44,952	2,231	47,183	32,834	80,017	14,734	2,819	4,250	21,803
STATE TOTAL	89,929	18,525	108,454	69,634	178,088	45,920	5,677	6,310	57,907
Ohio									
C-1	57,489	4,164	61,653	38,981	100,634	16,212	3,301	5,740	25,253
F-3	13,320	1,233	14,553	10,223	24,776	1,957	194	236	2,387
G-2	40,262	1,332	41,594	27,957	69,551	3,680	4,925	3,784	12,389
STATE TOTAL	111,071	6,729	117,800	77,161	194,961	21,849	8,420	9,760	40,029
Pennsylvania									
F-1	68,102	5,228	73,330	50,092	123,422	22,035	5,559	7,116	34,710
F-2	94,003	1,018	95,021	86,560	181,581	2,643	3,523	2,736	8,902
B-2	69,989	2,584	72,573	50,805	123,378	5,726	5,771	9,772	21,269
B-1	13,423	2,151	15,574	9,876	25,450	2,064	2,108	2,928	7,100
A	58,033	6,288	64,321	44,428	108,749	13,888	2,333	2,332	18,553
STATE TOTAL	303,550	17,269	320,819	241,761	562,580	46,356	19,294	24,884	90,534
S. Carolina									
D-2	52,766	790	53,556	36,277	89,833	40,039	8,288	4,392	52,719
STATE TOTAL	52,766	790	53,556	36,277	89,833	40,039	8,288	4,392	52,719
Tennessee									
I-2	32,543	19,028	51,571	28,203	79,774	49,897	1,332	2,516	53,745
J-5	19,969	1,570	21,539	12,191	33,730	5,739	678	1,280	7,697
J-4	57,714	14,930	72,644	42,008	114,652	59,106	1,156	2,184	62,446
J-3	126,181	54,821	181,002	100,805	281,807	130,821	2,220	4,192	137,233
J-1	52,826	24,594	77,420	43,749	121,169	27,701	969	1,828	30,498
STATE TOTAL	289,233	114,943	404,176	226,956	631,132	273,264	6,355	12,000	291,619
Virginia									
J-1	29,689	718	30,407	19,832	50,239	3,202	802	6,096	10,100
C	8,513	165	8,678	5,292	13,970	725	481	3,656	4,862
G-5	22,388	595	22,983	14,149	37,132	4,746	690	5,240	10,676
STATE TOTAL	60,590	1,478	62,068	39,273	101,341	8,673	1,973	14,992	25,638
W. Virginia									
G-3	45,440	163	45,603	30,254	75,857	136	882	7,136	8,154
G-2	12,718	72	12,790	9,464	22,254	23	282	2,676	2,981
F-3	39,479	839	40,318	27,726	68,044	3,545	899	6,288	10,732
B-3	15,352	2,742	18,094	11,059	29,153	534	1,424	5,620	7,578
G-5	52,588	448	53,036	33,344	86,380	5,075	2,086	13,992	21,153
G-4	16,253	18	16,271	11,473	27,744	64	175	3,088	3,327
STATE TOTAL	181,830	4,282	186,112	123,320	309,432	9,377	5,748	38,800	53,925
REGION TOTAL	1,723,570	240,623	1,964,193	1,246,352	3,211,380	1,039,788	153,668	192,046	1,385,502

TABLE II Cont. SUMMARY OF FISHERIES RESOURCE INFORMATION - APPALACHIAN REGION - 1964

State and Water Area	10 Acres Water/ Licensed Angler	11 Acres Water/ Capita	12 Percent License Sales/ Capita	13 Reservoirs and Lakes (M/D's)	14 Ponds (M/D's)	15 Streams (M/D's)	16 Total Supply (Man-days)	17 Total Demand (Man-days)	18 Surplus or Need (Man-days)	19 Percent Need Fulfilled
Alabama										
J-5	2.17	.444	18.1	5,962,563	191,129	197,677	6,351,369	3,497,196 S	2,854,173	181.6
E-3	1.50	.248	14.9	2,567,536	702,091	338,323	3,627,950	2,323,941 S	1,304,009	156.1
E-4	.79	.081	10.2	1,898,179	1,295,389	403,286	3,596,854	3,522,351 S	74,503	102.1
STATE TOTAL	1.44	.201	14.0	10,448,278	2,188,609	939,286	13,576,173	9,343,488 S	4,232,685	145.3
Georgia										
E-2	.44	.058	13.1	118,728	594,814	269,072	982,614	1,143,241 N	160,627	85.9
J-4	.61	.034	5.4	-	110,722	50,170	160,892	136,091 S	24,801	118.2
E-1	1.26	.369	27.4	2,346,377	722,485	326,746	3,395,608	2,354,257 S	1,041,351	144.2
D-2	.58	.058	10.1	-	112,100	50,813	162,913	135,596 S	27,317	120.1
STATE TOTAL	.94	.172	18.2	2,465,105	1,540,121	696,801	4,702,027	3,769,185 S	932,842	124.7
Kentucky										
I-1	1.35	.208	10.0	1,764,151	321,281	532,355	2,617,787	1,464,072 S	1,153,715	178.8
H	.69	.070	9.4	86,751	557,814	412,291	1,056,856	803,225 S	253,631	131.6
G-4	.40	.029	6.5	33,997	14,056	185,885	233,938	331,853 N	97,915	70.5
G-2	.31	.033	9.1	8,201	88,054	177,309	273,564	414,883 N	141,319	65.9
STATE TOTAL	.93	.109	11.7	1,893,100	981,205	1,307,840	4,182,145	3,014,033 S	1,168,112	138.8
Maryland										
B-3	.57	.075	10.8	174,145	21,566	469,107	664,818	690,813 N	25,995	96.2
STATE TOTAL	.57	.075	10.8	174,145	21,566	469,107	664,818	690,813 N	25,995	96.2
Mississippi										
E-5	.66	.10	12.5	358,265	1,609,435	253,635	2,221,335	1,526,798 S	694,537	145.5
STATE TOTAL	.66	.10	12.5	358,265	1,609,435	253,635	2,221,335	1,526,798 S	694,537	145.5
New York										
F-1	.57	.072	9.6	480,328	124,916	105,270	710,514	966,833 N	256,319	73.5
B-1	1.05	.130	11.6	2,366,665	280,354	564,730	3,211,749	2,881,161 S	330,588	111.5
STATE TOTAL	.91	.011	12.4	2,846,993	405,270	670,000	3,922,263	3,847,994 S	74,269	101.9
N. Carolina										
J-2	.59	.099	12.3	954,992	196,915	110,416	1,261,623	1,038,696 S	222,927	121.5
D-1	.46	.038	7.8	450,860	194,230	227,800	872,890	976,756 N	103,866	89.4
STATE TOTAL	.53	.062	11.5	1,405,152	391,145	338,216	2,134,513	2,015,452 S	119,061	105.9
Ohio										
G-1	.41	.051	11.6	496,087	227,439	307,664	1,031,190	1,748,579 N	717,389	59.0
F-3	.16	.013	7.3	59,884	13,367	12,650	85,901	403,260 N	317,359	21.3
G-2	.30	.028	9.1	112,608	339,333	202,822	654,763	1,173,139 N	518,376	55.8
STATE TOTAL	.34	.036	10.5	668,579	580,139	523,136	1,771,854	3,324,978 N	1,553,124	53.3
Pennsylvania										
F-1	.47	.036	7.0	674,271	383,015	381,418	1,438,704	2,144,045 N	705,341	67.1
F-2	.01	.003	3.3	80,876	242,735	146,650	470,566	2,836,492 N	2,365,926	16.6
B-2	.29	.020	6.7	175,216	397,622	523,779	1,096,617	2,065,821 N	969,204	53.1
B-1	.46	.048	9.1	63,158	145,241	156,941	365,340	436,984 N	71,649	83.6
A	.29	.021	6.6	424,973	160,744	124,995	710,712	1,772,383 N	1,061,671	40.1
STATE TOTAL	.28	.015	5.4	1,418,393	1,329,357	1,333,783	4,081,634	9,255,730 N	5,174,096	44.1
S. Carolina										
D-2	.98	.090	9.0	1,225,193	571,043	235,411	2,031,647	1,798,469 S	233,178	113.0
STATE TOTAL	.98	.090	9.0	1,225,193	571,043	235,411	2,031,647	1,798,469 S	233,178	113.0
Tennessee										
I-2	1.04	.363	22.0	1,526,848	91,775	134,858	1,753,482	924,491 S	828,991	190.0
J-5	.36	.083	21.6	175,613	46,714	68,608	290,935	430,190 N	139,255	67.6
J-4	.86	.165	15.3	1,808,644	79,648	117,062	2,005,354	1,347,709 S	657,645	148.8
J-3	.76	.210	19.3	4,003,123	152,958	224,691	4,380,772	2,923,099 S	1,457,673	149.9
J-1	.39	.093	16.2	847,651	66,764	97,981	1,012,396	1,216,269 N	203,873	83.2
STATE TOTAL	.72	.182	25.2	8,361,879	437,859	643,200	9,442,936	6,841,758 S	2,601,178	138.0
Virginia										
J-1	.33	.039	10.5	97,981	55,258	326,746	479,985	864,111 N	384,126	55.5
C	.56	.119	14.9	22,185	33,141	195,962	251,288	254,254 N	2,966	98.8
G-5	.46	.069	14.0	145,228	47,541	280,864	473,633	660,950 N	187,317	71.7
STATE TOTAL	.41	.056	12.4	265,394	135,940	803,572	1,204,906	1,779,315 N	574,409	67.7
W. Virginia										
G-3	.18	.018	9.9	4,162	60,770	382,490	447,422	1,251,640 N	804,218	35.7
G-2	.23	.016	6.6	704	19,430	143,434	163,568	371,642 N	208,074	44.0
F-3	.27	.023	8.4	108,477	61,941	337,037	507,455	1,149,944 N	642,489	44.1
B-3	.42	.063	12.7	16,340	98,114	301,232	415,686	513,093 N	97,407	81.0
G-5	.40	.051	12.7	155,295	143,725	749,971	1,048,991	1,511,650 N	462,659	69.4
G-4	.20	.016	7.8	1,958	12,058	165,517	179,533	460,550 N	281,017	39.0
STATE TOTAL	.29	.029	10.0	286,936	396,038	2,079,681	2,762,655	5,258,519 N	2,495,864	52.5
REGION TOTAL	.71	.078	9.8	31,817,513	10,587,727	10,293,668	52,698,906	52,764,209 N	65,303	99.9

TABLE III SUMMARY OF PROJECTED FISHERIES RESOURCE INFORMATION - APPALACHIAN REGION - 1980

	1 Licensed Resident Anglers	2 Licensed Non-Resident Anglers	3 Total Licensed Anglers	4 Un-Licensed Anglers	5 Total Anglers	6 Reservoirs and Lakes (Acres)	7 Ponds (Acres)	8 Streams (Acres)	9 Total Water (Acres)
Alabama									
J-5	98,400	12,743	111,143	66,373	177,516	201,932	4,527	3,688	210,147
E-3	70,603	8,035	78,638	47,538	126,176	87,284	16,799	6,312	110,395
E-4	142,281	1,764	144,045	92,354	236,399	63,305	29,707	7,524	100,536
STATE TOTAL	311,284	22,542	333,826	206,265	540,091	352,521	51,033	17,524	421,078
Georgia									
E-2	53,814	538	54,352	34,113	88,465	5,931	15,193	5,020	26,144
J-4	5,267	216	5,483	4,351	9,834	--	2,828	936	3,764
E-1	86,381	6,090	92,471	52,866	145,337	79,551	18,454	6,096	104,101
D-2	5,783	21	5,804	3,814	9,618	187	2,863	948	3,998
STATE TOTAL	151,245	6,865	158,110	95,144	253,254	85,669	39,338	13,000	138,007
Kentucky									
I-1	42,713	22,512	65,225	38,044	103,269	70,664	9,053	9,932	89,649
H	30,745	2,632	33,377	20,888	54,265	9,736	14,582	7,692	32,010
G-4	11,881	1,594	13,475	9,065	22,540	5,398	656	3,668	9,552
G-2	19,459	3,524	22,983	14,179	37,162	8,568	3,216	3,308	15,092
STATE TOTAL	104,798	30,262	135,060	82,176	217,236	94,366	27,537	24,400	146,303
Maryland									
B-3	25,297	5,654	30,951	19,448	50,399	6,402	881	8,752	16,035
STATE TOTAL	25,297	5,654	30,951	19,448	50,399	6,402	881	8,752	16,035
Mississippi									
E-5	66,864	12,169	79,033	49,388	128,421	11,708	25,885	4,732	42,325
STATE TOTAL	66,864	12,169	79,033	49,388	128,421	11,708	25,885	4,732	42,325
New York									
F-1	33,915	10,914	44,829	27,101	71,930	23,550	8,777	1,964	34,291
B-1	99,908	6,834	106,742	66,441	173,183	77,723	19,694	10,536	107,953
STATE TOTAL	133,823	17,748	151,571	93,542	245,113	101,273	28,471	12,500	142,244
N. Carolina									
J-2	57,290	20,756	78,046	47,097	125,143	37,886	5,702	2,060	45,648
D-1	57,387	2,846	60,233	42,905	103,138	15,234	5,623	4,250	25,107
STATE TOTAL	114,677	23,602	138,27	90,002	228,281	53,120	11,325	6,310	70,755
Ohio									
G-1	69,287	5,016	74,303	47,380	121,683	17,249	5,835	5,740	28,824
F-3	13,817	1,279	15,096	10,653	25,749	1,957	232	236	2,425
G-2	46,141	1,527	47,668	31,589	79,257	8,915	9,863	3,784	22,562
STATE TOTAL	129,245	7,822	137,067	89,622	226,689	28,121	15,930	9,760	53,811
Pennsylvania									
F-1	86,725	6,660	93,385	64,491	157,876	34,099	8,073	7,116	49,288
F-2	83,768	905	84,673	87,503	172,176	3,118	5,951	2,736	11,805
B-2	89,164	3,290	92,454	65,003	157,457	16,124	9,918	9,772	35,814
B-1	16,739	2,682	19,421	12,240	31,661	3,186	4,514	2,928	10,628
A	65,611	7,112	72,723	50,319	123,042	22,453	4,018	2,332	28,803
STATE TOTAL	342,007	20,649	362,656	279,556	642,212	78,980	32,474	24,884	136,338
S. Carolina									
D-2	64,527	968	65,495	46,664	112,159	40,339	11,595	4,392	56,326
STATE TOTAL	64,527	968	65,495	46,664	112,159	40,339	11,595	4,392	56,326
Tennessee									
I-2	35,604	20,818	56,422	30,989	87,411	50,602	3,550	2,516	56,668
J-5	34,818	2,737	37,555	20,978	58,533	16,664	1,806	1,280	19,750
J-4	69,167	17,894	87,061	51,173	138,234	63,586	3,083	2,184	68,853
J-3	156,534	68,014	224,548	126,851	351,399	145,072	5,919	4,192	155,183
J-1	61,686	28,721	90,407	51,570	141,977	27,751	2,584	1,828	32,163
STATE TOTAL	357,809	138,184	495,993	281,561	777,554	303,675	16,942	12,000	332,617
Virginia									
J-1	36,153	875	37,028	24,414	61,442	4,699	1,177	6,096	11,971
C	10,996	213	11,209	6,895	18,104	3,600	787	3,656	8,043
G-5	25,197	670	25,867	16,071	41,938	4,970	1,049	5,240	11,259
STATE TOTAL	72,346	1,758	74,104	47,380	121,484	13,269	3,013	14,992	31,274
W. Virginia									
G-2	16,535	94	16,629	12,583	29,212	1,848	370	2,676	4,894
F-3	45,816	976	46,792	32,009	78,801	11,040	1,180	6,288	18,508
B-3	17,325	3,094	20,419	12,505	32,924	1,046	1,869	5,620	8,535
G-5	55,335	470	55,805	34,556	90,361	13,808	2,737	13,992	30,537
G-4	16,628	25	16,653	11,711	28,364	949	229	3,088	4,266
G-3	53,698	193	53,891	36,075	89,966	2,089	1,157	7,136	10,382
STATE TOTAL	205,337	4,852	210,189	139,439	349,628	30,780	7,542	38,800	77,122
REGION TOTAL	2,079,259	293,075	2,372,334	1,520,187	3,892,521	1,200,223	271,966	192,046	1,664,235

TABLE III Cont. SUMMARY OF PROJECTED FISHERIES RESOURCE INFORMATION - APPALACHIAN REGION - 1980

State and Water Area	10 Acres Water/ Licensed Angler	11 Acres Water/ Capita	12 Percent License Sales/ Capita	13 Reservoirs and Lakes	14 Ponds	15 Streams (1,000's Man-Days)	16 Total Supply	17 Total Demand	18 Surplus or Need		19 Percent Need Fulfilled
Alabama											
J-5	1.89	.286	13.4	6,179.1	311.9	197.7	6,688.7	4,050.5	S	2,638.1	165.1
E-3	1.40	.196	12.6	2,670.9	1,157.4	338.3	4,166.7	2,680.2	S	1,486.5	155.1
E-4	.70	.071	10.0	1,937.1	2,046.8	403.3	4,387.2	4,427.7	N	40.5	99.1
STATE TOTAL	1.26	.155	12.3	10,787.1	3,516.1	939.3	15,242.6	11,158.4	S	4,084.2	136.6
Georgia											
E-2	.48	.062	12.8	181.5	1,046.8	269.1	1,497.4	1,568.2	N	70.8	95.5
J-4	.69	.037	5.2	—	194.8	50.2	245.0	182.2	S	62.8	134.5
E-1	1.13	.274	28.8	2,434.3	1,271.5	326.7	4,032.5	2,872.1	S	1,160.4	140.4
D-2	.69	.071	10.3	5.7	197.3	50.8	253.8	180.8	S	73.1	140.4
STATE TOTAL	.87	.144	16.5	2,621.5	2,710.4	696.8	6,028.7	4,803.3	S	1,225.4	125.5
Kentucky											
I-1	1.37	.247	11.8	2,162.3	623.8	532.4	3,318.4	1,859.3	S	1,459.1	178.5
H	.96	.110	10.5	297.9	1,004.7	412.3	1,714.9	1,041.6	S	673.3	164.6
G-4	.71	.58	7.2	165.2	47.3	185.9	398.3	399.2	N	0.9	99.8
G-2	.66	.081	10.5	262.2	221.6	177.3	661.1	659.8	S	1.3	100.2
STATE TOTAL	1.08	.146	13.4	2,887.6	1,897.4	1,307.9	6,092.7	3,959.9	S	2,132.8	153.9
Maryland											
B-3	.52	.067	10.5	195.9	60.7	469.1	725.7	820.1	N	94.4	88.5
STATE TOTAL	.52	.067	10.5	195.9	60.7	469.1	725.7	820.1	N	94.4	88.5
Mississippi											
E-4	.54	.071	11.2	358.3	1,783.5	253.6	2,395.4	2,337.3	S	58.1	102.5
STATE TOTAL	.54	.071	11.2	358.3	1,783.5	253.6	2,395.4	2,337.3	S	58.1	102.5
New York											
F-1	.76	.105	10.4	720.6	604.7	105.3	1,430.6	1,322.4	S	108.2	108.2
B-1	1.01	.118	10.9	2,378.3	1,356.9	564.7	4,300.0	3,494.4	S	805.6	123.1
STATE TOTAL	.93	.114	12.2	3,098.9	1,961.6	670.0	5,730.6	4,816.8	S	913.8	119.0
N. Carolina											
J-2	.58	.095	11.9	1,159.3	392.9	110.4	1,662.6	1,322.0	S	340.6	125.8
D-1	.42	.032	7.2	466.2	387.4	227.8	1,081.4	1,239.0	N	157.6	87.3
STATE TOTAL				1,625.5	780.3	338.2	2,744.0	2,561.0	S	183.0	107.1
Ohio											
G-1	.39	.046	11.1	527.8	402.0	307.7	1,237.5	2,095.8	N	858.3	59.0
F-3	.16	.013	7.2	59.9	16.0	12.6	88.5	418.4	N	329.9	21.2
G-2	.47	.047	9.7	272.8	679.6	202.8	1,155.2	1,401.8	N	246.6	82.4
STATE TOTAL	.39	.042	10.6	860.5	1,097.6	523.1	2,481.2	3,916.0	N	1,434.8	63.4
Pennsylvania											
F-1	.53	.038	6.8	1,043.4	556.2	381.4	1,981.1	2,789.0	N	807.9	71.0
F-2	.14	.004	2.5	95.4	410.0	146.7	652.1	2,790.7	N	2,138.6	23.4
B-2	.39	.026	6.6	493.4	683.4	523.8	1,700.5	2,706.4	N	1,005.9	62.8
B-1	.55	.060	9.4	97.5	311.0	156.9	565.4	556.1	S	9.3	101.7
A	.40	.029	6.5	687.1	276.8	125.0	1,088.9	2,065.0	N	976.1	52.7
STATE TOTAL	.38	.019	5.0	2,416.8	2,237.4	1,333.8	5,988.0	10,907.2	N	4,919.2	54.8
S. Carolina											
D-2	.86	.065	7.5	1,234.4	798.9	235.4	2,268.7	2,183.0	S	85.7	103.9
STATE TOTAL	.86	.065	7.5	1,234.4	798.9	235.4	2,268.7	2,183.0	S	85.7	103.9
Tennessee											
I-2	1.00	.330	20.7	1,548.4	244.6	134.8	1,927.9	1,002.1	S	925.8	192.4
J-5	.53	.141	24.8	509.9	124.4	68.6	703.0	780.8	N	77.8	90.0
J-4	.79	.135	13.6	1,945.7	212.4	117.1	2,275.2	1,601.7	S	673.5	142.1
J-3	.69	.164	16.6	4,439.2	407.8	224.7	5,071.7	3,576.9	S	1,494.8	141.8
J-1	.36	.077	14.8	849.2	178.0	97.0	1,125.2	1,410.7	N	285.5	79.8
STATE TOTAL	.67	.152	22.7	9,292.4	1,167.2	642.2	11,103.0	8,372.2	S	2,730.8	132.6
Virginia											
J-1	.32	.033	10.0	143.8	81.1	326.7	551.6	1,052.5	N	500.9	52.4
C	.72	.104	14.2	110.2	54.2	196.0	360.4	343.8	S	16.6	104.8
G-5	.44	.059	13.3	152.1	72.3	280.9	505.2	741.9	N	236.7	68.1
STATE TOTAL	.42	.050	11.8	406.1	207.6	803.6	1,417.2	2,138.2	N	721.0	66.2
W. Virginia											
G-3	.19	.018	9.6	63.9	79.7	382.5	526.1	1,486.2	N	960.1	35.4
G-2	.29	.018	6.2	56.6	25.5	143.4	225.5	496.3	N	270.7	45.4
F-3	.40	.035	8.7	337.8	81.3	337.0	756.2	1,379.0	N	622.8	54.8
B-3	.42	.062	12.6	32.0	128.8	301.2	462.0	579.1	N	117.1	79.8
G-5	.55	.076	13.8	422.5	188.6	750.0	1,361.1	1,644.6	N	283.5	82.8
G-4	.26	.020	7.9	29.0	15.8	165.5	210.3	477.9	N	267.6	44.0
STATE TOTAL	.37	.036	9.9	941.8	519.7	2,079.6	3,541.2	6,063.1	N	2,521.9	58.4
REGION TOTAL	.70	.075	9.3	36,726.8	18,728.3	10,292.2	65,759.0	64,036.5	S	1,722.5	102.7

TABLE IV. SUMMARY OF PROJECTED FISHERIES RESOURCE INFORMATION - APPALACHIAN REGION - 2000

	1 Licensed Resident Anglers	2 Licensed Non-Resident Anglers	3 Total Licensed Anglers	4 Total Anglers 1/	5 Total Water (Acres) 2/	6 Acres of Water/ Licensed Angler	7 Acres Total Water per Capita	8 Percent License Sales/ Capita
Alabama								
J-5	97,416	12,615	110,031	181,943	210,147	1.91	.117	8.2
E-3	82,367	9,373	91,740	148,796	110,395	1.20	.142	10.6
E-4	169,698	2,104	171,802	285,801	100,536	.59	.051	8.6
STATE TOTAL	349,481	24,092	373,573	616,540	421,078	1.12	.106	9.5
Georgia								
E-2	65,003	650	65,653	107,683	26,144	.40	.047	11.6
J-4	6,462	265	6,727	12,305	3,764	.56	.027	4.6
E-1	100,243	7,067	107,310	170,149	104,101	.97	.194	18.7
D-2	6,594	24	6,618	11,026	3,998	.60	.059	9.8
STATE TOTAL	178,302	8,006	186,308	301,163	138,007	.74	.106	14.3
Kentucky								
I-1	44,879	23,660	68,539	108,792	89,649	1.31	.223	11.2
H	39,115	3,348	42,463	69,761	32,010	.75	.075	9.2
G-4	12,988	1,743	14,731	24,733	9,552	.65	.051	7.0
G-2	23,041	4,173	27,214	44,296	15,092	.55	.062	9.5
STATE TOTAL	120,023	32,924	152,947	247,582	146,303	.95	.116	12.2
Maryland								
B-3	29,487	6,590	36,077	59,479	16,035	.44	.049	9.0
STATE TOTAL	29,487	6,590	36,077	59,479	16,035	.44	.049	9.0
Mississippi								
E-5	86,904	15,817	102,721	168,109	42,325	.41	.050	10.2
STATE TOTAL	86,904	15,817	102,721	168,109	42,325	.41	.050	10.2
New York								
F-1	41,401	13,323	54,724	88,616	34,291	.63	.075	9.0
B-1	118,132	8,080	126,212	207,384	107,953	.86	.084	9.2
STATE TOTAL	159,533	21,403	180,936	296,000	142,244	.79	.082	10.4
N. Carolina								
J-2	70,162	25,420	95,582	154,443	45,648	.48	.069	10.5
D-1	77,623	3,850	81,473	143,476	25,107	.31	.019	5.8
STATE TOTAL	147,785	29,270	177,055	297,919	70,755	.40	.035	8.8
Ohio								
G-1	91,262	6,607	97,869	161,862	28,824	.29	.031	9.9
F-3	16,187	1,499	17,686	31,007	2,425	.14	.009	5.8
G-2	58,392	1,933	60,325	101,255	22,562	.37	.034	8.8
STATE TOTAL	165,841	10,039	175,880	294,124	53,811	.30	.029	9.4
Pennsylvania								
F-1	107,458	8,253	115,711	198,111	49,288	.43	.028	6.0
F-2	20,026	216	20,242	89,576	11,805	.58	.003	0.4
B-2	110,327	4,071	114,398	197,315	35,814	.31	.019	5.9
B-1	19,847	3,179	23,026	37,705	10,628	.46	.047	8.8
A	72,846	7,897	80,743	140,626	28,803	.36	.020	5.2
STATE TOTAL	330,504	23,616	354,120	663,433	136,338	.38	.014	3.6
So. Carolina								
D-2	72,025	1,080	73,105	132,282	56,326	.77	.039	5.0
STATE TOTAL	72,025	1,080	73,105	132,282	56,326	.77	.039	5.0
Tennessee								
I-2	40,833	23,875	64,708	100,778	56,668	.88	.240	17.3
J-5	44,639	3,509	48,148	75,537	19,750	.41	.091	20.6
J-4	79,449	20,553	100,002	160,309	68,853	.69	.098	11.3
J-3	182,682	79,375	262,057	413,895	155,183	.59	.112	13.2
J-1	72,891	33,938	106,829	168,889	32,163	.30	.056	12.6
STATE TOTAL	420,494	161,250	581,744	919,408	332,617	.57	.107	18.6
Virginia								
J-1	45,562	1,103	46,665	78,106	11,972	.26	.056	9.1
C	14,941	290	15,231	24,830	8,043	.53	.024	12.4
G-5	34,042	906	34,948	57,059	11,259	.32	.040	12.1
STATE TOTAL	94,545	2,299	96,844	159,995	31,274	.32	.035	10.7
W. Virginia								
G-3	67,974	245	68,219	115,197	10,382	.15	.013	8.5
G-2	19,258	110	19,368	34,551	4,894	.25	.014	5.6
F-3	57,388	1,222	58,610	100,357	18,508	.32	.024	7.4
B-3	22,904	4,091	26,995	43,778	8,535	.32	.043	11.6
G-5	57,034	485	57,519	93,216	30,537	.53	.073	13.6
G-4	18,104	27	18,131	30,986	4,266	.24	.018	7.7
STATE TOTAL	242,662	6,180	248,842	418,085	77,122	.31	.028	8.9
REGION TOTAL	2,397,586	342,566	2,740,152	4,574,119	1,664,235	.61	.053	8.8

1/. Includes unlicensed anglers.
2/. No additional habitat beyond 1980 considered.

TABLE IV Cont. SUMMARY OF PROJECTED FISHERIES RESOURCE INFORMATION - APPALACHIAN REGION - 2000

State and Water Area	9 Total Supply	10 Total Demand	11 Surplus or Need		12 Percent of the Need Fulfilled
	(1,000's Man-Days)				
Alabama					
J-5	6,688.7	4,166.8	S	2,521.9	160.5
E-3	4,166.7	3,028.0	S	1,138.7	137.6
E-4	4,387.2	5,205.7	N	818.5	84.2
STATE TOTAL	15,242.6	12,400.5	S	14,002.6	122.9
Georgia					
E-2	1,497.4	1,869.4	N	372.0	80.0
J-4	245.0	220.6	S	24.0	111.1
E-1	4,032.5	3,243.4	S	789.1	124.3
D-2	253.8	202.6	S	51.2	125.3
STATE TOTAL	6,028.7	5,536.0	S	492.7	108.9
Kentucky					
I-1	3,318.4	1,933.8	S	1,384.6	171.6
H	1,714.9	1,274.5	S	440.4	134.6
G-4	398.3	431.5	N	33.2	92.3
G-2	661.1	765.1	N	104.0	86.4
STATE TOTAL	6,092.7	4,404.9	S	1,687.8	138.3
Maryland					
B-3	725.7	948.0	N	222.3	76.6
STATE TOTAL	725.7	948.0	N	222.3	76.6
Mississippi					
E-5	2,395.4	2,941.9	N	546.5	81.4
STATE TOTAL	2,395.4	2,941.9	N	546.5	81.4
New York					
F-1	1,430.6	1,578.1	N	147.5	90.7
B-1	4,300.0	4,040.4	S	259.6	106.4
STATE TOTAL	5,730.6	5,618.5	S	112.1	102.0
N. Carolina					
J-2	1,662.6	1,589.7	S	72.9	104.6
D-1	1,081.4	1,673.7	N	592.3	64.6
STATE TOTAL	2,744.0	3,263.4	N	519.4	84.1
Ohio					
G-1	1,237.5	2,714.3	N	1,476.8	45.6
F-3	88.5	501.1	N	412.6	17.7
G-2	1,155.2	1,743.7	N	588.5	66.3
STATE TOTAL	2,481.2	4,959.1	N	2,477.9	50.0
Pennsylvania					
F-1	1,981.1	3,412.5	N	1,431.4	58.1
F-2	652.1	1,634.6	N	982.5	39.9
B-2	1,700.5	3,319.6	N	1,619.1	51.2
B-1	565.4	646.9	N	81.5	87.4
A	1,088.9	2,334.4	N	1,245.5	46.7
STATE TOTAL	5,988.0	11,348.1	N	5,360.1	52.8
S. Carolina					
D-2	2,268.7	2,519.6	N	250.9	90.0
STATE TOTAL	2,268.7	2,519.6	N	250.9	90.0
Tennessee					
I-2	1,927.9	1,123.4	S	804.5	171.6
J-5	703.0	977.0	N	274.0	71.9
J-4	2,275.2	1,813.1	S	462.1	125.4
J-3	5,071.7	4,108.0	S	963.7	123.4
J-1	1,125.2	1,651.9	N	526.7	68.1
STATE TOTAL	11,103.0	9,673.4	S	1,429.6	114.8
Virginia					
J-1	551.6	1,316.1	N	764.5	41.9
C	360.4	449.4	N	89.0	80.1
G-5	505.2	977.4	N	472.2	51.7
STATE TOTAL	1,417.2	2,742.9	N	1,325.7	51.7
W. Virginia					
G-3	526.1	1,882.3	N	1,356.2	27.9
G-2	225.5	580.5	N	355.0	38.8
F-3	756.2	1,719.1	N	962.9	43.9
B-3	462.0	749.9	N	287.9	61.6
G-5	1,361.1	1,687.2	N	326.1	80.7
G-4	210.3	519.3	N	309.0	40.5
STATE TOTAL	3,541.2	7,138.3	N	3,597.1	49.6
REGION TOTAL	65,759.0	73,494.5	N	7,735.5	89.5

TABLE V SUMMARY OF PROJECTED FISHERIES RESOURCE INFORMATION - APPALACHIAN REGION - 2020

	1	2	3	4	5	6	7	8
	Licensed Resident Anglers	Licensed Non-Resident Anglers	Total Licensed Anglers	Total Anglers1/	Total Water (Acres)2/	Acres of Water Per Licensed Angler	Acres Total Water Per Capita	Percent License Sales/ Capita
Alabama								
J-5	130,263	16,869	147,132	246,465	210,147	1.43	.115	7.1
E-3	97,074	11,047	108,121	177,623	110,395	1.02	.102	9.0
E-4	193,674	2,402	196,076	332,701	100,536	.51	.037	7.0
STATE TOTAL	421,011	30,318	451,329	756,789	421,078	.93	.074	7.9
Georgia								
E-2	78,638	787	79,425	131,734	26,144	.33	.034	10.2
J-4	7,575	311	7,886	14,892	3,764	.48	.019	3.9
E-1	117,026	8,250	125,276	200,731	104,101	.83	.136	15.3
D-2	7,664	28	7,692	13,899	3,998	.52	.048	9.1
STATE TOTAL	210,903	9,376	220,279	361,256	138,007	.62	.076	12.1
Kentucky								
I-1	48,417	25,525	73,942	117,857	89,649	1.21	.191	10.3
H	47,974	4,107	52,081	86,330	32,010	.61	.055	8.3
G-4	14,531	1,950	16,481	27,793	9,552	.58	.044	6.7
G-2	30,130	5,457	35,587	58,656	15,092	.42	.041	8.1
STATE TOTAL	141,052	37,039	178,091	290,636	146,303	.82	.089	10.8
Maryland								
B-3	33,482	7,483	40,965	69,279	16,035	.39	.033	6.9
STATE TOTAL	33,482	7,483	40,965	69,279	16,035	.39	.033	6.9
Mississippi								
E-5	104,528	19,024	123,552	203,520	42,325	.34	.038	9.4
STATE TOTAL	104,528	19,024	123,552	203,520	42,325	.34	.038	9.4
New York								
F-1	49,539	15,942	65,481	107,203	34,291	.52	.054	7.8
B-1	137,199	9,384	146,583	244,918	107,953	.74	.060	7.6
STATE TOTAL	186,738	25,326	212,064	352,121	142,244	.67	.058	8.7
N. Carolina								
J-2	84,818	30,730	115,548	188,346	45,648	.40	.050	9.3
D-1	87,818	4,356	92,174	171,538	25,107	.27	.012	4.2
STATE TOTAL	172,636	35,086	207,722	359,884	70,755	.34	.023	6.9
Ohio								
G-1	106,175	7,687	113,862	189,632	28,824	.25	.025	9.2
F-3	16,045	1,486	17,531	32,411	2,425	.14	.006	4.2
G-2	75,564	2,501	78,065	132,994	22,562	.29	.023	7.6
STATE TOTAL	197,784	11,674	209,458	355,037	53,811	.26	.021	8.2
Pennsylvania								
F-1	124,386	9,553	133,939	232,983	49,288	.37	.021	5.3
F-2	--	--	--	---	11,805	.00	.002	0.0
B-2	131,388	4,848	136,236	239,335	35,814	.26	.014	5.2
B-1	24,164	3,871	28,035	46,115	10,628	.38	.037	8.4
A	67,966	7,368	75,334	140,149	28,803	.38	.014	3.4
STATE TOTAL	347,904	25,640	373,544	658,582	136,338	.36	.010	2.8
S. Carolina								
D-2	51,327	770	52,097	113,180	56,326	1.08	.025	2.3
STATE TOTAL	51,327	770	52,097	113,180	56,326	1.08	.025	2.3
Tennessee								
I-2	48,757	28,508	77,265	121,130	56,668	.73	.166	14.3
J-5	56,272	4,423	60,615	95,900	19,750	.33	.061	17.4
J-4	85,696	22,170	107,866	175,856	68,853	.64	.070	8.8
J-3	202,809	88,121	290,930	465,853	155,183	.53	.077	10.1
J-1	82,828	38,565	121,393	193,864	32,163	.26	.040	10.4
STATE TOTAL	476,362	181,787	658,069	1,052,603	332,617	.50	.074	14.8
Virginia								
J-1	56,286	1,362	57,648	97,664	11,972	.21	.017	8.1
C	19,382	376	19,758	32,451	8,043	.41	.047	11.3
G-5	44,543	1,185	45,728	75,281	11,259	.25	.028	10.9
STATE TOTAL	120,211	2,923	123,134	205,396	31,274	.26	.024	9.7
W. Virginia								
G-3	83,719	301	84,020	145,297	10,382	.12	.009	7.0
G-2	22,680	129	22,809	42,661	4,894	.21	.009	4.2
F-3	66,070	1,407	67,477	118,254	18,508	.27	.017	6.2
B-3	30,612	5,467	36,079	58,578	8,535	.24	.032	10.8
G-5	68,458	582	69,040	112,435	30,537	.44	.057	12.7
G-4	20,060	30	20,090	34,508	4,266	.21	.016	7.4
STATE TOTAL	291,599	7,916	299,515	511,733	77,122	.26	.019	7.7
REGION TOTAL	2,755,527	394,362	3,149,819	5,290,016	1,664,235	.53	.038	7.2

1/. Includes unlicensed anglers.
2/. No additional habitat beyond 1980 considered.

TABLE V. Cont. SUMMARY OF PROJECTED FISHERIES RESOURCE INFORMATION - APPALACHIAN REGION - 2020

State and Water Area	9 Total Supply	10 Total Demand (1,000's Man-Days)	11 Need or Surplus	12 Percent of Need Fulfilled
Alabama				
J-5	6,688.7	5,131.1	S 1,557.6	130.3
E-3	4,166.7	3,471.5	S 695.2	120.0
E-4	4,387.2	5,938.0	N 1,550.8	73.8
STATE TOTAL	15,242.6	14,540.6	S 702.0	104.8
Georgia				
E-2	1,497.4	2,243.8	N 746.4	66.7
J-4	245.0	261.6	N 16.6	93.6
E-1	4,032.5	3,702.9	S 329.6	108.9
D-2	253.8	232.3	S 21.5	109.2
STATE TOTAL	6,028.7	6,440.6	N 411.9	93.6
Kentucky				
I-1	3,318.4	2,050.6	S 1,267.8	161.8
H	1,714.9	1,523.6	S 191.3	112.6
G-4	398.3	476.6	N 78.3	83.6
G-2	661.1	979.1	N 318.0	67.5
STATE TOTAL	6,092.7	5,029.9	S 1,062.8	121.1
Maryland				
B-3	725.7	1,089.2	N 363.5	66.6
STATE TOTAL	725.7	1,089.2	N 363.5	66.6
Mississippi				
E-5	2,395.4	3,500.5	N 1,105.1	68.4
STATE TOTAL	2,395.4	3,500.5	N 1,105.1	68.4
New York				
F-1	1,430.6	1,856.7	N 426.1	77.0
B-1	4,300.0	4,635.6	N 335.6	92.7
STATE TOTAL	5,730.6	6,492.3	N 761.7	88.3
N. Carolina				
J-2	1,662.6	1,898.5	N 235.9	87.5
D-1	1,081.4	1,980.0	N 898.6	54.6
STATE TOTAL	2,744.0	3,878.5	N 1,134.5	70.7
Ohio				
G-1	1,237.5	3,144.4	N 1,906.9	39.3
F-3	88.5	523.8	N 435.3	16.9
G-2	1,155.2	2,241.5	N 1,086.3	51.5
STATE TOTAL	2,481.2	5,909.7	N 3,428.5	42.0
Pennsylvania				
F-1	1,981.1	3,947.5	N 1,966.4	50.1
F-2	652.1	1,634.6	N 982.5	39.9
B-2	1,700.5	3,972.3	N 2,271.8	42.8
B-1	565.4	774.8	N 209.4	72.9
A	1,088.9	2,340.0	N 1,251.1	46.5
STATE TOTAL	5,988.0	12,669.2	N 6,681.2	47.3
S. Carolina				
D-2	2,268.7	2,317.2	N 48.5	97.9
STATE TOTAL	2,268.7	2,317.2	N 48.5	97.9
Tennessee				
I-2	1,927.9	1,302.4	S 625.5	148.0
J-5	703.0	1,213.6	N 510.6	57.9
J-4	2,275.2	1,964.7	S 310.5	115.8
J-3	5,071.7	4,553.2	S 518.5	111.3
J-1	1,125.2	1,875.0	N 749.8	60.0
STATE TOTAL	11,103.0	10,908.9	S 194.1	101.8
Virginia				
J-1	551.6	1,623.2	N 1,071.6	33.9
C	360.4	569.5	N 209.1	63.2
G-5	505.2	1,264.7	N 759.3	39.9
STATE TOTAL	1,417.2	3,457.4	N 2,040.2	41.0
W. Virginia				
G-3	526.1	2,353.8	N 1,827.7	22.3
G-2	225.5	709.0	N 483.5	31.8
F-3	756.2	1,998.6	N 1,242.3	37.8
B-3	462.0	981.8	N 519.8	47.0
G-5	1,361.1	1,989.0	N 627.9	68.4
G-4	210.3	573.5	N 363.2	36.6
STATE TOTAL	3,541.2	8,605.6	N 5,064.4	41.1
REGION TOTAL	65,759.0	84,839.5	N 19,130.3	77.5

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE REPRODUCTION

TABLE VI SUMMARY OF WILDLIFE RESOURCE INFORMATION - APPALACHIAN REGION - 1964

	1	2	3	4	5	6	7	8	9	10
	Licensed Hunters	Total Hunters 1/	Big Game Hunters	Small Game Hunters	Water-fowl Hunters	Big Game	Small Game (1,000's	Water-fowl Man-Days)	Total Man-days	Average Man-days Per Hunter
Alabama										
J-5	54,170	64,719	5,825	63,425	2,589	37.9	856.2	13.5	907.6	14.0
E-3	42,340	50,585	4,553	49,573	2,023	29.6	669.2	10.5	709.4	14.0
E-4	81,503	97,375	8,764	95,428	3,895	57.0	1,288.3	20.3	1,365.5	14.0
STATE TOTAL	178,013	212,679	19,142	208,426	8,507	124.4	2,813.8	44.2	2,982.4	14.0
Georgia										
E-2	28,298	33,809	16,228	27,047	338	66.5	319.2	1.3	387.0	11.4
J-4	5,429	6,486	3,113	5,189	65	12.8	61.2	.3	74.2	11.4
E-1	27,691	33,084	15,880	26,467	331	65.1	312.3	1.3	378.7	11.4
D-2	3,989	4,766	2,288	3,813	48	9.4	45.0	.2	54.6	11.4
STATE TOTAL	65,407	78,145	37,509	62,516	782	153.8	737.7	3.0	894.5	11.4
Kentucky										
I-1	26,866	32,098	2,247	31,456	963	15.1	280.6	5.7	401.4	12.5
H	21,316	25,467	1,783	24,958	764	11.9	302.0	4.5	318.4	12.5
G-4	13,313	15,906	1,113	15,588	477	7.5	188.6	2.8	198.9	12.5
G-2	13,630	16,284	1,140	15,958	489	7.6	193.1	2.9	203.6	12.5
STATE TOTAL	75,125	89,755	6,283	87,960	2,693	42.1	1,064.3	15.9	1,122.3	12.5
Maryland										
B-3	24,385	29,134	18,937	27,677	1,457	100.4	334.9	9.0	444.3	15.2
STATE TOTAL	24,385	29,134	18,937	27,677	1,457	100.4	334.9	9.0	444.3	15.2
Mississippi										
E-5	50,792	60,683	12,137	57,649	2,427	78.9	807.1	12.1	898.1	14.8
STATE TOTAL	50,792	60,683	12,137	57,649	2,427	78.9	807.1	12.1	898.1	14.8
New York										
F-1	33,978	40,595	30,040	28,417	2,030	117.2	198.9	9.1	325.2	8.0
B-1	95,167	113,700	84,138	79,590	5,685	328.1	557.1	25.6	910.9	8.0
STATE TOTAL	129,145	154,295	114,178	108,007	7,715	445.3	756.0	34.7	1,236.0	8.0
N. Carolina										
J-2	45,424	54,270	6,512	43,416	543	31.3	738.6	2.8	772.1	14.2
D-1	53,664	64,115	7,694	51,292	641	36.9	871.8	3.3	912.2	14.2
STATE TOTAL	99,088	118,385	14,206	94,708	1,184	68.2	1,610.0	6.0	1,684.3	14.2
Ohio										
G-1	53,560	63,990	4,479	62,710	1,280	10.8	758.8	6.9	776.5	12.1
F-3	15,717	18,778	1,314	18,402	376	3.2	222.7	2.0	227.8	12.1
G-2	46,139	55,124	3,859	54,022	1,102	9.3	653.7	6.0	668.9	12.1
STATE TOTAL	115,416	137,892	9,652	135,134	2,758	23.2	1,635.1	14.9	1,673.2	12.1
Pennsylvania										
F-1	142,460	170,203	141,208	161,693	6,808	353.2	1,616.9	33.4	2,003.5	11.8
F-2	183,753	219,538	182,217	208,561	8,782	455.5	2,085.6	43.0	2,584.2	11.8
B-2	152,318	181,981	151,044	172,882	7,279	377.6	1,728.8	35.7	2,142.1	11.8
B-1	28,961	34,601	28,719	32,871	1,384	71.8	328.7	6.8	407.3	11.8
A	84,497	100,952	83,790	95,904	4,038	209.5	959.0	19.8	1,188.3	11.8
STATE TOTAL	591,989	707,275	587,038	671,911	28,291	1,467.6	6,719.1	138.6	8,325.3	11.8
S. Carolina										
D-2	42,453	50,720	15,216	40,576	1,522	98.9	491.0	8.2	598.1	11.8
STATE TOTAL	42,453	50,720	15,216	40,576	1,522	98.9	491.0	8.2	598.1	11.8
Tennessee										
I-2	28,928	34,562	4,147	33,525	1,728	13.7	482.8	9.8	506.3	14.6
J-5	17,076	20,401	2,448	19,789	1,020	8.1	285.0	5.8	298.9	14.6
J-4	43,896	52,444	6,293	50,871	2,622	20.8	732.5	14.9	768.3	14.6
J-3	93,647	111,884	13,426	108,527	5,594	44.3	1,562.8	31.9	1,639.0	14.6
J-1	42,835	51,177	6,141	49,642	2,559	20.3	714.8	14.6	749.7	14.6
STATE TOTAL	226,382	270,468	32,455	262,354	13,523	107.1	3,777.9	77.1	3,962.1	14.6
Virginia										
J-1	33,082	39,524	20,157	37,153	158	135.1	449.6	.9	585.5	14.8
C	14,471	17,289	8,817	16,252	69	59.1	196.6	.4	256.1	14.8
G-5	24,172	28,879	14,728	27,146	116	98.7	328.5	.6	427.8	14.8
STATE TOTAL	71,725	85,692	43,702	80,551	343	292.8	974.7	1.9	1,269.4	14.8
W. Virginia										
G-3	53,424	63,828	37,659	59,998	383	252.3	726.0	1.1	979.4	15.3
G-2	15,799	18,876	11,137	17,743	113	74.6	214.7	.3	289.6	15.3
F-3	51,152	61,114	36,057	57,447	367	241.6	695.1	1.0	937.7	15.3
B-3	21,784	26,026	15,355	24,464	156	102.9	296.0	.4	399.3	15.3
G-5	54,883	65,571	38,687	61,637	393	259.2	745.8	1.1	1,006.1	15.3
G-4	17,572	20,994	12,386	19,734	126	83.0	238.8	.4	322.1	15.3
STATE TOTAL	214,614	256,409	151,281	241,023	1,538	1,013.6	2,916.4	4.3	3,934.3	15.3
REGION TOTAL	1,884,534	2,251,532	1,061,736	2,078,492	72,740	4,016.3	24,638.0	369.9	29,024.3	12.9

1/. Includes unlicensed hunters.

AD-A041 407 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. VOLUME 22. APPEND--ETC(U)
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2 OF 4
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TABLE VI Cont. SUMMARY OF WILDLIFE RESOURCE INFORMATION - APPALACHIAN REGION - 1964

	11	12	13	14	15	16	17	18	19	20
	Big Game Habitat	Small Game habitat	Water-fowl Habitat	Total Habitat	Acres Per Licensed Hunter	Hunter Days/ Acre Big Game	Hunter Days/ Acre Small Game	Hunter Days/ Acre Water-fowl	Hunter Days/ Acre Total Hunters	Percent Pop. Licensed
	(1,000's Acres)									
Alabama			(Acres)							
J-5	2,240.5	3,716.9	223,040	3,939.9	72.7	.017	.230	.060	.230	11.8
E-3	3,274.6	4,097.0	97,000	4,194.0	69.1	.009	.163	.108	.169	10.2
E-4	4,928.4	5,939.8	125,290	6,065.1	74.4	.012	.217	.162	.225	7.5
STATE TOTAL	10,443.5	13,753.7	445,330	14,199.0	79.8	.012	.205	.099	.210	9.1
Georgia										
E-2	1,994.7	2,517.0	12,480	2,529.5	69.4	.033	.127	.106	.153	9.1
J-4	374.1	469.7	400	470.1	87.1	.034	.130	.635	.158	6.6
E-1	2,747.9	2,714.9	59,660	2,774.6	100.2	.024	.115	.022	.136	10.6
D-2	312.3	498.3	990	499.3	124.8	.030	.090	.189	.109	8.9
STATE TOTAL	5,429.0	6,199.9	73,530	6,273.4	95.9	.028	.119	.041	.142	9.4
Kentucky										
I-1	3,199.2	4,033.2	64,250	4,097.4	152.3	.005	.094	.088	.098	7.6
H	2,407.3	3,258.5	13,310	3,271.8	153.6	.005	.093	.339	.097	7.9
G-4	1,350.3	1,523.3	6,005	1,529.3	115.0	.006	.124	.469	.130	8.0
G-2	1,155.6	1,394.0	14,265	1,408.3	103.6	.007	.139	.202	.145	9.0
STATE TOTAL	8,112.4	10,209.0	97,830	10,306.8	137.2	.005	.104	.162	.109	8.0
Maryland										
B-3	660.1	957.4	10,585	968.0	39.7	.152	.350	.853	.458	12.1
STATE TOTAL	660.1	957.4	10,585	968.0	39.7	.152	.350	.853	.458	12.1
Mississippi										
E-5	4,308.8	6,359.6	233,505	6,593.1	129.8	.018	.127	.052	.136	12.5
STATE TOTAL	4,308.8	6,359.6	233,505	6,593.1	129.8	.018	.127	.052	.136	12.5
New York										
F-1	1,273.1	2,128.9	17,510	2,446.4	63.1	.092	.093	.522	.152	12.0
B-1	2,944.3	4,808.3	27,230	4,835.5	50.8	.111	.116	.940	.188	13.1
STATE TOTAL	4,217.4	6,937.2	44,740	6,981.9	54.1	.106	.109	.776	.177	12.8
N. Carolina										
J-2	3,177.0	2,887.0	34,090	2,921.1	64.3	.010	.256	.081	.264	12.2
D-1	2,638.6	3,521.2	18,540	3,539.7	65.9	.014	.248	.176	.258	9.3
STATE TOTAL	5,815.6	6,408.2	52,630	6,460.8	65.2	.012	.251	.115	.261	10.4
Ohio										
G-1	2,513.3	4,339.8	58,309	4,398.1	82.1	.004	.175	.119	.177	10.7
F-3	312.7	551.8	7,518	559.3	35.6	.010	.404	.270	.407	8.5
G-2	1,881.1	3,363.3	29,616	3,392.9	73.6	.005	.194	.201	.197	10.2
STATE TOTAL	4,707.1	8,254.9	95,443	8,350.3	72.4	.005	.198	.156	.200	10.2
Pennsylvania										
F-1	4,811.4	6,098.3	68,170	6,166.5	43.3	.073	.265	.489	.325	13.0
F-2	2,223.4	3,783.3	41,130	3,824.4	20.8	.205	.551	1.046	.676	6.3
B-2	4,830.3	6,715.8	144,360	6,860.2	45.0	.078	.257	.247	.312	14.1
B-1	1,658.0	2,467.2	16,760	2,484.0	85.7	.043	.133	.405	.164	17.9
A	2,084.8	2,595.2	38,590	2,633.8	31.2	.100	.370	.513	.451	9.0
STATE TOTAL	15,607.9	21,659.8	309,010	21,968.9	37.1	.094	.310	.448	.379	9.4
S. Carolina										
D-2	1,501.1	2,304.8	61,240	2,366.0	55.7	.066	.213	.134	.253	7.2
STATE TOTAL	1,501.1	2,304.8	61,240	2,366.0	55.7	.066	.213	.134	.253	7.2
Tennessee										
I-2	1,762.7	2,456.7	48,910	2,505.6	86.7	.008	.197	.201	.202	19.0
J-5	882.0	1,201.3	9,460	1,210.8	70.8	.009	.237	.615	.247	18.4
J-4	1,574.5	1,976.3	58,230	2,034.5	46.3	.013	.371	.257	.378	11.6
J-3	2,780.6	3,623.0	134,430	3,757.4	40.1	.016	.431	.237	.430	14.2
J-1	1,123.7	1,535.3	21,370	1,556.7	36.4	.018	.466	.683	.482	13.0
STATE TOTAL	8,123.5	10,792.6	272,400	11,065.0	48.9	.013	.350	.283	.358	14.0
Virginia										
J-1	1,782.7	2,305.6	5,410	2,311.0	69.8	.076	.195	.164	.253	11.2
C	1,260.1	1,025.0	3,800	1,028.8	71.0	.047	.192	.102	.249	20.7
G-5	1,453.0	1,876.3	6,450	1,882.7	77.8	.068	.175	.101	.227	14.5
STATE TOTAL	4,495.8	5,206.9	15,660	5,222.6	72.8	.065	.187	.123	.243	13.3
W. Virginia										
G-3	2,139.2	2,717.7	23,060	2,740.8	51.3	.118	.267	.046	.357	11.5
G-2	810.6	1,031.8	13,160	1,045.0	66.1	.092	.208	.024	.277	8.2
F-3	1,708.2	2,399.1	16,870	2,416.0	47.2	.141	.290	.061	.388	10.6
B-3	1,665.7	2,061.0	5,380	2,066.4	94.8	.062	.144	.081	.193	14.6
G-5	4,471.4	4,774.5	24,470	4,819.0	87.8	.058	.156	.045	.209	12.9
G-4	1,111.9	1,166.2	2,860	1,169.1	66.4	.075	.205	.123	.276	8.4
STATE TOTAL	11,907.0	14,170.3	85,800	14,256.1	66.4	.085	.206	.050	.276	11.1
REGION TOTAL	85,329.2	113,214.3	1,797,703	115,011.9	61.0	.047	.218	.206	.252	10.7

COPY AVAILABLE TO DTIC DOES NOT PERMIT FULLY LEGIBLE REPRODUCTION

TABLE VII SUMMARY OF WILDLIFE RESOURCE INFORMATION - APPALACHIAN REGION - 1980

State and Water Areas	1 Total Licensed Hunters	2 Total Hunters 1/	3 Total Habitat (1,000's Acres)	4 Acres/ Hunter	5 Hunter-days/ Acre	6 Gross Demand (1,000's M/D's)	7 Net Needs (1,000's M/D's)
	---- (1,000's) ----						
Alabama							
J-5	76.4	91.2	3,814.6	41.8	.335	1,276.8	369.2
E-3	50.9	60.7	4,147.8	68.3	.205	850.0	140.6
E-4	102.6	122.6	5,964.8	48.7	.287	1,717.0	351.4
STATE TOTAL	229.9	274.5	13,927.2	50.7	.276	3,843.8	861.4
Georgia							
E-2	35.3	42.3	2,494.9	59.0	.193	481.9	94.9
J-4	6.9	8.2	458.3	55.9	.203	93.1	18.9
E-1	35.4	42.2	2,736.7	64.8	.176	481.3	102.6
D-2	4.6	5.4	497.2	92.1	.124	61.8	7.2
STATE TOTAL	82.2	98.1	6,187.1	63.1	.181	1,118.1	223.6
Kentucky							
I-1	27.1	32.3	4,071.4	126.0	.099	404.2	2.8
H	21.8	26.0	3,254.0	125.2	.100	325.6	7.2
G-4	13.4	16.0	1,528.4	95.5	.131	200.0	1.1
G-2	15.6	18.7	1,385.6	74.1	.170	233.6	30.0
STATE TOTAL	77.9	93.1	10,239.4	109.9	.114	1,163.5	41.2
Maryland							
E-3	29.2	34.9	954.6	27.4	.555	530.2	85.9
STATE TOTAL	29.2	34.9	954.6	27.4	.555	530.2	85.9
Mississippi							
E-5	55.5	66.3	6,492.7	97.9	.151	981.2	83.1
STATE TOTAL	55.5	66.3	6,492.7	97.9	.151	981.2	83.1
New York							
F-1	38.8	46.3	2,128.4	46.0	.174	370.5	45.3
B-1	117.4	140.3	4,772.9	34.0	.235	1,122.3	211.4
STATE TOTAL	156.2	186.6	6,901.3	37.0	.216	1,492.8	256.7
No. Carolina							
J-2	55.8	66.7	2,869.9	43.1	.330	946.1	174.0
D-1	70.3	84.0	3,499.9	41.7	.341	1,193.0	280.8
STATE TOTAL	126.1	150.6	6,369.8	42.3	.336	2,139.2	454.9
Ohio							
G-1	61.4	73.4	4,325.6	58.9	.205	888.1	111.6
F-3	16.6	19.9	556.0	28.1	.431	239.7	11.9
G-2	48.7	58.1	3,372.9	58.1	.209	703.6	34.7
STATE TOTAL	126.7	151.4	8,254.5	54.5	.229	1,831.4	158.2
Pennsylvania							
F-1	179.9	214.9	6,063.9	28.2	.418	2,536.5	533.0
F-2	214.3	255.9	3,673.4	14.3	.822	3,020.7	436.5
B-2	189.1	225.9	6,768.4	30.0	.394	2,665.6	523.5
B-1	29.8	35.7	2,474.9	69.3	.170	420.7	13.4
A	95.6	114.2	2,564.6	22.5	.525	1,347.2	158.9
STATE TOTAL	708.7	846.7	21,545.2	25.4	.464	9,990.7	1,665.4
So. Carolina							
D-2	61.1	73.0	2,316.0	31.7	.372	861.6	263.5
STATE TOTAL	61.1	73.0	2,316.0	31.7	.372	861.6	263.5
Tennessee							
I-2	29.3	35.0	2,465.0	70.4	.207	510.7	4.4
J-5	20.6	24.6	1,189.5	48.4	.302	359.5	60.6
J-4	57.4	68.6	1,975.2	28.8	.507	1,001.5	233.2
J-3	128.7	153.8	3,627.3	23.6	.619	2,245.9	606.9
J-1	52.9	63.2	1,515.9	24.0	.608	922.5	172.8
STATE TOTAL	288.9	345.2	10,772.9	31.2	.468	5,040.2	1,078.1
Virginia							
J-1	39.7	47.4	2,275.9	48.0	.308	701.5	116.0
C	15.0	17.9	1,010.1	56.4	.262	264.9	8.8
G-5	25.9	31.1	1,866.0	60.0	.246	459.5	31.7
STATE TOTAL	80.6	96.4	5,152.0	53.4	.278	1,425.9	156.5
W. Virginia							
G-3	62.7	74.9	2,681.6	35.8	.428	1,146.4	167.0
G-2	21.0	25.1	1,002.0	39.9	.384	384.6	95.0
F-3	56.7	67.7	2,395.3	35.4	.432	1,036.1	98.4
B-3	22.3	26.6	2,061.3	77.5	.197	406.9	7.6
G-5	54.6	65.2	4,826.1	73.9	.207	998.5	7.6
G-4	17.7	21.1	1,167.5	55.1	.277	323.7	1.6
STATE TOTAL	235.0	280.8	14,133.8	50.3	.304	4,296.3	362.1
REGION TOTAL	2,258.0	2,697.6	113,246.5	42.0	.306	34,714.9	5,690.6

1/. Includes unlicensed hunters.

TABLE VIII SUMMARY OF WILDLIFE RESOURCE INFORMATION - APPALACHIAN REGION - 2000

State and Water Areas	1 Total Licensed Hunters (1,000's)	2 Total Hunters 1/ (1,000's)	3 Total Habitat (1,000's Acres)	4 Acres/ Hunter	5 Hunter-days/ Acre	6 Gross Demand (1,000's M/d)	7 Net Needs (1,000's M/D's)
Alabama							
J-5	116.4	139.1	3,659.8	26.3	.531	1,946.8	1,039.2
E-3	65.3	78.0	4,095.5	52.5	.266	1,091.8	382.4
E-4	139.0	166.1	5,826.5	35.1	.399	2,325.8	960.3
STATE TOTAL	320.7	382.2	13,581.8	35.4	.395	5,364.4	2,382.0
Georgia							
E-2	45.5	54.4	2,460.0	45.2	.252	619.8	232.8
J-4	9.1	10.9	445.1	40.8	.280	124.5	50.3
E-1	46.7	55.7	2,697.8	48.4	.236	635.5	256.8
D-2	5.1	6.1	496.0	81.3	.139	69.1	14.5
STATE TOTAL	106.4	127.1	6,098.9	48.0	.238	1,448.8	554.3
Kentucky							
I-1	28.4	33.9	4,040.8	119.2	.105	424.1	22.7
H	27.0	32.3	3,232.5	100.1	.125	403.6	85.2
G-4	14.4	17.2	1,522.3	88.5	.142	215.5	16.6
G-2	19.1	22.8	1,370.4	60.1	.208	285.1	81.5
STATE TOTAL	88.9	106.3	10,166.0	95.6	.131	1,328.3	206.0
Maryland							
B-3	39.1	46.7	936.6	20.1	.758	710.3	266.0
	39.1	46.7	936.6	20.1	.758	710.3	266.0
Mississippi							
E-5	68.2	81.5	6,357.9	77.9	.190	1,206.2	308.1
STATE TOTAL	68.2	81.5	6,357.9	77.9	.190	1,206.2	308.1
New York							
F-1	51.2	61.2	2,105.5	34.4	.232	489.5	164.3
B-1	157.5	188.1	4,697.9	25.0	.320	1,505.0	594.1
STATE TOTAL	208.7	249.3	6,803.4	27.3	.293	1,994.5	758.4
No. Carolina							
J-2	72.4	86.5	2,806.8	32.4	.438	1,228.9	456.8
D-1	113.9	136.0	3,446.1	25.3	.560	1,931.0	1,018.8
STATE TOTAL	186.3	222.5	6,252.9	28.1	.505	3,159.9	1,475.6
Ohio							
G-1	83.6	99.9	4,243.6	42.5	.285	1,209.0	432.5
F-3	23.8	28.5	541.0	19.0	.636	344.4	116.6
G-2	63.2	75.4	3,321.4	44.1	.275	912.9	244.0
STATE TOTAL	170.6	203.8	8,106.0	39.8	.304	2,466.3	793.1
Pennsylvania							
F-1	242.3	289.4	5,977.0	20.7	.571	3,415.4	1,411.9
F-2	284.6	340.0	3,483.1	10.2	1.152	4,011.9	1,427.7
B-2	250.4	299.2	6,663.6	22.3	.530	3,530.8	1,388.7
B-1	32.1	38.4	2,465.4	64.2	.184	452.7	45.4
A	133.3	159.3	2,480.9	15.6	.758	1,879.7	691.4
STATE TOTAL	942.7	1,126.3	21,070.0	18.7	.631	13,290.5	4,965.2
So. Carolina							
J-2	99.2	118.5	2,260.0	19.1	.619	1,398.5	800.4
STATE TOTAL	99.2	118.5	2,260.0	19.1	.619	1,398.5	800.4
Tennessee							
I-2	32.2	38.6	2,415.2	62.6	.233	563.0	56.7
J-5	28.3	33.8	1,163.7	34.4	.424	493.8	194.9
J-4	77.2	92.2	1,909.2	20.7	.705	1,345.9	577.6
J-3	181.7	217.0	3,477.6	16.0	.911	3,168.9	1,529.9
J-1	71.3	85.2	1,462.0	17.2	.850	1,243.4	493.7
STATE TOTAL	390.7	466.8	10,427.7	22.3	.653	6,815.0	2,852.9
Virginia							
J-1	51.6	61.7	2,228.9	36.1	.410	913.1	327.6
C	18.2	21.8	987.5	45.3	.326	322.3	66.2
G-5	33.4	39.9	1,840.8	46.1	.321	590.3	162.5
STATE TOTAL	103.2	123.4	5,057.2	41.0	.361	1,825.7	556.3
W. Virginia							
G-3	86.5	103.3	2,617.5	25.3	.604	1,580.4	601.0
G-2	26.9	32.1	980.6	30.5	.501	491.0	201.4
F-3	80.0	95.6	2,353.4	24.6	.621	1,462.4	524.7
B-3	24.7	29.5	2,048.8	69.5	.221	451.8	52.5
G-5	55.7	66.6	4,821.4	72.4	.211	1,018.3	12.2
G-4	19.6	23.4	1,160.6	49.6	.309	358.7	36.6
STATE TOTAL	293.4	350.5	13,982.3	39.9	.384	5,362.6	1,428.3
REGION TOTAL	3,018.1	3,604.9	111,100.7	30.8	.417	46,371.0	17,346.6

1/. Includes unlicensed hunters.

TABLE IX SUMMARY OF WILDLIFE RESOURCE INFORMATION - APPALACHIAN REGION - 2020

State and Water Areas	1 Total Licensed Hunters (1,000's)	2 Total Hunters 1/ (1,000's)	3 Total Habitat (1,000's Acres)	4 Acres/ Hunter	5 Hunter-days/ Acre	6 Gross Demand (1,000's M/D's)	7 Net Needs (1,000's M/D's)
Alabama							
J-5	176.9	211.3	3,452.7	16.3	.857	2,958.8	2,051.2
E-3	86.7	103.6	4,023.8	38.8	.360	1,449.8	740.4
E-4	189.9	226.9	5,647.4	24.9	.562	3,176.9	1,811.4
STATE TOTAL	453.5	541.8	13,123.9	24.2	.578	7,585.5	4,603.1
Georgia							
E-2	60.4	72.1	2,410.2	33.4	.341	822.0	435.0
J-4	12.5	14.9	427.5	28.7	.398	170.0	95.8
E-1	63.1	75.4	2,644.8	35.1	.325	859.5	480.8
D-2	6.0	7.2	494.5	68.7	.167	82.4	27.8
STATE TOTAL	142.0	169.6	5,977.0	35.2	.324	1,933.9	1,039.4
Kentucky							
I-1	30.8	36.8	3,998.6	108.6	.115	460.4	59.0
H	33.9	40.5	3,203.7	79.1	.158	505.7	187.3
G-4	16.0	19.1	1,514.9	79.3	.157	238.4	39.5
G-2	27.7	33.1	1,340.4	40.5	.309	413.9	210.3
STATE TOTAL	108.4	129.5	10,057.6	77.7	.161	1,618.4	496.1
Maryland							
B-3	56.9	67.9	905.4	13.3	1.140	1,032.7	588.4
STATE TOTAL	56.9	67.9	905.4	13.3	1.140	1,032.7	588.4
Mississippi							
E-5	83.4	99.6	6,220.8	62.5	.237	1,474.1	576.0
STATE TOTAL	83.4	99.6	6,220.8	62.5	.237	1,474.1	576.0
New York							
F-1	69.8	83.4	2,075.8	24.9	.321	666.9	341.7
B-1	214.9	256.8	4,596.8	17.9	.447	2,054.4	1,143.5
STATE TOTAL	284.7	340.2	6,672.6	19.6	.408	2,721.3	1,485.2
No. Carolina							
J-2	97.3	116.2	2,727.0	23.5	.605	1,650.5	878.4
D-1	177.6	212.2	3,374.5	15.9	.893	3,013.2	2,101.0
STATE TOTAL	274.9	328.4	6,101.5	18.6	.764	4,663.6	2,979.3
Ohio							
G-1	102.7	122.7	4,188.8	34.1	.354	1,484.9	708.4
F-3	32.4	38.8	523.2	13.5	.896	469.0	241.2
G-2	89.8	107.2	3,246.6	30.3	.400	1,297.6	628.7
STATE TOTAL	224.9	268.7	7,958.6	29.6	.408	3,251.5	1,578.3
Pennsylvania							
F-1	308.8	368.9	5,885.3	16.0	.740	4,353.6	2,350.1
F-2	395.4	472.4	3,193.8	6.8	1.745	5,573.9	2,989.7
B-2	334.4	399.5	6,528.7	16.3	.722	4,714.0	2,571.9
B-1	36.9	44.1	2,452.8	55.6	.212	520.5	113.2
A	187.7	224.3	2,369.1	10.6	1.117	2,646.2	1,457.9
STATE TOTAL	1,263.2	1,509.2	20,429.7	13.5	.872	17,808.2	9,482.9
So. Carolina							
D-2	155.9	186.2	2,184.6	11.7	1.006	2,197.7	1,599.6
STATE TOTAL	155.9	186.2	2,184.6	11.7	1.006	2,197.7	1,599.6
Tennessee							
I-2	40.3	48.1	2,349.9	48.8	.299	702.9	196.6
J-5	40.0	47.8	1,129.2	23.6	.618	697.7	398.8
J-4	106.2	126.9	1,820.3	14.3	1.017	1,852.2	1,083.8
J-3	261.6	312.6	3,274.4	10.5	1.393	4,563.6	2,924.6
J-1	98.1	117.2	1,389.1	11.8	1.232	1,711.5	961.8
STATE TOTAL	546.2	652.6	9,527.9	15.3	.956	9,527.9	5,565.8
Virginia							
J-1	69.5	83.0	2,166.0	26.1	.567	1,228.8	643.3
C	23.7	28.3	957.4	33.8	.438	419.2	163.1
G-5	45.5	54.3	1,811.2	33.4	.444	804.1	376.3
STATE TOTAL	138.7	165.7	4,934.6	29.8	.497	2,452.0	1,182.6
W. Virginia							
G-3	126.8	151.6	2,523.4	16.6	.919	2,318.7	1,339.3
G-2	41.0	49.0	936.9	19.1	.800	749.8	400.2
F-3	109.2	130.4	2,304.6	17.7	.866	1,995.3	1,057.6
B-3	29.9	35.8	2,034.7	56.8	.269	547.1	147.8
G-5	62.7	74.9	4,793.7	64.0	.239	1,146.4	140.3
G-4	22.1	26.4	1,152.1	43.6	.350	403.7	81.6
STATE TOTAL	391.7	468.0	13,745.4	29.4	.521	7,161.0	3,226.7
REGION TOTAL	4,124.4	4,927.4	107,839.6	21.9	.588	63,427.8	34,403.4

1/. Includes unlicensed hunters.

TABLE I SUMMARY OF WILDLIFE RESOURCE INFORMATION - PUBLIC HUNTING AREAS - APPALACHIAN REGION - 1964

State and Water Area	(Acres) State Fish & Game Lands	State Forests	U. S. Forest Service	Other Federal Lands	State Parks 1/	County Parks	Farm 2/ Game Coop.	Totals
Alabama								
J-5	53,000	—	90,857	105,227	—	—	—	249,084
E-3	55,934	—	160,047	39,424	—	—	—	255,405
E-4	37,777	—	219,730	61,000	—	—	—	318,507
STATE TOTAL	146,711	—	470,634	205,651	—	—	—	822,996
Georgia								
E-2	25,000	—	84,168	26,061	—	—	—	135,229
J-4	—	—	15,402	—	—	—	—	15,402
E-1	152,000	—	580,283	19,9[illegible]	—	—	—	752,244
D-2	—	—	—	—	—	—	—	—
STATE TOTAL	177,000	—	679,853	46,022	—	—	—	902,875
Kentucky								
I-1	33,026	15,124	320,848	3,000	—	—	—	371,998
H	37,086	789	86,046	—	—	—	—	123,921
G-4	11,000	10,000	116	—	—	—	—	21,116
G-2	—	800	54,737	—	—	—	—	55,537
STATE TOTAL	81,112	26,713	461,747	3,000	—	—	—	572,572
Maryland								
B-3	18,809	99,981	—	2,550	1,813	—	—	123,153
STATE TOTAL	18,809	99,981	—	2,550	1,813	—	—	123,153
Mississippi								
E-5	250	—	152,555	—	—	—	—	152,805
STATE TOTAL	250	—	152,555	—	—	—	—	152,805
New York								
F-1	6,402	94,185	—	—	627	—	—	100,587
B-1	25,326	192,500	10,237	4,546	—	—	—	232,609
STATE TOTAL	31,728	286,685	10,2[illegible]	4,546	627	—	—	333,823
No. Carolina								
J-2	—	—	760,675	2,648	—	—	—	763,323
D-1	34,540	—	162,763	1,565	—	—	—	198,868
STATE TOTAL	34,540	—	923,438	4,213	—	—	—	962,191
Ohio								
G-1	22,942	23,963	42,474	8,000	13,152	26,657	—	137,188
F-3	3,464	—	—	—	1,687	4,062	—	9,213
G-2	15,614	123,160	49,000	—	5,737	—	—	204,511
STATE TOTAL	42,020	158,123	91,474	8,000	20,576	30,719 3/	—	350,912
Pennsylvania								
F-1	274,306	573,051	470,420	3,600	12,556	—	225,413	1,559,346
F-2	47,471	21,087	—	15,871	4,756	—	226,568	315,753
B-2	286,649	930,204	—	1,113	21,119	—	447,354	1,686,439
B-1	158,840	192,927	—	473	3,300	—	81,060	436,600
A	149,898	187,934	—	2,878	18,210	—	78,741	337,661
STATE TOTAL	917,164	1,805,203	470,420	23,935	59,941	—	1,059,136	4,335,799
So. Carolina								
D-2	100,464	—	72,553	22,560	—	—	—	195,577
STATE TOTAL	100,464	—	72,553	22,560	—	—	—	195,577
Tennessee								
I-2	100,217	—	—	45,066	—	156	—	145,439
J-5	15,990	8,451	—	37,631	—	—	—	62,072
J-4	30,800	6,600	153,057	10,622	—	—	—	201,079
J-3	47,420	23,212	180,317	34,766	3,600	2,003	—	291,318
J-1	23,900	—	267,463	480	4,600	152	—	296,595
STATE TOTAL	218,327	38,263	600,837	128,565	8,200	2,311	—	996,503
Virginia								
J-1	6,400	—	101,949	200	—	—	—	108,549
C	36,145	—	528,665	—	—	—	—	564,810
G-5	18,466	—	226,667	—	—	—	—	245,133
STATE TOTAL	61,011	—	857,281	200	—	—	—	918,492
W. Virginia								
G-3	19,399	6,595	—	—	-	-	—	25,994
G-2	18,291	8,026	—	—	-	—	—	26,317
F-3	9,270	13,038	3,891	—	—	5,235	—	31,434
B-3	40,005	—	173,983	—	—	—	—	213,988
G-5	37,566	41,283	727,810	—	—	200	—	806,859
G-4	12,058	7,810	—	—	—	—	—	19,868
STATE TOTAL	136,589	76,752	905,684	—	—	5,435	—	1,124,460
REGION TOTAL	1,965,725	2,491,720	5,696,713	449,242	91,157	38,465	1,059,136	11,792,158

1/. State Parks closed to hunting not included in the tables.
2/. Private land open to public hunting by agreement with the State Fish and Game Department.
3/. Muskingum Conservancy District.

Listed below are the information sources used in several of the preceding tables.

Table I

Cols. 1 and 5	U. S. Bureau of Census Reports
Cols. 2 thru 4	Office of Appalachian Studies, U. S. Army Corps of Engineers

Table II

Cols. 1 thru 3	License statistics from state records
Col. 4	Includes 9 - 11 year old youngsters. National Survey of Fishing and Hunting, 1965.
Col. 5	National Survey of Fishing and Hunting, 1965. Statistics indicate that 66.3 percent of total freshwater fishermen in U. S. were licensed.
Cols. 6 thru 9	Data on reservoirs and lakes furnished by Corps of Engineers and Tennessee Valley Authority. Pond acreages obtained from U. S. Soil Conservation Service records. Stream data from state records and map measurements.
Cols. 13 thru 18	Utilization statistics of fishery habitat based on values of 30.6 man-days per acre for reservoirs and lakes, 68.9 man-days per acre for ponds, and 53.6 man-days per acre for streams.

Table III

Cols. 1 thru 5	Multiple-regression statistical formula
Cols. 6 thru 9	Data supplied by U. S. Army Corps of Engineers and U. S. Soil Conservation Service.

Table VI

Col. 1	License statistics from state records.
Col. 2	National Survey of Fishing and Hunting, 1965. Statistics indicate that 83.7 percent of nation's hunters are licensed.
Col. 3	Records of state surveys. Percentage of total hunters who hunted big game was applied to water area figures. In some instances, percentages for the whole state were used. Where the state has been broken into regions, the regional percentage was used.
Col. 4	Computed in same manner as for big game hunters.
Col. 5	Duck stamp sales were divided by the license sales for each water area. The percentage was then applied to the calculated hunters for each area.
Cols. 6 thru 8	Computed from data gathered by various states through mail questionnaires. In instances where data not available, figures from National Survey of Fishing and Hunting, 1965. Waterfowl use figure taken from Waterfowl Status Report, 1965.
Cols. 11 thru 14	U.S.D.A.'s Soil and Water Conservation Needs Inventory for respective states. Wetlands and Permanent Water Inventories. Big game habitat includes - 50% of pasture, 100% of forest, 50% of other lands, 100% of Federal land, and 20% of Water Areas. Small game habitat include - 100% of cropland, pasture, forest, other land, Federal land, and 20% of Water Areas.

Table VII

Cols. 1 and 2	Multiple regression statistical formula.

TABLE XI ESTIMATED EXPENDITURES OF FRESHWATER FISHERMEN 12 YEARS OLD AND OLDER IN APPALACHIA DURING 1964 AND PROJECTED TO 1980, 2000, AND 2020.

Itemized Expense	Individual Annual Expense [1]	Percent of Total Expense	(Millions of Dollars) 1964	1980 [2]	2000 [2]	2020 [2]
Food	$10.70	12.06	33.8	41.0	48.2	55.7
Lodging	3.31	3.73	10.5	12.7	14.9	17.3
Transportation	14.35	16.18	45.4	55.0	64.6	74.8
Fishing Equipment	10.45	11.76	33.0	40.0	47.0	54.3
Boats, Motors & Other Equipment	22.00	24.80	69.6	84.3	99.1	114.6
Licenses, Tags, & Permits	2.66	3.00	8.4	10.2	12.0	13.9
Privilege Fees	2.06	2.32	6.5	7.9	9.3	10.7
Bait, Guides and Other Trip Expense	21.60	24.35	68.3	82.8	97.3	112.5
Boat Launching	.34	.38	1.1	1.3	1.5	1.8
Other Expense	1.24	1.40	3.9	4.8	5.6	6.5
Total	$88.71	100.00	280.5	340.0	399.5	462.1

1/. National Survey of Fishing and Hunting, 1965

2/. Projected values based on assumption that the average expenditures per fisherman and the real value of the dollar remain the same as in 1964.

TABLE XII ESTIMATED EXPENDITURES OF HUNTERS 12 YEARS OLD AND OLDER IN APPALACHIA DURING 1964 AND PROJECTED TO 1980, 2000, AND 2020.

Itemized Expense	Individual Annual Expense	Percent of Total Expense	(Millions of Dollars) 1964	1980 2/	2000 2/	2020 2/
Food	$ 8.53	10.3	16.3	19.6	26.2	35.8
Lodging	1.58	1.9	3.0	3.6	4.8	6.6
Transportation	12.39	15.0	23.8	28.5	38.1	52.1
Hunting Equipment	29.25	35.5	56.4	67.5	90.2	123.3
Other Equipment	9.25	11.2	17.8	21.3	28.5	38.9
License Tags & Permits	5.30	6.4	10.2	12.2	16.3	22.3
Privilege Fees & Other	4.21	5.1	8.1	9.7	12.9	17.7
Dogs	10.78	13.1	20.8	24.9	33.3	45.5
Other	1.25	1.5	2.4	2.9	3.8	5.2
Total	$82.54	100.0	158.8	190.2	254.1	347.4

1/. Total expenditures were calculated using the 1965 National Survey of Fishing and Hunting figures of $9.55 per day for big game hunting, $4.79 per day for small game hunting, and $6.44 per day for waterfowl hunting.

2/. Projected values based on the assumption that the average expenditures per hunter and the real value of the dollar remain the same as in 1964.

TABLE XIII SUMMARY OF COMMERCIAL FISHERIES HABITAT - APPALACHIAN REGION - 1964 - 1980.

	Potential Usable 1964		Additional Developments 1964 - 1980	
	Area (Acres)	Supply (Pounds)	Area (Acres)	Supply (Pounds)
	1,000's		1,000's	
NORTHERN APPALACHIA				
Kentucky	64.1	962.1	46.2	692.4
Virginia	5.6	84.2	2.5	38.0
West Virginia	9.7	145.3	17.0	254.9
Ohio	16.0	239.9	5.2	78.5
Maryland	3.9	58.5	----	-----
Pennsylvania	42.0	629.4	22.2	333.4
New York	46.8	702.0	----	-----
Totals	188.1	2,821.4	93.1	1,397.2
SOUTHERN APPALACHIA				
Tennessee	253.6	16,742.2	20.1	781.5
North Carolina	-----	-----	----	-----
South Carolina	56.0	840.0	21.8	327.0
Georgia	59.9	898.1	25.9	388.5
Alabama	334.4	22,557.2	7.6	570.8
Mississippi	-----	-----	----	-----
Totals	703.9	41,037.5	75.4	2,067.8
Region Totals	892.0	43,858.9	168.5	3,465.0

PART II

INDIVIDUAL PROJECT
REPORTS

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

District Engineer
U.S. Army Engineers District, Baltimore
Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

April 3, 1968

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife on the plan for flood control and allied purposes at the Davenport Center Reservoir site on Charlotte Creek, New York State. This report has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 incl.) in cooperation with the New York State Conservation Department. It has the concurrence of that agency as indicated by letter, dated March 15, 1968.

The Bureau previously issued a report on this project in February 1948. This report is based on recent project data and is for consideration of pre-authorization studies and will be published in Appendix "K" of the report for "Development of Water Resources in Appalachia".

INTRODUCTION

Pursuant to the Appalachian Regional Development Act of 1965; Sec. 206, the Secretary of the Army was authorized and directed to prepare a comprehensive plan for the development and efficient utilization of the water and related resources of the Appalachian Region, especially as it might enhance the economy of the Region. Several Federal agencies, including the Department of the Interior, were authorized to assist in the preparation of the plan. This project is one which has been selected for study in response to the Act.

This report is based on engineering data which are included in the Sub-Region B Report for Development of Water Resources in Appalachia. The evaluations have been made in accordance with Senate Document Number 97, Supplement 1, 87th Congress, 2nd Session, entitled "Evaluation Standards for Primary Outdoor Recreation Benefits". Populations within the project area are based on trends as expressed in the developmental "benchmarks" for the Appalachian Region as of May 15, 1967. Benefits for the project are dependent upon the implementation of the plan for development of the fish and wildlife resources.

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DESCRIPTION OF THE AREA

The project area is located on Charlotte Creek, a tributary of the Susquehanna River, approximately five miles above the mouth and one mile east of the town of West Davenport in Delaware County, New York. The topography is moderately hilly, with fairly broad stream valleys. The stream bottom in the project area is largely pasture and cropland with scattered stands of hardwoods, a few conifers, and some areas of dense brush. Several small marshes and ponds are within the impoundment area.

The hills bordering the valley are mainly wooded. Sugar maple, beech, yellow birch, paper birch, hemlock and white pine are the predominant species present. A few abandoned farm lands on the hillsides are reverting to forest cover and are in various stages of succession.

DESCRIPTION OF THE PROJECT

The project is being designed for flood control, low flow augmentation for the Susquehanna River, and recreation, including fish and wildlife.

The dam will be an earth-fill structure, 4,525 feet long, rising 105 feet above the stream bed. A concrete spillway will be located in the right abutment and the outlet works will be through a conduit in the bottom of the dam. The structure will provide control for a drainage area of 164 square miles. Pertinent engineering data concerning the reservoir storage are presented in table 1.

Table 1. Davenport Center Reservoir Project

Pool	Elevation (ft. m.s.l.)	Capacity (acre feet)	Area (surface acres)	Stream Inundated (miles)
Max. Flood Pool	1290	116,000	2,700	10.0
Summer Pool	1259	45,000	1,690	8.5
Minimum Pool	1204	--	100	--

About 6,140 acres will be acquired for the project. This includes lands needed for all of the project features and the reservoir area.

FISHERY RESOURCES

Without the Project

Charlotte Creek in the project area contains both warmwater and coldwater species of fish. The creek, upstream from the project area, is considered a good trout stream. Below the project area, warmwater fishes become dominant. Brown trout and small mouth bass are the most important game fish

species present in the area. Other sport fishes commonly found include largemouth bass and chain pickerel. It is estimated that the 9.5-mile segment of Charlotte Creek within the project area receives 1,900 man-days of fishing, annually.

With the Project

The Davenport Center Reservoir will eliminate about 8.5 miles of Charlotte Creek. This will result in a loss of 1,700 man-days of stream fishing, annually. Downstream from the proposed dam, approximately one mile of the stream will be changed to a tailwater fishery and provide 1,200 man-days of fishing per year.

The conservation pool of the reservoir will remain relatively stable during the recreation season and provide about 1,690 surface acres of water. The reservoir at this elevation will be about six miles long and relatively narrow with no embayments of significant size. The impoundment will sustain a warmwater fishery that will provide approximately 25,400 man-days of fishing, annually.

WILDLIFE RESOURCES

Without the Project

The principal game species in the project area are white-tailed deer, ruffed grouse, ring-necked pheasants, gray squirrels, cottontail rabbits, woodcock, and waterfowl. Fur animals present include muskrats, mink, raccoon and fox.

Hunter use within the reservoir area is moderate. Pheasants and waterfowl receive most of the hunting pressure. The low, natural pheasant population is augmented by stocking. Waterfowl hunting consists of jump shooting along the stream and in the few marsh and pond areas.

The project is located in an area which supports a large population of white-tailed deer. Although deer hunting is relatively insignificant in the reservoir area, the adjacent forested lands receive a considerable amount of use by deer hunters.

The reservoir area supports about 800 man-days of hunting, annually.

With the Project

Davenport Center Reservoir will inundate 1,690 acres of land at the summer pool level. This will result in an annual loss of about 800 man-days of hunting which occurred in the stream bottom. Hunter use of lands adjacent to the reservoir are not expected to change with the project.

FISH AND WILDLIFE PLAN

The Davenport Center project will have varying effects on the fish and wildlife resources. To insure that the project includes consideration for the adequate development of these resources, the following fish and wildlife plan is proposed. All of the evaluations given are based on the implementation of the measures suggested in the plan.

Fishery

The project will result in a net gain of 24,700 man-days of fishing valued at $49,400, annually. The reservoir and tailwater fisheries will provide 23,700 and 1,000 man-days, respectively. The fishery evaluations are summarized in table 2.

The New York State Conservation Department will determine and initiate the management practices that will be needed to establish and maintain the fisheries in the reservoir and tailwater. To accomplish this, portions of the reservoir and tailwater should be placed under the management of the State agency under the terms of a Fish and Wildlife General Plan.

To insure adequate fishermen access to the reservoir, parking spaces and launching facilities should be provided at various locations to accommodate a design load of 135 automobiles in addition to that required by other interests. Approximately 45 of the parking spaces should be large enough for cars with boat trailers. Also, certain roads which lead to the reservoir should not be abandoned but be maintained for fishermen access.

Fishing should be permitted from the upstream face of the dam. The gradual slope of the dam, together with the rock riprap, often tends to attract and concentrate fish in this area.

A reservoir zoning plan should be developed cooperatively by all of the agencies responsible for the recreation activities. Such a plan will prevent possible conflicts with regard to the use of the impoundment.

Fishermen access to the tailwater area should be provided. This would include the stilling basin and the entire stream for a distance of about one mile below the dam.

Maintenance of a tailwater fishery requires releases of water from the reservoir of suitable temperature and quality. The intake and control tower, as presently designed for this project, will provide multiple level releases. This will not only benefit the tailwater fisheries but should also be beneficial for the fisheries in the Susquehanna River.

A minimum instantaneous flow of 40 second-feet should be maintained in Charlotte Creek below the dam at all times to adequately sustain the fishery.

The full commercial fishery potential of Davenport Center Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the near future. The New York State Conservation Department shall determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with other reservoir activities. Such commercial harvesting would utilize for food and possibly industrial use a fishery resource potential through reduction of rough fish populations. The reservoir's commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 25,000 pounds of food and industrial fishes per year.

Wildlife

The project will cause losses to the wildlife resources as indicated in table 2. To compensate for these losses a block of land 1,400 acres in size, should be made available to the New York State Conservation Department as a wildlife management area under the terms of a Fish and Wildlife General Plan. It should be located on the north side or upper end of the project area. The specific location will be determined when information concerning the overall project acquisition is available.

Scenic easements for the lands adjacent to the reservoir may be purchased as part of the project. This could provide a means for enhancing the hunting opportunity in the project area if public hunting easements were purchased also. The New York Conservation Department should be given the opportunity to consider the possibilities of such a measure during advanced planning.

Estimated Costs of the Fish and Wildlife Plan

The initial cost of establishing a fish population in Davenport Center Reservoir will be approximately $16,000. Other initial costs include the provision of fishermen access to the reservoir and tailwaters area. This should include only the cost of boat launching ramps and parking lots needed to accommodate the fishermen.

The annual operation and maintenance cost for the reservoir and tailwater fisheries will amount to about $5,000 and $200 respectively.

Table 2. An Evaluation of the Fish and Wildlife Resources for the Davenport Center Project with the Fish and Wildlife Plan Implemented

Resource Unit	Without the Project: Miles or Acres	Without the Project: Man-days	With the Project: Miles or Acres	With the Project: Man-days	Net Gain Man-days	Net Benefit Dollars
Fishery						
Stream	8.5 mi.	1,700	--	--	--	--
Reservoir	--	--	1,690 ac.	25,400	23,700	47,400
Tailwater	1 mi.	200	1 mi.	1,200	1,000	2,000
Wildlife						
Reservoir	1,690 ac.	800	--	--	--	--
Potential Management Area	--	--	1,400 ac.	800 1/	--	--

1/ Increase in man-days is a result of intensive wildlife management techniques and mitigates project incurred losses.

Not including the purchase of the land, the initial cost of developing the wildlife management area is estimated at $50,000. Annual operation and maintenance costs for the area are approximately $10,000.

RECOMMENDATIONS

In the interest of providing for the full development of the fish and wildlife resources in the planning for the Davenport Center Reservoir project, it is recommended that:

1. The conservation and development of the fish and wildlife resources be among the purposes for which the project is authorized.

2. Reservoir parking facilities capable of accommodating 90 automobiles and 45 boat trailers in addition to the needs of other recreationists be constructed.

3. Fishing be permitted from the upstream face of the dam.

4. A plan for zoning the reservoir and project lands to prevent any conflicts in use be developed cooperatively by U.S. Corps of Engineers, the Bureau of Outdoor Recreation, the New York State Conservation Department, and the Bureau of Sport Fisheries and Wildlife during pre-construction planning.

5. Fishermen access be provided to the tailwaters. This access to include a strip of land about 300 feet in width from the stilling basin and continuing downstream Charlotte Creek for one mile. This access can be assured by purchase of land, or by easement.

6. A multiple-level outlet be installed in the dam to control the physical and chemical qualities of the water releases and that the elevations of the intake openings be determined during pre-construction studies in cooperation with the New York State Conservation Department and the Bureau of Sport Fisheries and Wildlife.

7. A minimum instantaneous flow of 40 second-feet be maintained in Charlotte Creek below the dam throughout the year.

8. To compensate for the wildlife losses resulting from the project, a 1,400 acre block of land on the north side or upper end of the project area be made available to the New York Conservation Department for wildlife management under the terms of a Fish and Wildlife General Plan. The specific location of this land to be determined during post-authorization studies.

9. If the purchase of scenic easements to the lands adjacent to the reservoir area are considered, the New York Conservation Department be given the opportunity to consider the possibilities of expanding such a measure to include public hunting easements.

10. Federal lands and waters in the project area be open to public use for fishing and hunting so long as title to the lands and structures be held by the Federal Government, except for sections reserved for safety, efficient operation, or protection of public property.

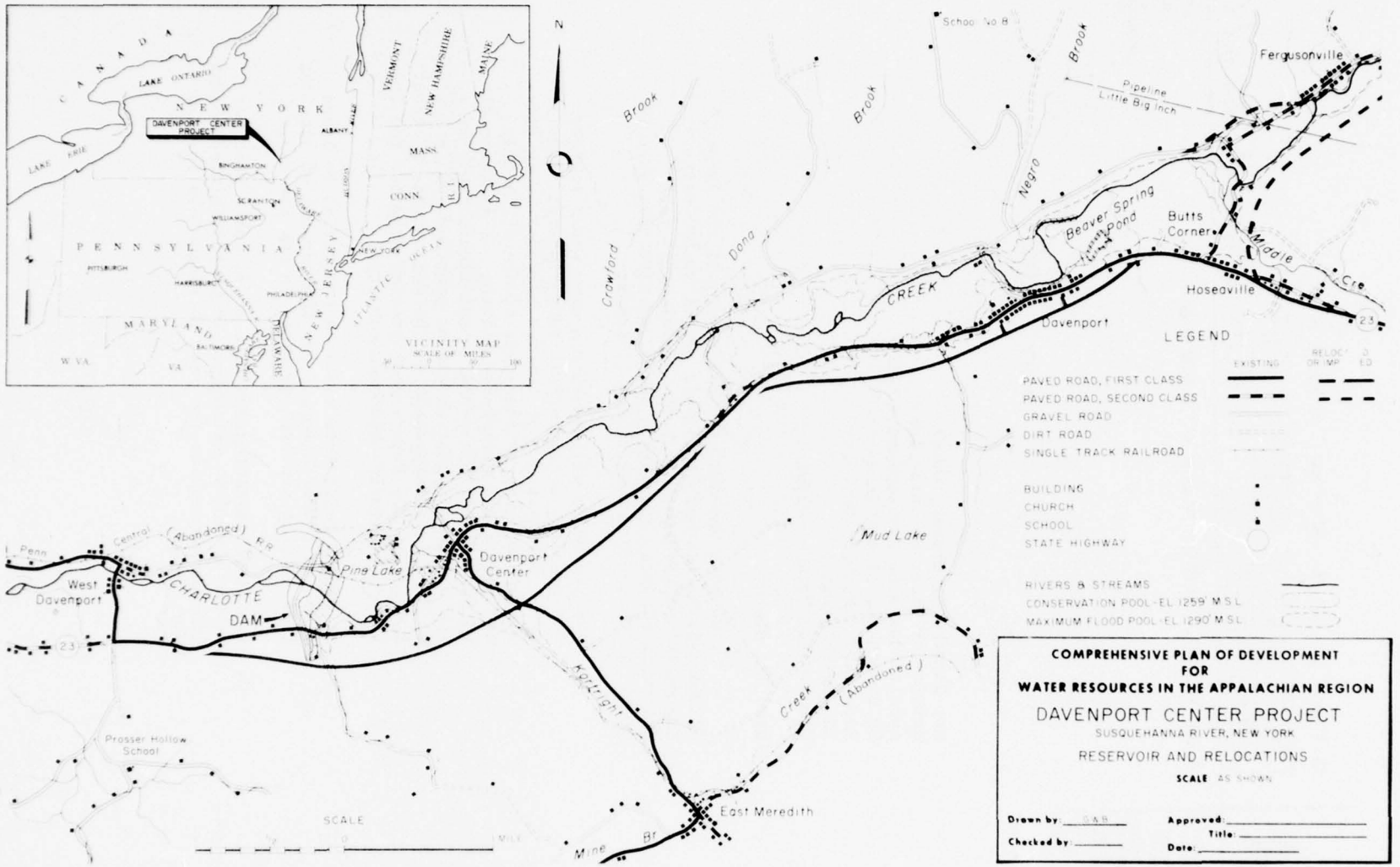
The Bureau's study and recommendations are based on project plans as currently developed. Should your study of the Davenport Center Reservoir project be authorized for advanced engineering and design, it is requested that engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

(Sgd) Richard E. Griffith

Regional Director



COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION

DAVENPORT CENTER PROJECT

SUSQUEHANNA RIVER, NEW YORK

RESERVOIR AND RELOCATIONS

SCALE AS SHOWN

Drawn by S.A.B. Approved:

Checked by Title:

Date:

G-113

STATE OF NEW YORK
CONSERVATION DEPARTMENT *Division of Fish and Game*

ALBANY, NEW YORK 12226

TEWART KILBORNE
Commissioner
MASON LAWRENCE
puty Commissioner
ROBERT E. YOUNG
puty Commissioner
LEIGHTON A. HOPE
Secretary

E. L. Cheatum
Director
GL 7-5690

A. G. Hall
Assistant Director
GL 7-5690

March 15, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development Program
US Department of the Interior
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed the draft copy of the Bureau of Sport Fisheries and Wildlife's report on the Corps of Engineers' Appalachian study of the Davenport Center Reservoir project, New York. We concur with this report except as noted in our following comments:

1. The reservoir will sustain a warm-water fishery and possibly a cold-water trout fishery, as well. Since there is a much greater need for trout fishing opportunity in this part of the State than for additional warm-water fishing, it is desirable to provide for the former. Additional depth in the recreation pool should be provided. This would be especially important to the maintenance of trout fishing in the future when greater drawdown for low flow augmentation becomes necessary.

2. We do not believe it would be beneficial to leave areas of timber standing for the purpose of creating fish habitat and fishing spots in this reservoir.

3. A minimum instantaneous flow of 40 cubic feet per second should be maintained in Charlotte Creek below the dam throughout the year to adequately sustain the fishery.

Mr. Raymond G. Oberst March 15, 1968

If and when your Bureau becomes engaged in further studies related to this project we request that our participation be invited.

Sincerely,

William G. Bentley

William G. Bentley
Acting Director
Division of Fish and Game

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 17, 1968

District Engineer
Buffalo District
U.S. Army Corps of Engineers
Foot of Bridge Street
Buffalo, New York 14207

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Stannard Reservoir Appalachian Project located on the Genesee River, Allegany County, New York, and Potter County, Pennsylvania. The project is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89-4, 89th Congress, 1st Session). This report is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.), in cooperation with the New York State Conservation Department, Division of Fish and Game, and the Pennsylvania Fish Commission and Pennsylvania Game Commission and have their concurrence as indicated by letters dated May 16, 1968, April 10, 1968, and March 26, 1968, respectively. It also has been coordinated with and represents the views of the Bureau of Commercial Fisheries.

Findings and conclusions are based on preliminary engineering data made available by your agency and are predicted on a 100-year projected period of analysis.

We reported on Stannard Reservoir briefly in our February 10, 1967, Needs, Problems, and Solutions Report on the Genesee Basin which was written under the Corps of Engineers' regular program.

DESCRIPTION OF THE AREA

The Stannard dam site is located on the Genesee River in the southern portion of Allegany County in the upper Genesee Basin known physiographically as part of the Allegheny Plateau. The reservoir will

extend into Potter County, Pennsylvania. The headwaters plateau area consists of broad valleys at elevations of 1,000 to 2,000 feet above mean sea level rising to the south, separated by rounded ridges rising 500 feet above the valley floors. The Genesee River falls 600 feet in its uppermost 11 miles within Pennsylvania. From the Pennsylvania border north to Portageville, New York, the fall is 530 feet in 62 miles.

DESCRIPTION OF THE PROJECT

We understand that you are presently considering a plan that will provide for water quality, water supply, irrigation, flood control, general recreation, and fish and wildlife. The following paragraphs describe our understanding of the project as presently contemplated.

The 99-foot earth dam will be located about four miles upstream from Wellsville, New York, controlling 168 square miles of drainage area. At full flood pool (elevation 1625), 1/ the structure will inundate a surface area of 2440 acres. The conservation pool at elevation 1620 will cover 2,330 acres. The Stannard Reservoir project will provide a water supply to meet daily flows at 95 c.f.s. for the proposed pulp and paper mill and weekend flows of 1,000 c.f.s. for three weekends of canoeing, one each in the months of June, July, and August. No flows during these months will be less than 205 c.f.s. The required 95 c.f.s. daily flow will be part of the 205 c.f.s. Of the 95 c.f.s. flow, 15 c.f.s. will be consumptive.

We understand that low-level releases can be provided when needed.

FISH AND WILDLIFE RESOURCES

Without the Project

The Genesee River and its tributaries in the headwater section and in the area of the dam provides outstanding trout fishing. Brown trout are the predominant species. Existing fish populations are supplemented by a stocking program carried out by the New York State Conservation Department, Division of Fish and Game, from Belmont to the Pennsylvania line. Rainbow trout are also present in lesser numbers. The 1968 stocking recommendation is 12,000 brown trout yearlings and 7,200 rainbow trout yearlings in the section from Wellsville to the Pennsylvania line. Although this stretch of river is primarily a coldwater fishing stream, smallmouth bass are present in limited numbers. Special regulations are in effect which allow anglers to keep any size and any number of bass which are caught during the trout season.

1/ All elevations refer to feet above mean sea level.

The State of New York has leasing arrangements or perpetual easements along the stretch of the main stem Genesee to be inundated by the reservoir. Thus, adequate access and heavy use of this stretch of river is assured.

Several good tributary trout streams enter into the Genesee at this locale. Among these are Cryder Creek, Chenunda Creek, Dyke Creek, and Marsh Creek. However, the majority of these streams suffer from low flows and warm water during the summer months.

Presently no pollution problems occur in the immediate reservoir locale. Most pollution sources are largely limited to the downstream segment of the Genesee Basin.

Based on present habitat productivity, fishing pressure, license sales, and projected fishermen increases, it is estimated that the average annual without the project use of the eight-mile segment of Genesee River to be inundated by the reservoir will be approximately 12,800 fishermen-days per year over the next 50 years. The 12-mile stretch of the Genesee River between Stannard and Belmont presently receives significant fishing pressure. This section is stocked predominantly with brown trout and some rainbows. About 9,000 fishermen-days per year valued at $47,250 can be attributed to the 12-mile downstream fisheries. Fisherman usage will increase over the next 50 years as a result of population increases, more leisure time, major highway construction (Southern Tier Expressway), and improved fish management techniques.

A road parallels the river all the way to Belmont providing good access to the Genesee River downstream from the site.

With the Project

Project construction will inundate a stretch of high quality trout stream and create a reservoir approximately eight miles long. Approximately 6.4 miles of the State-leased section of the Genesee River will be inundated as well as one mile of the Genesee River in Pennsylvania and about two miles of Cryder Creek in New York and Pennsylvania. Project construction in this section of the Genesee River will destroy most of the important State-leased segments of the stream in New York and alter the environmental characteristics of the river within the reservoir. The reservoir without management will provide no significant fishery. With management the reservoir, created in the upper basin where lake-type fishing is lacking, will provide excellent trout fishing. The stream fishery downstream from the dam will be improved due to flow regulation.

Supplemental stocking of Stannard Reservoir with rainbow trout by the New York Conservation Department will be required if a significant fishery is created.

Since smallmouth bass exist in the watershed it is possible a two-story fishery would be workable at Stannard Reservoir, e.g., a rainbow trout and smallmouth bass combination. In the summer the surface waters of Stannard would warm up sending trout to deeper colder water. Smallmouth bass fishing could take up the slack period. It is possible that smallmouth bass fishing could be established during early impoundment to help control rough species and utilize the niche not suitable for trout.

Downstream from the reservoir, flows in the Genesee River will be maintained at not less than 205 c.f.s. during the summer months. A daily flow of 95 c.f.s. is needed for the proposed pulp and paper mill below the stannard site and 1,000 c.f.s. is needed for one weekend of canoeing each month during June, July, and August. The 95 c.f.s. daily industrial flow requirement would be part of the 205 c.f.s., and of the 95 c.f.s., 15 c.f.s. would be consumptive. Since facilities for bottom draw off will be available it is expected that a high level trout fishery can be developed and maintained below the site.

Stannard Reservoir will provide 150,000 fisherman-days usage valued at $787,500 over the life of the project. These figures are contingent upon provision of minimum basic fishermen access facilities and zoning of the more productive fishery areas against intensive motor boat use. Other management features such as stocking and regulation of drawdown will be necessary if full benefits are realized.

Based on a minimum flow of 205 c.f.s. together with coldwater releases, the average annual fisherman use of the Genesee River downstream from the reservoir to Belmont (approximately 12 miles) will be about 18,000 fishermen-days over the life of the project -- an increase of 9,000 fishermen-days having a new incidental recreational benefit of $47,250. In other words, it is possible the fishermen use of the downstream section will double with the coldwater releases. Higher utilization will result from better survival and growth of stocked trout, a more productive trout fishery throughout the late summer months, and a substantial increase in angler use.

Wildlife Resources

Without the Project

Most bottom-land areas in the upper reaches of the Genesee River Basin are of only moderate productivity for farm-game species. Many of these same areas are in pasture or some form of farmland, and have only limited value as forest game habitat.

Deer are also abundant in the upper section of the basin. Some pheasants are present. Cottontails are also found in substantial numbers in the areas and flood plain pasture lands are favored by gray and fox

squirrels. Ruffed grouse, gray squirrel, and woodcock are found throughout the forested areas. Some wild turkeys also inhabit the southern portion of the basin.

Although the area is located on the western fringe of the Atlantic Flyway there is currently little significant waterfowl use of this section of the Genesee Basin. Approximately 7,000 annual big game hunter-days and 6,000 small game hunter-days can be attributed to the area without the project. Waterfowl use is estimated at 1,500 hunter-days annually in the vicinity of Stannard Reservoir.

With the Project

The project as planned will have a detrimental effect on wildlife resources, mostly cottontail rabbits and pheasants. Deer losses will be minimal. About 1,400 acres of wildlife habitat will be permanently inundated. It is estimated that the loss of hunter use will average 1,000 hunter-days annually over the economic life of the project mostly due to small game losses. There will be no resulting benefits to wildlife from development of this reservoir other than forming a resting area for waterfowl.

FISH AND WILDLIFE PLAN

Fisheries

Stannard Reservoir would create lake-type fishing opportunities for trout in the upper Genesee Basin where such lakes are notably scarce. The only lakes in this region providing lake-type fishing opportunities are Allen Lake, a man-made lake owned by the New York State Conservation Department and Rushford Lake, a man-made lake owned by the Rochester Gas and Electric Corp.

To provide maximum fisherman utilization and additional access for land-based fishermen, five fishing piers each providing at least 150 feet of fishable length should be constructed adjacent to recreational developments in areas of good fishery habitat. These structures would also serve to attract fish populations. Location of fishing piers should be determined through coordinated efforts between your staff and the New York State Conservation Department, Division of Fish and Game. Rock material from adjacent construction would provide prime material for this purpose; however, wooden piers on piling would be satisfactory. Such fishing piers should be "T" shaped or "L" shaped to provide a maximum of 150 feet of fishable length on both sides in water four feet deep or more. It is estimated that each fishing pier will attract additional use of 2,000 fishermen-days annually.

The increased availability of the fishery resources from these piers would result in an annual enhancement benefit of 10,000 fishermen-days having a net recreational value of $52,500.

In recent years the increasing popularity in pleasure boating has confronted the reservoir fishery manager with an acute problem of conflict with fishing interests. In order to realize proper utilization of the fishery resources it has become necessary to incorporate use of conflicting interests into management plans for Stannard Reservoir. It is inevitable that a conflict of interest will develop at Stannard and a zoning plan should be drawn up during the project planning phases. Specific recommendations for zoning regulations or location of zoned areas should result from coordinated efforts between representatives of this Bureau, the New York State Conservation Department, Division of Fish and Game, the Bureau of Outdoor Recreation, and the Corps of Engineers.

Minimum access facilities for the reservoir would require boat ramps and parking facilities to handle a peak load of 200 cars and boat trailers. Increased fishermen-utilization of the reservoir accruing to enhancement features (fishing pier) would require similar features for another 200 cars. The total parking requirements for fishermen access to the reservoir would be 400 cars and/or trailers. Access space should include provision for land-based fishermen as well and should be distributed as widely as possible around the reservoir in 10 sites. Parking areas for the fishing piers and boat ramps could be combined provided boating activity does not interfere with pier fishermen.

Minimum access facilities for stream fishermen along the Genesee River would require space for 120 fishermen's cars (space for 25 autos should be provided in the first mile downstream from the dam) and the acquisition in fee, or by easement, of much of the west bank between the river and the road. Access should be sufficient to compensate for the loss of New York State's leased fishing rights along the Genesee River due to inundation by Stannard Reservoir.

The downstream fishing opportunities should be improved considerably with the flows and low-level releases being considered. It is essential that downstream water temperatures be between 55-60° F. to maintain a good trout fishery. Downstream releases should be well oxygenated for better survival and growth of trout. Multiple releases with Howell-Bunger aerating devices would accomplish the desired result. A minimum flow of 25 c.f.s. is all that is needed to maintain a fishery equivalent to what's there now. Flows of 205 c.f.s. as planned would improve water quality between Wellsville and Belmont and therefore provide increased fishery benefits estimated at 9,000 fishermen-days annually at a value of $47,250 downstream as far as Belmont. Additional incidental warmwater fishery benefits may be provided below Belmont.

A drawdown of the recreational pool should not exceed five feet during the period April 1 through September 30 each year in order that fishermen can get to the reservoir and in order not to diminish littoral areas which provide food and spawning areas for fish.

Land and water under Federal ownership in the project area should be open to free hunting and fishing except for sections reserved for safety, efficient operation or protection of public property.

With a minimum downstream release of not less than 205 c.f.s. and implementation of the above basic minimum and enhancement facilities it is estimated that the average annual utilization of the reservoir and stream fisheries would be 178,000 fishermen-days having a recreational value of $934,500. Included in this figure are $47,250 and $52,500 attributable to incidental and enhancement benefits, respectively. Table 1 summarizes the fishery benefits expected to occur as a result of the project.

The full commercial fishery potential of Stannard Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the future. The New York State Conservation Department shall determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with other reservoir activities. Such commercial harvesting would utilize for food and possibly industrial use a fishery potential through reduction of rough fish populations. The reservoir's commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 35,000 pounds of food and industrial fishes per year.

Table 1. Effects of Stannard Reservoir Project on Fishery Resources Assuming Implementation of the Fish and Wildlife Plan

	Without Project		With Project	With Project & Mgt.		Net Benefit	
	M/D	Value	M/D	M/D	Value	M/D	Value
Genesee R. (8 mi. stream inundated by reservoir)	12,800	$67,200	0	150,000	$787,500	137,200	$720,300
Fishing piers (5)	0	--	--	10,000	52,500	10,000	52,500
Genesee R. (12 mi. stream below reservoir)	9,000	47,250	9,000	18,000	94,500	9,000	47,250
TOTALS	21,800	$114,450	9,000	178,000	$934,500	156,200	$820,050

Wildlife

The wildlife loss of 1,000 hunter-days attributable mostly to small game can be mitigated by making available for hunting all public lands acquired at the site that are not required for project operation, safety, or intensive recreational development.

Public hunting and wildlife habitat management should be a part of the land-use program, consistent with other purposes of the project, on all Federally-owned lands acquired in conjunction with the Stannard Reservoir project. Through close coordination among cooperating agencies during project planning, maximum multiple-use development can be assured between operational, recreational, and wildlife interests.

Cost of the Fish and Wildlife Plan

The initial cost of establishing a fish population in the reservoir which includes survey, pre-impoundment fish control, and stocking would approximate $6,700. The annual cost, based on 100-year project life and a 3¼ percent interest rate would be $227.

Reservoir fishermen access, including parking lots and boat launching ramps, would total about $80,000, or $2,710 annually.

Costs of reservoir fishery operation and maintenance, including such things as corrective stocking, fish population control, post impoundment surveys, and the maintenance of fisherman access facilities would total about $8,000, which would be borne by the New York State Conservation Department, Division of Fish and Game.

Operation and maintenance costs of downstream fishing facilities would total about $1,000 annually and would be borne by the New York State Conservation Department, Division of Fish and Game.

Costs of land acquisition, or easements, needed downstream to compensate for the loss of New York States' leased fishing rights along the Genesee River due to inundation by Stannard Reservoir is about $2,000. These costs should be borne by the project and be non-reimbursable.

It is estimated that the five fishing piers will cost $15,000 each to construct. Floating piers would be used at a much cheaper cost but are not as permanent, requiring maintenance.

RECOMMENDATIONS

We recommend --

1. That five fishing piers either "L" shaped or "T" shaped be constructed in Stannard Reservoir at an estimated project cost of approximately $15,000 each.

2. That fisherman access, including parking areas and launching ramps to accommodate 400 fishermen's cars and boat trailers, be constructed at Federal cost at strategic locations around the reservoir.

3. That fisherman access to the west bank, including parking areas to accommodate a total of 120 fishermen's cars, be provided at Federal cost along the Genesee River downstream from the dam.

4. That a program of reservoir zoning be developed in cooperation with the New York State Conservation Department, Division of Fish and Game, Corps of Engineers, Bureau of Outdoor Recreation and this Bureau, to permit the best fishermen use of the better fishery habitat.

5. That a minimum downstream release be as large as possible without seriously reducing the recreational uses of the reservoir. In no event should the minimum release be less than 50 c.f.s.

6. That the drawdown of the recreational pool not exceed five feet during the period April 1 through September 30 each year.

7. That the temperature of the downstream flows be maintained between 55-60° F.

8. That multiple level outlets with aerating devices such as the Howell-Bunger valves be included as facilities in the Stannard Dam.

9. That public hunting and wildlife habitat management be a part of the land-use program, consistent with other purposes of the project, on all Federally-owned lands acquired in conjunction with the Stannard Reservoir project.

10. That additional modifications to achieve maximum project benefits be made in project facilities or operations, subsequent to completion of construction, as may be desirable to obtain maximum overall project benefits, on the basis of follow-up studies by this Bureau to improve or supplement measures taken for the conservation and development of fishery resources.

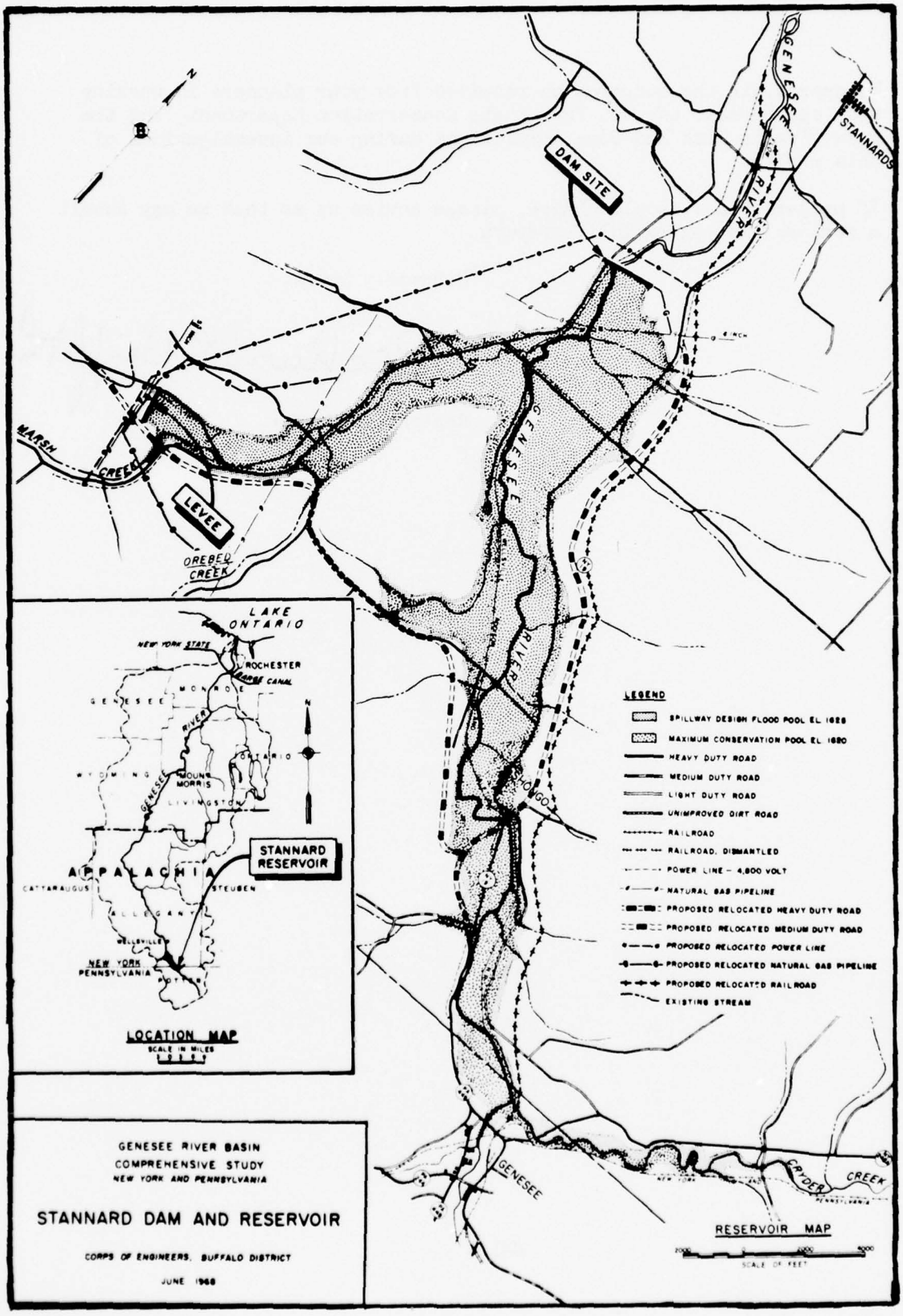
We appreciate the cooperation received from your planners in working with our Bureau, the New York State Conservation Department, and the Pennsylvania Fish and Game Commissions during our investigations of this project.

If project plans should change, please advise us so that we may submit a revised fish and wildlife report.

Sincerely yours,

Richard E. Griffith

Regional Director


DAM SITE
STANNARDS
GENESEE RIVER
MARSH CREEK
LEVEE
OREBED CREEK
LAKE ONTARIO
NEW YORK STATE
ROCHESTER
GENESEE
MONROE
LIVINGSTON
APPALACHIA
STEUBEN
ALLEGANY
NEW YORK
PENNSYLVANIA
STANNARD RESERVOIR
LOCATION MAP
SCALE IN MILES
LEGEND
SPILLWAY DESIGN FLOOD POOL EL. 1628
MAXIMUM CONSERVATION POOL EL. 1580
HEAVY DUTY ROAD
MEDIUM DUTY ROAD
LIGHT DUTY ROAD
UNIMPROVED DIRT ROAD
RAILROAD
RAILROAD, DISMANTLED
POWER LINE - 4,800 VOLT
NATURAL GAS PIPELINE
PROPOSED RELOCATED HEAVY DUTY ROAD
PROPOSED RELOCATED MEDIUM DUTY ROAD
PROPOSED RELOCATED POWER LINE
PROPOSED RELOCATED NATURAL GAS PIPELINE
PROPOSED RELOCATED RAILROAD
EXISTING STREAM
GENESEE
CRYDER CREEK
RESERVOIR MAP
SCALE OF FEET
GENESEE RIVER BASIN
COMPREHENSIVE STUDY
NEW YORK AND PENNSYLVANIA
STANNARD DAM AND RESERVOIR
CORPS OF ENGINEERS, BUFFALO DISTRICT
JUNE 1968

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
P.O. BOX 1673
HARRISBURG 17120

April 10, 1968

CFN ✓ EHR ___
EIA ___ ___
PCS ___ ___
JLG ✓ ___
JEH ___ EJH ___
JMM ___ FILES ___

Mr. Norrel F. Wallace, Supervisor
Division of River Basin Studies
U. S. Fish and Wildlife Service
55 Pleasant Street
Concord, New Hampshire 03301

Dear Mr. Wallace:

Thank you for the copy of the draft of your conservation and development report on Stannard Reservoir, New York and Pennsylvania.

Since only a minor portion of the proposed impoundment would lie in Pennsylvania, we concur with your report which we are sure was developed in conjunction with the New York State Conservation Department. We have only a few comments.

We were pleased to see in the draft a recommendation for establishing fishing piers in the impoundment. We believe this type facility will greatly increase utilization of the fishery.

Apparently the entire impoundment would be managed for trout and supplemental plantings would be needed. While we have nothing against this type management, we are wondering if warmwater species do not now exist in the watershed and will therefore appear in the impoundment. If this is true possibly some consideration should be given to establishing suitable warmwater game species during early impoundment--to help control rough species and to utilize the niche not suitable for trout.

Sincerely yours,

Gordon L. Trembley

Gordon L. Trembley
Assistant Executive Director
Fisheries

GLT:p

cc: Comm. Rankin
Keen Buss

RECEIVED
APR 1 1968
BRANCH OF RIVER BASINS
CONCORD AREA OFFICE

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
P. O. BOX 1567
HARRISBURG, PA. 17120

OFFICE OF
EXECUTIVE DIRECTOR
TELEPHONE
AREA CODE 717 - 787-3633

ADMINISTRATIVE DIVISIONS:

ACCOUNTING	787-3076
ADMINISTRATION	787-5670
INFORMATION & EDUCATION	787-6286
LAW ENFORCEMENT	787-5749
LAND MANAGEMENT	787-6810
LAND TITLES	787-6568
MINERALS	787-2162
PROPAGATION	787-6711
RESEARCH	787-5529

March 26, 1968

CFN NW EHR ___
EIA ___ ___
FCB ___ RMB ___
JLG gls ___
JEH ___ BJH ___
JMM ___ FILES ___

Mr. Norrel F. Wallace
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
55 Pleasant Street
Concord, New Hampshire 03301

Dear Mr. Wallace:

We have reviewed the conservation and development report on Stannard Reservoir, Genesee River Basin, in Pennsylvania and New York.

A very small section of this dam is within Pennsylvania; losses will be at a minimum. We concur with your report.

Very truly yours,

Glenn L. Bowers
Executive Director

G-128

RECEIVED
MAR 27 1968
BRANCH OF RIVER BASINS
CONCORD AREA OFFICE

STATE OF NEW YORK
CONSERVATION DEPARTMENT

ALBANY, NEW YORK 12226

STEWART K. BLOOMER
Commissioner
MASON LAWRENCE
Deputy Commissioner
LEIGHTON A. HOPE
Deputy Commissioner
ROBERT E. YOUNG
Deputy Commissioner
IRWIN H. KING
Secretary

May 16, 1968

Mr. Raymond G. Oberst, Acting Chief
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed the draft copy of the Bureau of Sport Fisheries and Wildlife's report on the Stannard Reservoir project, New York, and have the following comments.

In the last line on page 7, change "500 hunter-days" to read "1,000 hunter-days". The same change should also be made on page 12 in the first line under "Wildlife".

On page 8 the second sentence under "Fisheries" should be changed to read "The only lakes in this region providing lake-type fishing opportunities are Allen Lake, a man-made lake owned by the New York State Conservation Department and Rushford Lake, a man-made lake owned by the Rochester Gas and Electric Corporation."

On page 10 the next to the last paragraph should be changed to read "A drawdown of the recreational pool should not exceed five feet during the period April 1 through September 30 each year in order that fishermen can get to the reservoir."

Otherwise we concur with this report.

Sincerely,

A. G. Hall, Director
Division of Fish and Game

STATE OF NEW YORK
CONSERVATION DEPARTMENT

ALBANY, NEW YORK 12226

STEWART KILBORNE
Commissioner
MASON LAWRENCE
Deputy Commissioner
LEIGHTON A. HOPE
Deputy Commissioner
ROBERT E. YOUNG
Deputy Commissioner
IRWIN H. KING
Secretary

May 20, 1968

Mr. Raymond G. Oberst, Acting Chief
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

Further regarding our letter to you of May 16 confirming telephone conversation with your office with reference to the review and comment of the Bureau of Sport Fisheries and Wildlife Service's report on Stannard Reservoir, the second to the last paragraph in our letter was in error and should have read as follows.

"A drawdown of the recreational pool should not exceed five feet during the period April 1 through September 30 each year in order that fishermen can get to the reservoir, and in order not to diminish littoral areas which provide food and spawning areas for fish."

Sincerely,

A. G. Hall, Director
Division of Fish and Game

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

September 7, 1967

District Engineer
Philadelphia District
U.S.Army Corps of Engineers
Custom House
Second and Chestnut Streets
Philadelphia, Pennsylvania 19106

Dear Sir:

This is the Bureau of Sport Fisheries and Wildlife's report on the proposed local flood control project for Delhi, New York, as authorized by the Appalachian Regional Development Act of 1965 (Section 206, P.L. 89-4). It has also been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.), in cooperation with the New York State Conservation Department, Division of Fish and Game. That agency's concurrence in the report is expressed in a letter dated July 13, 1967.

We have reviewed the plans for flood control on West Branch of the Delaware River within the village of Delhi, Delaware County, New York, as described in your reconnaissance report of August 1966. The proposed improvements are indicated on the attached map (Plate 1). A 3,300 foot levee would be constructed from State Highway 28, opposite the north end of Page Avenue, and extend along the west bank of the river to Kingston Street. The Kingston Street bridge will be rebuilt. The river channel would be straightened and widened to approximately 175 feet between Kingston and Bridge Streets by cutting and filling. A reinforced flood wall will be constructed along the east bank of the river and will extend downstream for about 800 feet from Bridge Street. The proposed plan provides for a lighted concrete footpath with benches along the entire levee. Concrete stairs will provide access to the stream at 300 foot intervals.

The fishery resources in the West Branch of the Delaware River are of high value. The river provides excellent habitat for trout and chain pickerel. Fishing pressure on that part of the river which will be influenced by the project ranges from high within the village of Delhi to moderate for several miles downstream. These segments of river presently provide annually about 600 and 1,000 angler-days, respectively.

The project will be harmful to the fishery resources. Widening the channel to 175 feet for one-third mile will make the river so shallow it will be virtually useless as fishery habitat. Fishing in this area would be insifnificant with the project. During construction additional losses could also occur to the fishery in the river for several miles downstream if the borrow and fill operations cause high turbidity during the peak of spring fishing or fall spawning periods of the trout. Although this would be a one-time loss, it could amount to at least 700 man-days of fishing.

Wildlife resources within the project area are of low value because of residential developments and therefore no significant damage to these resources will occur with the project.

Losses to the fishery resources of the West Branch of the Delaware River could be minimized if certain measures are incorporated in the construction plans for the project. Loss of habitat from channel widening could be partially mitigated if the river bottom were covered with rock material and if stream deflectors were placed in the channel to provide for proper water movement during low flows. The New York State Conservation Department will cooperate and provide the technical assistance needed to incorporate these features into the project design. These measures, together with the proposed access development along the levee, would mitigate losses by about 400 man-days fishing annually, worth $800. Scheduling project construction, specifically the channelization, during July or August would lessen the detrimental effects to the fishery. If this could be accomplished, it would prevent a loss of about 600 man-days fishing during the construction period, valued at $1,200.

On the basis of the above discussion, the Bureau of Sport Fisheries and Wildlife recommends that:

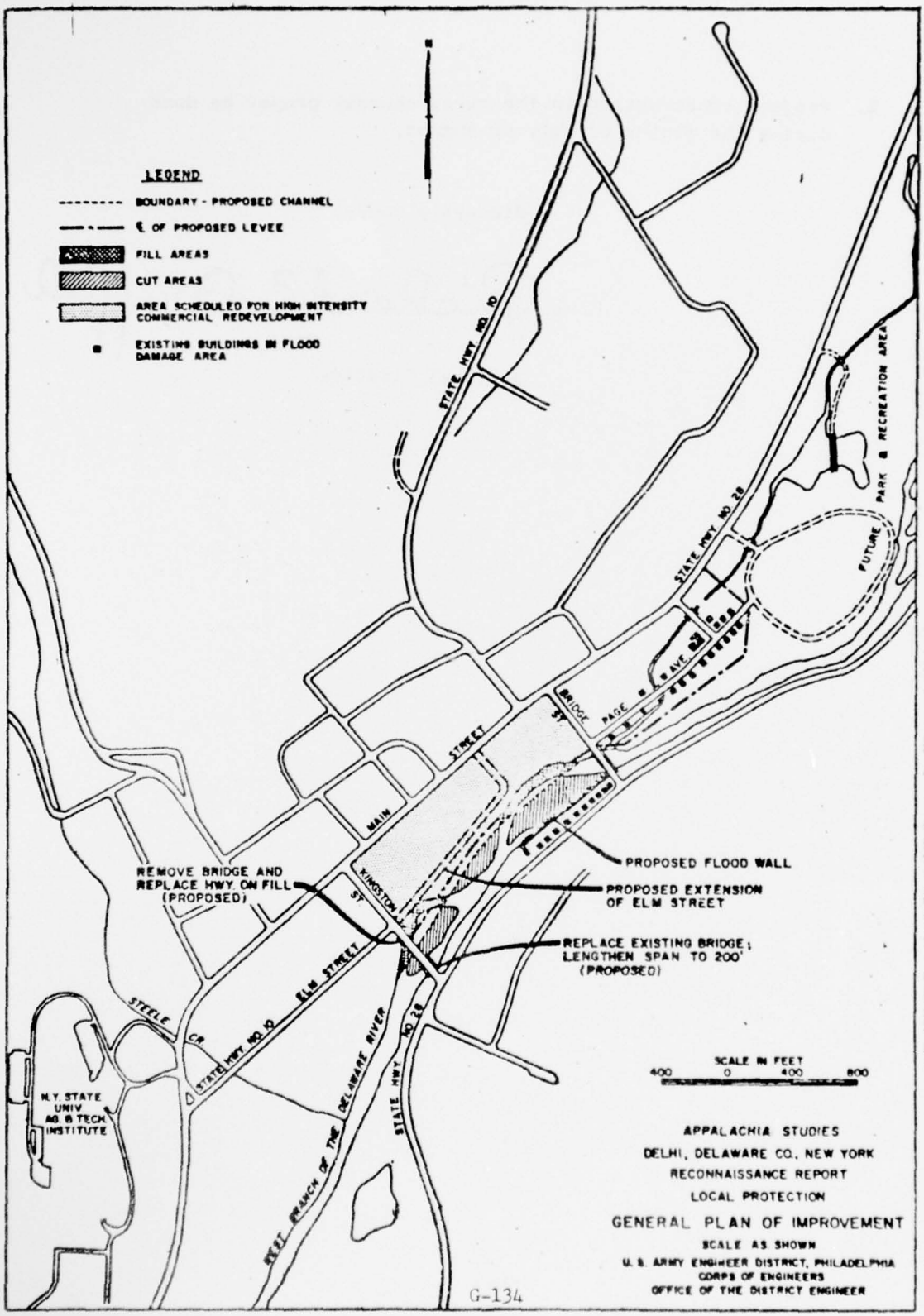
1. The assistance of the New York State Conservation Department be solicited to provide a plan for stream improvement, and that such a plan be incorporated into the project.

2. Project construction in the river channel proper be done during the months of July or August.

Sincerely yours,

Richard E. Griffith

Regional Director


LEGEND
BOUNDARY - PROPOSED CHANNEL
℄ OF PROPOSED LEVEE
FILL AREAS
CUT AREAS
AREA SCHEDULED FOR HIGH INTENSITY COMMERCIAL REDEVELOPMENT
EXISTING BUILDINGS IN FLOOD DAMAGE AREA
STATE HWY NO 10
STATE HWY NO 28
FUTURE PARK & RECREATION AREA
BRIDGE ST
PAGE AVE
MAIN STREET
KINGSTON AVE
ELM STREET
STEELE CR
STATE HWY NO 10
DELAWARE RIVER
STATE HWY NO 28
WEST BRANCH OF THE DELAWARE RIVER
N.Y. STATE UNIV AG & TECH INSTITUTE
REMOVE BRIDGE AND REPLACE HWY ON FILL (PROPOSED)
PROPOSED FLOOD WALL
PROPOSED EXTENSION OF ELM STREET
REPLACE EXISTING BRIDGE; LENGTHEN SPAN TO 200' (PROPOSED)
SCALE IN FEET
400 0 400 800
APPALACHIA STUDIES
DELHI, DELAWARE CO., NEW YORK
RECONNAISSANCE REPORT
LOCAL PROTECTION
GENERAL PLAN OF IMPROVEMENT
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, PHILADELPHIA
CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER

STATE OF NEW YORK
CONSERVATION DEPARTMENT *Division of Fish and Game*

ALBANY, NEW YORK 12226

R. STEWART KILBORNE
Commissioner
CECIL E. HEACOX
Deputy Commissioner
W. MASON LAWRENCE
Deputy Commissioner
ROBERT E. YOUNG
Deputy Commissioner
LEIGHTON A. HOPE
Secretary

E. L. Cheatum
Director
GL 7-5690

A. G. Hall
Assistant Director
GL 7-5690

July 13, 1967

Mr. Donald H. Reese,
Chief, Appalachian Area
Development Program
U.S. Fish and Wildlife Service
Room 6405, Federal Building
550 Main Street
Cincinnati, Ohio 4502

Re: Review Draft on local flood protection project, West Branch Delaware River, Delhi, New York

Dear Mr. Reese:

Commissioner Kilborne has asked me to thank you for your letter of June 20. We concur in your review draft concerning this flood control project.

Sincerely,

E. L. Cheatum
Director
Division of Fish and Game

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

April 26, 1968

District Engineer
Nashville District, Corps of Engineers
306 Federal Office Building
Nashville, Tennessee 37202

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife on the plan for hydroelectric power development and recreation, including fish and wildlife, at the Parker Branch Reservoir site on Rockcastle River, Kentucky. This report has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 incl.), in cooperation with the Kentucky Department of Fish and Wildlife Resources. It has the concurrence of that agency as indicated by letter dated March 11, 1968. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

The Bureau of Sport Fisheries and Wildlife previously issued a preliminary report on the Rockcastle River project, dated July 22, 1964, which included the Parker Branch site.

INTRODUCTION

Pursuant to the Appalachian Regional Development Act of 1965; Sec. 206, the Secretary of the Army was authorized and directed to prepare a comprehensive plan for the development and efficient utilization of the water and related resources of the Appalachian Region, especially as it might enhance the economy of the region. Several Federal agencies, including the Department of the Interior, were authorized to assist in the preparation of the plan. This project is one which has been selected for study in response to the Act.

This report is based on engineering data contained in the U.S. Army Corps of Engineers' survey report on Rockcastle River, Kentucky, dated July, 1964. The evaluations have been made in accordance with Senate Document Number 97, Supplement 1, 87th Congress, 2nd Session, entitled "Evaluation Standards for Primary Outdoor Recreation Benefits." Populations within

the project are based on trends as expressed in the developmental "benchmarks" for the Appalachian region. Benefits for the project are dependent upon the implementation of the plan for development of the fish and wildlife resources.

DESCRIPTION OF THE AREA

The project area lies within the upper part of the Rockcastle River watershed in Rockcastle, Laurel, Jackson, and Clay Counties, Kentucky. The Rockcastle River is a principal tributary of the Cumberland River and is formed by the confluence of the Middle and South Forks. The river flows in a southwesterly direction and empties into Lake Cumberland. There are no stream flow records for the river in the project area, but calculated estimates for the average annual and minimum monthly flows are 445 and 1.6 second-feet, respectively.

The topography is mountainous and the ridges and slopes are forested with a mixed pine-hardwood type. The Horse Lick Creek and Middle Fork drainages in the project area are characterized by narrow valleys with steep slopes which restrict agricultural activity. In contrast, the South Fork flows through a rather shallow, broad valley which is farmed extensively. The farm units consist of pasture, tobacco plots, meadows, and small corn fields. Most of the land in the project area is privately owned with the exception of 1,616 acres in Daniel Boone National Forest. Approximately one half of the project area is within the National Forest boundary.

The population of the counties in the project area was 68,660 according to the 1960 census. London, the largest town, contained a population of a little over 4,000 people. It is estimated that these counties will increase in population to about 80,000 people by the year 2020.

DESCRIPTION OF THE PROJECT

The proposed Parker Branch Dam will be located at mile 49.3 on Rockcastle River in Rockcastle and Laurel Counties, Kentucky. The main purposes of the project are hydroelectric power production and recreation. The dam will be a rockfill structure, 161 feet high, and 900 feet long. An uncontrolled spillway will be constructed in a saddle on the right bank located approximately 2,000 feet upstream from the dam. The power plant will consist of a single unit of 22,400 kilowatts capacity. Pertinent engineering data are presented in table 1.

Table 1. Engineering Data, Parker Branch Reservoir project, Kentucky

Pool	Elevation 1/	Surface Acres	Stream Miles Inundated
Power	1,000	8,700	62
Summer	997	8,200	60
Minimum	976	5,100	--

The project operation will be principally for hydroelectric power production. Although flood control is not a project purpose, the power pool could be used for flood storage.

Power production at the Parker Branch project will probably be on a peaking basis. The power plant will operate from 2 to 4 hours each weekday and shut down on weekends. The water use of the power plant at maximum, normal, and minimum capacity is 3,200, 2,650, and 2,540 second-feet, respectively. During shutdowns, the turbine leakage and structural seepage will be about 15 second-feet.

Parker Branch Reservoir will provide a rather stable pool during the recreation season. Although the maximum drawdown is 24 feet, the average level of the reservoir during May through September will be at elevation 997. This will provide a pool of about 8,200 surface acres.

Approximately 23,300 acres of land will be acquired for the project. This includes: (1) land for the damsite, construction area, and permanent structures; (2) the reservoir area and a minimum of 300 feet horizontally from the top of the power pool; (3) severance land; and (4) land for public use.

FISHERY RESOURCES

Without the Project

The Rockcastle River and several tributaries affected by the project, provide 103 miles of excellent stream habitat and high quality fishing. Major game fishes include walleye, largemouth bass, smallmouth bass, spotted bass, rock bass, and various other sunfishes. Catfish,

1/ Elevations are in feet above mean sea level.

suckers, drum, and carp also contribute to the fishery. According to recent stream surveys, several tributaries in the project area are considered as important trout streams and are being stocked with rainbow trout. These include the Horse Lick Creek, Indian Creek, Laurel Fork, and Clover Bottom tributaries. In addition to being a fine fishing stream, the Rockcastle River serves as a major spawning area for the walleye and white bass fisheries of Lake Cumberland.

Rockcastle River is relatively free of pollution. Occasionally, drainage from abandoned coal mines on Raccoon and Little Raccoon Creeks causes adverse effects to fish and other aquatic life in the South Fork of the Rockcastle River. Fish kills in this area occur during periods of heavy rains, which flush coal mines of accumulated acid waste.

With the exception of a major portion of the South Fork, the Rockcastle River and its tributaries flow through Daniel Boone National Forest. Within the forest, the topography is rugged, wilderness in character with limited access. The State of Kentucky's "Preliminary Kentucky Outdoor Recreation Plan" recommends that Rockcastle River from Parker Branch downstream be classified as a wild river with a free flow.

The river provides scenic beauty along its entire length. Fishing is performed primarily by bank fishermen. However, a section of the main river from Livingston to Highway 80 bridge receives heavy use by float fishermen. It is estimated that Rockcastle River from the Narrows upstream to the damsite provides 2,000 man-days of fishing, annually. In the proposed reservoir area the river and tributaries receive 1,900 fishermen-days use each year.

With the Project

The overall effects of the Parker Branch project will be detrimental to the fisheries resources. Directly affected will be more than 103 miles of the Rockcastle River and its tributaries with additional indirect influences on the Lake Cumberland fishery.

The reservoir will inundate more than 62 miles of the upstream portion of the river and its tributaries, causing a loss of 1,900 angling days of stream fishing annually. The 41-mile segment of the river downstream from the dam to the Narrows will be adversely affected by two aspects of project operation. The first aspect concerns the production of hydroelectric power on a peaking basis. The stream flow of Rockcastle River immediately below the dam is expected to receive daily variations ranging from a minimum of 15 second-feet to a maximum of 2,650 second-feet. This will not only destroy the stream habitat, but a safety hazard stemming from stream fluctuations will be created as well.

Secondly, releases from the lower-levels of the reservoir will result in discharges of poor water quality.

Thermal stratification of the reservoir from May through September will promote conditions whereby the lower levels of the impoundment could become cold and nearly devoid of dissolved oxygen. In turn, lethal levels of undesirable gases will likely develop. The combination of these operational aspects will seriously reduce the productive capabilities of the river and also restrict fishermen use. This will result in a loss of approximately 1,500 man-days of fishing annually in the 41-mile downstream segment.

The Lake Cumberland white bass and walleye fisheries will also be damaged as a result of the project operation. The low temperature of the water released from the lower levels of the reservoir will prevent these species from spawning in Rockcastle River. In addition, the wide variation in flows will reduce or possibly eliminate the value of the river as a spawning area. About 25 percent of Lake Cumberland's total white bass reproduction occurs in the Rockcastle River. Its loss will reduce the fishing effort for white bass and walleyes on Lake Cumberland by approximately 150,000 and 5,000 man-days a year respectively.

Parker Branch Reservoir is expected to become an average warmwater fishery. The summer pool will provide a surface area of 8,200 acres. Most of the fishing pressure at this reservoir will result from a redistribution of fishing activity from other impoundments in the area. Increased activity of fishermen in the immediate vicinity will result in an increase of 26,000 fishermen-days annually of reservoir fishing.

The full commercial fishery potential of Parker Branch Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of the individual reservoirs as part of an overall interlocking system may be feasible in the near future. The Kentucky Department of Fish and Wildlife Resources shall determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with other reservoir activities. Such commercial harvesting would utilize for food and possibly industrial use a fishery resource potential through reduction of rough fish populations. The reservoir's commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 125,000 pounds of food and industrial fishes per year.

WILDLIFE RESOURCES

Without the Project

Habitat conditions for wildlife species within the Parker Branch Reservoir area are diversified. Narrow river bottoms bordered by steep slopes and bluffs characterize the Rockcastle River and Horse Lick Creek, Middle Fork tributaries. This area is principally forested and includes a few scattered farm units and abandoned croplands. Forest game species common to the area are white-tailed deer, gray squirrels, ruffed grouse, and raccoon. The bottom lands of the South Fork of Rockcastle River are broad and farmed extensively. Only scattered stands of timber are present. Farm game species include bobwhite quail and cottontail rabbits. Turkeys are found throughout the project area in limited numbers, but are reported to be increasing. A turkey season recently was opened in Jackson, Laurel, and Rockcastle Counties. Waterfowl use of the area is insignificant.

It is estimated that hunting in the proposed project area will amount to about 2,400 man-days annually.

With the Project

Parker Branch Reservoir will destroy 8,700 acres of wildlife habitat. This will eliminate an estimated 2,400 hunter-days annually. The reservoir will provide a resting area for waterfowl, but only a slight increase in numbers is expected. Lands adjacent to the reservoir will not be appreciably affected.

FISH AND WILDLIFE PLAN

The Parker Branch project will be detrimental to the fish and wildlife resources. However, if certain measures in the project plan are implemented, the adverse effects to these resources would be nullified.

The following plan is proposed for developing the fish and wildlife resources of the Parker Branch Reservoir. The fish and wildlife evaluations presented in its plan are contingent upon full implementation of the measures suggested for the conservation and utilization of these resources.

Fishery

The project under the Fish and Wildlife Plan is expected to provide an annual net gain of about 29,000 man-days of fishing use, valued at $35,000. Approximately 4,900 man-days of the net gain would be attributable to the tailwater fishery. In addition, the losses to the Lake Cumberland white bass and walleye fisheries would be prevented. The fishery evaluations are summarized in table 2.

The Kentucky Department of Fish and Wildlife Resources will determine and initiate the management practices that will be needed to establish and maintain the fisheries in the reservoir and Rockcastle River downstream from the dam. To accomplish this, portions of the reservoir and stream should be placed under the management of the State agency under the terms of a General Plan for Fish and Wildlife Management.

To insure adequate fishermen access to the reservoir, parking and launching facilities should be provided at various locations to accommodate a design load of 670 automobiles, in addition to that required by other interests. Approximately 220 of the parking spaces should be large enough to accommodate cars with boat trailers. Certain roads leading to the reservoir should not be abandoned, but be maintained for fishermen access.

Fishing should be permitted from the upstream face of the dam. The gradual slope of the dam together with the rock riprap often tends to attract and concentrate fish in this area.

Areas of standing timber in a reservoir create important habitat for some species of fish and also provide good fishing locations. Before plans for clearing the reservoir become final, selection of certain cove areas not to be cleared of timber should be determined by the Kentucky Department of Fish and Wildlife Resources, the U.S. Forest Service and the Bureau of Sport Fisheries and Wildlife in cooperation with the U.S. Army Corps of Engineers.

A plan for zoning the reservoir should be developed cooperatively by all of the agencies responsible for the recreation activities. Such a plan would prevent possible conflicts with regard to the use of the impoundment.

The maintenance of the fishery downstream from the dam will require releases of water from the reservoir of suitable temperature and quality. In this regard, a multiple level outlet should be installed to provide for the regulation of the quality and temperature of the water released. In addition to the downstream segment per se, proper water temperature and quality must also be maintained to prevent any detrimental effects to the white bass and walleye fisheries of Lake Cumberland.

It will be necessary to stabilize the downstream flows which will vary greatly as a result of peak-power operation. The daily occurrence and magnitude of these variations will adversely affect the fisheries of both the Rockcastle River and Lake Cumberland. To prevent the occurrence of these effects, a sub-impoundment with a regulated outlet should be constructed downstream from Parker Branch Dam. This structure will store the water discharged during power operations and release it at a constant rate. The regulating reservoir should have enough

capacity to store the maximum power release of 2,650 second-feet for a four-hour period. This will insure a sufficient water supply to provide adequate flows in the river during the weekend period when power operations will be shut down. The sub-impoundment should be constructed as close to the Parker Branch Dam as the project operation will permit. Fishermen access to the regulating reservoir and the stream immediately below it should be provided.

To properly sustain the fishery of the Rockcastle River, releases from Parker Branch Reservoir should be of sufficient magnitude to maintain a minimum instantaneous flow of 100 second-feet downstream at the Narrows (river mile 8.7).

Wildlife

The project will be detrimental to the wildlife resources and result in a loss of 2,400 man-days of hunting annually. Lands acquired by the project will provide for partial and possibly the entire mitigation of the wildlife resources. The degree of mitigation will depend on the amount and location of the lands acquired. A special effort should be made to compensate for the wildlife losses as described below.

Over 1,600 acres of U.S. Forest land will be required for the project. From the standpoint of the wildlife resources, these acreages should be replaced, if possible. The Kentucky Department of Fish and Wildlife Resources and the U.S. Forest Service have suggested two primary areas where replacement lands would be suitable for wildlife management. The locations, in order of preference, are the lands bordering Crooked Creek just west of the project area and lands surrounding the upstream portion of Horse Lick Creek. The Kentucky Department of Fish and Wildlife Resources, the U.S. Forest Service, and the Bureau of Sport Fisheries and Wildlife will coordinate with the U.S. Corps of Engineers to determine the exact locations of these replacement lands during preconstruction planning.

Additional blocks of land may be acquired by the project adjacent to the South Fork of the Rockcastle River arm of the reservoir. Project lands in this area should be made available to the Kentucky Department of Fish and Wildlife Resources for wildlife management under the terms of a Fish and Wildlife General Plan.

Estimated Costs of the Fish and Wildlife Plan

The initial cost of establishing a fishery in Parker Branch Reservoir would be approximately $20,000. This would include the cost of pre-and post-impoundment studies and the initial management measures to establish the fishery. Other initial costs would result from providing fishermen access to the reservoir and sub-impoundment and should include

Table 2. Effects of the Parker Branch Project on the Fish and Wildlife Resources

Unit	Without the Project: Miles or Acres	Without the Project: Man-days Use	With the Project: Man-days Use	Fish & Wildlife Plan Implemented With the Project: Miles or Acres	Fish & Wildlife Plan Implemented With the Project: Man-days Use	Net Increase Man-days	Net Annual Value
Fishery							
Stream	62 mi	1,900	--	--	--	--	--
Reservoir	8,100 ac	--	26,000	8,100 ac	26,000	24,100	$20,300
Downstream	41 mi	2,000	500	34 mi	6,900	4,900	$14.700
Lake Cumberland	N/A						
White Bass Fishing		600,000	450,000	--	600,000	--	
Walleye Fishing		5,000	--	--	5,000	--	
Wildlife							
Reservoir	8,700 ac	2,400	--	--	--	--	
Mitigation lands							
Within National Forest 1/				1,600 ac	2,000		
Outside National Forest 2/							

1/ It is proposed that approximately 1,600 acres of National Forest land be replaced in the Crooked Creek or Horse Lick Creek areas. These lands would be managed for wildlife under the terms of an existing cooperative agreement between the Kentucky Department of Fish and Wildlife Resources and the U.S. Forest Service.

2/ Certain lands purchased as part of the project in the vicinity of the South Fork arm of the reservoir should be made available to the Kentucky Department of Fish and Wildlife Resources for wildlife management under the terms of a Fish and Wildlife General Plan.

only the cost of the boat launching ramps and parking lots needed to accommodate the fishermen. These costs will be determined by the construction agency.

The annual operation and maintenance cost for fisheries management of the reservoir would be about $8,000. Although no initial costs are expected for fisheries downstream, there will be an annual operation and maintenance cost resulting from the project amounting to approximately $500.

There will be some initial and annual operation and maintenance costs associated with wildlife management practices. These costs cannot be established until it is known what lands will be made available to the Kentucky Department of Fish and Wildlife Resources.

RECOMMENDATIONS

In the interest of providing for the full development of the fish and wildlife resources in the planning for the Parker Branch project, it is recommended that:

1. The conservation and development of the fish and wildlife resources be among the purposes for which the project is authorized.

2. Parking and boat launching facilities be provided at several locations on the reservoir that will be capable of accommodating 670 automobiles and 220 boat trailers in addition to the needs of other recreationists.

3. Fishing be permitted from the upstream face of the dam.

4. Standing timber be left in certain cove areas of the reservoir. These areas to be selected in cooperation with the Kentucky Department of Fish and Wildlife Resources, the Bureau of Commercial Fisheries, Corps of Engineers, the U.S. Forest Service, and the Bureau of Sport Fisheries and Wildlife during pre-construction planning.

5. A zoning plan be developed to prevent conflicts between reservoir uses. This plan should be developed cooperatively by the Kentucky Department of Fish and Wildlife Resources, the Kentucky Division of Boating, the U.S. Corps of Engineers, the Bureau of Outdoor Recreation, the U.S. Forest Service, and the Bureau of Sport Fisheries and Wildlife during pre-construction planning.

6. A multiple-level outlet be installed in the dam to control the physical and chemical qualities of the water releases and that

the elevations of the intake openings be determined during pre-construction studies in cooperation with the Kentucky Department of Fish and Wildlife Resources and the Bureau.

7. A sub-impoundment with a controlled outlet be constructed in the Rockcastle River to provide for flow regulation. The sub-impoundment should have sufficient capacity to store the maximum power release of 3,200 second-feet for a four-hour period, and should be located as close to the Parker Branch Dam as project operation will permit.

8. A minimum instantaneous flow of 100 second-feet should be maintained at all times downstream in the Rockcastle River at the Narrows (river mile 8.7).

9. Fishermen access be provided to the sub-impoundment.

10. The Kentucky Department of Fish and Wildlife Resources, the Bureau of Sport Fisheries and Wildlife, and the U.S. Forest Service coordinate with the U.S. Corps of Engineers to determine the exact location of replacement lands in either the Crooked Creek or upper Horse Lick Creek areas, which can be managed for wildlife.

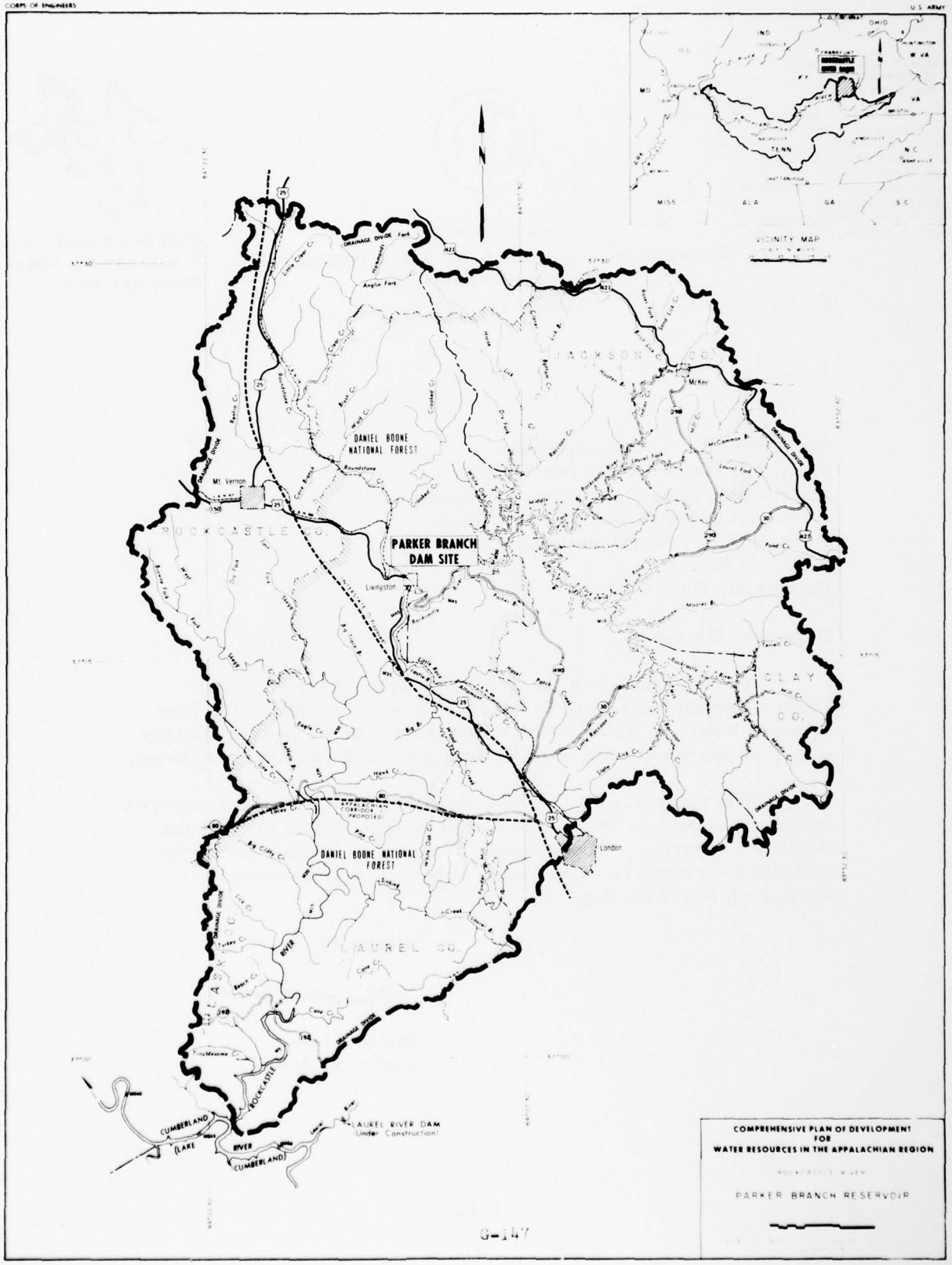
11. Severance and other lands purchased above the 300-foot horizontal line in the area of the South Fork arm of Rockcastle River be made available to the Kentucky Department of Wildlife Resources for wildlife management, under the terms of a Fish and Wildlife General Plan.

We appreciated the opportunity to report on the fish and wildlife resources associated with the Parker Branch project. We would like to be kept informed if there are any significant changes in project plans. If the project is authorized, we will look forward to coordinating the post-authorization planning on those aspects of the project which will affect the fish and wildlife resources.

Sincerely yours,

(Sgd) Richard E. Griffith

CORPS OF ENGINEERS U.S. ARMY



COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION

ROCKCASTLE RIVER

PARKER BRANCH RESERVOIR

G-147

FISH & WILDLIFE
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4-John Featherston, Lexington
1-Sam Garnett, Hazard
4-Dr. Robert C. Webb, Grayson
4-Dr. J. L. Becknell, Manchester

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF FISH & WILDLIFE RESOURCES
MINOR CLARK, COMMISSIONER

STATE OFFICE BLDG ANNEX
FRANKFORT, KY. 40601
PHONE 564-3400

March 11, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resources Surveys
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed the draft copy of your report on the Parker Branch Reservoir Project which was transmitted by your letter of March 1, 1968. With the exception of the needed changes listed below, we concur with the findings which you have presented.

The reference to Kentucky Department of Natural Resources on Page 9 should be changed to Kentucky Department of Fish and Wildlife Resources. The Kentucky Division of Boating should be included as a cooperator in zoning plans which is covered by Paragraph No. 5 on Page 16.

Sincerely,

Minor Clark

Minor Clark
Commissioner

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

District Engineer
U.S. Army Engineer District, Huntington
Corps of Engineers
P.O. Box 2127
502 8th Street
Huntington, West Virginia 25721

April 3, 1968

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Lower Knox Creek Reservoir project, Kentucky and Virginia. The project is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89-4, 89th Congress, 1st Session). This report is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 *inc.*) in cooperation with the Kentucky Department of Fish and Wildlife Resources and the Virginia Commission of Game and Inland Fisheries. Concurrence of these agencies in this report is expressed in letters dated March 25, 1968 and March 27, 1968, respectively.

This report is based on preliminary engineering data furnished by Mr. Lawhun of your staff on February 14, 1968 and was considered in arriving at elevations representing the average condition covering a 100-year project life.

DESCRIPTION OF THE AREA

The project under consideration is in Pike County, Kentucky, and Buchanan County, Virginia. Knox Creek follows a winding course through narrow valleys with steep hills. The hills are generally forested with a predominance of second-growth hardwoods. Extensive coal mine operations occur in the upper Knox Creek watershed on Lester Fork.

DESCRIPTION OF THE PROJECT

The damsite under consideration is located on Knox Creek about 0.4 mile above its confluence with Tug Fork (tributary of Big Sandy River) and will control a drainage area of 113 square miles. The dam will consist of rock fill and will be 225 feet high. An uncontrolled spillway will be excavated through the ridge of the left valley wall. The controlled outlet works will be located in the right abutment of the dam and will consist of a tunnel about 854 feet long.

We are pleased to note that project plans include multi-level outlets in the dam to provide control of temperature and dissolved oxygen for the preservation of downstream fisheries; three reservoir access sites; one fishing access site below the dam; and purchase of 17,980 acres of land for road relocation, severance, and recreational use.

The purpose of the project is for flood control, water quality control, general recreation, fish and wildlife recreation, and economic expansion.

Pertinent engineering data are presented in table 1.

Table 1. Pertinent Engineering Data,
Lower Knox Creek Reservoir Project

Pool	Elevation 1/ (feet)	Capacity (acre-feet)	Area (acres)
Permanent	788	2,270	101
Water Quality Control and Recreation	826	6,020	220
Flood Control	925	47,950	869

FISH AND WILDLIFE RESOURCES

Without-the-Project

Fishery Resources

Fishery Resources of Knox Creek and tributaries are of low value. Shallow water limits fisherman activity, and utilization is considered insignificant.

Wildlife Resources

Wildlife resources within the area to be affected by Lower Knox Creek Reservoir are of negligible value. Moderate populations of squirrel and raccoon are found in the surrounding hills where occasional hunter activity occurs. Hunter use of the area subject to project inundation is insignificant.

1/ All elevations refer to feet above mean sea level.

With-the-Project

Fishery Resources

The water quality control and recreation pool will inundate approximately 5 miles of Knox Creek and 2 miles of tributaries. In view of the negligible value of existing resources, the construction of Knox Creek Reservoir will be totally beneficial and economically significant to the area. Benefits are based on implementation of the Fish and Wildlife Plan which follows and the proper disposal of coal wash by the coal companies on Lester Fork.

Wildlife Resources

Construction of Lower Knox Creek Reservoir will have no significant effect on wildlife habitat. Project acquired lands will provide incidental wildlife benefits if made available to the Kentucky Department of Fish and Wildlife Resources and Virginia Commission of Game and Inland Fisheries for management under the terms of a General Plan. The 17,430 acres of acquired land for recreational use will provide about 4,000 man-days of big game and small game hunting with a recreational day value of $6,000 (table 2).

FISH AND WILDLIFE PLAN

Fishery

The volume of assured downstream low flows of Lower Knox Reservoir has not been determined. It is assumed that it will be of sufficient quantity to provide a sport fishery below the dam. Quality of water is of equal importance to the downstream fishery. Proper temperature and dissolved oxygen content will be required in downstream flows to manage and develop fishing opportunity. The multi-level outlet works will require three high-level intakes. Elevation of intakes should be coordinated with the Kentucky Department of Fish and Wildlife Resources, Federal Water Pollution Control Administration and this Bureau prior to the preparation of a General Design Memorandum.

Plans for reservoir clearing should be coordinated with the Kentucky Department of Fish and Wildlife Resources and this Bureau, to obtain maximum fishery benefits compatible with other project purposes.

To permit optimum public use for all recreational activities, a zoning plan considering the needs of all users should be developed through cooperative action by the Corps of Engineers, Bureau of Outdoor Recreation, Kentucky Department of Fish and Wildlife Resources, and this Bureau.

Table 2. An Evaluation of the Fish and Wildlife Resources for the Lower Knox Creek Reservoir Project with the Fish and Wildlife Plan Implemented.

	Without-the-Project			With-the-Project			
	Resource Unit	Miles or Acres	Man-days	Miles or Acres	Man-days	Net Gain Man-days	Net Benefit Dollars
Fishery							
	Stream	7 Mi.	Neg.	--	--	--	--
	Reservoir	--	--	220 Acres	3,300	3,300	3,300
	Tailwaters	0.4 Mi.	Neg.	0.4 Mi.	400	400	600
Wildlife							
	Reservoir Area	869 Acres	Neg.	--	--	--	--
	Other Project Lands	--	--	17,430 Acres	4,000	4,000	6,000 1/

1/ Incidental Benefits - not enhancement.

Assuming implementation of the fishery plan as well as the features included in the project plan, the reservoir will support about 3,300 fisherman days use valued at $3,300.

The 0.4-mile reach of stream from the dam to its mouth will provide a net increase of 400 angler-days use valued at $600; assuming implementation of both fishery and project plans. Overall, the project will result in a net annual fishery gain of about 3,700 fisherman days valued at $3,900.

Wildlife

All project lands within the Lower Knox Creek Reservoir project, excluding lands which may be reserved for intensive development of general recreation or for safety, efficient operation, or protection of public property, should be made available for administration by the Kentucky Department of Fish and Wildlife Resources and the Virginia Commission of Game and Inland Fisheries under a General Plan for Wildlife Management in accordance with provisions of the Fish and Wildlife Coordination Act.

Standing timber to provide improved wildlife habitat for forest game, should be left in certain areas to be selected by the Kentucky Department of Fish and Wildlife Resources and this Bureau during pre-construction planning.

Cost of the Fish and Wildlife Plan

The initial cost of establishing a fish population in the reservoir will be approximately $2,000. The annual cost, based on 100-year project life and a 3¼ percent interest rate, would be $70.

Cost of reservoir fishery operation and maintenance including such things as supplemental stocking, fish population, control, post impoundment surveys, and the maintenance of fisherman access facilities will total about $1,600.

Operation and maintenance costs of the downstream fishing facility will be about $200.

Annual operation and maintenance costs of the 17,430 acres of project-acquired lands to be extensively managed for big and small game hunting is estimated at $4,400.

The foregoing cost estimates are preliminary and are subject to change depending on the degree of management undertaken by the Kentucky Department of Fish and Wildlife Resources.

RECOMMENDATIONS

On basis of the foregoing, the Bureau recommends:

1. That the elevations of portals in the multiple-level outlet be selected during pre-construction planning by the Kentucky Department of Fish and Wildlife Resources, Federal Water Pollution Control Administration, and this Bureau.

2. That standing timber be left in certain selected areas that will be inundated; and these areas be selected by the Kentucky Department of Fish and Wildlife Resources and this Bureau during pre-construction planning.

3. That a zoning plan be developed to prevent conflicts between reservoir users. This plan should be developed through cooperative action by the Corps of Engineers, Bureau of Outdoor Recreation, Kentucky Department of Fish and Wildlife Resources, and this Bureau.

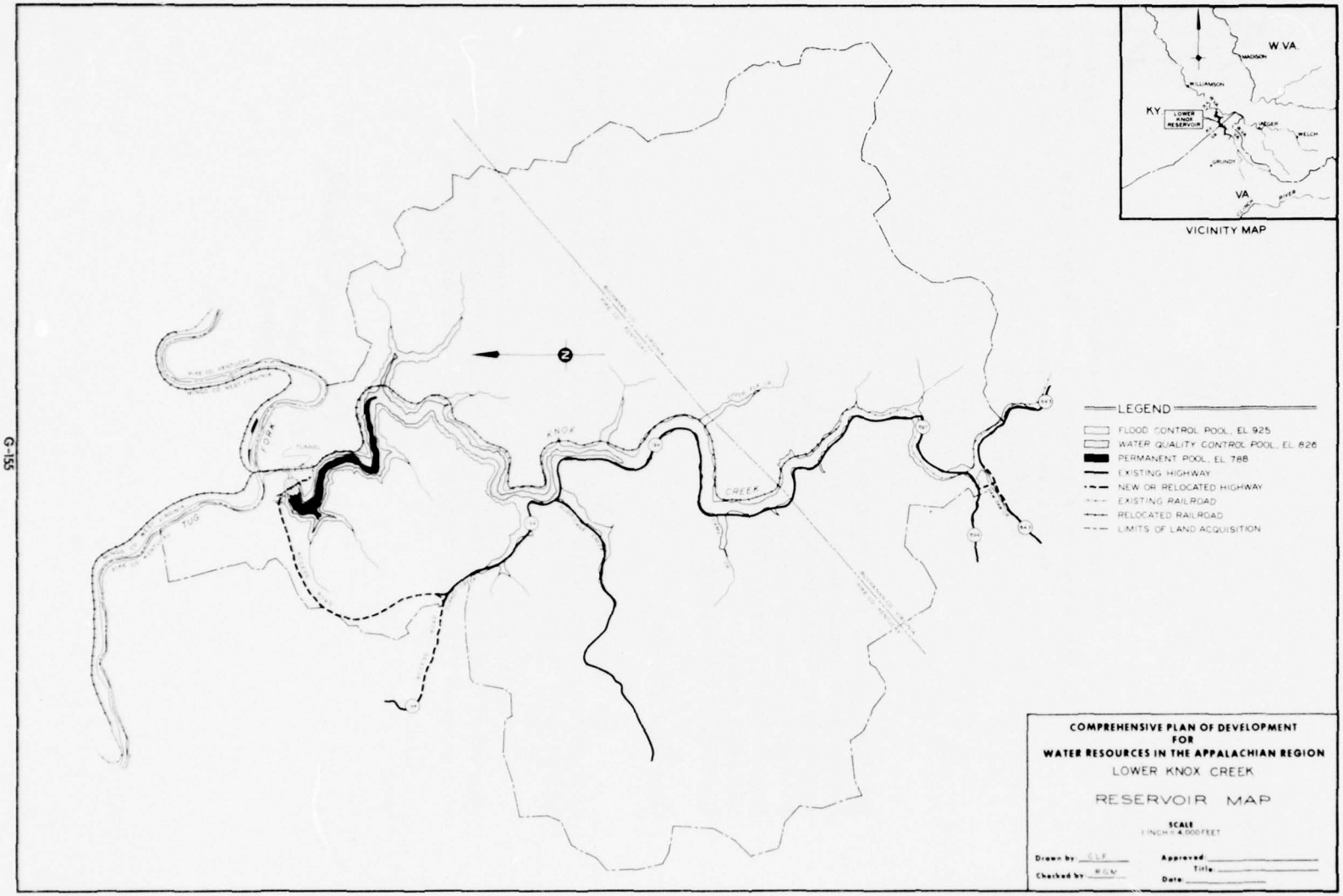
4. That all project lands within the Lower Knox Creek Reservoir project, excluding lands which may be reserved for intensive development of general recreation or for safety, efficient operation, or protection of public property, be made available for administration by the Kentucky Department of Fish and Wildlife Resources and the Virginia Commission of Game and Inland Fisheries under a General Plan for Wildlife Management in accordance with provisions of the Fish and Wildlife Coordination Act.

The Bureau's study and recommendations are based on project plans as currently developed. Should your study of the Lower Knox Creek project be authorized for advanced engineering and design, it is requested that engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

Richard E. Griffith


W VA
MADISON
WILLIAMSON
KY
LOWER KNOX RESERVOIR
MINGO
WELCH
GRUNDY
VA
RIVER
VICINITY MAP
LEGEND
FLOOD CONTROL POOL, EL 925
WATER QUALITY CONTROL POOL, EL 826
PERMANENT POOL, EL 788
EXISTING HIGHWAY
NEW OR RELOCATED HIGHWAY
EXISTING RAILROAD
RELOCATED RAILROAD
LIMITS OF LAND ACQUISITION
KNOX
CREEK
TUG
FORK
COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
LOWER KNOX CREEK
RESERVOIR MAP
SCALE
1 INCH = 4,000 FEET
Drawn by CLF
Checked by RGM
Approved
Title
Date

FISH & WILDLIFE
COMMISSION
BY DISTRICTS

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H. DR. JAMES SALATO, Columbia
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H. JOHN FEATHERSTON, [illegible]ington
H. SAM [illegible] HAZAR[illegible]
H. DR. ROBERT J. WEBB, [illegible]ton
H. DR. J. L. BEGNELL, M[illegible]ster

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF FISH & WILDLIFE RESOURCES
MINOR CLARK, COMMISSIONER

STATE OFFICE B[illegible] ANNEX
FRANKFORT [illegible] 40601
PHONE 564 [illegible] 0

March 25, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed the draft copy of your report on the Corps of Engineers study of the Lower Knox Creek Reservoir project, and we concur with your findings.

The Department of Fish and Wildlife Resources will be interested in assuming the responsibility for wildlife management on any lands which may become available for this purpose.

Sincerely,

Minor Clark

Minor Clark
Commissioner

. AARON, CHAIRMAN
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COMMONWEALTH OF VIRGINIA

COMMISSION OF GAME AND INLAND FISHERIES
BOX 1642
RICHMOND, 23213

CHESTER F. PHELPS, EXECUTIVE DIRECTOR
SEVEN NORTH SECOND STREET
BOX 1642
RICHMOND, 23213

March 27, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development Program
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

Reference is made to your letter of March 14 concerning the Bureau of Sport Fisheries and Wildlife's report on the Corps of Engineer's study of the Lower Knox Creek Reservoir project, Kentucky and Virginia.

We have no comments to make and concur in the proposed report.

Sincerely yours,

Chester F. Phelps

Chester F. Phelps
Executive Director

CFP:na

G-157

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 13, 1968

District Engineer
Nashville District, Corps of Engineers
306 Federal Office Building
Nashville, Tennessee 37202

Dear Sir:

This is a supplemental report of the Bureau of Sport Fisheries and Wildlife on the Celina Reservoir Project, Cumberland River, Kentucky. It has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.), in cooperation with the Kentucky Department of Fish and Wildlife Resources and the Tennessee Game and Fish Commission and has their concurrence as indicated by letters both dated April 24, 1968. This is to confirm that the previous report of the Bureau of Sport Fisheries and Wildlife on this project of July 22, 1965, is still valid. A copy of that report is attached.

The Celina Reservoir project is presently being reconsidered under the authority of the Appalachian Regional Development Act of 1965; Sec. 206. The project formulation is based on engineering and operating data as presented in the Corps of Engineer's report entitled "Celina Reservoir Project - Design Memorandum No. 2 - Restudy of Project Economics" dated November 1965.

The description and evaluations of the fish and wildlife resources in our July 22, 1965 report are still applicable although minor changes have been incorporated in the project plan. The size of the dam and reservoir have increased and a navigation lock has been included. The dam will now be 74.5 feet high above streambed instead of 70 feet. This will increase the sizes of the winter, summer, and surcharge pools to 15,000, 15,800, and 16,900 surface-acres respectively. The larger reservoir is not expected to increase the fishery benefits of the project nor cause any serious effects to the tailwater fishery below Wolf Creek Dam. It will, however, inundate additional wildlife habitat raising the project incurred hunting losses to approximately 1600 man-days annually.

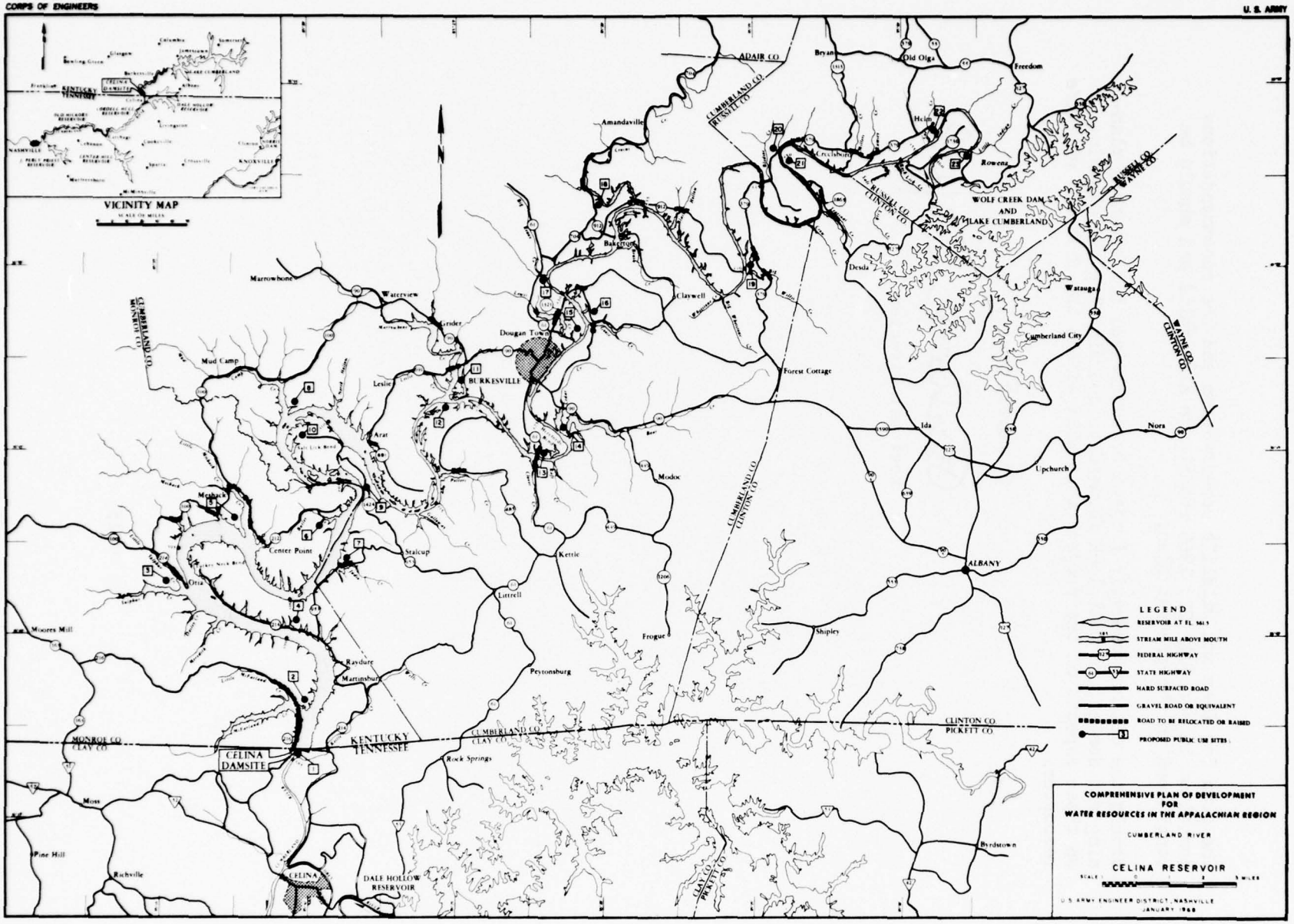
The plan for fish and wildlife conservation and the recommendations contained in our July 22, 1965 report are also valid and should be considered in the present plan.

Should the Celina Reservoir Project be authorized for advanced planning and design, we will look forward to coordinating the planning on those aspects of the project that will affect the fish and wildlife resources.

Sincerely yours,

Richard E. Griffith

Regional Director


CORPS OF ENGINEERS
U. S. ARMY
VICINITY MAP
ADAIR CO
CUMBERLAND CO
PULASKI CO
RUSSELL CO
CLINTON CO
WAYNE CO
WOLF CREEK DAM AND LAKE CUMBERLAND
Amandaville
Bryan
Old Olga
Freedom
Helm
Creelsburg
Rowena
Bakerton
Claywell
Desda
Watauga
Cumberland City
Marrowbone
Waterview
Grider
Dougan Town
Mud Camp
Leslie
BURKESVILLE
Arat
Forest Cottage
Ida
Nora
Upchurch
Modoc
Mcbeth
Center Point
Stalcup
Kettle
ALBANY
Otis
Littrell
Moores Mill
Frogue
Shipley
Raydure
Martinsburg
Peytonsburg
MONROE CO
CLAY CO
KENTUCKY
TENNESSEE
CELINA DAMSITE
Rock Springs
CLINTON CO
PICKETT CO
Byrdstown
Moss
Pine Hill
Richville
CELINA
DALE HOLLOW RESERVOIR
LEGEND
RESERVOIR AT EL. 1615
STREAM MILE ABOVE MOUTH
FEDERAL HIGHWAY
STATE HIGHWAY
HARD SURFACED ROAD
GRAVEL ROAD OR EQUIVALENT
ROAD TO BE RELOCATED OR RAISED
PROPOSED PUBLIC USE SITES
COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
CUMBERLAND RIVER
CELINA RESERVOIR
U.S. ARMY ENGINEER DISTRICT, NASHVILLE
JANUARY 1968

FISH & WILDLIFE
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BY DISTRICTS

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- R. P. Countzler, Greenville
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- John Featherston, Lexington
- Sam Garnett, Hazard
- Dr. Robert C. Webb, Grayson
- Dr. J. L. Becknell, Manchester

Commonwealth of Kentucky
Department of Fish & Wildlife Resources
Minor Clark, Commissioner

State Office Bldg. Annex
Frankfort, Ky. 40601
Phone 564-3400

April 24, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development Program
Room 6405 - Federal Building
550 Main
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed the copy of your proposed report on the Corps Study on the Celina Reservoir Project which was transmitted by your letter of April 18, 1968. This department concurs in the findings presented in your supplemental report.

Sincerely,

Minor Clark

Minor Clark
Commissioner

TENNESSEE GAME AND FISH COMMISSION

DOCTORS BLDG. • 706 CHURCH STREET • NASHVILLE, TENN. 37203

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FRED W. STANBERRY, DIRECTOR
DAVID M. GOODRICH, ASS'T. DIR.
HAROLD E. WARVEL, ASS'T. DIR.



April 24, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resources Surveys
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6504 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We concur with your report on the Celina Reservoir project, which was submitted with your letter of April 18. We heartily endorse your recommendations concerning general public access and specific fisherman access to the tailwater area.

Yours very truly,

Harold E. Warvel

Harold E. Warvel, Acting Director
Tennessee Game and Fish Commission

HEW:HMN:mf

cc: Mr. Pollock

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

July 22, 1965

CE-O-cu

District Engineer
U. S. Army, Corps of Engineers
Nashville, Tennessee

Dear Sir:

The Bureau of Sport Fisheries and Wildlife, in cooperation with the Tennessee Game and Fish Commission and the Kentucky Department of Fish and Wildlife Resources, has completed fish and wildlife studies of the Celina Dam and Reservoir project on the Cumberland River, Monroe, Cumberland, Clinton, and Russell Counties, Kentucky, and Clay County, Tennessee, authorized by the River and Harbor Act of July 24, 1946 (Public Law 525, 79th Congress, 2d Session). This letter contains our findings based on design and operational data supplied by your office prior to March 1, 1965, and is presented pursuant to provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

PROJECT DESCRIPTION

The proposed Celina Dam and Reservoir project is a unit in the comprehensive plan for development of water resources of the Cumberland River Basin. The damsite is 74.6 miles below Wolf Creek Dam at river mile 385.5, near the State boundary between Monroe County, Kentucky, and Clay County, Tennessee. Present design plans provide for a concrete (gravity) and earth fill dam 2,775 feet long and 70 feet high. The spillway section will consist of five tainter gates each 45 feet wide by 41 feet high. The power plant will consist of three generating units with a total normal rated capacity of 96,000 kilowatts. The project will be equipped with a navigation lock, 84 by 400 feet, located in the east bank, if found economically feasible.

Operation for hydropower will be dependent on Wolf Creek Dam outflows. Future Wolf Creek operational schedules are not available at this time; however, normal Celina power discharges will be in the neighborhood of 30,000 c.f.s. with maximum power discharges up to 40,000 c.f.s. There will be 1 foot of pondage below normal operating pool level for the generation of power in addition to run-of-river flows.

PERTINENT DATA

CELINA DAM AND RESERVOIR

General

Damsite (miles above mouth)	385.5
Drainage area above damsite (square miles)	6,308
Drainage area to Wolf Creek Dam (square miles)	500

Dam

Top elevation	564
Streambed elevation	494
Maximum height above streambed (feet)	70

Reservoir

Winter power pool:

Elevation	555
Area (surface acres)	12,409
Total storage (acre-feet)	233,600

Summer power pool:

Elevation	556.5
Area (surface acres)	13,165
Total storage (acre-feet)	252,800

Surcharge pool:

Elevation	559
Area (surface acres)	14,467
Total storage (acre-feet)	287,300

Outlet Works

Spillway crest elevation	518.3
Tainter gates (number)	5
Height (feet)	41
Width (feet)	45
Penstocks (number)	3
Diameter (feet)	20
Intake, invert elevation	494

Wolf Creek Tail Water Elevations

Zero discharge	542
With Celina	554
Normal discharge (22,000 c.f.s.)	560
With Celina	564
Maximum discharge (30,000 c.f.s.)	575
With Celina	575

FISH AND WILDLIFE RESOURCES

Fishery Resources

Fishery resources of the Cumberland River were evaluated from the proposed Celina Damsite (river mile 385.5) to Wolf Creek Dam (river mile 460.1). Completion of Wolf Creek Dam in 1951 has produced significant water temperature changes downriver. Annual discharge temperatures usually range between 44° and 54° F. Cordell Hull Dam, under construction at river mile 313.5, will back water to river mile 399 at flat summer pool elevation 504.

The Wolf Creek tail water will be inundated by the Celina Reservoir. The first mile below the dam is a concentration point for fish moving upriver and for fish passing through the turbines. This fish concentration presently supports approximately 40 percent of the total fishing pressure expended on the evaluated stretch of river. The tail water was initially stocked with rainbow trout in 1953; brown trout and kamloop trout were initially stocked in 1961. This stretch of Cumberland River is now being successfully managed by the Kentucky Department of Fish and Wildlife Resources as a tail water trout fishery. Based on recent surveys of the Kentucky Department of Fish and Wildlife Resources, it is estimated that 95 percent of tail water fishermen are in quest of trout and 85 percent of the trout fishermen travel more than 25 miles to fish in the tail water. The Corps has provided several picnic and camping sites and a boat launching ramp below the dam. Safe use facilities for bank fisherman access to the stilling basin (turbulent water zone) have not been provided.

The remaining 74 miles of Cumberland River, including 60 miles of free-flowing river and 14 miles of Cordell Hull Reservoir (under construction), that will be affected by the Celina project support a stream and reservoir fishery of moderate value. Fisherman use is moderate where access to the river is available; however, access is very poor. There are only six possible sites to launch a boat in the 74-mile stretch, including a recently completed launching ramp at Burkesville by the Kentucky Department of Fish and Wildlife Resources. The other five sites are at bridge and ferry crossings where boat launching is difficult. Bank fisherman access is also scarce.

The most important fish harvested are rainbow trout, brown trout, flathead catfish, blue catfish, channel catfish, bluegill, carp, walleye, sauger, freshwater drum, white bass, largemouth bass, smallmouth bass, spotted bass, paddlefish, and suckers. Excluding the fishing immediately below Wolf Creek Dam, the 74-mile river segment presently provides approximately 4,000 man-days of sport fishing. The Kentucky Department of Fish and Wildlife Resources plans to provide, over the next 10 years, five additional boat launching ramps along the river at existing roads. Increased trout stocking is also planned when the national fish hatchery, presently under construction at Dale Hollow, Tennessee, becomes operative. Based on present use and future management plans, average annual fisherman utilization will increase to about 10,000[1] man-days.

The average annual commercial fish harvest is valued at about $3,000.[2]

Wildlife Resources

Habitat conditions within the 14,467-acre project area are of moderate value for farm game, and waterfowl in moderate numbers utilize the main river during migration. Bottom lands along the Cumberland River and tributaries are extensively cleared for pasture and the production of corn, soybeans, tobacco, and hay. Second-growth mixed hardwood stands located on the steeper slopes and river bluffs provide habitat of low value for forest game species such as squirrels, raccoon, and deer.

The project area presently supports about 1,500 man-days of sport hunting. A deer season was provided in Monroe County in 1964 as the result of deer released by the Kentucky Department of Fish and Wildlife Resources near Vernon, Kentucky, in 1959. Deer released by the Kentucky Department in 1950 on Three Forks State Refuge, located along the southern boundary of Metcalfe County adjoining Cumberland County, have established an expanding herd that will eventually help stock project lands. With deer in the Cumberland County portion of the proposed project area and continued growth of the deer herd in Monroe County, the total average annual sport hunting utilization will increase to 1,600 man-days.

Commercial fur bearer harvest will amount to $1,600, annually.

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1. Estimates of sport fishing and hunting utilization are expressed as average annual man-days expected during the 100-year economic life of the project.

2. Monetary expressions of commercial harvest of fish and wildlife resources are given in terms of gross revenue at the fisherman and trapper level.

PROJECT EFFECTS AND INCIDENTAL BENEFITS

Fishery Resources

Construction of the Celina project will convert the last free-flowing segment (60 miles) of Cumberland River below Cumberland Falls (river mile 562) and the upper 14 miles of Cordell Hull Reservoir into a 13,165-acre reservoir. As the damsite is near the Tennessee State line, the Celina project will provide a new tail water fishery in Tennessee and a new reservoir fishery in Kentucky.

The Wolf Creek tail water will be inundated by backwater of Celina Reservoir. During zero power discharge, Wolf Creek tail water is very shallow (elevation 542). Seepage of about 55 c.f.s. prevents complete shoal drying. With the Celina project, the Wolf Creek tail water will be 12 feet deeper (elevation 554). Although the greatest fishing pressure and harvest now occur during low-water stages, we believe that conditions within Wolf Creek tail water will not be affected to the extent that suitable conditions for trout management will be eliminated.

The 13,165-acre Celina Reservoir will increase fisherman utilization, provided provisions are made for adequate public access. The area of influence will be small because of Lake Cumberland, Dale Hollow, and Barren River Reservoirs, within 35 miles or less driving distance. Green River and Cordell Hull Reservoirs, presently under construction, will add to available fishing waters falling in the above category. Fishing pressure will be mostly due to a redistribution and increased activity of local fishermen. Reservoir and tail water utilization attributable to the project is estimated at 44,000 man-days, valued at $46,000.[1]

Increased trout stocking, upriver migrations, and downriver movement of fish through turbines will increase fishermen pressure in the Celina and Wolf Creek tail waters. Stilling basins and tailraces will be especially favored by fishermen because of high fish concentrations. In this regard there will be a need to provide adequate safe use facilities for bank fishermen.

Construction of the reservoir will eliminate the present river-type commercial fishery in the project area, but will offer opportunity for development based on the new reservoir environment. Viewed as an isolated unit, the commercial fishery potential at Celina Reservoir is limited due to size combined with only moderate inherent productivity. As part of a larger framework of commercial fishing development, based on rotated utilization of the extensive reservoir complex of Kentucky and Tennessee, Celina Reservoir could make a subsidiary but significant contribution. Such coordinated and interlocking development would require a high level

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1. Monetary expressions of noncommercial use of fish and wildlife resources are based on Senate Document 97, Supplement No. 1, "Evaluation Standards for Primary Outdoor Recreation Benefits," dated June 4, 1964.

of management, liberalization of restrictions, plus modernization of harvesting, processing and marketing methods. The Tennessee Game and Fish Commission, Kentucky Department of Fish and Wildlife Resources, Tennessee Valley Authority and the Bureau of Commercial Fisheries are all working jointly towards implementation of this concept. It is the considered judgment of the Bureau of Commercial Fisheries that this coordinated development will continue to move forward, resulting at Celina Reservoir, in an estimated average annual commercial fishing production of 325,000 pounds worth $19,500.

Wildlife Resources

Game habitat losses will be complete for the 13,165 acres involved at maximum summer pool, elevation 556.5, and partial for an additional 1,302 acres up to elevation 559 set aside for surcharge.

Expanded water area will result in a slightly increased waterfowl use during migration; however, significant project-occasioned benefits are not anticipated.

Hunter utilization of farm, forest, and waterfowl species occurs in the main river bottoms and on the lower slopes. Based on existing use and trends, and considering continued growth of deer herds in Cumberland and Monroe Counties, it is estimated that sport-hunter utilization will be reduced by about 1,300 man-days. Commercial fur harvest value is not expected to change appreciably with the project.

PLAN FOR FISH AND WILDLIFE CONSERVATION

In order to realize the maximum public benefit from project related fish and wildlife resources, the following measures are proposed for consideration in your General Design Memorandum.

Public Access. We have not investigated potential access sites and public use facilities in the reservoir zone. We would, however, like to examine your plans for public use development when they become available and have an opportunity to recommend modifications if deemed necessary.

We would like to point out that adequate bank fisherman access to the Celina and Wolf Creek tail waters is necessary for the safety of sport fishermen. Inclusion of riprapped stairways or fishing platforms would supply bank fishermen maximum safety and fishing opportunity.

Commercial Fishery Development. During preconstruction planning, the Bureau of Commercial Fisheries, the Tennessee Game and Fish Commission, and the Kentucky Department of Fish and Wildlife Resources be given the opportunity to

consider modifications permitting reasonable development of the commercial fishery potential of the reservoir and tail water.

Project Lands. It is our understanding that lands for the project will be procured in accordance with the Joint Land Acquisition Policy and sound real estate practices. Assuming that suitable lands will be purchased above surcharge pool level, the loss of hunting opportunity could be mitigated on such lands through intensive management. Licensing of project-acquired lands for game-management purposes to the Kentucky Department of Fish and Wildlife Resources would provide for such mitigation.

RECOMMENDATIONS

On basis of the foregoing, the Bureau recommends that:

(1) safe fisherman facilities be provided Celina and Wolf Creek tail waters in the form of riprapped walkways or fishing platforms; and,

(2) project-acquired lands suitable for game-management purposes be licensed to the Kentucky Department of Fish and Wildlife Resources for the mitigation of wildlife resource losses.

Should your restudy of the Celina Reservoir project be received favorably by Congress for advanced engineering and design, the Tennessee Game and Fish Commission, Kentucky Department of Fish and Wildlife Resources, and the Bureau will wish to suggest a plan for fisherman and hunter access and other fish and wildlife measures which may deserve consideration in final design planning.

This report has been reviewed by the Bureau of Commercial Fisheries, the Kentucky Department of Fish and Wildlife Resources, and the Tennessee Game and Fish Commission. Copies of letters from Commissioner Clark (2) and Director Stanberry are attached.

The cooperation extended by your staff is greatly appreciated.

Sincerely yours,

James R. Fielding

James R. Fielding
Acting Regional Director

Attachments 3

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 13, 1968

District Engineer
Nashville District, Corps of Engineers
306 Federal Office Building
Nashville, Tennessee 37202

Dear Sir:

This letter constitutes the conservation and development report of the Bureau of Sport Fisheries and Wildlife on the proposed cargo lift over Wolf Creek Dam. It has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.) in cooperation with the Kentucky Department of Fish and Wildlife Resources and has their concurrence as indicated by their letter dated April 24, 1968.

The project is being considered at this time under the authority of the Appalachian Regional Development Act of 1965, (Section 206, PL 89-4). We understand that the project is the same as presented in the Corps of Engineers report entitled "Feasibility Study for Cargo Life Over Wolf Creek Dam" dated, 1965.

The cargo lift will provide a by-pass system for transporting bulk cargo over Wolf Creek Dam. The system will consist of a 48-inch wide conveyor belt for solid products and two 8-inch pipelines for liquid materials (plate 1). It is assumed that coal and pulpwood will be transported downstream and petroleum products will be brought into the area. However, the need for a cargo lift is dependent on the construction of the Celina project with a lock, which will permit barge traffic to move upstream to Wolf Creek Dam.

We have ascertained that the construction of the cargo lift would not significiantly affect the fish or wildlife resources in the area. The operation of such a by-pass system would, however, create a possible source of water pollution from pipeline breaks or spillage. These potential problems should receive consideration during pre-construction planning.

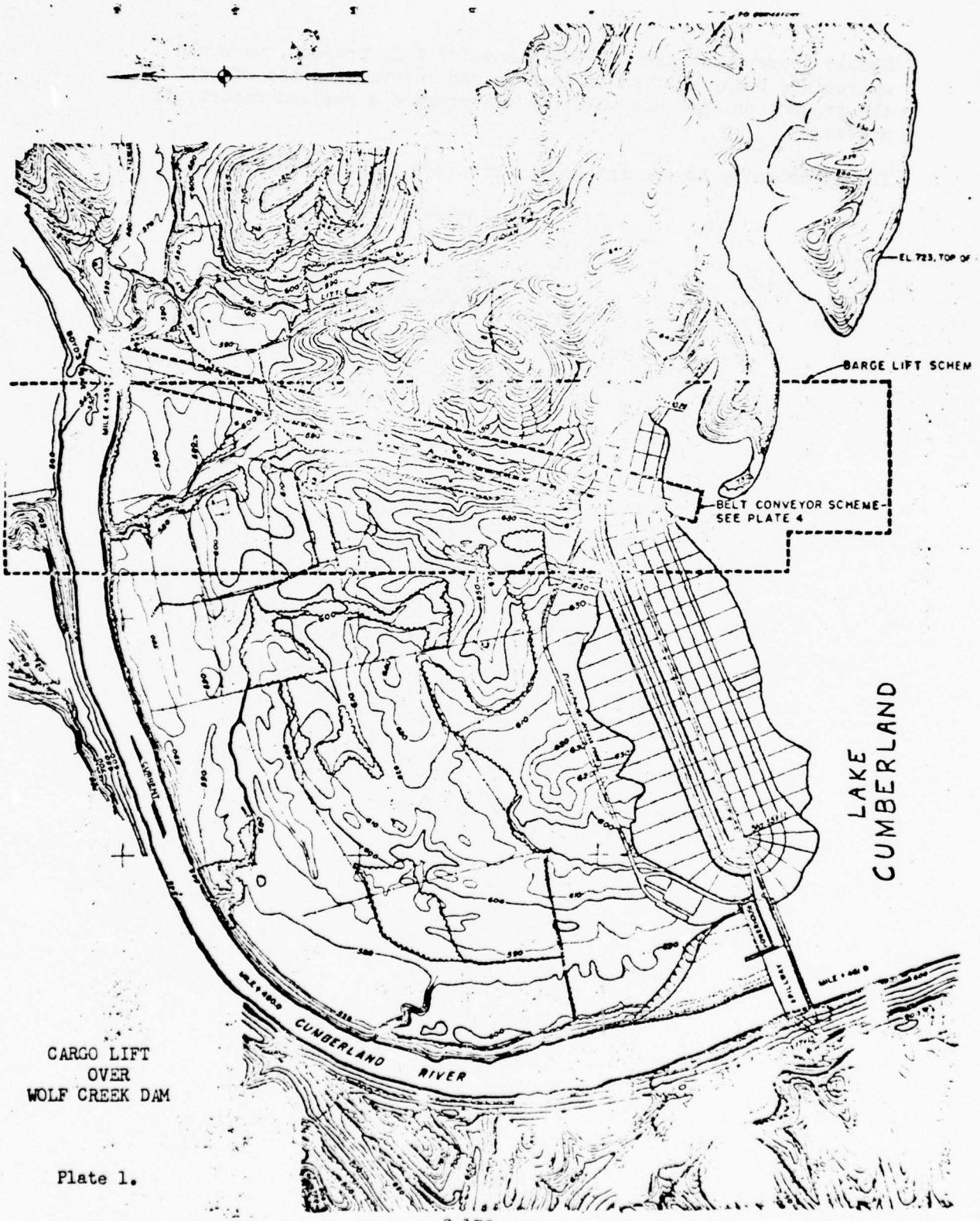
Should there be changes in the plans for this project, we would appreciate being advised so that we can re-evaluate the effects of the project on fish and wildlife and prepare a revised report, if necessary.

The opportunity to comment on the proposed plans is appreciated.

Sincerely yours,

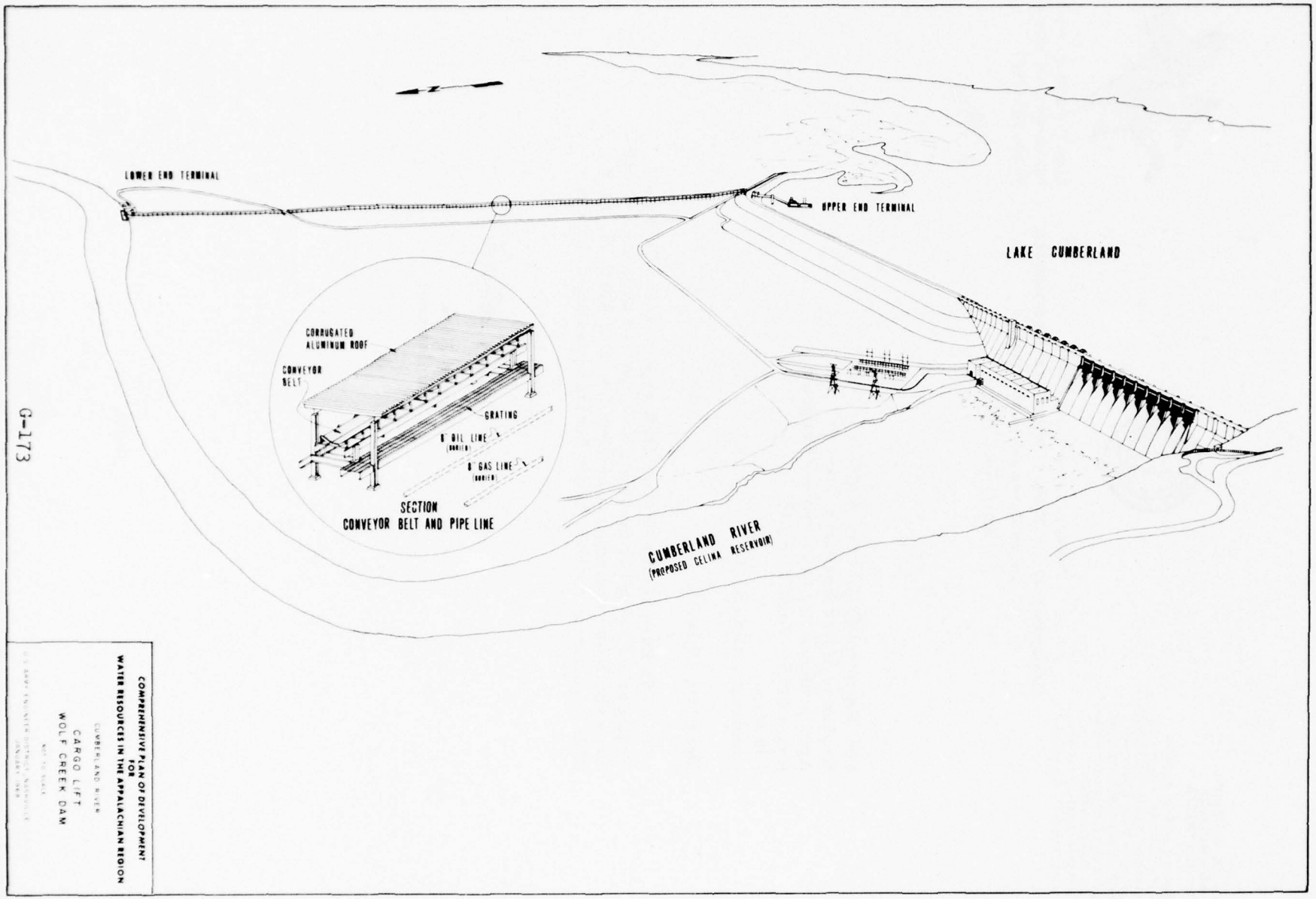
Richard E. Griffith

Regional Director



CARGO LIFT
OVER
WOLF CREEK DAM

Plate 1.



COMPREHENSIVE PLAN OF DEVELOPMENT FOR WATER RESOURCES IN THE APPALACHIAN REGION

CUMBERLAND RIVER

CARGO LIFT

WOLF CREEK DAM

G-173

FISH & WILDLIFE
COMMISSION
BY DISTRICTS

- BOYCE R. McELYA, PADUCAH
- R. P. COUNTZLER, GREENVILLE
- WARREN C. ROSBOTTOM, LOUISVILLE
- DR. JAMES SALATO, COLUMBIA
- DR. FRED SCROGGIN, DRY RIDGE
- JOHN FEATHERSTON, LEXINGTON
- SAM GARNETT, HAZARD
- DR. ROBERT C. WEBB, GRAYSON
- DR. J. L. BECKNELL, MANCHESTER

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF FISH & WILDLIFE RESOURCES
MINOR CLARK, COMMISSIONER

STATE OFFICE BLDG ANNEX
FRANKFORT, KY. 40601
PHONE 564-3400

April 24, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development Program
Room 6405 - Federal Building
550 Main
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed your draft report on the Corps of Engineer's Feasibility Study for a Cargo Lift over Wolf Creek Dam which was transmitted by your letter of April 18, 1968. This department concurs in the findings presented therein.

Sincerely,

Minor Clark

Minor Clark
Commissioner

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 7, 1968

District Engineer
Nashville District, Corps of Engineers
306 Federal Office Building
Nashville, Tennessee 37202

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife on the plan for hydroelectric power development and flood control at the Devils Jumps Reservoir site on the Big South Fork of the Cumberland River, Kentucky and Tennessee. This report has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 incl.) in cooperation with the Kentucky Department of Fish and Wildlife Resources and the Tennessee Game and Fish Commission and has their concurrence as indicated by letters both dated April 24, 1968. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

The Bureau of Sport Fisheries and Wildlife previously issued a preliminary report concerning this project, dated July 9, 1957.

INTRODUCTION

Pursuant to the Appalachian Regional Development Act of 1965; Sec. 206, the Secretary of the Army was authorized and directed to prepare a comprehensive plan for the development and efficient utilization of the water and related resources of the Appalachian region, especially as it might enhance the economy of the region. Several Federal agencies, including the Department of the Interior, were authorized to assist in the preparation of the plan. This project is one which has been selected for study in response to the Act.

This report is based on engineering data contained in the review report by the U.S. Army Corps of Engineers on the Big South Fork, Cumberland River, Kentucky and Tennessee, dated June 30, 1958. The evaluations have been made in accordance with Senate Document Number 97, Supplement 1, 87th Congress, 2nd Session, entitled "Evaluation Standards for Primary Outdoor Recreation Benefits." Populations within the project area are based on trends as expressed in the developmental "benchmarks"

for the Appalachian region as of May 15, 1967. Benefits for the project are dependent upon the implementation of the plan for development of the fish and wildlife resources.

DESCRIPTION OF THE AREA

The project area is located within the Big South Fork basin in McCreary County, Kentucky and in Scott, Morgan, Fentress and Pickett Counties, Tennessee. The Big South Fork is the third largest of the Cumberland River tributaries. It is formed in Tennessee by the junction of its two principal tributaries, Clear Fork and New River. It flows northerly into the state of Kentucky and empties into Lake Cumberland. Stream flow of the Big South Fork in the project area averages about 1,700 second-feet with recorded minimum and maximum flows of 11 and 69,600 second-feet, respectively.

The topography is mountainous and characterized by long ridges and deep, narrow valleys. The area is largely forested with the upland hardwood-pine type. Agriculture is very limited and confined mostly to the narrow bottoms of some tributary streams. The area is extremely rugged and the river is readily accessible at only a few points.

Approximately 75 percent of the project area is in Tennessee and 25 percent in Kentucky. Most of the land is in private ownership except for about 4,500 acres of Daniel Boone National Forest in McCreary County, Kentucky. All of the project land in Kentucky is within the boundaries of the National Forest.

According to the 1960 census, the population of the counties in the project area was 59,899. The entire population is considered as rural. By the year 2020, it is expected that this population will increase to 146,510. The city of Knoxville, Tennessee, is about 30 miles from the project area and is the nearest population center of any size.

DESCRIPTION OF THE PROJECT

The proposed Devils Jumps Dam will be located on the Big South Fork at mile 48.1, McCreary County, Kentucky. The main purposes of the project are hydroelectric power production and flood control. The dam will be a rockfill structure 483 feet high and 6,250 feet long with the top at elevation 1,233. 1/ The spillway will be located in a saddle on the right bank and discharge into a side channel which empties into the main stream some distance below the dam. Seven tainter gates, 50 feet wide by 37 feet in height, will discharge the excess waters from the

1/ All elevations are in feet above mean sea-level.

reservoir. The power house will have four units capable of producing 480 megawatts of power at installed capacity. Pertinent engineering data for the reservoir are presented in table 1.

Table 1, Pertinent Engineering Data, Devils Jumps Reservoir, Kentucky and Tennessee

Pool	Elevation	Surface Acres	Stream Miles Main Stem 1/
Flood Control	1,220.0	36,990	83.0
Power	1,212.8	34,210	75.25
Minimum	1,146.8	18,260	60.0

The project will be operated principally for the production of peaking hydroelectric power on a 4.5-day basis. The power plan will be shutdown for several hours each day and approximately 60 hours every weekend. This type of operation will cause varying streamflows daily in the river below the power plant. Releases for maximum and normal power production will be 17,300 and 15,500 second-feet, respectively. Flows during the shutdown periods will be about 50 second-feet. These will result from leakage through the power plant and seepage from the reservoir.

The flood control storage in Devils Jumps Reservoir will, in effect, be a transfer of flood storage from Lake Cumberland and will increase the annual average energy output of the Lake Cumberland power plant. This is possible because the water stored and released for power production from the Devils Jumps power pool will provide 91 percent stream flow regulation of the Big South Fork drainage above the dam.

The size of Devils Jumps Reservoir will vary each year depending on runoff. The project is designed to provide for a 66-foot drawdown from the top of the power pool to maintain power production during any period. However, a fluctuation of 66 feet will not occur during any one-year period. A series of dry years could cause a continuous lowering of the power pool to the minimum pool level. This would have occurred only once during a simulated project operation covering a 35.5 year period from 1915 to 1954. The average yearly fluctuation of the reservoir will be about 18 feet.

1/ Includes Clear Fork and New River

Approximately 87,300 acres of land will be acquired for the project. This includes the reservoir area up to a minimum of 300 feet horizontally from the flood-control pool; severance lands; public use lands; and lands presently under the administration of the U.S. Forest Service.

FISHERY RESOURCES

Without the Project

The fishery resources of over 100 miles of streams in the Big South Fork River Basin that will be affected by the project are of good quality. This does not include the New River and tributaries whose fisheries value have been reduced by acid waters and silt from coal mine drainage. The remainder of the basin provides fishing for smallmouth bass, rock bass, catfish, and various sunfishes. Muskellunge are present in the upper reaches of Clear Fork and tributaries while trout are stocked in Williams Creek, North White Oak Creek and in both of the streams named Laurel Fork. White bass and walleyes from Lake Cumberland use the Big South Fork River as a major spawning area. During spring migrations, fishing for these species is very popular. Most of this fishing occurs from the area known as Devils Jumps downstream into Lake Cumberland.

Big South Fork is a free-flowing river, bordered by extremely rugged and scenic terrain. Access is very limited and the area is relatively uninhabitated and unspoiled by man. Collectively, these characteristics typify the Big South Fork as Tennessee's only true wild river in a wilderness setting. During recent years, recognition of the river for its uniqueness has resulted in an increased fishing use, especially by float fishermen.

Big South Fork River and major tributaries in the proposed reservoir area provide an estimated 10,300 man-days of fishing annually. Below the damsite, the river provides an additional 1,000 angler-days annually, not including the fishing pressure for white bass and walleyes during spawning season.

With the Project

The Devils Jumps project will be detrimental to the fisheries resources. Directly affected will be the stream fisheries of the Big South Fork River and tributaries with additional influences on the fishery of Lake Cumberland.

The reservoir will inundate approximately 110 miles of streams causing a loss of 10,300 man-days of stream fishing, annually. Also, Tennessee's only true wild river and the incalcuable asthetic values associated with it will be destroyed.

The project operation will affect the remaining four miles of the Big South Fork from the dam downstream to Lake Cumberland. The normal production of hydroelectric power on a peaking basis will cause daily variations in the stream flow from 50 to 15,500 second-feet. This will cause scouring in the remaining section of the Big South Fork and result in a reduction of fish habitat. It will also cause a constant fluctuation of the river which will impair the spawning success of the fish and create a safety hazard to fishermen and other stream users. Also, releases from lower levels of the reservoir will probably result in discharges of poor water quality. Thermal stratification of the reservoir could occur from May through September. This will promote conditions whereby the lower levels of the impoundment could become cold, nearly devoid of dissolved oxygen, and develop lethal levels of undesirable gases. The combination of these operational aspects will probably result in the loss of 1,000 man-days annually of stream fishing in the remaining four miles of the Big South Fork River.

The white bass and walleye fisheries of Lake Cumberland will also be damaged as a result of project operation. Big South Fork is the major spawning area for the Lake Cumberland white bass and walleye fisheries. The low temperature of the water discharged from the lower levels of the reservoir will prevent spawning migration of these species into the remaining section of the Big South Fork River. In addition, the wide variation of flows will virtually eliminate the value of the remaining section of river as a spawning area. Approximately 40 percent of the total Lake Cumberland white bass reproduction occurs in this river. Loss of the river as a spawning area will reduce the fishing effort for white bass at Lake Cumberland by about 180,000 man-days a year. Approximately 5,000 man-days of walleye fishing will also be lost annually.

Devils Jumps Reservoir is expected to develop into an average warmwater reservoir fishery. The power pool will provide an average surface area of 28,400 acres. Many reservoirs, some of considerable size, are located near the project area. Most of the fishing use of the reservoir will result from a redistribution of fishing activity from these other impoundments. Fishing will increase by an estimated 85,200 man-days annually.

The full commercial fishery potential of Devils Jumps Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the near future. Such commercial harvesting would utilize, for food and possible industrial use, a fishery resources potential through reduction of rough fish populations. The commercial fish potential of the reservoir will be about 426,000 pounds of food and industrial fishes per year.

WILDLIFE RESOURCES

Without the Project

Wildlife habitat in the Big South Fork Basin is characterized by narrow stream valleys and high steep ridges. The area is predominantly forested and therefore forest game species are the most common. The important species include white-tailed deer, gray squirrels, ruffed grouse, wildl turkeys, and raccoon. Farm game such as bobwhite quail and cottontails are scarce because of limited agricultural activity.

Squirrels presently provide the most hunting. However, deer are on the increase in the area and are becoming an important major game species. Turkeys are found only in limited numbers but measures are being taken to reestablish this species. Waterfowl use of the area is insignificant.

Annual hunting pressure in the project area amounts to about 7,600 and 2,000 man-days in Tennessee and Kentucky, respectively.

With the Project

The Devils Jumps Reservoir will destroy approximately 37,000 acres of wildlife habitat. This includes about 28,000 acres in Tennessee and 9,000 acres in Kentucky. Annually, the project will eliminate about 7,600 hunter-days in Tennessee and 2,000 hunter-days in Kentucky. Hunting losses in Kentucky will be partially compensated when project-acquired private lands become part of the Daniel Boone National Forest.

FISH AND WILDLIFE PLAN

The Devils Jumps project will be detrimental to the fish and wildlife resources in the area. However, these adverse effects can be nullified if certain measures are included in the project plan.

The following plan suggests the steps needed to insure adequate development of the fish and wildlife resources associated with the project. The evaluations presented are contingent upon the implementation of the measures suggested in the plan.

Fish

The Kentucky Department of Fish and Wildlife Resources and the Tennessee Game and Fish Commission will determine and initiate the management practices that will be needed to establish and maintain the reservoir fishery. The Kentucky agency will manage the stream below the dam. Portions of the reservoir and stream should be placed under the management of these state agencies under the terms of a Fish and Wildlife General Plan.

To insure adequate fishermen access to the reservoir and tailwater area, parking and boat launching facilities should be provided at various locations to accommodate a design load of 1,100 automobiles, in addition to the requirements of other recreationists. Approximately 575 of the parking spaces should be large enough to accommodate cars with boat trailers.

Areas of standing timber in a reservoir create important habitat for some species of fish and also provide good fishing locations. Before reservoir clearing plans become final, selection of areas not to be cleared should be determined by the Kentucky Department of Fish and Wildlife Resources, the Tennessee Game and Fish Commission, the U.S. Forest Service, and the Bureau of Sport Fisheries and Wildlife in cooperation with the U.S. Army Corps of Engineers.

A plan for zoning the reservoir should be developed cooperatively by all of the agencies responsible for the recreation activities. Such a plan would prevent possible conflicts with regard to the use of the impoundment.

The maintenance of the fishery downstream from the dam, including a portion of the Big South Fork arm of Lake Cumberland, will require releases of water from the reservoir of suitable temperature and quality. In this regard, multi-level outlets should be installed in the dam to provide for the regulation of the quality and temperature of the water released. In addition, proper water temperature and quality must also be maintained to prevent any detrimental effects to the white bass and walleye spawning in the river.

To insure that the remaining section of the Big South Fork River can be sucessfully used as a spawning area by white bass and walleyes, minimum flows in the river will be needed during the spring season. The peaking power operation will cause flow variations that will adversely affect both the spawning of the fish and the incubation of the eggs. Each year, walleye and white bass eggs hatch during the period February 15 to May 1. During this time it is estimated that a minimum instantaneous flow of 1,000 second-feet will be needed in the river below the dam.

The commercial fishery potential of Devils Jumps Reservoir should be retained as an open item for planning consideration. The Kentucky Department of Fish and Wildlife Resources and the Tennessee Game and Fish Commission shall determine the need and feasibility of harvesting the commercial fish species and control the operations to insure compatibility with other reservoir activities.

With the above measures implemented, the project will provide a net gain of 73,900 man-days of reservoir fishing annually valued at $57,000. In addition, the losses to the Lake Cumberland white bass and walleye fisheries will be prevented. Fishery evaluations are summarized in table 2.

Wildlife

Since all of the Kentucky portion of the project is within the boundaries of the Daniel Boone National Forest, all project-acquired lands in this area will be administered by the U.S. Forest Service. Mitigation of project-occasioned wildlife losses in Kentucky is possible. The degree of mitigation, however, will depend on the amount and location of private lands that can be brought into the National Forest with the project. Large National Forest holdings can be managed effectively and, in turn, provides more public hunting land. If the 4,500 acres of Forest Service land required by the project is replaced, loss of hunting opportunities will be mitigated. The Kentucky Department of Wildlife Resources and Daniel Boone National Forest have a working cooperative agreement concerning wildlife management on forest lands.

The project will also cause substantial losses to the wildlife resources in Tennessee. To compensate for these losses, all of the land between the No Business Creek and Station Camp Creek arms of the reservoir to the eastern boundary of Pickett State Park and Forest should be acquired at project cost. This would provide an area of approximately 9,700 acres and should be made available to the Tennessee Game and Fish Commission under the terms of a General Plan for Fish and Wildlife Management. This would combine the 9,700 acres with the 12,000-acre Pickett State Park and Forest and provide an area large enough to be intensively managed for wildlife in compatability with other public uses.

Other project lands suitable for wildlife management should be made available to the Tennessee Game and Fish Commission under the terms of a General Plan for Fish and Wildlife Management.

The measures discussed above would partially or wholly compensate for the hunting lost in Kentucky. The acquisition of land in Tennessee for the mitigation of the wildlife resources would provide 7,200 man-days of hunting annually if managed in conjunction with the Pickett State Park and Forest.

The effects of the project on the wildlife resources are presented in table 2.

Table 2. Effects of the Devils Jumps Project on the Fish and Wildlife Resources

Resource Unit	Miles or Acres	Without the Project (man-days)	With the Project (man-days)	Fish & Wildlife Plan Implemented With the Project: Miles or Acres	(man-days)	Net Increase (man-days)	Net Annual Value (dollars)
Fishery							
Stream	110 mi.	10,300	--	--	--	--	--
Reservoir	28,400 ac.	--	85,200	28,400 ac.	85,200	73,900	57,000
Downstream	4 mi.	1,000	--	--	--	--	--
Totals		11,300	85,200		85,200	73,900	57,000
Lake Cumberland							
White Bass Fishing		600,000	420,000	--	600,000	--	
Walleye Fishing		5,000	--	--	5,000	--	
Wildlife							
Reservoir							
Kentucky	9,000	2,000	-- 1/	4,500	2,000 1/	--	
Tennessee	23,000	7,600	--	--	--	--	
Mitigation lands (Tennessee)				9,700	7,200	--	

1/ Lands acquired in Kentucky will come under the administration of the U.S. Forest Service. This will open more lands to hunting and wildlife management practices can be implemented under an existing cooperative agreement between the Kentucky Department of Natural Resources and Daniel Boone National Forest. The degree of mitigation will depend on the location and amount of private lands brought into the National Forest with the project. If the 4,500 acres of Forest Service land needed for the project is replaced, the wildlife losses would be mitigated.

Estimated Costs of the Fish and Wildlife Plan

The initial cost of establishing a fishery in Devils Jumps Reservoir is estimated at $50,000. This includes the cost of studies to determine and initiate the management measures needed to establish the fishery. Other initial costs include fishermen access to the reservoir and tailwater area, but should include only the cost of the boat launching ramps and parking lots needed to accommodate the fishermen. These costs will be determined by the construction agency. The annual operation and maintenance cost associated with management of the reservoir fishery will be about $20,000.

The acquisition cost attributable to the wildlife mitigation lands will be approximately $800,000. The cost for the initial development of this area, including any needed developments on the existing state-owned land, will be about $100,000. The annual operation and maintenance costs will amount to approximately $25,000 for the wildlife management area.

RECOMMENDATIONS

In the interest of providing for the full development of the fish and wildlife resources in the planning for the Devils Jumps Project, it is recommended that:

1. The conservation and development of the fish and wildlife resources be among the purposes for which the project is authorized.

2. Parking and boat launching facilities for fishermen be provided at several locations on the reservoir that will be capable of accommodating 1,100 automobiles and 575 boat trailers in addition to the needs of other recreationists.

3. Timber be left standing in certain areas of the reservoir and these areas be selected in cooperation with the Kentucky Department of Fish and Wildlife Resources, the Tennessee Game and Fish Commission, the U.S. Corps of Engineers, the Bureau of Commercial Fisheries, the U.S. Forest Service, and the Bureau of Sport Fisheries and Wildlife during pre-construction planning.

4. A zoning plan to prevent conflicts of use on the reservoir be developed cooperatively by the Kentucky Department of Fish and Wildlife Resources, the Kentucky Division of Boating, the Tennessee Game and Fish Commission, the Tennessee Department of Conservation, the U.S. Corps of Engineers, the U.S. Forest Service, the Bureau of Outdoor Recreation and the Bureau of Sport Fisheries and Wildlife during pre-construction planning.

5. Multi-level outlets be installed in the dam to control the physical and chemical qualities of the water releases and the elevations of the intake portals be determined during pre-construction studies in cooperation with the Kentucky Department of Fish and Wildlife Resources and the Bureau of Sport Fisheries and Wildlife.

6. A minimum instantaneous flow of 1,000 second-feet be maintained in the Big South Fork River below the Devils Jumps Dam during the period of February 15 to May 1 to insure that the river can be used as a spawning area by white bass and walleyes.

7. The commercial fishery potential of the reservoir be realized, when necessary, for human needs and as a fishery management tool.

8. Lands obtained in the Kentucky portion of the project area and placed under the administration of the National Forest Service, be brought under the existing cooperative agreement between the Daniel Boone National Forest and Kentucky Department of Fish and Wildlife Resources for wildlife management purposes.

9. Approximately 9,700 acres of land above the flood pool be acquired to mitigate the project occasioned losses to wildlife resources and this area be located between the No Business Creek and Station Camp Creek arms of the reservoir and extend to the eastern boundary of Pickett State Park and Forest. These lands be made available to the Tennessee Game and Fish Commission under the terms of a Fish and Wildlife General Plan for wildlife management.

10. Selected project lands above the flood pool level be licensed to the Tennessee Game and Fish Commission under the terms of a Fish and Wildlife General Plan for wildlife management.

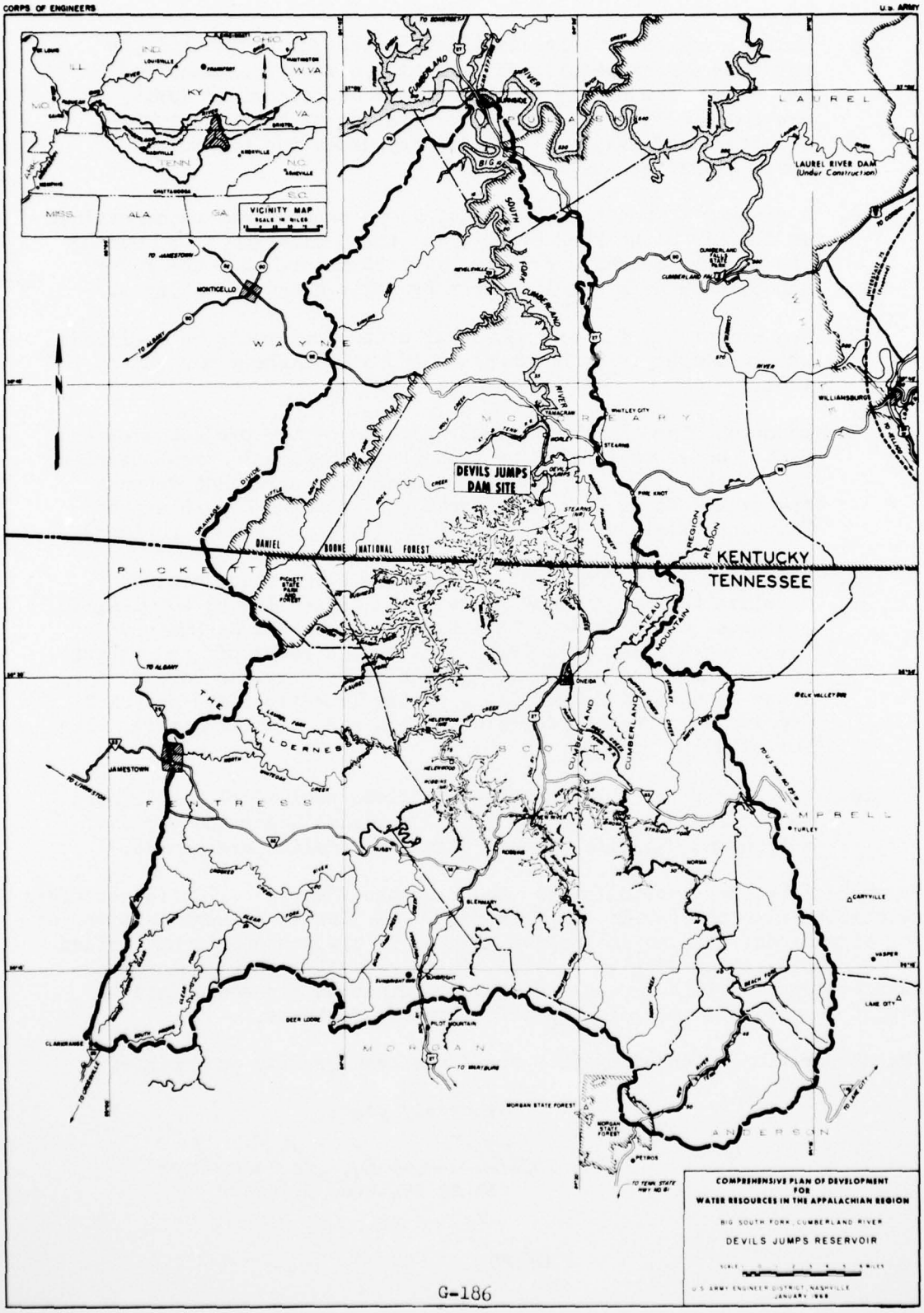
We appreciate the opportunity to report on the fish and wildlife resources associated with the Devils Jumps project. We wish to be kept informed of any significant changes in project plans. If the project is authorized for advanced engineering and design, it is requested that engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

Thomas A. Schmidt

Acting Regional Director


CORPS OF ENGINEERS
U.S. ARMY
VICINITY MAP
SCALE IN MILES
LAUREL RIVER DAM
(Under Construction)
DEVILS JUMPS
DAM SITE
DANIEL BOONE NATIONAL FOREST
KENTUCKY
TENNESSEE
WAYNE
PICKETT
FENTRESS
MORGAN
CAMPBELL
ANDERSON
MONTICELLO
JAMESTOWN
WILLIAMSBURG
ONEIDA
WHITLEY CITY
STEARNS
WORLEY
BIG SOUTH FORK CUMBERLAND RIVER
COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
BIG SOUTH FORK, CUMBERLAND RIVER
DEVILS JUMPS RESERVOIR
U.S. ARMY ENGINEER DISTRICT, NASHVILLE
JANUARY 1968

TENNESSEE GAME AND FISH COMMISSION

DOCTORS BLDG. • 706 CHURCH STREET • NASHVILLE, TENN. 37203

RS OF COMMISSION
WHALLEY, JR. . . . JACKSON
BOHANON . . . COOKEVILLE
T. SMITH . . . BRISTOL
H. BLACKBURN . . . CAMDEN
HOWARD . . . PULASKI
LOWE . . . CHATTANOOGA
T. McDADE . . . ALCOA
REER RICKETSON . . . NASHVILLE
TRONG . . . MEMPHIS

FRED W. STANBERRY, DIRECTOR
DAVID M. GOODRICH, ASS'T. DIR.
HAROLD E. WARVEL, ASS'T. DIR.



April 24, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resources Surveys
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We concur with and have no additions at this time concerning the Bureau of Sport Fisheries and Wildlife's report draft on the proposed Devils Jumps Reservoir project. We are of the opinion, however, that if this project is authorized, irreplaceable natural resource values will be destroyed.

Yours very truly,

Harold E. Warvel

Harold E. Warvel, Acting Director
Tennessee Game and Fish Commission

HEW:HMN:mf

FISH & WILDLIFE
COMMISSION
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DR. J. L. BECKNELL, MANCHESTER

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF FISH & WILDLIFE RESOURCES
MINOR CLARK, COMMISSIONER

STATE OFFICE BLDG. ANNEX
FRANKFORT, KY. 40601
PHONE 564-3400

April 24, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development Program
Room 6405 - Federal Building
550 Main
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed the draft report on the Devils Jump Reservoir Project which was transmitted by your letter of April 19, 1968. This department concurs in the findings presented therein.

Sincerely,

Minor Clark

Minor Clark
Commissioner

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

February 13, 1967

District Engineer
U. S. Army Engineer District, Louisville
Corps of Engineers
P.O. Box 59
Louisville, Kentucky 40201

Dear Sir:

This is the Bureau of Sport Fisheries and Wildlife report on the Upper Licking River Basin with respect to the proposed developments in the Royalton-Salyersville, Kentucky area as authorized by the Appalachian Regional Development Act of 1965 (Section 206(e), PL 89-4). This report has been prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 Incl.) in cooperation with the Kentucky Department of Fish and Wildlife Resources. It has the concurrence of that agency as indicated by letter dated February 6, 1967.

Our Bureau has previously studied the fish and wildlife resources at the Royalton site and the results were included in the Bureau of Sport Fisheries and Wildlife report on the Licking River Basin, Kentucky, dated September 30, 1964.

DESCRIPTION OF AREA

The project is located on the Licking River in the vicinity of Salyersville and Royalton, Kentucky. The topography of the area is characterized by steep-sided ridges and narrow stream valleys. The ridges are forested with oaks predominating, interspersed with hickory and poplar. The bottom lands are mainly in pasture with some cultivation of corn and tobacco. The stream banks are bordered with brush in varying density with occasional larger trees.

Flows of the Licking River vary considerably in the project area. Flows average about 85 c.f.s. at the dam site and about 160 c.f.s. at Salyersville. At times there is no flow in the river. High turbidity affects water quality much of the time.

AD-A041 407 CORPS OF ENGINEERS CINCINNATI OHIO F/G 8/6
DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. VOLUME 22. APPEND--ETC(U)
MAY 69

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3 OF 4
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PROJECT DESCRIPTION

The primary purpose of the project is to provide flood protection for the town of Salyersville, Kentucky, and provide a flood-free area for an industrial park. The main feature of the project, Royalton Dam, will provide this protection and other benefits including water quality control, water supply, and recreation including fish and wildlife. The dam will be constructed on the Licking River approximately a quarter of a mile upstream from Royalton, Kentucky. Other project proposals are channel improvement of the Licking River in the Salyersville vicinity and the possible construction of several smaller dams by the Soil Conservation Service. Much of the flood plain downstream from the dam to Salyersville is planned for an industrial park and other developments.

We are pleased to note that project plans include multi-level outlets in the dam to provide temperature control and dissolved oxygen for water quality control purposes and the preservation of downstream fisheries.

The project plan also includes acquisition of lands and development of parking facilities downstream from the dam to provide fisherman access to the reservoir tailwaters; and development of several access sites to the reservoir, with parking and boat launching facilities provided at each site for fishing and general recreation use. Exact locations of the access sites will be determined after the project is authorized. Pertinent engineering data are presented in Table 1.

Table 1. - Structure Data

Pool	Elevation (ft. m.s.l.)	Surface Area (acres)	Storage (acre-feet)
Minimum	922	790	12,976
Water quality control & water supply	925	860	15,466
Seasonal	932	1,080	22,186
Flood Control	958	2,280	64,506

Project operation will provide temporary storage for flood waters which normally will be evacuated soon after they occur. Minimum flows of about 17 c.f.s. released from the water quality and supply pool will influence the river downstream to West Liberty.

In addition to lands needed for reservoir operation, acquisition of approximately 4,200 acres above the flood control pool is anticipated.

FISHERY SECTION

Without the Project

The quality of the fishery resource in the 47-mile segment of Licking River from the upper limits of the reservoir site downstream to West Liberty ranges from moderate to good. Extreme high and low flows and high turbidity are major limiting factors. In the upstream portion, use is limited to sucker fishing during the spring and to a largemouth bass-channel catfish fishery during the remainder of the year. From Salyersville downstream to West Liberty the river increases in value and provides bank and float fishing for largemouth bass, spotted bass, white crappie, longear sunfish, green sunfish, bluegill, warmouth, and various species of catfish.

Cave Run Dam is under construction on the Licking River. The flood control pool of the reservoir impounded by that dam will extend upstream to the vicinity of West Liberty. A white bass and walleye fishery is expected to develop in the reservoir. Many of these fish, especially the white bass, probably will migrate upstream to the project area and improve the fishery value of the river.

Fishing pressure on the five miles of river within the proposed reservoir area and the ten miles downstream from the dam site to Salyersville would amount to about 200 and 500 man-days1/, respectively. The 32-mile river segment from Salyersville to West Liberty would average 2,200 man-days.

1/ Estimates of man-day use for sport fish and game are average annual, utilizing the economic project life of 100 years.

With the Project

In general, the proposed Royalton Dam and Reservoir will improve the fishery resources in the area of project influence. Although Royalton Reservoir will inundate five miles of the Licking River at maximum flood storage, the 1,080-acre seasonal pool will provide a fishery to an area in need of fishing opportunities.

The habitat of the river downstream from the dam to West Liberty is expected to improve, except for the destruction, by channelization, of an eight mile segment in the vicinity of Salyersville. However, any benefits to the stream fishery are contingent on a minimum release from the reservoir of 17 c.f.s. of suitable quality to support fish life.

The Department of Agriculture's Soil Conservation Service is studying seven reservoir sites located on tributary streams in the Upper Licking River watershed. The watershed is one of ten Status IV projects in Kentucky to be investigated under the Appalachian program. Of the seven, the site located on Stinson Creek is being considered for multiple-purpose use -- specifically for recreation. Should this site be selected for construction, it could provide approximately 4,200 man-days of fishing annually.

The full commercial fishery potential of Royalton Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the near future. The Kentucky Department of Fish and Wildlife Resources shall determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with other reservoir activities. Such commercial harvesting would utilize for food and possibly industrial use a fishery resource that would otherwise be wasted, and at the same time improve sport fishing potential through reduction of rough fish populations. Royalton Reservoir's commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 27,000 pounds of food and industrial fishes per year.

The Royalton Reservoir is expected to provide about 16,200 fisherman-days. The 10-mile portion of the Licking River from the dam to Salyersville and the 32-mile segment downstream to West Liberty will receive 1,200 and 3,300 man-days of fishing, respectively. Total net fishery benefits occurring to the project are $22,400 as summarized in Table 2.

Table 2. - Estimated Fishery Utilization Without the Project and With the Project, and Benefits Occurring to the Project.

Resource Unit	Without Project (Man-days)	With Project (Man-days)	Benefits (Man-days)	Value (Dollars)
Licking River				
Reservoir site (5 miles)	200			
Dam to Salyersville (10 miles)	500	1,200		
Salyersville to West-Liberty (32 miles)	2,200	3,300		
Total Streams	2,900	4,500	1,600	2,000
Reservoirs				
Royalton Reservoir		16,200		
S.C.S. Reservoir		4,200		
Total Reservoirs		20,400	20,400	20,400
Grant Total	2,900	24,900	22,000	22,400

WILDLIFE SECTION

Without the Project

Wildlife habitat within the project area is of low to moderate value. The river valley within the proposed reservoir and downstream to Salyersville is inhabited largely by small game. The important species include bobwhite quail and cottontail rabbits which sustain the bulk of the hunting pressure in the area. Waterfowl use is insignificant.

Forested lands adjacent to the project area support good populations of gray squirrels and ruffed grouse. White-tailed deer are the only big game species in the area. Hunting pressure is heavy on small game species and comparatively light on big game. Fur-animal populations are low and trapping activities are limited.

Average annual hunting pressure within the Royalton Reservoir area is estimated at 250 man-days. An additional 250 man-days of hunting occur on the river bottoms from the dam site downstream to Salyersville.

With the Project

Royalton Reservoir will permanently inundate 1,080 acres of river valley at the seasonal pool level and about 1,200 additional acres will be intermittently flooded. More habitat will be lost downstream from the dam when the flood plain is developed for industrial purposes. Hunting on the forested areas adjacent to the project lands is not expected to change as a result of the project.

The impoundment will provide a resting area for migrating waterfowl; however, significant benefits are not anticipated.

Construction of Royalton Reservoir and development of the industrial complex on the downstream flood plain will result in a project loss of about 370 man-days of hunting annually.

DISCUSSION

Developments anticipated under the Appalachian Development Program will result in a greater demand for fishing and hunting opportunities. More specifically, this applies to proposed developments in the Upper Licking River Basin. The project will improve the fishery resources if certain precautions are taken but will cause minor losses to the wildlife resources. To insure the maximum development and use of the fish and wildlife resources, several measures should be included in the project plan.

The fishery resource of the Licking River is expected to improve overall from Royalton Dam downstream to West Liberty. Benefits attributed to the river in this section are dependent on the project operation to provide a minimum flow of 17 c.f.s. in the river at the dam.

To insure that the above-mentioned flow will provide favorable levels of temperature and dissolved oxygen for downstream fisheries, all discharges, other than spillway flows during flood periods, will be accomplished by means of high level and low level sluices. Determinatio of number and elevation of intakes should be coordinated with the Kentucky Department of Fish and Wildlife Resources, the Federal Water Pollution Control Administration, and this Bureau.

It will be necessary to provide certain protective measures for the eight miles of Licking River downstream from the dam if the fishery benefits for this segment are to be realized. The natural vegetation along the river banks should be left undisturbed and protected in a continuous strip 10 yards wide on each side of the river and be available for public use.

The provision of adequate access will also be necessary if the fishery benefits credited to the project are to occur. Sites conveniently located within the reservoir area; immediately below the dam; and at several points along the river downstream to Salyersville would be desirable.

You have not as yet provided information regarding your plans for timber clearing. It is possible that a general clearing of the seasonal pool area may be undesirable from a fishery standpoint. Before a plan is formulated, the Kentucky Department of Fish and Wildlife Resources and this Bureau should be given the opportunity to review it and suggest modifications if needed.

Royalton Reservoir will provide an outlet for several types of water oriented recreation. To insure orderly use of the reservoir, a zoning plan should be developed and enforced to regulate public use. The plan should be formulated in cooperation with the Kentucky Department of Fish and Wildlife Resources, Kentucky Division of Boating, Bureau of Sport Fisheries and Wildlife, Bureau of Outdoor Recreation, and other interested agencies.

Although the project will be detrimental to the wildlife resources, mitigation of these losses is possible. The forest habitat adjacent to project lands is suitable for wild turkey management. However, to establish a huntable flock on these lands, a release site of considerable size that can be intensively managed is necessary. Due to the topography of the area it may be that the taking line will encompass sufficient land. If not, additional lands should be acquired to furnish a unit of approximately 1,000 acres. Introduction of wild turkeys to this general area would provide about 2,000 man days of hunting annually valued at $6,000. Other lands acquired in accordance with the Joint Land Acquisition Policy could be managed for bob-white quail and cottontail rabbits.

RECOMMENDATIONS

On the basis of the foregoing discussion, the Bureau recommends that:

1. A minimum flow of 17 c.f.s. be maintained in the Licking River below Royalton Dam;

2. The natural vegetation on the banks of the Licking River be left undisturbed and protected within a strip 10 yards wide on each side of the river for a distance of 8 miles downstream from Royalton Dam;

3. Determination of number and elevation of multi-level outlets be coordinated with the Kentucky Department of Fish and Wildlife Resources, the Federal Water Pollution Control Administration, and this Bureau;

4. Detailed plans of the reservoir site for recreational zoning, clearing, and public access be developed cooperatively by the Corps of Engineers, Bureau of Outdoor Recreation, Kentucky Department of Fish and Wildlife Resources, Kentucky Division of Boating, any other interested agencies, and this Bureau;

5. Wildlife losses be mitigated by acquisition of 1,000 acres of land at Federal project cost;

6. All lands and water areas within Royalton Reservoir Project, excluding lands which may be reserved for intensive development of general recreation, or for safety, efficient operation, or protection of public property, be made available for administration by the Kentucky Department of Fish and Wildlife Resources under a General Plan for Fish and Wildlife Management in accordance with provisions of the Fish and Wildlife Coordination Act;

7. You include language in your report recommending that additional detailed studies of fish and wildlife resources be conducted, as necessary, after the project is authorized, in accordance with the Fish and Wildlife Coordination Act, and that such reasonable modifications be made in authorized project facilities as may be agreed upon by the Director, Bureau of Sport Fisheries and Wildlife, the Chief of Engineers, and the Commissioner of the Kentucky Department of Fish and Wildlife Resources for the conservation and improvement of these resources.

Sincerely yours,

Eugene E. Crawford

Act'g. Regional Director
Bureau of Sport Fisheries & Wildlife

FISH & WILDLIFE
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5TH [illegible] Fred Scroggin[illegible]y Ridge
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9TH Dr. J. L. Becknell Manchester

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF FISH & WILDLIFE RESOURCES
MINOR CLARK, COMMISSIONER

[illegible] State Office Bldg. Annex
Frankfort, Ky. 406[illegible]
Phone 564-3400

February 6, 1967

Mr. Donald H. Reese, Chief
Appalachian Area Development Program
Bureau of Sport Fisheries & Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Reese:

This is to advise you that I have reviewed your draft report of the proposed developments in the Royalton - Salyersville area by the U. S. Army Corps of Engineers. I concur wholeheartedly in both the fishery and the wildlife sections of the report; however, on page 9 at the top of the page, I would suggest that the continuous strip of 10 yards be modified to include 20 yards. We have had a great deal of experience in attempting to maintain free public access around all of our 41 state-owned lakes. Thirty feet is just almost too small an area to adequately control; sixty feet would give much more public control.

I want to particularly emphasize our approval of your recommendation number six and want to assure both you and the U. S. Army Corps of Engineers that the Department of Fish and Wildlife Resources is ready and able to manage the wildlife and the hunting on the proposed 1,000 acres.

Sincerely,

Minor Clark

Minor Clark
Commissioner

bs

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. Post Office and Courthouse
Boston, Massachusetts 02109

March 20, 1967

District Engineer
U. S. Army Engineer District, Louisville
Corps of Engineers, P. O. Box 59
Louisville, Kentucky 40201

Dear Sir:

Our report on the fish and wildlife resources of the Upper Licking River Basin with respect to the proposed developments in the Royalton-Salyersville, Kentucky area, dated February 13, 1967, contained a statement that we wish to correct.

On page 3, first paragraph, second sentence it states that "Minimum flows of about 17 c.f.s. released from the water quality and water supply pool will influence the river downstream to West Liberty." Maximum releases from the water quality and supply pool will be about 17 c.f.s. during the summer months. However, winter releases from the same pool will be around 9 second feet.

It is our understanding that releases from all reservoir pools during summer, fall and winter will provide a flow of about 17 c.f.s. which, at times, will be slightly higher or lower. Spring flows will be much higher. An occasional flow of about 2,000 c.f.s. is expected during peak flood stage.

In view of the above, please change on page 3 of our report the second sentence of the first paragraph to read, "Minimum flows of about 17 c.f.s. released from the reservoir will influence the river downstream to West Liberty."

Thank you for your continued cooperation.

Sincerely yours,

Richard E. Griffith

Regional Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

October 16, 1968

District Engineer
U.S. Army, Corps of Engineers
Louisville, Kentucky

Dear Sir:

This is our report on a potential levee and channel improvement project at Midland City, Kentucky, on the Licking River, which is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89-4, 89th Congress, 1st Session). It has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

We have reviewed the project plans depicted on the preliminary map enclosed in your letter dated August 6, 1968, (ORLED-P). The map shows levee and channel improvement plans to be completed in 1980, 2000, and 2020 on the Licking River several miles below Cave Run Dam.

The Kentucky Department of Fish and Wildlife Resources is presently negotiating for a 300-acre fish hatchery site on the right bank of Licking River immediately downstream from the dam. The water for the hatchery would be supplied through a special pipe installed in the outlet works of the project. The upper section of the proposed levee would be constructed along the stream within the hatchery site. Consequently, the design and location of the levee in this area should be closely coordinated with the Kentucky Department of Fish and Wildlife Resources so that any conflicts that may arise with the hatchery operation can be resolved.

Aside from the possible effects on the proposed fish hatchery, we do not believe that construction and operation of the project would significantly affect fish and wildlife resources of the area, or that the project would offer feasible opportunities for the improvement of these resources.

This report has been reviewed and concurred in by the Kentucky Department of Fish and Wildlife Resources, and a copy of Commissioner Clark's letter is attached.

Please advise us of any changes made in the project plans so that we can reevaluate the effects of the project on fish and wildlife and prepare a revised report, if necessary.

We appreciate the opportunity to comment on the proposed plans.

Sincerely yours,

C. Edward Carlson

C. Edward Carlson
Regional Director

Attachment

FISH & WILDLIFE
COMMISSION
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COMMONWEALTH OF KENTUCKY
DEPARTMENT OF FISH & WILDLIFE RESOURCES
MINOR CLARK, COMMISSIONER

STATE OFFICE BLDG. ANNEX
FRANKFORT, KY. 40601
PHONE 564-3400

October 9, 1968

Mr. W. L. Towns
Deputy Regional Director
U. S. Department of the
Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and
Wildlife
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Towns:

I have reviewed your proposed report concerning the levee and channel improvement project at Midland City, Kentucky. Please be advised that I concur completely with the report.

Sincerely,

Minor Clark
Minor Clark
Commissioner

MC/mkj

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

April 16, 1968

District Engineer
U. S. Army Engineer District, Savannah
P. O. Box 889
Savannah, Georgia 31402

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Curry Creek Reservoir Appalachian Project, Georgia, which is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89-4, 89th Congress, 1st Session). This report is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16. U.S.C. 661-666 inc.) in cooperation with the Georgia State Game and Fish Commission. It has the concurrence of that agency as indicated by letter dated March 29, 1968. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

This report is based on engineering data included in your letters dated August 1, 1967 and October 27, 1967 and were considered in arriving at evaluations representing the average condition covering a 100-year project life.

The Curry Creek reservoir is located on the North Oconee River about 12 miles upstream from Athens, Georgia. The reservoir will inundate approximately 12 miles of the North Oconee River, about 3 miles of Little Curry Creek, and nearly 7 miles of Curry Creek. The topography is both hilly and mountainous with narrow stream valleys. The major portion of the watershed is composed of woodlands.

PROJECT DESCRIPTION

The concrete dam with impervious earth wings will be approximately 1,200 feet long, will have a crest elevation of 724' 1/ and will rise 85' in height above streambed. The spillway will be a controlled, concrete weir in the valley and have a crest at elevation 681'. The releases through the spillway will be controlled by three Tainter gates, each 30 feet wide and 25 feet high. A 180-foot-long impervious earthfilled dike located in a valley about 900' east of the dam is also included in the project formulation.

1/ All elevations refer to feet above mean sea level.

At sediment pool elevation of 661', the reservoir will inundate 1,120 acres (table 1). The conservation pool at elevation 700' will cover 5,720 acres and at full flood control pool (elevation 706'), the surface area will be 6,600 acres.

Under normal project operation, 65 c.f.s. of water will be released downstream to supply water to the city of Athens.

Table 1. Engineering Data, Curry Creek Reservoir Project

Pool	Elevation (ft. m.s.l.)	Capacity (Ac. Ft.)	Area (Acres)
Flood Control	706	180,000	6,600
Conservation	700	141,000	5,720
Sediment	661	14,000	1,120

FISH AND WILDLIFE RESOURCES

Without-the-Project

Fishery Resources

The Curry Creek Reservoir project will affect about 12 miles of North Oconee River within the reservoir area and approximately 12 miles of the river downstream from the dam. The existing species of fish in this stream are channel catfish, largemouth bass, suckers, and sunfish. Some largemouth bass fishing is carried on in the beaver dams of the marshy areas. During high water, the main stream carries a heavy load of suspended sand. An average of approximately 1,920 man-days of fishing annually is expected to take place in the 24 miles of stream during the period of project analyses. Fisherman use of Curry Creek and Little Curry Creek is negligible.

Wildlife Resources

Wildlife species present in the project area are white-tailed deer, squirrels, cottontails, swamp rabbit, mourning doves, raccoon, mink, muskrat, and beaver. Important waterfowl species such as the mallard, green-winged teal, wood duck, and black duck use the area as wintering grounds and resting sites during migration periods. Flocks of waterfowl ranging between 6,000-8,000 birds have been wintering in the swamp and bottom-land hardwood complex. Beaver ponds are also common to the area. The acreage contained within the project area will

support an average of 1,500 upland-game-hunter days annually over the life of the project.

With-the-Project

Fishery Resources

The conservation pool of Curry Creek Reservoir will inundate about 12 miles of fishery habitat in the North Oconee River and alter the fishery habitat in 12 miles of the river below the dam.

The 12 miles of stream inundated will result in the loss of 960 fisherman-days use. The impounded segment will be replaced by a 5,720-acre reservoir fishery.

Wildlife Resources

Inundation of 5,720 acres of wildlife habitat by the conservation pool will permanently eliminate 950 hunter-days annually. Of major concern is the destruction of the wetlands habitat in the project area which serves as wintering grounds and resting sites for large flocks of waterfowl during migration flights. Wetland habitat is critical in this part of the State. There are few such areas and this is one of the most important in this part of Georgia. Even though alternate areas are developed, they will not be of the same quality as the wetland area that will be inundated by the project.

An additional 100 acres to be used for the damsite, construction areas, and permanent structures will eliminate another 20 man-days of hunting annually.

It is expected that the amount of upland game hunting on the 3,180 acres of habitat lying between the conservation pool and the 300-foot horizontal strip above maximum flood pool will be the same as under without-the-project conditions. Generally, this narrow strip is unsuitable for wildlife management purposes.

FISH AND WILDLIFE PLAN

Fish

Access facilities to the reservoir should be sufficient to accommodate anticipated fishing pressure. This would require space for parking facilities for about 540 fisherman cars. Of the 540 fisherman parking spaces, about 180 should be large enough to accommodate cars with boat trailers.

All reservoir bridges that are constructed 15 feet or less above the surface of the conservation pool should be provided with a safe sidewalk or catwalk on both sides to accommodate fishermen. Parking areas, and in some instances boat launching ramps, at the ends of the causeways or bridges should be provided also. Design for the bridge fishing facility should be coordinated with the Georgia State Highway Department, Game and Fish Commission, Corps of Engineers, and the Bureau prior to preparation of the General Design Memorandum.

A zoning plan should be developed to prevent conflicts between types of reservoir uses. This plan should be developed through post-authorization cooperation studies between this Bureau, the Georgia State Game and Fish Commission and the Corps of Engineers.

Standing timber should be left in selected cove areas which are to be inundated. These areas provide a varied fish habitat, act as fish concentrators, and help fishermen locate fish concentrations. These areas should be selected during preconstruction planning phases prior to preparation of the General Design Memorandum.

To improve the downstream fishery, a multiple-stage outlet should be incorporated into the project design. The elevations of outlet portals in the dam should be determined by future cooperative studies between the Georgia State Game and Fish Commission and this Bureau prior to the preparation of a General Design Memorandum. Outlets at various levels are necessary to maintain desirable water quality in the downstream fishery.

Downstream fisherman access will be needed to realize the fishery benefits resulting from reservoir operation. It will be necessary to provide parking facilities for at least 20 fisherman cars. Picnickers, sightseers, and other general recreationists would use the tailwater area, so that parking facilities in excess of the 20 needed for fishermen should be planned. In addition to tailwater access, eleven one-acre access sites are needed along the 12-mile stretch to Athens. An average of one site per mile is preferred.

Based on a minimum instantaneous flow of 65 c.f.s., provision of access sites and tailwater parking facilities, good quality water releases, and the inclusion of multi-level outlets in the project design, the 12-mile downstream fishery to Athens would provide an estimated 2,880 man-days of fishing annually. This represents an increase of 1,920 man-days, valued at $3,360, over the without-the-project evaluation.

The reservoir fishery which will be formed will support about 97,240 fisherman days; assuming implementation of the Fishery Plan. This represents a reservoir benefit of 96,280 man-days having a net recreational value of $144,900.

The full commercial fishery potential of Curry Creek Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the future. The Georgia Game and Fish Commission shall determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with other reservoir activities. Such commercial harvesting would utilize for food and possibly industrial use a fishery potential through reduction of rough fish populations. The reservoir's commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 86,000 pounds of food and industrial fishes per year.

Wildlife

To mitigate wildlife losses, the fish and wildlife plan includes the project acquisition of an additional 700 acres of land outside the presently contemplated fee acquisition line. This area is located in the upper reach of Cabin Creek (see plate 2). In conjunction with this area, it is requested that a water control structure be placed in the existing bridge crossing to facilitate shallow flooding of bottom-land hardwoods during the fall and early winter months. The upland area of this acquisition tract would be managed for upland game production and public hunting. The management unit and water control structure should be made available to the Georgia Game and Fish Commission under the terms of a Fish and Wildlife General Plan.

Standing timber to provide resting, roosting, and breeding habitat for waterfowl should be left in selected backwater areas at the upper ends of the conservation pool as shown in plate 1. Also fruit and mast-bearing trees and shrubs which serve as a source of food supply for waterfowl and forest game should be left undisturbed on the strip of shoreline above the conservation pool.

The Bureau of Outdoor Recreation proposes that an additional 2,000 acres be acquired to develop the recreational potential of the project area. To promote compatability between hunting and other recreational use, it would be necessary to restrict hunting to those periods when conflicts would be at a minimum. Most of the hunting could take place during October, November, and December; months of low, general-recreation use. If this land is acquired as recommended by the Bureau of Outdoor Recreation, hunting should be permitted in areas not intensively developed for general recreation and during those periods when conflicts would be at a minimum. Hunting regulations concerned with the use of this area should be established by the Georgia Game and Fish Commission.

Cost of the Fish and Wildlife Plan

The initial cost of establishing a fish population in the reservoir which includes survey, pre-impoundment fish control, and stocking would approximate $45,760. The annual cost, based on 100-year project life and a 3¼ percent interest rate would be $1,550.

Costs of reservoir fishery operation and maintenance, including such things as corrective stocking, fish population control, post-impoundment surveys, and the maintenance of fisherman access facilities would total about $14,000, which would be borne by the Georgia State Game and Fish Commission.

Operation and maintenance costs of the downstream fishing facilities would total about $2,400 annually and would be borne by the Georgia State Game and Fish Commission.

The 700 acres of additional land needed to mitigate project-occasioned wildlife losses will cost approximately $98,000. A water-control device in the existing bridge structure is estimated to cost $5,000. All of these costs should be borne by the project as mitigation measures. Costs for annual operation and maintenance would be about $1,000.

The 2,200 acres that would be acquired for general recreation and be made available to the Georgia State Game and Fish Commission for hunting under the terms of a General Plan would receive minimum management which would entail certain operation and maintenance costs primarily for the maintenance of access roads and land posting. These costs would amount to about $500 annually and would be borne by the Georgia State Game and Fish Commission.

Table II. Effects of Curry Creek Reservoir Project on Fishery Resources Assuming Implementation of the Fish and Wildlife Plan

Resource Unit	Without Project (Man-days)	With Project (Man-days)	Benefits (Man-days)	Benefits (Dollars)
Stream (12 Mi.)	960	--	--	--
Reservoir	--	97,240	96,280	144,900
Downstream (12 Mi.)	960	2,880	1,920	3,360
Totals	1,920	100,120	98,200	148,260

RECOMMENDATIONS

On basis of the foregoing, the Bureau recommends that:

1. Reservoir parking facilities sufficient to accommodate 540 fisherman cars, 180 large enough for car with boat trailer, be provided on the reservoir portion of the project in addition to those facilities needed for general recreation.

2. Sidewalks or catwalks be incorporated on all reservoir bridges constructed 15 feet or less above the surface of the conservation pool to accommodate fishermen. Parking areas at the ends of the bridge or causeway should be provided also.

3. A zoning plan be developed to prevent conflicts between reservoir users. This plan should be developed cooperatively between this Bureau, the Georgia State Game and Fish Commission, and the Corps of Engineers, at an appropriate time during post-authorization studies.

4. Standing timber be left in selected cove areas that will be inundated to provide improved fish and wildlife habitat. Fruit and nut-bearing trees and shrubs also be left undisturbed on the strip of shoreline above the conservation pool.

5. Multi-level outlets be incorporated in your project design. The elevations of the portals to be determined during future cooperative studies between the Georgia State Game and Fish Commission and this Bureau prior to preparation of a General Design Memorandum.

6. Tailwater parking facilities be provided for at least 20 fisherman cars.

7. An average of one fisherman-access site per mile be provided to utilize the downstream fishery to Athens.

8. To mitigate project-induced wildlife losses, a total of approximately 700 acres of additional land, located in the upper reach of Cabin Creek, be acquired in fee ownership and made available to the Georgia Game and Fish Commission under the terms of a general plan. In conjunction with this plan, it is further recommended that the project install a water-control device in the existing county road bridge as shown on plate 2.

9. Hunting be allowed on all lands acquired for general recreation during months of low recreation use. These lands should be made available to the Georgia Game and Fish Commission in accordance with a General Plan for Fish and Wildlife Management as provided in the Fish and Wildlife Coordination Act.

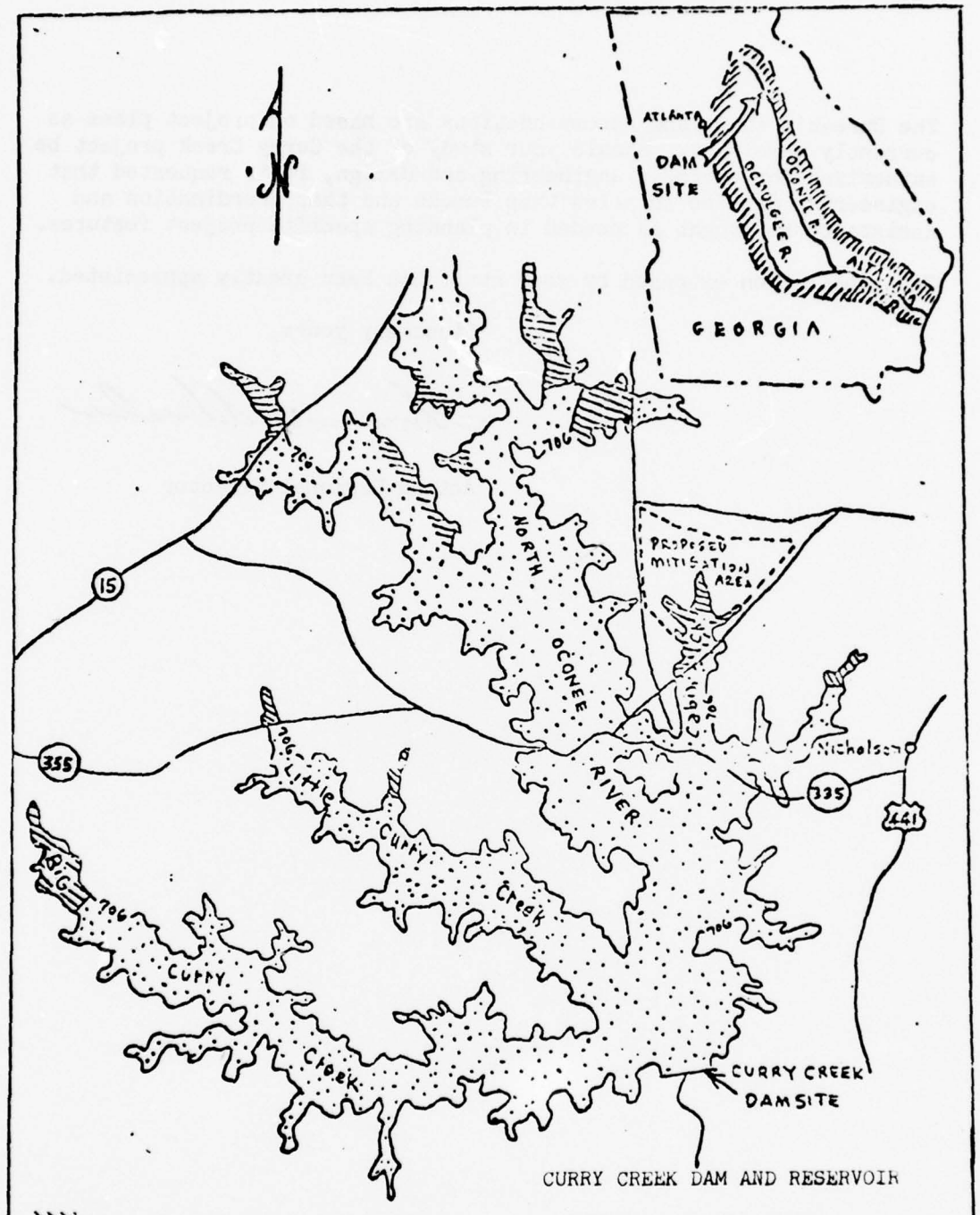
The Bureau's study and recommendations are based on project plans as currently developed. Should your study of the Curry Creek project be authorized for advanced engineering and design, it is requested that engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

Thomas A. Schroeder

Acting Regional Director



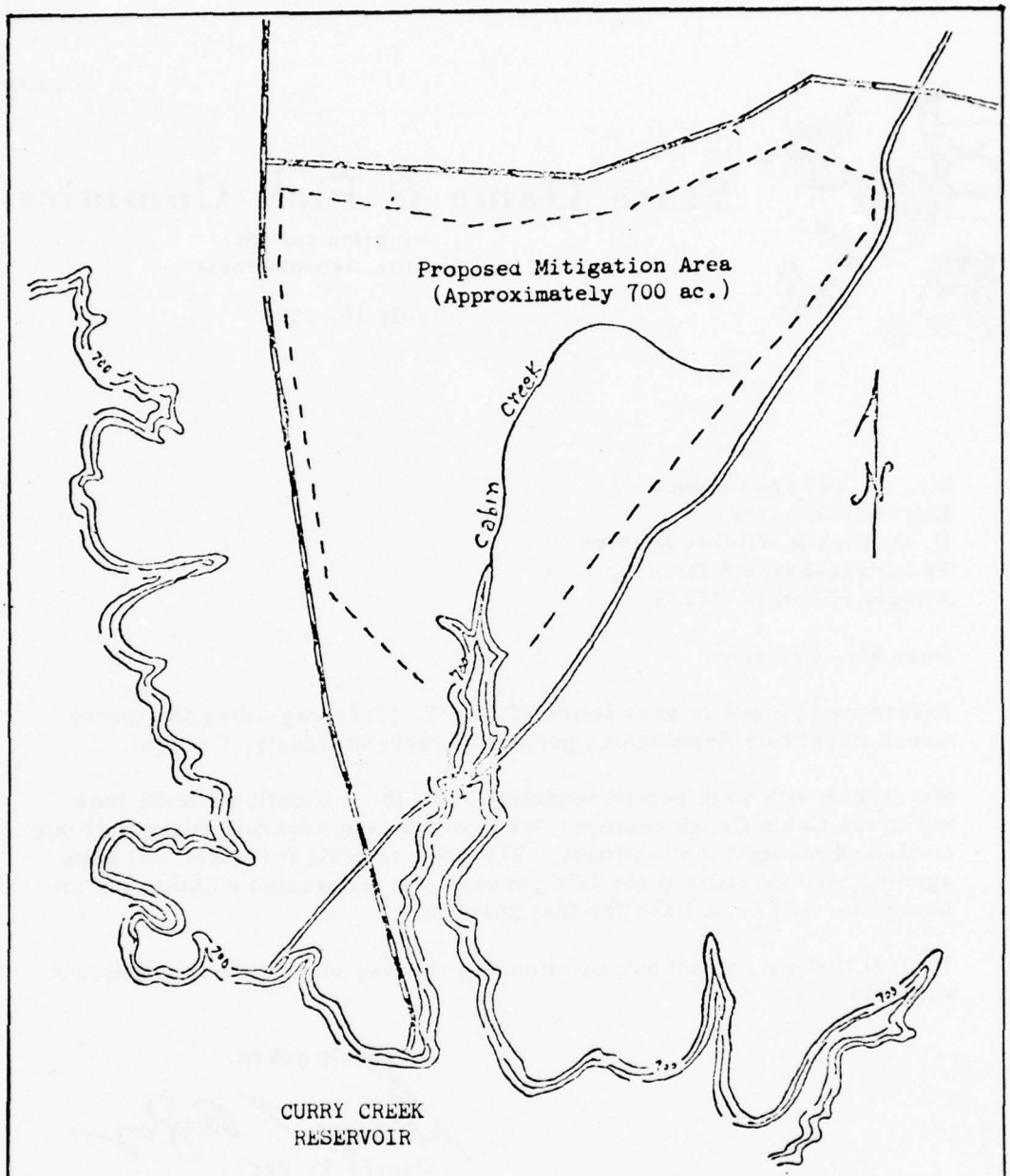
CURRY CREEK DAM AND RESERVOIR

ALTAMAHA RIVER BASIN, GA.

1 0 1 2 MILES

Backwater areas in the normal pool where all standing timber should be left undisturbed to serve as waterfowl cover areas for resting, roosting and breeding habitat.

United States Department of the Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife



WILDLIFE MITIGATION AREA
CURRY CREEK DAM AND RESERVOIR

ALTAMAHA RIVER BASIN, GA.

United States Department of the Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife

July 1968

PLATE 2

DIRECTOR



State Game & Fish Commission

401 STATE CAPITOL
ATLANTA, GEORGIA 30334

July 16, 1968

Mr. C. Edward Carlson
Regional Director
U. S. Fish & Wildlife Service
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Carlson:

Reference is made to your letter of July 8, 1968, regarding the Curry Creek Reservoir Appalachian project in Jackson County, Georgia.

We concur with your recommendations that the mitigation site be located in the Cabin Creek section. We feel that this area will more suit our needs and management abilities. The area suitable for waterfowl management will be utilized for this purpose and the section suitable for upland game will be utilized for that purpose.

We feel that we can accomplish much in the way of wildlife management with this site.

Sincerely yours,

George T. Bagby

George T. Bagby
Director

GTB/HH/bl

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

District Engineer
U.S. Army Engineer District, Mobile
Corps of Engineers
2301 Airport Boulevard
Box 2288
Mobile, Alabama 36601

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Dalton Reservoir Project, Whitfield and Murray Counties, Georgia. The project is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89). This report is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.) in cooperation with the Georgia State Game and Fish Commission and has their concurrence as indicated by letters dated March 21, 1968 and April 11, 1968. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

DESCRIPTION OF THE AREA

The Dalton Reservoir project is located in northwest Georgia, approximately 6 miles southeast of the city of Dalton. The topography is rolling with broad, low valleys along the main stem Conasauga River and its principal tributaries. Most of the reservoir area is composed of agricultural land with forested hillsides.

Highway access to the project is good. Federal Highway 76 crosses the upper end of the reservoir and connects Dalton and Chatsworth, Georgia. Other State and local highways lead to the reservoir area.

DESCRIPTION OF THE PROJECT

The damsite being considered for the reservoir is located at mile 24.8 on the Conasauga River, Whitfield and Murray Counties, Georgia. The dam will consist of earth embankments and concrete non-overflow sections on each side of a gated, concrete spillway. The spillway, with twelve 42-foot-long by 24-foot-high radial gates, will have a crest at elevation 666 feet 1/.

1/ All elevations refer to feet above mean sea level.

The reservoir at maximum flood control pool elevation of 687.5 feet will inundate an area of 13,000 acres. The normal summer recreation pool at elevation 680 will have an area of 8,650 acres.

The reservoir will be operated to provide minimum flows varying from 80 c.f.s. in January to 226 c.f.s. in September.

Table 1. Pertinent Engineering Data, Dalton Reservoir Project

Pool	Elevation (feet)	Capacity (Ac. Ft.)	Area (Acres)
Flood Control	687.5	186,000	13,000
Conservation	680	110,000	8,650

FISH AND WILDLIFE RESOURCES

Without the Project

Fishery Resources

The fishery resources in the project area are of moderate value. Important fish species present are spotted bass, channel catfish, crappie, and sunfishes. Walleyes were prevalent in the main stem of the Conasauga River in former years, but have gradually disappeared. Pollutants from Drowning Bear Creek can be detrimental to the tailwater fisheries and will require constant flows to dilute the existing sewage effluents. Conditions involving this pollution will be most severe during the warmer months when downstream releases are at a minimum. Approximately 3,600 man-days of fishing annually, will take place in the 40 miles of streams in the reservoir area and 1,125 man-days in the 25 miles downstream from the dam during the period of analysis.

Wildlife Resources

Bobwhites, ruffed grouse, squirrels, cottontails, white-tailed deer, and mourning doves are present in moderate numbers throughout most of the project area. The 19,500 acres contained within the project area is estimated to support an average of 6,160 man-days of small game hunting and 1,640 man-days of big game hunting annually over the life of the project.

With the Project

Fishery Resources

The conservation pool will inundate approximately 15 miles of fishery habitat in the Conasauga River and 25 miles of tributaries. The 40 miles of stream fishery habitat will be replaced by a reservoir fishery. The normal summer pool for recreational purposes will be at elevation 680 from May 1 through October 31, except for an average of once each 4 years when this pool level will be maintained from June 1 through October 31.

The encroachment of rough fish from the reservoir up into the trout waters of three major tributaries is expected following construction. If preventive measures are not taken, approximately 10,800 man-days of trout fishing in these streams will be serviously affected. Ways and means to preserve the trout fisheries are presented in the Fish and Wildlife Plan.

Wildlife Resources

Approximately 19,500 acres of land will be acquired for the Dalton Reservoir project. This includes: (1) land for the damsite, construction area, and permanent structures; (2) land for specific recreation use; and (3) land for joint use.

Inundation by the conservation pool will destroy 8,650 acres of wildlife habitat. The Bureau of Outdoor Recreation has recommended that 2,000 acres be intensively developed for general recreation. This acreage will be broken up into smaller units and will be unsuitable for wildlife management purposes. The damsite and construction area will adversely affect approximately another 100 acres of wildlife habitat.

As a result of flooding by the conservation pool, dam construction, and intensive, general recreation development and use, a total of 10,725 acres of wildlife habitat will be lost. This will permanently eliminate about 4,300 hunter-days annually.

FISH AND WILDLIFE PLAN

Fish

Access facilities to the reservoir should be provided to accommodate anticipated fishing pressure. This would require space for parking facilities for about 725 cars and 365 trailers. These parking spaces would be in addition to the parking provided for general recreationists.

All reservoir bridges that are constructed 15 feet or less above the surface of the conservation pool should be provided with a safe sidewalk or catwalk on both sides to accommodate fishermen. Parking areas, and in some instances boat launching ramps, at the ends of the causeways or bridges should be provided also. Design for the bridge-fishing facility should be coordinated with the Georgia State Highway Department, State Game and Fish Commission, Corps of Engineers, and this Bureau prior to preparation of the General Design Memorandum.

Tailwater and downstream fisherman access will be needed to realize the fishery benefits resulting from reservoir operation. At least 6 one-acre parking areas located at accessible points along the river will be required.

To improve the reservoir fish habitat, standing timber should be left in selected areas which are to be inundated. These areas should be selected during preconstruction planning phases prior to preparation of the General Design Memorandum.

To prevent conflicts between fishermen and pleasure boaters, a zoning plan should be developed in cooperation with the Georgia State Game and Fish Commission, Bureau of Outdoor Recreation, Corps of Engineers, and this Bureau during post-authorization studies.

Based on a minimum instantaneous flow of 80 c.f.s., provision of downstream access sites and tailwater parking facilities, and good quality water releases, the 25-mile reach of Conasauga River from the dam to its confluence with the Coosawattee River would provide a net increase of 5,135 fisherman-days, valued at $8,490, over the without the project evaluation.

To prevent contamination from rough fish and to preserve the trout fisheries in the headwaters of Holley Creek, Mill Creek (Murray County), and Conasauga River, small barriers should be constructed across the streams near the upper end of the flood control pool. Details on the design and construction of the barriers should be coordinated with the Georgia State Game and Fish Commission and this Bureau during pre-construction planning phases prior to preparation of the General Design Memorandum.

Assuming fulfillment of the Fishery Plan, the reservoir fishery will support about 190,300 fisherman-days, annually. This represents a reservoir benefit of 186,700 man-days having a net recreational value of $186,700.

The full commercial fishery potential of Dalton Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the future.

The Georgia State Game and Fish Commission shall determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with other reservoir activities. Such commercial harvesting would utilize for food and possibly industrial use a fishery resource potential through reduction of rough fish populations. The reservoir's commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 130,000 pounds of food and industrial fishes per year.

Wildlife

To mitigate wildlife losses resulting from inundation of project lands, intensive general recreation use, and damsite construction, about 4,200 acres of land should be acquired outside the presently contemplated acquisition line. This land, along with other closely associated project lands in the Upper Holly Creek arm of the reservoir, will form a continuous tract of about 6,300 acres.

Standing timber to provide cover and nesting sites for waterfowl should be left in the Holly River tributary at the upper end of the conservation pool. Timber and brush should also be maintained in its natural state in the backwaters of Buck Creek and Don Branch.

If this land is managed intensively for waterfowl and upland game hunting and made available to the Georgia Game and Fish Commission under the terms of a fish and wildlife General Plan, it would support about 3,980 man-days of small game hunting, 1,060 man-days of big game hunting, and 620 man-days of waterfowl hunting.

If the approximately 2,500 acres of project land in the upper reach of the Conasauga River and the 900 acres in the upper reach of Mill Creek (Murray County) not planned for general recreation development were made available to the Georgia State Game and Fish Commission under the terms of a fish and wildlife General Plan, they would support a total of approximately 2,040 man-days of upland game hunting per year over the period of analysis.

Cost of the Fish and Wildlife Plan

The initial cost for establishing a fish population in the reservoir which includes survey, pre-impoundment fish control, and stocking is estimated at $43,250. Based on a 100-year project life and a 3¼ percent interest rate, the annual cost would be $1,465.

Costs of reservoir fishery operation and maintenance, including such things as supplemental stocking, fish population control, post impoundment surveys, weed control, and the maintenance of fisherman-access facilities would total about $17,000, which would be borne by the Georgia State Game and Fish Commission.

Operation and maintenance costs of the downstream fishing facilities would total about $1,200 annually and would be borne by the Georgia State Game and Fish Commission.

The 4,200 acres of additional land needed to mitigate wildlife losses will require certain initial costs for hunter parking facilities, access roads, equipment, and land posting. These costs would approximate $25,000. Cost of land acquisition is about $420,000. All of these costs should be borne by the project and be non-reimbursable. These costs would total about $445,000, which when reduced to an appropriate annual equivalent is $15,000. Costs of annual operation and maintenance would be about $5,000.

Total cost for the construction of three stream barriers to preserve trout fisheries on three main tributaries would amount to about $3,000, or $100 annually.

The 3,400 acres of project-acquired land in the Upper Conasauga river and Upper Mill Creek arms of the reservoir would be managed extensively for upland game hunting. Annual operation and maintenance costs would be about $1,700.

The foregoing cost estimates are preliminary and are subject to change depending on the degree of management undertaken by the State Game and Fish Commission.

RECOMMENDATIONS

On basis of the foregoing, the Bureau recommends that:

1. Reservoir parking facilities sufficient to accommodate 725 cars and 365 boat trailers be provided on the reservoir portion of the project in addition to those facilities needed for general recreation.

2. Sidewalks or catwalks be incorporated on all reservoir bridges constructed 15 feet or less above the surface of the conservation pool to accommodate fishermen. Parking areas at the ends of the bridge or causeway should be provided also.

3. A zoning plan be developed to prevent conflicts between reservoir uses. This plan should be developed cooperatively between this Bureau, the Georgia State Game and Fish Commission, and the Corps of Engineers, at an appropriate time during post-authorization studies.

4. At least 6 one-acre parking areas be provided at accessible points downstream from the reservoir.

Table 2. An Evaluation of the Fish and Wildlife Resources for the Dalton Reservoir Project with the Fish and Wildlife Plan Implemented.

	Without the Project		With the Project			
Resource Unit	Miles or Acres	Man-days	Miles or Acres	Man-days	Net Gain Man-days	Net Benefit Dollars
Fishery						
Stream	40 Mi.	3,600	—	—	—	—
Reservoir	—	—	8,650 Ac.	190,300	186,700	186,700
Tailwaters & Downstream	25 Mi.	1,125	25 Mi.	6,260	5,135	8,490
Wildlife						
Project Area	19,500 Ac	7,800	—	—	—	—
Intensively Mng'd. Hunting Unit	—	—	6,300 Ac. 1/	5,660	--	—
Other Project Lands	—	—	3,400 Ac.	2,040	—	—

1/ Includes 2,100 acres of project land (flood pool plus 300' surcharge) and 4,200 acres of additional land to be purchased in fee to mitigate project-occasioned upland hunting losses.

5. Small barriers be constructed across Holly Creek, Mill Creek (Murray County), and Conasauga River above the flood control pool to prevent contamination from rough fish and to preserve the stream's trout fisheries.

6. Standing timber be left in certain areas that will be inundated to provide improved fish and wildlife habitat. These areas be selected by the Georgia State Game and Fish Commission and this Bureau during pre-construction planning.

7. A total of 4,200 acres of land be acquired outside the presently contemplated acquisition line at project cost and made available to the Georgia State Game and Fish Commission under the terms of a General Plan for fish and wildlife management.

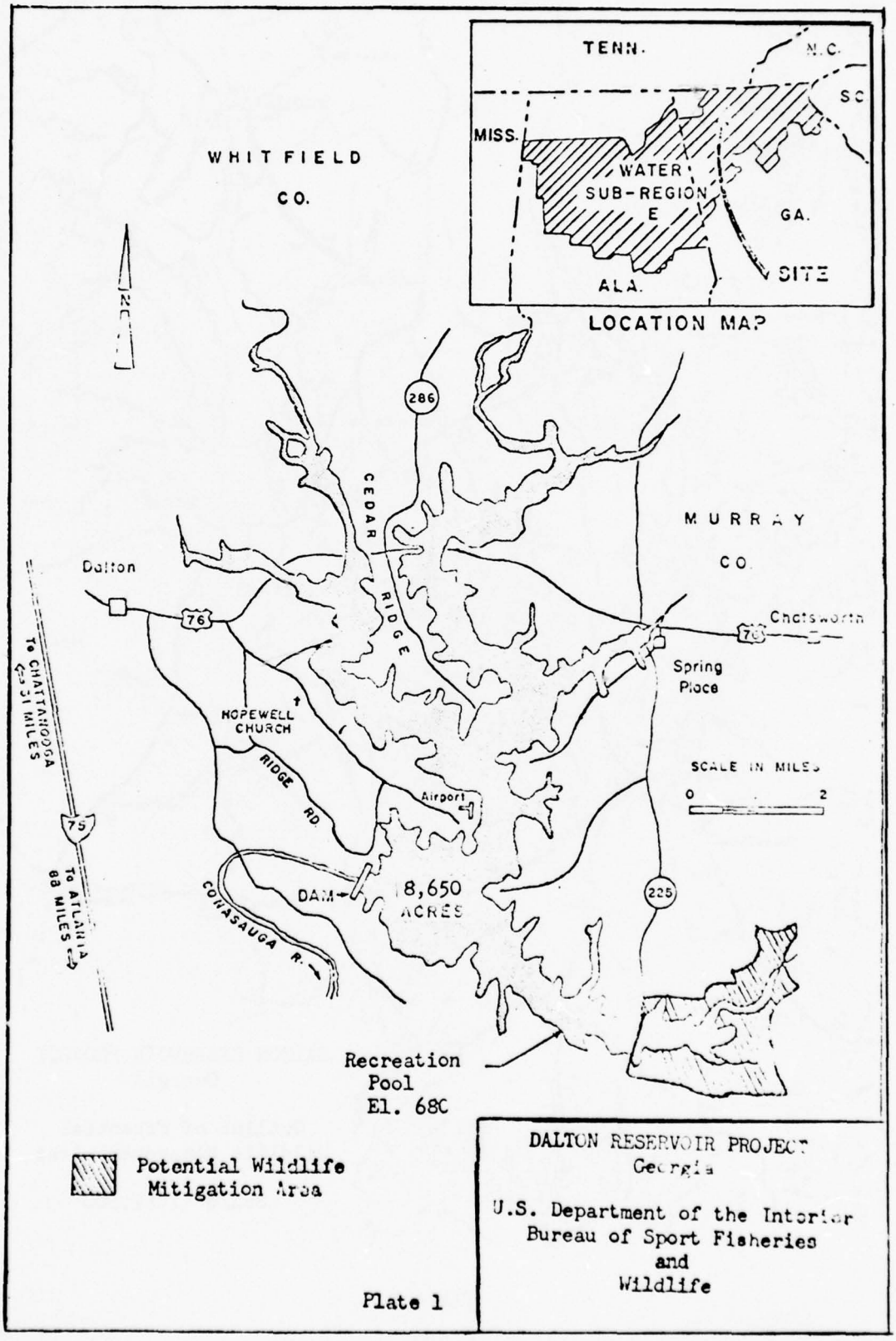
8. Approximately 2,500 acres of project land in the upper reach of the Conasauga River and about 900 acres in the upper reach of Mill Creek (Murray County) be made available to the Georgia Game and Fish Commission in accordance with a General Plan for Fish and Wildlife Management as provided for in the Fish and Wildlife Coordination Act.

The Bureau's study and recommendations are based on project plans as currently developed. Should your study of the Dalton Creek project be authorized for advanced engineering and design, it is requested that engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

Richard E. Griffith


TENN.
N.C.
S.C.
MISS.
WATER SUB-REGION E
GA.
ALA.
SITE
LOCATION MAP
WHITFIELD CO.
MURRAY CO.
286
CEDAR RIDGE
Dalton
76
Chatsworth
Spring Place
HOPEWELL CHURCH
RIDGE RD.
Airport
SCALE IN MILES
0
2
To CHATTANOOGA 31 MILES
To ATLANTA 88 MILES
75
DAM
8,650 ACRES
COHASAUGA R.
225
Recreation Pool El. 680
Potential Wildlife Mitigation Area
DALTON RESERVOIR PROJECT
Georgia
U.S. Department of the Interior
Bureau of Sport Fisheries and Wildlife
Plate 1



DALTON RESERVOIR PROJECT
Georgia

Outline of Potential
Wildlife Management Area

Scale 1:62,500

Plate 2

GEORGE T. BAGBY
DIRECTOR

State Game & Fish Commission

401 STATE CAPITOL
ATLANTA, GEORGIA 30334

March 21, 1968

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development
Bureau of Sport Fisheries
6405 Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

Reference is made to your recent request for our comments regarding the Dalton Dam Reservoir Project.

We have reviewed the draft copy, and the only additional comments that we would like to make are listed below. These are possibilities for additional development that we think would be beneficial to the fishery.

(1) Warm water discharge;
(2) Catwalks for fishermen on all bridges;
(3) Installation of fishing piers with one specifically designated area to be in the tailwater;
(4) Adequate launching ramp facilities; and
(5) Barriers to be constructed on all sizable tributaries to prevent contamination by rough fish.

We appreciate the opportunity of commenting on this proposal.

Sincerely yours,

Leon Kirkland

Leon Kirkland
Chief of Fisheries

LK:tv

GEORGE T. BAGBY
DIRECTOR

State Game & Fish Commission

401 STATE CAPITOL
ATLANTA, GEORGIA 30334

April 11, 1968

Mr. Raymond G. Oberst, Chief
Appalachian Area Development
6405 Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

Reference is made to your recent request regarding comments from our Wildlife Division on the Dalton Reservoir Project in Murray and Whitfield counties, Georgia.

After reading the review draft presented to the District Engineer, Corps of Engineers at Mobile, Alabama, we concur with the recommendations made for the Dalton Project. We would like to add these additional comments regarding the operation and development of the lands for wildlife purposes.

1. As per your map, platt 1, we would recommend that standing timber in the proposed wildlife management area be left in backwaters of the impoundment. This would provide cover and nesting sites for waterfowl. We would recommend that the backwaters of Buck Creek and Don Branch be maintained in a natural state leaving timber and bush in natural state.

2. We would recommend that the boundary of the proposed wildlife area be well marked with signs and yellow paint designating it as the boundary of a wildlife management area.

3. We would further request that a launching ramp be constructed near the lower limits of the boundary on the west side of the lake.

As far as we can determine, these are the immediate necessary items to be attended to regarding the management of this area. This department

will assume the responsibility of the management, control, protection, and restocking, if necessary, of the area once it has been acquired and this department given control of the area.

If you need further information regarding this matter, such as work plans or cost expenditures, please advise.

Sincerely yours,

Hubert Handy
Coordinator
Game Management

HH/bl

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

District Engineer
U.S. Army Engineers District, Norfolk
Corps of Engineers
803 Front Street
Norfolk, Virginia 23510

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Hipes Reservoir project, Botetourt County, Virginia. The project is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89). This report is prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.) in cooperation with the Virginia Commission of Game and Inland Fisheries. It has the concurrence of that agency as indicated by letter dated March 29, 1968. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

DESCRIPTION OF THE AREA

The Hipes Reservoir site lies in the northwestern portion of Botetourt County and the northeastern portion of Craig County, Virginia. The damsite is on Craig Creek about 14.8 miles upstream from its confluence with the James River. The project area lies west of Eagle Rock, Virginia, in Water Area C.

Craig Creek is a moderately swift tributary of the Upper James River flowing northeasterly through a narrow valley of the Ridge and Valley province in western Virginia. Approximately 70 percent of the reservoir area is forested with stands of low value second growth timber. Most of the remaining cleared land in the area is used for pasture, with some cropland production.

DESCRIPTION OF THE PROJECT

The project plan under consideration consists of a dam and reservoir which will provide for flood control, recreation, water quality control, and fish and wildlife conservation. The dam will be an earth fill structure 2,400 feet long, with an overall height of 172 feet. A short dike 120 feet long will be built in a saddle 1,900 feet west of the spillway. The spillway design will consist of three 50-foot wide by 34-foot high tainter gates. The outlet works will consist of

an intake tower with 2 -4-foot by 6-foot sluice gates and 10 additional 3-foot by 5-foot intake gates for selective discharge regulation. Pertinent engineering data are presented in table 1.

Table 1. Pertinent Engineering Data, Hipes Reservoir Project

Pool	Elevation 1/	Capacity (acre-feet)	Area (acres)
Min. Conservation	1130	115,700	3,170
Max. Conservation	1160	231,400	4,540
Flood Control	1175	304,700	5,250

Lands within the reservoir site will be acquired in fee title up to elevation 1180 or to elevation 1,175 (maximum flood pool elevation) plus a 300-foot horizontal strip bordering the 1,175-foot contour whichever encompasses the greater land area. The total area will consist of 8,790 acres. This includes 1,076 acres for recreation areas above the take line and 812 acres of Government-owned land in the Jefferson National Forest.

The project plan also includes the following: construction of a trout rearing station below the dam; six 2-acre access sites located at accessible points along Craig Creek downstream from the dam to its mouth; and initial development of 8 access sites to the reservoir, with parking and boat launching facilities provided at each site for fishing and general recreation use. An additional 14 sites are planned for future installation.

FISH AND WILDLIFE RESOURCES

Without the Project

Fishery Resources

Fishery Resources in the upper reaches of Craig Creek consist primarily of coldwater species such as trout while the lower reaches provide habitat for such species as smallmouth bass, rock bass, bluegills, and

1/ All elevations refer to feet above mean sea level.

suckers. Fishing pressure is moderate. Annual fisherman use of the 20 miles of stream within the reservoir site is estimated at 3,600 fisherman-days. The 14.8-mile tailwater area receives about 4,800 man-days of fisherman use annually.

Wildlife Resources

The immediate reservoir and downstream areas consist of an interspersion of mixed forests and cultivated lands surrounded by steep pine-hardwood slopes. Wildlife resources in the affected area consist of forest and farm game and fur animals. Hunting pressure is moderate to high with deer, squirrel, rabbit, and turkey providing the most significant hunting opportunity. Average annual hunting pressure on upland and big game species in the 8,790 acres of project land is estimated at 3,120 and 880 man-days, respectively, over the period of analysis.

With the Project

Fishery Resources

Hipes dam will create a 4,540-acre pool when at maximum conservation pool, elevation 1160, and eliminate approximately 80 acres of warmwater fish habitat in 20 miles of Craig Creek. This will result in a loss of 3,600 man-days of stream fishing. The impoundment will provide an attractive reservoir fishery of predominantly warmwater species similar to existing populations. Largemouth bass, walleyes, striped bass, crappie, and trout will also be added to the reservoir.

Wildlife Resources

Construction of the Hipes project will also cause a complete loss of existing forest and farm game habitat in the conservation pool and a partial loss of similar habitat which will be periodically inundated in the flood pool. Waterfowl habitat provided by the project is expected to be of poor quality and to consist mainly of resting areas.

A total of 4,780 acres of wildlife habitat will be permanently inundated by the conservation pool and partially inundated by the flood pool. This would result in an average annual loss of about 1,680 man-days of small game hunting and 420 man-days of big game hunting over the life of the project.

FISH AND WILDLIFE PLAN

Fish

The proposed project includes plans for the development of a trout fishery in the 14.8-mile tailwater area. Our study indicates that

approximately 150,000 acre-feet of winter-stored cold water (below 65°F) will be available after stratification each year. A theoretical printout of reservoir operation revealed that this quantity of cold water would be sufficient to maintain trout habitat conditions in the tailwaters each year for the period of record flows. The theoretical operation included water evacuated for both flood control and water quality control purposes from June 1 to September 15.

To provide temperature-controlled water below the dam, a multiple-stage outlet is being incorporated into the project design. The elevations of outlet portals should be determined by future cooperative studies between the Virginia Commission of Game and Inland Fisheries and this Bureau prior to preparation of a General Design Memorandum.

Tailwater and downstream access will also be needed to realize the fishery benefits resulting from reservoir operation. At least 6 two-acre parking areas located at accessible points along Craig Creek downstream from the dam to its mouth will be required.

Based on adequate access, good water quality, and a minimum instantaneous flow of 80 c.f.s., the 14.8 miles of tailwaters will provide a net increase of about 7,300 angler-days use valued at $29,100.

Access to the reservoir will be good. The eight initially planned access sites as well as the additional 14 sites planned for the future will provide boating access to the major portions of the reservoir. Based on fishery management techniques and inclusion of the aforementioned access facilities, the reservoir will provide an average utilization of 71,600 fisherman-days, with a net benefit of 68,000 man-days valued at $66,200 (table 2).

The proposed trout rearing station below the Hipes Dam would permit ultimate development of the cold water storage potential at this site. The Commission is seeking to expand its rearing facilities in its hatchery system. However, most sources of cold water in western Virginia which can be considered adequate for this purpose have already been developed. The proposed project offers a unique opportunity for expansion of rearing facilities because it will possess such an abundant cold water supply.

The facility under study would require about 20 acres of land for a residence, a combination shop and office, and ten, 200 feet by 10 feet, raceways. Operation of the facility would require piping a continuous flow of 20 c.f.s. from the dam to the rearing station which will be fed by gravity flow through the raceways and returned to Craig Creek.

Table 2. Average Annual Fisheries Values, Hipes Reservoir Project, Virginia.

Resource Unit	Without Project (man-days)	With Project (man-days)	Benefits (man-days)	Benefits (dollars)
Stream (20 miles or 80 acres)	3,600	--	--	--
Reservoir (4,540 acres)	--	71,600	68,000	66,200
Tailwaters (14.8 miles or 100 acres)	4,800	12,100 1/	7,300	29,100
Totals	8,400	83,700	75,300	95,300

1/ Based on stocking of hatchery - reared trout.

Additional lands and facilities would be desirable to accommodate anticipated visitors to the trout station. A schematic layout of the proposed trout rearing station as designed by the Virginia Commission of Game and Inland Fisheries is presented in plate 2.

Production of trout at the proposed Hipes station is expected to approximate 75,000 pounds annually. These fish will be used to stock Virginia waters not on Federal lands which are open to public fishing. Fish from this station will also be used to stock the authorized Gathright Project tailwater as well as the Hipes Project tailwater. The expected production has the potential to supply approximately 112,500 man-days of additional trout fishing opportunity annually to Virginia fishermen. This assumes the current return rate of stocked trout (75 percent) and creel (½ lb. per man-day) will be realized from the station's output. Based on Senate Document 97, Supplement Number 1, the fishing opportunity resulting from the output of this facility has a value of $337,500, assuming each man-day has a unit value of $3.00.

To prevent conflicts between fishermen and pleasure boaters, a zoning plan should be developed in cooperation with the Virginia Commission of Game and Inland Fisheries, Bureau of Outdoor Recreation, U.S. Forest Service, Corps of Engineers, and this Bureau during post-authorization studies.

The full commercial fishery potential of Hipes Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the future. The Virginia Commission of Game and Inland Fisheries will determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with other reservoir activities. Such commercial harvesting will utilize for food and possibly industrial use a fishery resource potential through reduction of rough fish populations. The reservoirs commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 68,000 pounds of food and industrial fishes per year.

Wildlife

We have investigated a proposed acquisition of lands (250 acres) outside project boundaries to mitigate wildlife losses incurred by the project. However, it was found that this land is primarily shale slopes offering little opportunity for intensive cultivation. For this reason, it is concluded that these lands do not possess management opportunity and it is very unlikely that wildlife productivity can be increased over and above current production. Therefore, acquisition and management would not result in increased hunting opportunity in the area to mitigate losses incurred by the project.

To offset some of the hunting losses, however, compatibility between hunting and other recreational use of project lands to be acquired for recreation should be promoted. It would be necessary to restrict hunting to those periods when conflicts would be at a minimum. Generally, hunting activity occurs during October, November, and December; months of low, general recreation use. If the above-mentioned lands are acquired for recreation, hunting should be permitted in areas not intensively developed for general recreation and during those periods when conflicts would be at a minimum.

In addition, all other project lands, excluding those which may be reserved for safety, efficient project operation, or protection of public property should be made available for wildlife management. Since the Corps of Engineers and U. S. Forest Service have agreed that administration of project associated land resources within the reservoir area will be the responsibility of the Forest Service, wildlife management practices on these lands should be carried out by both the U. S. Forest Service and the Virginia Commission of Game and Inland Fisheries under terms of a cooperative agreement now in effect between the two agencies.

Cost of the Fish and Wildlife Plan

The initial cost of establishing a desirable fish species composition in the reservoir would approximate $37,000. The annual cost, based on 100-year project life and a 3¼ percent interest rate would be $1,250.

Costs of reservoir fishery operation and maintenance, including such things as corrective stocking, fish population control, post-impoundment surveys, zoning, and the maintenance of fisherman access facilities would total about $7,000 annually.

Development of the tailwaters will require allocating 50 percent of the initial construction costs to local interests for fishery enhancement purposes under P.L. 89-72. The Virginia Water Resources Commission has provided your agency with a letter of intent to cost share in this project feature. Initial construction costs will cover such easement as may be necessary for the right of use to the Craig Creek stream bed up to the ordinary high water mark from the proposed Hipes Dam downstream to the mouth of Craig Creek, and acquisition and development of six access areas of about two acres each for parking and boat launching. Local interest share of this cost is presently estimated at $156,000. In addition, the Virginia Commission of Game and Inland Fisheries will assume all operation and maintenance costs connected with developing, managing and stocking this area. Total annual stocking costs of tailwater fisheries are about $5,100, and annual cost of routine maintenance and major replacements would average $1,800.

The 20 acres of land necessary for the proposed trout rearing station would cost about $6,000. The land is included within the project acquisition line and the cost will be assumed by the Federal Government as project costs. Trout rearing facilities including: water supply

Table 3. DETAILED ESTIMATE OF CAPITAL COSTS
HIPES MULTIPLE PURPOSE RESERVOIR PROJECT
TROUT REARING STATION
(July 1967 Prices)

Item	Unit	Quantity	Unit Price	Amount
BUILDING, GROUNDS AND UTILITIES				
Initial Development				
Water supply to aerator	L.S.			$ 81,000
Aerator	L.S.			11,000
Water supply to raceways	L.S.			60,000
Raceways	Each	10	$11,360	113,600
Buildings				
Garage, shop & office building	L.S.			40,000
Visitor center	L.S.			40,000
Residence	L.S.			22,500
Domestic water supply	L.S.			10,000
Sanitary sewer system	L.S.			15,000
Roads & parking	L.S.			48,800
Site preparation & landscaping	L.S.			20,000
Electric Service	L.S.			6,000
Fences	L.S.			10,000
Miscellaneous	L.S.			5,000
Subtotal, Building, Grounds and Utilities				$482,900
Contingencies				96,600
TOTAL BUILDING, GROUNDS AND UTILITIES				$579,500
ENGINEERING AND DESIGN				
Initial Development	L.S.			$ 70,000
TOTAL ENGINEERING AND DESIGN				$ 70,000
SUPERVISION AND ADMINISTRATION				
Initial Development	L.S.			$ 56,000
TOTAL SUPERVISION AND ADMINISTRATION				$ 56,000
	TOTAL TROUT HATCHERY			$705,500
	ROUNDED			$706,000

Table 4. ESTIMATED OPERATION AND MAINTENANCE COSTS
HIPES TROUT REARING STATION

		Total Cost
Fingerlings to Hipes		
206,250 fingerlings at $.06		$12,375
Fingerlings to catchable size		
2.5 fish per lb.		32,625
Station Maintenance		
Station Superintendent and two fish culturists		
Superintendent (salary)	$ 7,000	
2 Fish Culturists at $5,000	10,000	
Travel and Subsistence	3,000	20,000
Maintain residence, visitors center, at 2%		1,200
Maintain office, garage, shop and storage building, rearing ponds, and roads and parking at 1%		1,400
Maintain grounds and landscaping (labor included in Station Maintenance above)		200
Heat and Power to Station		1,800
Equipment maintenance, water quality control, 3 trucks, etc.		2,500
TOTAL OPERATION AND MAINTENANCE		$72,100

works, aerator, and raceways would total about $265,600 or $9,000 annually. 1/ Buildings, including a visitor's center, would cost about $102,500 or $3,500 annually. Other physical facilities such as roads, parking, landscaping, fencing, utilities, and miscellaneous would cost about $114,800 or $3,900 annually. The cost of engineering and design, contingencies, supervision, and administration would approximate $222,600 or $7,500 annually. Annual operation and maintenance would be about $72,100, and the annual cost of major replacements would be about $2,200. Details of construction costs and operation and maintenance costs are presented in tables 3 and 4, respectively.

RECOMMENDATIONS

On basis of the foregoing, the Bureau recommends that:

1. The elevations of portals in the multiple-stage outlet be selected during pre-construction planning by the Virginia Commission of Game and Inland Fisheries, Corps of Engineers, and this Bureau.

2. Reservoir water storage include the capability to provide 20 c.f.s. to the trout rearing station at any time.

3. A minimum of 20 acres of land below the dam be provided for construction of the trout rearing station.

4. A zoning plan be developed to prevent conflicts between reservoir uses. This plan should be developed cooperatively between this Bureau, the Bureau of Outdoor Recreation, the Virginia Commission of Game and Inland Fisheries, and the Corps of Engineers, at an appropriate time during post-authorization planning.

5. All project lands, excluding those which may be reserved for safety, efficient operation, or protection of public property should be made available for wildlife management. Management practices on these lands should be carried out by both the U. S. Forest Service and the Virginia Commission of Game and Inland Fisheries under terms of a cooperative agreement, now in effect, between the two agencies.

1/ Annual costs amortized at 3¼ percent interest rate over the 100-year life of the project.

The Bureau's study and recommendations are based on project plans as currently developed. Should your study of Hipes Reservoir project be authorized for advanced engineering and design, it is requested that engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

Richard E. Griffith

CORPS OF ENGINEERS

U.S. ARMY

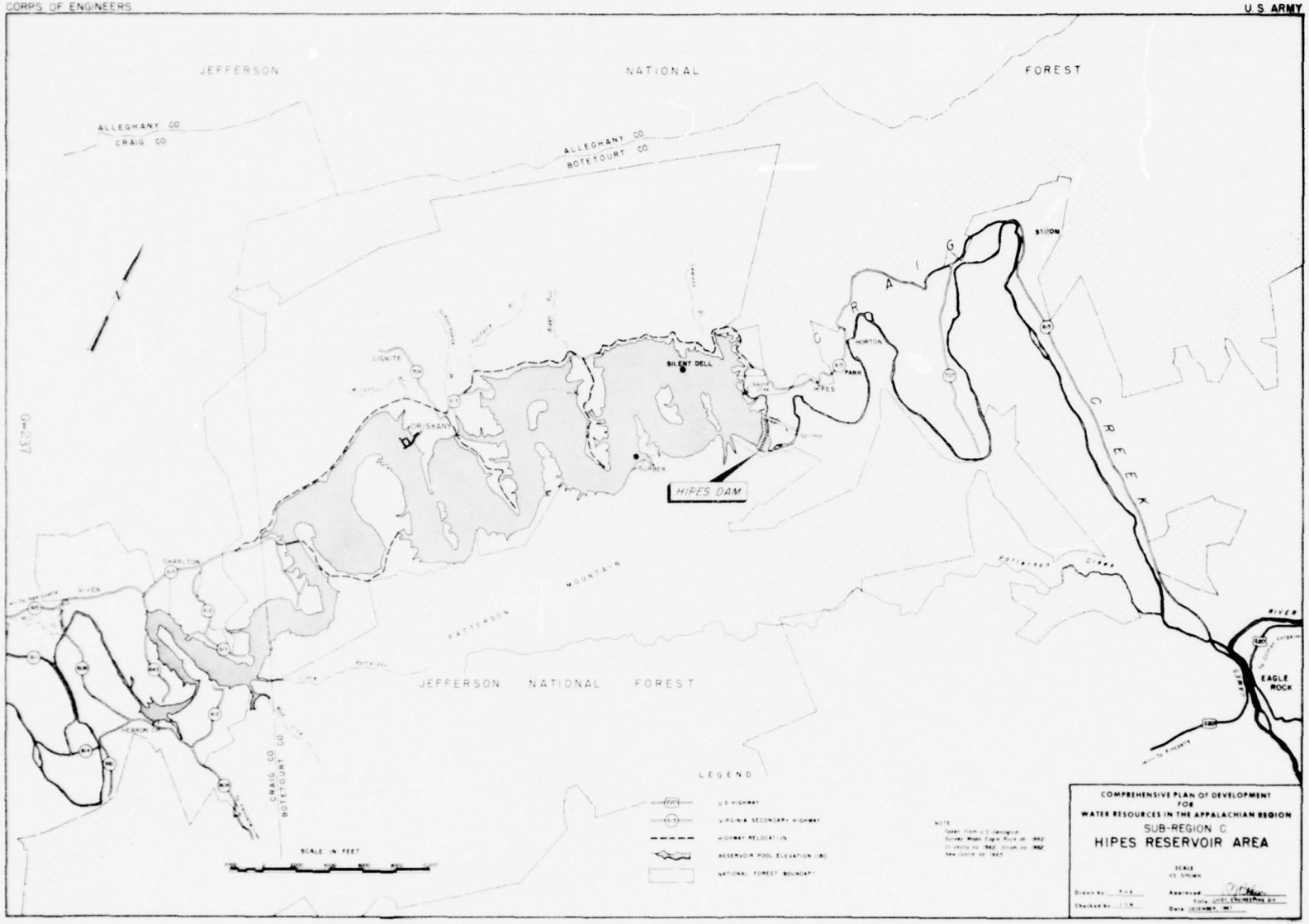


Plate 1

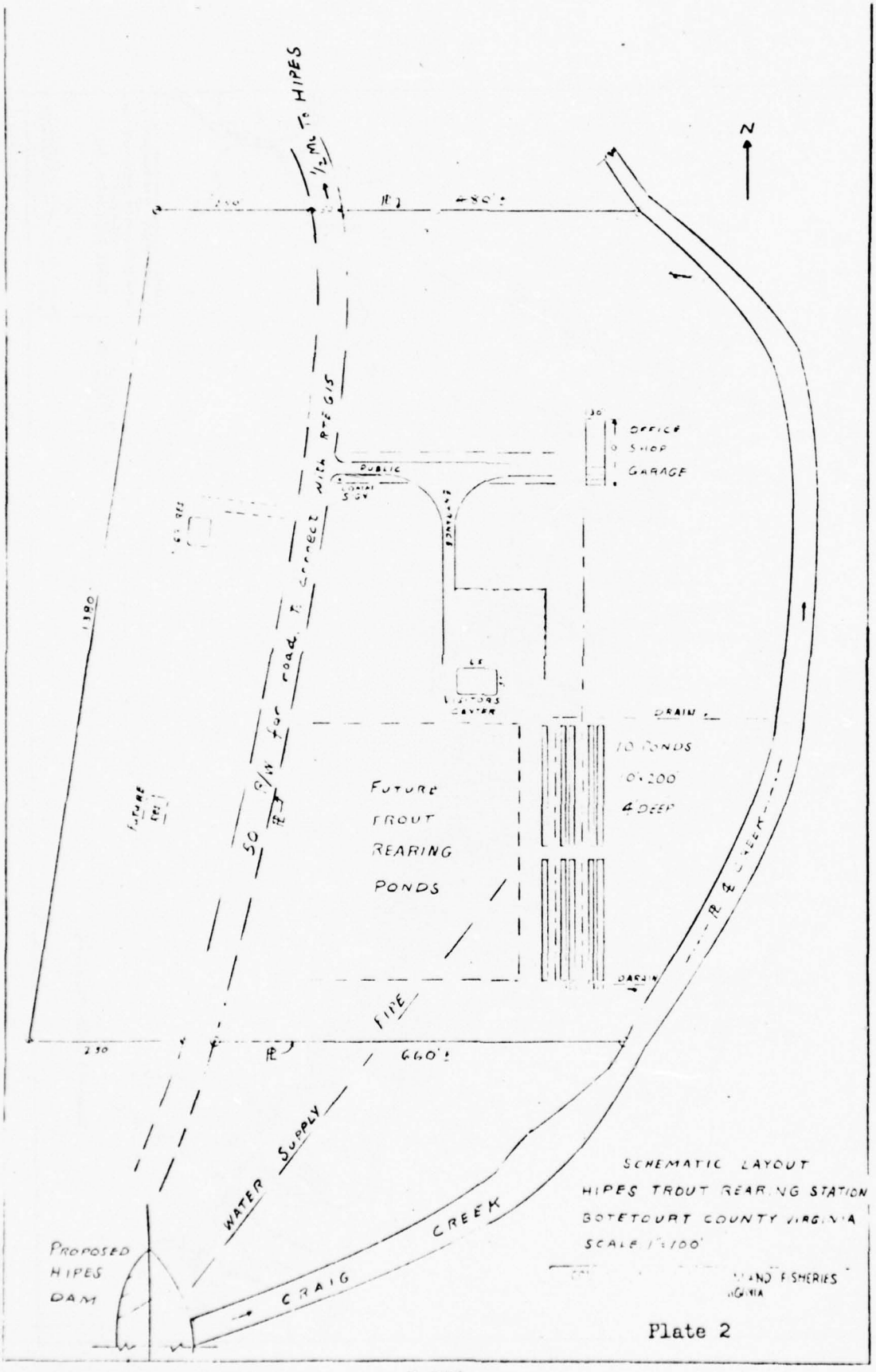

1/2 MI. TO HIPES
N
OFFICE
SHOP
GARAGE
PUBLIC
50' R/W for road & access with R.T.E. G/S
FUTURE TROUT REARING PONDS
10 PONDS
10'x200'
4' DEEP
DRAIN
DRAIN
FUTURE
FIRE
1380'
230'
660'
WATER SUPPLY
CRAIG CREEK
PROPOSED HIPES DAM
SCHEMATIC LAYOUT
HIPES TROUT REARING STATION
BOTETOURT COUNTY VIRGINIA
SCALE 1"=100'
AND FISHERIES
GINIA

Plate 2

COMMONWEALTH OF VIRGINIA

J. C. AARON, CHAIRMAN
1231 RAM LION TRAIL, MARTINSVILLE 24112
HOMER G. BAUSERMAN, JR.
1408 SO. RANDOLPH ST., ARLINGTON 22204
RICHARD F. BEIRNE, III
P. O. BOX 271, COVINGTON 24426
CURTIS L. COLEMAN, M. D.
618 MEDICAL ARTS BLDG., RICHMOND 23219
EDWARD E. EDGAR
1433 HUNTINGTON CRESCENT, NORFOLK 23509
A. REE ELLIS
BOX 484, WAYNESBORO 22980
RALPH G. GUNTER, ABINGDON 24210
M. GARDNER SMITH
P. O. BOX 874, NEWPORT NEWS 23607
G. RICHARD THOMPSON, MARSHALL 22115
E. FLOYD YATES, POWHATAN 23139

COMMISSION OF GAME AND INLAND FISHERIES
BOX 1642
RICHMOND, 23213

CHESTER F. PHELPS, EXECUTIVE DIRECTOR
SEVEN NORTH SECOND STREET
BOX 1642
RICHMOND, 23213

March 29, 1968

Mr. Raymond G.Oberst, Chief,
Section of Water Resource Surveys
Appalachian Area Development Program
Room 6405 Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

Refer to the review draft of the Bureau of Sport Fisheries and Wildlife report on the Corps of Engineer's Hipes Reservoir Project.

This is to advise that the report has been reviewed and that our personnel participated in the preparation of the report. We have no comment other than to concur in the report.

Sincerely

Jack M. Hoffman
Chief, Fish Division

G

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

September 7, 1967

District Engineer
Philadelphia District
U. S. Army Corps of Engineers
Custom House
Second and Chestnut Streets
Philadelphia, Pennsylvania 19106

Dear Sir:

This is the report of the Bureau of Sport Fisheries and Wildlife on Wabash Creek for flood control at Tamaqua, Pennsylvania, as authorized by the Appalachian Regional Development Act of 1965 (Section 206, P.L. 89-4). This report has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.), in cooperation with the Pennsylvania Fish and Game Commissions. Concurrence of these agencies in this report is expressed in letters dated June 26, 1967 and July 5, 1967, respectively.

We have reviewed the plans for flood control on Wabash Creek, in the city of Tamaqua, Schuylkill County, Pennsylvania, as described in your reconnaissance report of October 1966. The main feature of the project is an open channel 3,500 feet in length, which will be excavated along the right-of-way centerline of the abandoned Reading Railroad. In addition, two retention basins from a defunct mining company will be used for storage. These features will, for the most part, replace the existing Wabash culvert, which passes Wabash Creek through Tamaqua underground.

This local flood protection site has minor fish and wildlife resources. Acid drainage resulting from coal mining has adversely affected the stream and its fishery. Wildlife resources are limited due to the urbanized character of the project area. We, therefore, anticipate no significant damages to the fish and wildlife resources, nor opportunities for their improvement through the project.

Further studies by this Bureau are not considered necessary, unless there are major changes in the project plans.

Sincerely yours,

Richard E. Griffith

Regional Director

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
HARRISBURG 17120

EXECUTIVE DIRECTOR

June 26, 1967

Mr. Donald H. Reese, Chief
Appalachian Area Development Program
U. S. Fish and Wildlife Service
Rm. 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Reese:

We have read the draft copy of the Bureau of Sport Fisheries and Wildlife on the proposed Corps of Engineers project for flood control of Wabash Creek at Tamaqua, Pennsylvania.

We agree that there would be no significant damages to fish life resulting from this project because of the small size of Wabash Creek and its highly acid nature due to mine drainage.

Your report has our approval.

Sincerely yours,

Robert J. Bielo
Executive Director

RJB:GLT:p

OFFICE OF
EXECUTIVE DIRECTOR
TELEPHONE
AREA CODE 717 - 787-3633

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
P. O. BOX 1567
HARRISBURG, PA. 17120

July 5, 1967

ADMINISTRATIVE DIVISIONS:

ACCOUNTING	787-3876
ADMINISTRATION	787-5670
INFORMATION & EDUCATION	787-6286
LAW ENFORCEMENT	787-5743
LAND MANAGEMENT	787-6818
LAND TITLES	787-6568
MINERALS	787-2162
PROPAGATION	787-6711
RESEARCH	787-5529

Donald H. Reese, Chief
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Reese:

We have received the Fish and Wildlife Service report on the flood control project on Wabash Creek, located at Tamaqua, Pennsylvania.

The Game Commission concurs with your report.

Very truly yours,

Glenn L. Bowers
Executive Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. Post Office and Courthouse
Boston, Massachusetts 02109

July 12, 1967

District Engineer
U. S. Army Engineer District, Philadelphia
Corps of Engineers
Custom House
Second & Chestnut Street
Philadelphia, Pennsylvania 19106

Dear Sir:

This is the report of the Bureau of Sport Fisheries and Wildlife on the Deer Lake Restoration Project, Pennsylvania, as authorized by the Appalachian Regional Development Act of 1965 (Section 206 (e), PL 89-4). This report has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.), in cooperation with the Pennsylvania Fish and Game Commissions and has their concurrence as indicated by letters dated July 7, 1967 and June 16, 1967, respectively.

The proposed restoration project is located on Deer Lake in the Borough of Deer Lake, in the southwest section of Schuylkill County, Pennsylvania. The main purpose of the project is to develop a recreational complex to serve the people in the borough of Deer Lake and surrounding communities. The reservoir is one of a few bodies of water in the county that is not affected by acid mine drainage and, therefore, has a high recreational potential.

The dam which forms Deer Lake was constructed in 1928 on Pine Creek, a tributary of the Schuylkill River. The reservoir is a small 18-acre impoundment about 1,800 feet long and 900 feet wide at the maximum dimensions. It is very shallow, averaging about one foot in depth, as a result of silt deposited from Pine Creek.

The project plan is to clear the lake bed of silt deposits. The silt will be used to fill shallow and swampy areas adjacent to the lake, including portions of the reservoir. This will reduce its size about

four surface acres. The entire area around the lake will be developed for recreation, to include a swimming beach, picnic sites, a boat launching ramp, and parking areas. The existing dam is considered to be structurally sound, but repairs will be made to the spillway lip, wing walls, and sluice gates.

The existing reservoir provides fishing for largemouth bass and sunfish. The quality is poor, but because there is a lack of fishing waters in the vicinity it receives high use. The fishery resources of Pine Creek consist of brook trout, brown trout, and smallmouth bass. The reservoir under present conditions provides about 1,400 man-days of fishing annually.

The quality of the fishery resource in Deer Lake will improve slightly with the restoration of the reservoir. The average depth of the impoundment will increase from one foot to about five feet. The size of the lake will decrease from 18 to about 14 surface acres when portions of the lake are filled. The decrease in surface area will partially offset the improvement of increased depth. It is probable that the reservoir will be managed for both a cold-water and warm-water fishery. Early season stocking of rainbow trout would provide "put-and-take" fishing until late June or early July. In late summer the water temperature is expected to rise beyond the tolerance limit of this species. For the remainder of the season, warm-water fishing would sustain the angling pressure. The project will not affect the fishery in Pine Creek.

It is anticipated that the restored Deer Lake will support about 2,500 fisherman-days annually, a gain of 1,100 man-days. However, after the estimated costs of providing "put-and-take" trout fishing are deducted, the annual benefit associated with the fishery is $700.

Due to the urbanized character of the project area, wildlife resources are not significant. The proposed project, therefore, is not expected to harm wildlife.

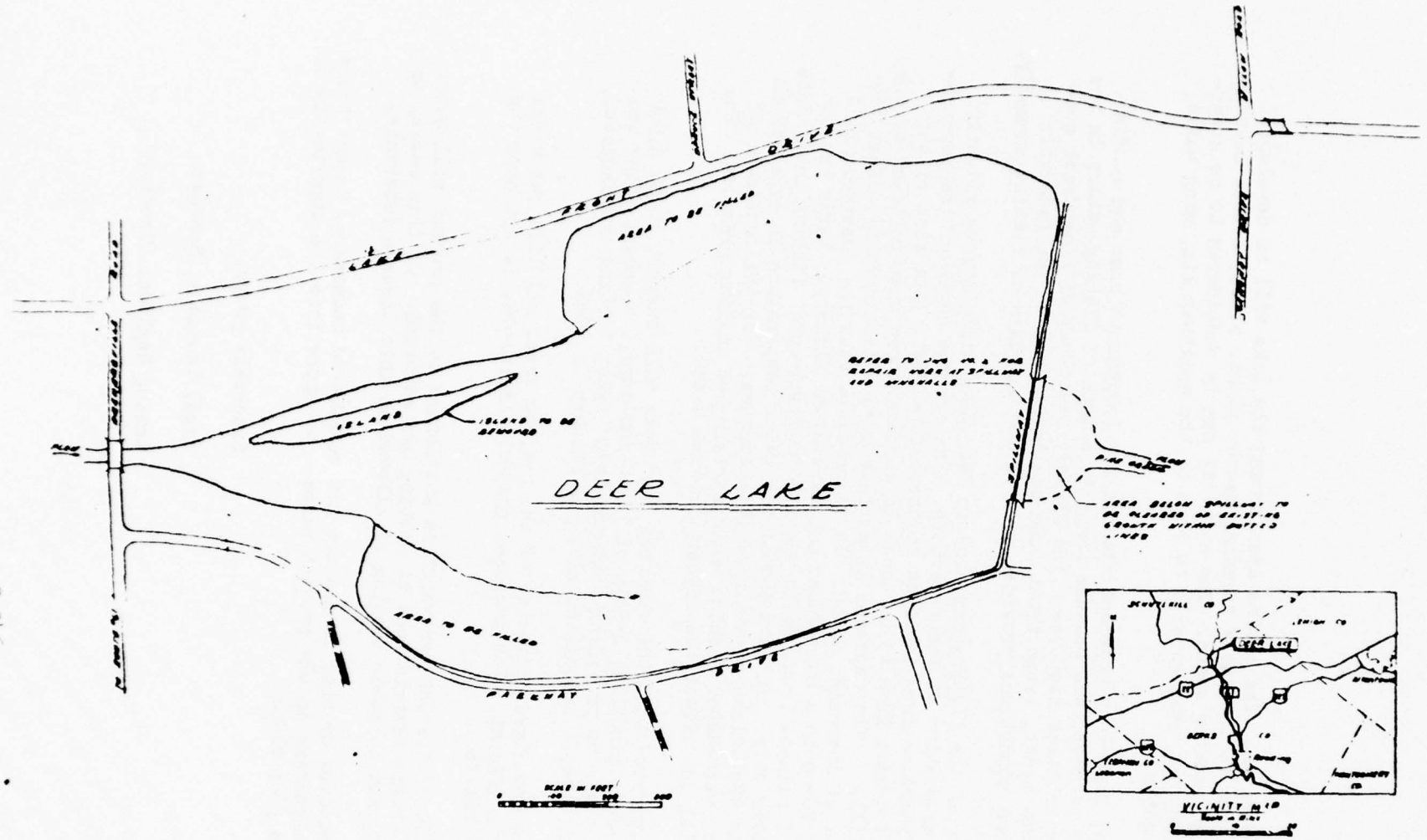
The additional fishing use which is attributed to the project will occur only if certain restrictions to boating are enforced. On this basis, we recommend that no power boating be allowed on this 14-acre reservoir.

Further studies by this Bureau are not considered necessary, unless there are major changes in the project plans. We appreciate the opportunity to report on your plans.

Sincerely yours,

(sgd) Thomas A. Schrader

Acting Regional Director



VICINITY MAP

APPALACHIA STUDIES
SCHUYLKILL COUNTY, PA.
RECONNAISSANCE REPORT
DEER LAKE RESTORATION

GENERAL PLAN

SCALE AS SHOWN

U.S. ARMY ENGINEER DISTRICT, PHILADELPHIA
CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER

OFFICE OF
EXECUTIVE DIRECTOR
TELEPHONE
AREA CODE 717 - 787-3633

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
P. O. BOX 1567
HARRISBURG, PA. 17120

June 16, 1967

ADMINISTRATIVE DIVISIONS

ACCOUNTING	787-5674
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MINERALS	787-2162
PROPAGATION	787-6711
RESEARCH	787-5529

Donald H. Reese, Chief
Appalachian Area Development Program
U. S. Fish and Wildlife Service
Room 6405 - Federal Building
Cincinnati, Ohio 45202

Dear Mr. Reese:

We have reviewed your report relating to the fish and wildlife resourses for the proposed Deer Lake Project, Pennsylvania.

The wildlife resources of this project are not significant, we concur with your report.

Very truly yours,

Glenn L. Bowers
Executive Director

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
HARRISBURG 17120

EXECUTIVE DIRECTOR

July 7, 1967

Mr. Donald H. Reese, Chief
Appalachian Area Development Program
U. S. Fish and Wildlife Service
Rm. 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Reese:

We have read the draft copies of the Bureau of Sport Fisheries and Wildlife's report on the proposed Corps of Engineers Appalachian Project for Deer Lake, Schuylkill County, Pennsylvania. We believe we discussed this project with one of your men on an earlier date and your report is essentially what we agreed upon at that time.

It would be only after the basin had been filled and we could make biological studies on depths, temperatures, water quality, etc., that we would be able to develop a suitable fish management program. We agree that it might be managed for both trout and a warmwater fishery, although the lake will be so small that we would not expect sustained high quality fishing because of the anticipated fishing pressure. We would certainly agree that motors should not be permitted on boats on this small impoundment.

The report has our approval.

Sincerely yours,

Robert J. Bielo
Executive Director

RJB:GLT:p

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. Post Office and Courthouse
Boston, Massachusetts 02109

May 22, 1967

District Engineer
U. S. Army Engineers District, Buffalo
Corps of Engineers
Foot of Bridge Street
Buffalo, New York 14207

Dear Sir:

This is our report on Conneaut Creek for flood control at and in the vicinity of Conneautville, Crawford County, Pennsylvania, as authorized by the Appalachian Regional Development Act of 1965, (Section 206 (e), PL 89-4). It has been prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 Incl.), in cooperation with the Pennsylvania Game and Fish Commissions. It has the concurrence of those agencies, as indicated in their letters of May 8 and May 9, 1967, respectively.

We have reviewed the project plans as described in your letter dated November 10, 1966. These plans include a 28-foot high earth dam with a riprapped spillway and uncontrolled outlet works ("dry-bed" type reservoir), enlargement of the culvert under Cussewago Road, and improvement to a culvert under the Bessemer and Lake Erie Railroad including a closure structure. The dam will be located on the south branch of an Unnamed Run, about 2,900 feet above the junction of the stream with Conneaut Creek, within the Borough limits of Conneautville.

Conneaut Creek, within the project area, is a stocked trout stream. In order to preserve the stream fishery, every effort should be made to minimize siltation of the stream during project construction.

Other than above, the project would not significantly affect fish and wildlife resources of the area, and the project would not offer feasible opportunities for the improvement of these resources.

Please advise us of any changes made in the project plans so that we can re-evaluate the effects of the project on fish and wildlife, and prepare a revised report, if necessary.

We appreciate the opportunity to comment on the proposed plan.

Sincerely yours,

Richard E. Griffith
Regional Director

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
HARRISBURG 17120

EXECUTIVE DIRECTOR

May 9, 1967

Mr. Donald H. Reese, Chief
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Reese:

We have reviewed the draft of your fish and wildlife report of the project on Conneaut Creek at Conneautville, Crawford County, Pennsylvania and have this following comment.

Conneaut Creek in this area is a stocked trout stream, and we request that during construction at the project an attempt be made to minimize siltation in this stream. Otherwise we agree that the project would not significantly affect fish resources of the area.

Sincerely yours,

Robert J. Bielo
Executive Director

RJB:GLT:p

OFFICE OF
EXECUTIVE DIRECTOR
TELEPHONE
AREA CODE 717 - 787-3633

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
P. O. BOX 1567
HARRISBURG, PA. 17120

May 8, 1967

ADMINISTRATIVE DIVISIONS:

ACCOUNTING	787-5676
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LAND TITLES	787-6568
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PROPAGATION	787-6711
RESEARCH	787-5529

Donald H. Reese, Chief
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Reese:

We have received your review draft of the fish and wildlife report on Conneaut Creek, Crawford County, Pennsylvania.

We concur with your report.

Very truly yours,

Glenn L. Bowers
Executive Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

January 10, 1968

District Engineer
U. S. Army Engineer District, Pittsburgh
Federal Building
1000 Liberty Avenue
Pittsburgh, Pennsylvania

Dear Sir:

This is the Bureau of Sport Fisheries and Wildlife report on potential reservoir projects being considered in your current Framework Studies for the Allegheny, Monongahela, and Beaver River Basins, as indicated in your Initial Investigation Report dated September 7, 1966. Additional data were supplied by your office in letters dated August 11, 1967 and October 20, 1967. The projects are located in West Virginia, Maryland, New York, and Pennsylvania, as presented in table 1. This report is authorized by the Appalachian Regional Development Act of 1965 (Section 206 (e) P.L. 89-4) and is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.) in cooperation with the West Virginia Department of Natural Resources, Maryland Department of Game and Inland Fish, New York State Conservation Department, and Pennsylvania Game and Fish Commissions and has their concurrence as indicated by letters dated October 27, 1967, December 1, 1967, November 22, 1967, October 24, 1967, and October 31, 1967, respectively.

This report contains preliminary appraisals of fish and wildlife potentials related to pool elevations supplied by your office and is provided to assist your planners in selecting potential sites for development that are most beneficial to fish and wildlife conservation. The Appalachian Developmental Benchmarks have been used in estimating the expected fishing use of the reservoirs. The benefits derived are projected to the year 2020. This is approximately the average annual use it would have received over the expected life of the project.

The Framework Study area is located in several counties in the states of Pennsylvania, Maryland, New York, and West Virginia. Table 1 explains

the location of the potential reservoir sites. The topography of the area is generally rugged with narrow, steep-walled valleys, some flat-topped hills, and an occasional broad and flat river valley.

The current sport fisheries within the confines of this Framework Study are principally stream type. Three primary factors were considered in evaluating the expected use on the twenty-three reservoir sites included in this study (table 2). First, the general topography bordering the river courses is characterized by steep-sloped canyon walls and moderate to high stream gradients--both tending to result in the formation of long, narrow basins with comparatively small productive zones. A second factor involves the overall water quality existing in this portion of Appalachia. Acidity, high sulfates, high turbidity, and heavy sedimentation resulting from coal mining operations in upstream watersheds of the region tend to reduce basic water quality and productive potential at the reservoir sites. Corrective measures have proved beneficial in some instances, but complete recovery is seldom achieved. Third, the current supply and demand calculations indicate a severe need for additional fishing opportunity in the portionnof Appalachia covered by this Framework Study. High monetary assessments were applied to the projected use on many of these waters due to anticipated increase in need. Metropolitan Pittsburgh exerts a heavy influence on this portion of Appalachia, and any waters that can supply opportunity should be given high priority and the fisheries potentials fully developed.

Estimates of expected use and monetary valuations associated with the proposed reservoir fisheries are based on the assumption that water quality will be adjusted to meet standards established by State game and fish agencies, (table 3). The cost of necessary rehabilitation or improvement of water quality is also assumed to be a project cost, rather than mitigation or enhancement.

Estimated initial costs for developing the fishery of these framework reservoirs are based on an average cost per acre for fishery development on a number of completed reservoirs located in the general region of the project area. A similar average per-acre value is used in calculating operational and maintenance costs(table 4). Since no detailed reservoir construction data are available at this time, no specific plans for fisheries development were made for each reservoir site. Therefore, no actual valuations were computed.

Wildlife resources within the study area are moderate to high in abundance, and consist of forest and farm game species. Forest habitat exists on most of the ridges and steeper side slopes, while the more gentle slopes are covered with brush and wasteland. Cleared lands, in cultivated forage crops and pasture, occupy flat-topped hills and

valleys bordering streams. Wildlife species present are deer, squirrel, grouse, rabbit, wild turkey, quail, and bear. Wildlife losses and the number of acres of land needed for mitigation for each reservoir are shown in table 5.

The total mitigation costs should include the acquisition cost, which will be determined by the current purchase price per acre, plus the initial development cost. The initial development cost will vary from $20 to $55 per acre while O & M cost will be about $20 per acre. The former cost does not include clearing of timbered areas or reverting fields. Activity of this type would vary from $100 to $400 per acre. The foregoing initial development and O & M costs depend on the type and intensity of wildlife management involved. These costs are preliminary estimates. More refined data can be provided when detailed investigations are undertaken.

Should any of the projects listed be selected for more detailed study and subsequent authorization, additional detailed studies of the fish and wildlife resources will be conducted by this Bureau in cooperation with the respective State game and fish agency. Project lands and waters should be made available to the appropriate State game and fish agency under a General Plan for fish and wildlife management as provided in the Fish and Wildlife Coordination Act.

Since each of the reservoirs authorized will be developed for a variety of recreational uses, a zoning plan for the several uses should be developed for each impoundment. This would minimize conflict of use and achieve optimum utilization of the potential recreational resources provided, including fishing and hunting. The plan should be developed cooperatively by the appropriate State agency, Corps of Engineers and this Bureau.

We recommend:

1. That detailed plans for recreational zoning, clearing, and public access at each reservoir be developed cooperatively by the appropriate State game and fish agency, other Federal recreational agencies, the Corps of Engineers, and this Bureau.

2. That all project lands and waters, excluding those which may be reserved for intensive development of general recreation, or for safety, efficient project operation, or protection of public property, be made available for administration by the appropriate State game and fish agency under a General Plan for fish and wildlife management in accordance with provisions of the Fish and Wildlife Coordination Act.

Sincerely yours,

Richard E. Griffith

Regional Director

Table 1. - Location of Potential Projects
by State and County

	Name of project	County	Nearest city
West Virginia	Ten Mile Creek	Harrison	Clarksburg
	Elk Creek	Harrison	Clarksburg
	Buckhannon River	Upshur	Buckhannon
	Middle Fork River	Randolph	Buckhannon
	Upper Tygart River	Randolph	Elkins
	Laurel Creek	Barbour	Phillipi
	Teter Creek	Barbour	Phillipi
	Big Sandy Creek	Preston, W. Va.	
		Fayette, Pa.	Bruceton Mills, W. Va.
Pennsylvania	Big Sandy Creek	Fayette, Pa.	
		Preston, W. Va.	Bruceton Mills, W. Va.
	Upper Casselman River	Somerset, Pa.	
		Garrett, Md.	Grantsville, Md.
	Laurel Hill Creek	Somerset	Ursina
	Broken Straw Creek	Warren	Garland
	Upper Stony Creek	Somerset	Shanksville
	Raccoon Creek	Beaver	Independence
	Clear Shade Creek	Somerset	Cairnbrook
	Tub Mill Creek	Westmoreland	Bolivar
	Glade Run	Butler	Evans City
	Little Connequenessing	Butler	Evans City
	Little Sandy Creek	Jefferson	Fairmount City
	North Fork	Jefferson	Brookville
	Dunkard Creek	Greene	Mount Morris
Maryland	Upper Youghiogeny	Garrett, Md.	Oakland, Md.
		Preston, W. Va.	
	Upper Casselman	Garrett, Md.	Grantsville, Md.
		Somerset, Pa.	
New York	Conewango Creek	Cattaraugus	Waterboro, N. Y.
	Cassadaga Creek	Chautauqua	Gerry, N.Y.

Table 2. - Description of Reservoir Sites
Included in Framework Studies

Name	Summer pool elev[1/]	Water area	Surface area (acres)	Existing water quality	Sport fish species
Little Sandy Creek	1233	F-1	1,960	Good,Ph-7.5-7.6	Trout
North Fork	1385	F-1	1,460	Good,Ph-7.3-7.4	Trout
Tub Mill Creek	1134	F-2	540	Good,Ph-6.8	Mod. Trout
Clear Shade Creek	2220	B-2	430	Good,Ph-6.7	Trout
Upper Stony Creek	2180	B-2	580	Marginal,Ph-5.8	Questionable
Little Connoquen-essing Creek	1006	F-2	820	Marginal to Good	Bass
Glade Run	1016	F-2	1,000	Good,Ph-7.6-7.7	Bass,Bluegill
Laurel Hill Creek	1516	B-2	1,420	Good,Ph-7.0	Trout,Bass
Casselman River	2165	B-2	1,300	Marginal,Ph-6.8	Minnow,Sucker
Upper Youghiogheny	2456	B-3	5,400	Good,Ph-6.8	Trout
Teter Creek	1430	G-5	1,280	Good	Bass
Laurel Creek	1570	G-5	1,400	marginal to Good	None
Buckhannon River	1492	G-5	4,550	Good	Bass
Middle Fork River	1930	G-5	4,300	Marginal,Ph-6.2	Trout-upper
Upper Tygart River	2285	G-5	1,560	Good,Ph-7.5	Trout-Bass
Elk Creek	1038	G-5	1,650	Unsatisfactory	None
Ten Mile Creek	975	F-3	700	Unsatisfactory	None
Big Sandy Creek	1636	F-3	3,100	Satisfactory	Bass, Trout
Dunkard Creek	900	F-2	1,400	Unsatisfactory	None
Cassadaga Creek	1267	F-1	3,350	Good	Muskie, Bass
Conewango Creek	1275	F-1	7,190	Good	Trout
Broken Straw Creek	1360	F-1	600	Good	Trout, Bass
Raccoon Creek	888	F-2	2,900	Unsatisfactory	None

1/ All elevations refer to feet above mean sea level.

Table 3. - Estimated Annual Fisherman-days and Benefits of Reservoirs Included in Framework Studies

Name of Project	Without project (fisherman days)	(dollars)	With project (fisherman days)	(dollars)	Net Benefits (fisherman days)	(dollars)
Little Sandy Creek	2,916	5,832	31,360	62,720	28,000	57,000
North Fork	2,066	4,132	26,280	52,560	24,000	48,000
Tub Mill Creek	788	1,167	14,118	21,177	13,000	20,000
Clark Shade Creek	608	1,216	8,600	17,200	8,000	16,000
Upper Stoney Creek	--	--	10,440	10,440	10,000	10,000
Little Connoquen-essing Creek	765	765	21,320	21,320	21,000	21,000
Glade Run	918	918	26,000	26,000	25,000	25,000
Laurel Hill Creek	2,066	4,132	19,880	39,760	18,000	36,000
Casselman River	--	--	19,067	28,600	19,000	29,000
Upper Youghiogheny	8,019	16,038	75,600	151,200	68,000	136,000
Teter Creek	1,525	1,525	11,520	11,520	10,000	10,000
Laurel Creek	--	--	15,400	15,400	15,000	15,000
Buckhannon River	5,346	5,346	50,050	50,050	45,000	45,000
Middle Fork River	2,575	1,288	38,700	19,350	36,000	18,000
Upper Tygart River	2,187	3,280	10,293	15,400	8,000	12,000
Elk Creek	--	--	28,050	28,050	28,000	28,000
Ten Mile Creek	--	--	21,000	21,000	21,000	21,000
Big Sandy Creek	4,374	8,748	62,000	124,000	58,000	116,000
Dunkard Creek	--	--	33,600	33,600	33,600	34,000
Cassadaga Creek	3,200	6,400	83,750	167,500	78,750	161,000
Conewango Creek	6,000	18,000	50,330	100,660	44,000	82,600
Brokenstraw Creek	1,600	3,200	10,200	20,400	18,800	17,200
Raccoon Creek	--	--	63,800	63,800	63,800	63,800

1/ Figures are rounded.

Table 4. - Estimated Fisheries Costs Associated with Framework Study Reservoirs

Name of Project	Surface area (acres)	Total develop-ment costs (dollars)	Annual[1/] costs (dollars)	Annual Operation and Maintenance costs (dollars)
Little Sandy Creek	1960	44,870	1,520	4,410
North Fork	1460	33,420	1,130	3,285
Tub Mill Creek	540	12,360	420	1,215
Clear Shade Creek	430	9,860	330	968
Upper Stony Creek	580	13,280	450	1,305
Little Connoquen-essing Creek	820	18,770	640	1,845
Glade Run	1000	22,890	780	2,250
Laurel Hill Creek	1420	32,510	1,100	3,195
Casselman River	1300	29,760	1,010	2,925
Upper Youghiogheny	5400	123,600	4,190	12,150
Teter Creek	1280	29,300	990	2,880
Laurel Creek	1400	32,050	1,090	3,150
Buckhannon	4550	104,180	3,530	10,238
Middle Fork Creek	4300	98,440	3,330	9,675
Upper Tygart River	1560	35,710	1,210	3,510
Elk Creek	1650	37,790	1,280	3,713
Ten Mile Creek	700	16,030	540	1,575
Big Sandy Creek	3100	70,970	2,400	6,975
Dunkard Creek	1400	32,050	1,090	3,150
Casadaga Creek	3350	76,680	2,600	7,540
Conewango Creek	7190	164,580	5,580	16,100
Brokenstraw Creek	600	13,730	460	1,350
Raccoon Creek	2900	66,380	2,250	6,525

1/ 3¼% over 100-year period.

Table 5. - Estimated Wildlife Habitat and Hunter-day Losses Occasioned by Reservoir Construction and Mitigation Requirements

Name of Project	Summer pool elevation (m.s.l.)	Surface area (acres)	Use (hunter-days)	Lands Needed for mitigation (acres)
Ten Mile Creek	975	700	270	600 - 1,000
Elk Creek	1,038	1,650	640	1,600 - 2,400
Bucknannon River	1,492	4,550	950	4,600 - 6,800
Middle Fork River	1,930	4,300	900	4,400 - 6,400
Upper Tygart River	2,285	1,560	330	1,600 - 2,400
Laurel Creek	1,570	1,400	290	1,400 - 2,200
Teter Creek	1,430	1,280	270	1,200 - 2,000
Upper Youghiogheny	2,456	5,400	2,500	5,400 - 8,000
Upper Casselman River	2,135	1,300	410	1,200 - 2,000
Laurel Hill Creek	1,516	1,420	440	1,400 - 2,200
Upper Stony Creek	2,180	580	180	600 - 800
Clear Shade Creek	2,220	430	130	400 - 600
Tub Mill Creek	1,134	540	360	600 - 800
Glade Run	1,913	1,000	680	1,000 - 1,600
Little Connoquenessing	1,006	820	550	800 - 1,200
Little Sandy Creek	1,233	1,960	640	1,600 - 3,000
North Fork	1,385	1,460	470	1,400 - 2,200
Dunkard Creek	900	1,400	950	1,400 - 2,200
Big Sandy Creek	1,336	3,100	1,200	3,000 - 4,600
Cassadaga Creek	1,267	3,350	500	3,200 - 5,000
Conewango Creek	1,277	8,900	1,400	8,500 -10,000
Brokenstraw Creek	1,340	360	120	300 - 500
Raccoon Creek	887	2,900	2,000	2,000 - 4,000

STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
CHARLESTON 25305

T. R. SAMSELL
DIRECTOR

October 27, 1967

DAVID C. CALLAGHAN
DEPUTY DIRECTOR

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Federal Building, Room 6405
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed the draft copy of your report on the Corps of Engineers current Framework Studies for the Allegheny, Monongahela, and Beaver River Basins, Pennsylvania, West Virginia and Maryland. Our review was confined to the West Virginia portion of the report, and we are in general concurrence with it.

We do feel obliged to comment on your Table 3. - Estimated Annual Fishermen-Use and benefits of Reservoirs Included in Framework Studies. We feel that it may be misleading to assign such substantial With Project benefits for Laurel Creek, Elk Creek and Ten Mile Creek where existing Without Project values are "0" due to acid pollution. Realizing that these benefits are projected to the year 2020, we are still dubious that such water quality improvement will occur at least in the near future. Thus, we are fearful that undue emphasis might be given to such undesirable projects from the benefits listed.

We realize that this report is very general and appreciate the chance to review it. We will look forward to future reviews of specific projects as they may develop.

Sincerely yours,

T. R. Samsell
Director

TRS:R:g

GEORGE B. SHIELDS
DIRECTOR

EDWIN M. BARRY
ASSISTANT DIRECTOR



Department of Game and Inland Fish
STATE OFFICE BUILDING ANNAPOLIS 21401

December 1, 1967

Mr. Jerome L. Johnson, Assistant Chief
Section of Water Resource Surveys
Appalachian Area Development Program
Room 6405 Federal Building
550 Main St.
Cincinnati, Ohio 45202

Dear Mr. Johnson:

The Maryland Department of Game and Inland Fish endorses your proposed report to the Corps of Army Engineers pertaining to the current Framework Studies for the Allegheny, Monongahela, and Beaver River Basins, Pennsylvania, West Virginia, and Maryland.

Thank you for the opportunity to comment on your report.

Sincerely yours,

George B. Shields
Director

cc.
Mr. Bitely
Mr. Goldsberry

G-262

COMMISSION

DR. WILLIAM B. HOLTON, CHM. GEORGE D. WALTERS, V. CHM. W. DESMOND WALKER ROYDEN A. BLUNT HAROLD E. WIBBERLEY, JR.

STATE OF NEW YORK
CONSERVATION DEPARTMENT *Division of Fish and Game*

R. STEWART KILBORNE
Commissioner
W. MASON LAWRENCE
Deputy Commissioner
ROBERT E. YOUNG
Deputy Commissioner
LEIGHTON A. HOPE
Secretary

ALBANY, NEW YORK 12226

E. L. Cheatum
Director
GL 7-5690
A. G. Hall
Assistant Director
GL 7-5690

November 22, 1967

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
Appalachian Area Development Program
Fish and Wildlife Service
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

On behalf of Commissioner Kilborne I am acknowledging your letter of November 14.

We have reviewed the draft copy of the Bureau of Sport Fisheries and Wildlife's report on the Corps of Engineers current Framework Studies for the Allegheny, Monongahela, and Beaver River Basins, Pennsylvania, West Virginia, Maryland and New York.

In Table 2, the sport fish species listed for the Cassadaga Creek reservoir site are "trout,bass". These should be changed to muskie, bass. If this is done, the change should be reflected in Table 3 under the headings "With Project" and "Net Benefits".

We concur in the remainder of the report.

Sincerely,

A. G. Hall
Assistant Director
Division of Fish and Game

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
P. O. BOX 1567
HARRISBURG, PA. 17120

OFFICE OF
EXECUTIVE DIRECTOR
TELEPHONE
AREA CODE 717 - 787-3633

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PROPAGATION	787-6711
RESEARCH	787-5529

October 24, 1967

Mr. Raymond G. Oberst, Chief
Appalachian Water Resources
U.S. Fish and Wildlife Service
Room 6405 Federal Building
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed your draft of the "Framework Studies for the Allegheny, Monongahela and Beaver River Basins, in Pennsylvania".

The initial development costs in your report are listed as $4.00 to $10.00 per acre. This should be increased "from $20.00 to $55.00 per acre". You should also increase the O & M maximum to $20.00 per acre. This data does not include clearing of timbered areas or reverting fields. Activity of this type would vary from $100.00 to $400.00 per acre.

We have no other comments.

Very truly yours,

Glenn L. Bowers
Executive Director

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
HARRISBURG 17120

EXECUTIVE DIRECTOR

October 31, 1967

Mr. Raymond G. Oberst, Chief
Section of Water Resource Surveys
U. S. Fish and Wildlife Service
Room 6405 - Federal Bldg.
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed the draft copy of your Bureau's report on the Corps of Engineers current Framework Studies for the Allegheny, Monongahela and Beaver River Basins in Pennsylvania, West Virginia and Maryland.

We agree in principle with your report but will withhold comments on specific dam sites until more precise information is available on each. We do note that some of the sites in Pennsylvania are located on streams carrying acid mine water.

The Pennsylvania Fish Commission will be pleased to participate in the planning for each site - especially as related to developing suitable conditions for fishing and boating.

Sincerely yours,

Robert J. Bielo

Robert J. Bielo
Executive Director

RJB:GLT:p

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 28, 1968

District Engineer
U.S. Army Engineers District, Pittsburgh
Corps of Engineers
2032 Federal Building
1000 Liberty Avenue
Pittsburgh, Pennsylvania 15222

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife on the plan for flood control and allied purposes at the St. Petersburg Reservoir site on the Clarion River, Pennsylvania. This report has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 incl.) in cooperation with the Pennsylvania Game and Fish Commission. It has the concurrence of those agencies as indicated by letters dated May 24, 1968 and May 23, 1968 respectively. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

INTRODUCTION

Pursuant to the Appalachian Regional Development Act of 1965; Sec. 206, the Secretary of the Army was authorized and directed to prepare a comprehensive plan for the development and efficient utilization of the water and related resources of the Appalachian Region, especially as it might enhance the economy of the Region. Several federal agencies, including the Department of the Interior, were authorized to assist in the preparation of the plan. This project is one which has been selected for study in response to the Act.

This report is based on engineering data which is contained in the 1st draft of the Sub-Region F Report on the Development of Water Resources in Appalachia. The evaluations have been made in accordance with Senate Document Number 97, Supplement 1, 87th Congress, 2nd Session, entitled "Evaluation Standards for Primary Outdoor Recreation Benefits". Populations within the project area are based on trends as expressed in the developmental benchmarks for the Appalachian Region as of May 15, 1967. Benefits for the project are dependent upon implementation

of the plan for development of the fish and wildlife resources.

DESCRIPTION OF THE AREA

The project area is located in the Clarion River Basin, Clarion, Forest, and Jefferson Counties, Pennsylvania. The Clarion River is one of the main tributaries of the Allegheny River. The general topography is hilly with narrow wooded valleys. The hill tops are relatively flat and generally are, or have been, under cultivation. Farming is largely marginal in this area and much of the agricultural land has been abandoned and is in various stages of plan succession. The timbered areas consist mainly of hardwood trees with scattered stands of softwoods.

The area lies in the bituminous coal belt which has been and is being mined quite extensively. Coal removal has included both underground and surface mining operations with strip mining being the most common. The latter method has caused the complete destruction of vegetative cover on many areas. Attempts to reclaim strip mines have been partially successful and some areas are in various stages of vegetative recovery while many others are still barren. Acid drainage from both underground and surface mines has polluted many of the streams in the area including the Clarion River.

DESCRIPTION OF THE PROJECT

The proposed St. Petersburg Dam site is located approximately five miles above the mouth of the Clarion River and near the town of St. Petersburg, Pennsylvania.

The project purposes are to provide flood control, water quality control, water supply, pumped storage power, and recreation, including fish and wildlife. The dam will be a concrete structure about 1,830 feet in length and 288 feet high above the stream bed. The spillway will be controlled by tainter gates. The pool elevations of the reservoir will be controlled by seven sluices through the spillway structures and a multi-level water quality control intake. The reservoir will provide control of a drainage area of approximately 1,245 square miles. Pertinent data concerning the reservoir storage are presented in table 1.

The project plan will also include a program for the abatement of pollution from acid mine drainage including the reclamation of strip mine areas for aesthetic and enhancement purposes.

Table 1. Pertinent Engineering Data, St. Petersburg Reservoir, Pennsylvania

Pool	Elevation 1/	Capacity (Acre-feet)	Area (Surface Acres)
Flood Control	1,155	981,084	13,590
Summer, Maximum	1,130	685,183	10,140
Winter, Maximum	1,111	515,203	7,780
Permanent	937	12,025	499

FISHERY RESOURCES

Without the Project

The fishery resources of the streams in the Clarion River Basin affected by the project are insignificant. Acid drainage from deep mines and strip mines has severely polluted most of the streams in the basin. Some of the unpolluted smaller tributaries are stocked with trout in early spring and provide some fishing for a short period. It is estimated that approximately 1,000 man-days of fishing occur annually in the project area.

With the Project

The St. Petersburg Reservoir will inundate approximately 50 miles of the Clarion River and major tributaries causing a loss of about 1,000 man-days of fishing annually.

The reservoir will provide an impoundment about 30 miles long, consisting of 10,140 surface acres during the recreation season. The lower end of the reservoir will be broad and have numerous coves, while the upper three-fourths will be narrow and winding.

The value of the fishery that develops in the reservoir will largely depend on the success of the mine acid abatement program. If the p^H of the reservoir can be maintained at 6 or above, it is estimated that it will provide 150,000 man-days of fishing annually. If the p^H drops below 6, the fishery resource of the reservoir would be seriously impaired.

1/ All elevations are in feet above mean sea-level.

It is expected that the mine acid abatement program will remedy only those sources which contribute the majority of the acid load to the Clarion River. This will not result in a complete abatement of the acid pollution. Although the tributary streams will be improved they will be of marginal quality and only of insignificant value from a fisheries standpoint.

The operation of a pumped storage power plant will cause wide fluctuations of the flow in the remaining 5-mile portion of the river, and therefore, it is not expected to develop a fishery of any importance.

The full commercial fishery potential of St. Petersburg Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the near future. Such commercial harvesting would utilize for food and possible industrial use, a fishery resource potential through the reduction of rough fish population. The Pennsylvania Fish Commission will determine the need and feasibility of such harvesting as well as control all such projects. The commercial fish potential of the reservoir will be about 150,000 pounds of food and industrial fishes per year.

WILDLIFE RESOURCES

Without the Project

The principal game species in the project area are white-tailed deer, cottontail rabbits, squirrels, and ruffed grouse. Raccoon and fox are also present.

Hunting pressure is generally heavy, particularly during the deer season when there is a large influx of hunters from the Pittsburgh area. Road access throughout the project area is good. There are a number of large strip-mined areas which presently are barren and in need of proper reclamation. It is estimated that 16,300 man-days of hunting occur annually on the lands which will be affected by the project.

With the Project

The St. Petersburg Reservoir will inundate 13,590 acres of land at full flood pool. This loss of habitat will eliminate approximately 16,300 man-days of hunting opportunity.

FISH AND WILDLIFE PLAN

The St. Petersburg project will have varying effects on the fish and wildlife resources. The following plan suggests the steps needed to insure adequate development of the fish and wildlife resources associated with the project. The evaluations presented are contingent upon the implementation of the measures suggested in the plan.

Fishery

The project will result in a net gain of 149,000 man-days of fishing valued at $149,000 annually. The reservoir fishery will support about 150,000 man-days of fishing, annually. Fishery evaluations are summarized in table 2.

The Pennsylvania Fish Commission will determine and initiate the management practices that will be needed to establish and maintain the fisheries in the reservoir. Portions of the reservoir should be managed by the state agency under the terms of a General Plan for Fish and Wildlife Management.

To insure adequate fisherman access to the reservoir, parking spaces and launching facilities should be provided at various locations to accommodate a design load of 550 automobiles and 275 boat trailers in addition to that required by other interests. Some of the roads which lead to the reservoir should not be abandoned but be maintained for fishermen access.

To provide maximum fisherman utilization and additional access for land-based fishermen, 10 fishing piers, each providing at least 150 feet of fishable length should be constructed adjacent to recreational developments in areas of good fishery habitat. These structures would also serve to attract fish populations. Rock material from adjacent construction would provide prime material for this purpose; however, wooden piers on piling would be satisfactory. Such fishing piers should be "T" shaped or "L" shaped to provide a maximum of 150 feet of fishable length on both sides in water four feet deep or more. The increased availability of the fishery resources from these piers would result in an annual enhancement benefit of 20,000 fishermen-days having a net recreational value of $20,000.

Spawning marshes for escoid fishes should be developed at suitable locations adjacent to the reservoir. Such marshes would be a major factor contributing to the establishment and maintenance of a sport fishery in St. Petersburg Reservoir.

Areas of standing timber in a reservoir create important habitat for some species of fish and also provide good fishing locations. Before plans for clearing the reservoir become final, selection of areas not to be

cleared should be determined by the Pennsylvania Fish Commission and the Bureau of Sport Fisheries and Wildlife in cooperation with the U.S. Corps of Engineers.

A reservoir zoning plan should be developed cooperatively by all of the agencies responsible for recreation activities. Such a plan would prevent possible conflicts with regard to the use of the impoundment.

The mine acid drainage abatement program that will be part of the project plan, should include measures that will sufficiently reduce the acid pollution so that the p^H of the reservoir will never fall below 6. All of the fishery evaluations are based on this assumption.

Wildlife

The project will cause losses to the wildlife resources as indicated in table 2. To compensate for these losses, approximately 10,500 acres of land should be made available to the Pennsylvania Game Commission as a wildlife management area under the terms of a General Plan for Fish and Wildlife Management. Proposed location of land for the wildlife management area is shown on plate 1.

Other project lands suitable for wildlife management should be made available to the Pennsylvania Game Commission under the terms of a General Plan for Fish and Wildlife Management.

Strip mines in the basin will be reclaimed as a part of the project plan. Reclamation should be done with a view towards developing the wildlife habitat potential of these areas. The various stages of plant succession on successfully reclaimed strip mined areas are valuable in maintaining several species of wildlife.

Estimated Costs of the Fish and Wildlife Plan

The initial cost of establishing a fishery in St. Petersburg Reservoir is estimated at $100,000. This includes the cost of studies to determine and initiate the management measures needed to establish the fishery. The annual operation and maintenance cost associated with management of the reservoir fishery will be about $20,000.

Other initial costs include fishermen access to the reservoir, but should include only the cost of the boat launching ramps and parking lots needed to accommodate the fishermen. These costs will be determined by the construction agency.

It is estimated that the 10 fishing piers will cost $15,000 each to construct. Floating piers would be used at a much cheaper cost but are not as permanent, requiring maintenance.

Table 2. Effects of the St. Petersburg Project on the Fish and Wildlife Resources

Resource Unit	Without the Project: Miles or Acres	Without the Project: (man-days)	With the Project: (man-days)	Fish & Wildlife Plan Implemented With the Project: Miles or Acres	Fish & Wildlife Plan Implemented With the Project: (man-days)	Net Increase (man-days)	Net Annual Value (dollars)
Fishery							
Stream	50 mi.	1,000	--	--	--	--	--
Reservoir	10,000 ac.	--	150,000	10,000 ac.	150,000	149,000	149,000
Fishing Piers (10)	--	--	--	--	20,000	20,000	20,000
Wildlife							
Reservoir	13,590 ac.	16,300	--	--	--	--	--
Mitigation land	--	--	--	10,500	16,300	--	--

The cost of developing spawning marshes is not known at this time. Developmental costs can be derived when the locations of these areas are determined.

Not including the cost of the land, the cost for the initial development of the game management area will be approximately $200,000. Annual operation and maintenance costs are estimated at $55,000.

RECOMMENDATIONS

In the interest of providing for the full development of the fish and wildlife resources in the planning for the St. Petersburg project, it is recommended that:

1. The conservation and development of the fish and wildlife resources be among the purposes for which the project is authorized.

2. Parking and boat launching facilities for fishermen be provided at several locations on the reservoir that will be capable of accommodating 550 automobiles and 275 boat trailers in addition to the needs of other recreationists.

3. Ten fishing piers wither "L" or "T" shaped be constructed in the reservoir and that the location of these piers be determined through coordination efforts of the U.S. Corps of Engineers, the Pennsylvania Fish Commission and the Bureau of Sport Fisheries and Wildlife.

4. Spawning marshes for esocid fishes be developed adjacent to the reservoir. The locations and sizes of such marshes will be determined during preconstruction planning.

5. Timber be left standing in certain areas of the reservoir and these areas be selected in cooperation with the Pennsylvania Fish Commission, the U.S. Corps of Engineers, the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife during preconstruction planning.

6. A zoning plan to prevent conflicts of use on the reservoir be developed cooperatively by the Pennsylvania Fish Commission, the U.S. Corps of Engineers, the Bureau of Outdoor Recreation, and the Bureau of Sport Fisheries and Wildlife during preconstruction planning.

7. The mine acid drainage abatement program be complete enough to sufficiently reduce the acid load of the streams in the Basin so that the reservoir will never have a p^H of less than 6.

8. The commercial fishery potential of the reservoir be realized, when necessary, for human needs and as a fishery management tool.

9. Approximately 10,550 acres of land above the flood pool be acquired to mitigate the project occasioned losses to the wildlife resources. These lands to be made available to the Pennsylvania Game Commission under the terms of a General Plan for Fish and Wildlife Management.

10. Selected project lands above the flood pool level be licensed to the Pennsylvania Game Commission under the terms of a General Plan for Fish and Wildlife Management.

11. The reclamation of strip mines should be completed so as to develop the wildlife habitat potential of these areas. The Pennsylvania Game Commission will provide the technical assistance needed to accomplish this.

We appreciate the opportunity to report on the St. Petersburg project. We wish to be kept informed of any significant changes in project plans. If the project is authorized for advanced engineering and design, it is requested that engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

(Sgd) Thomas A. Schrader

Acting Regional Director

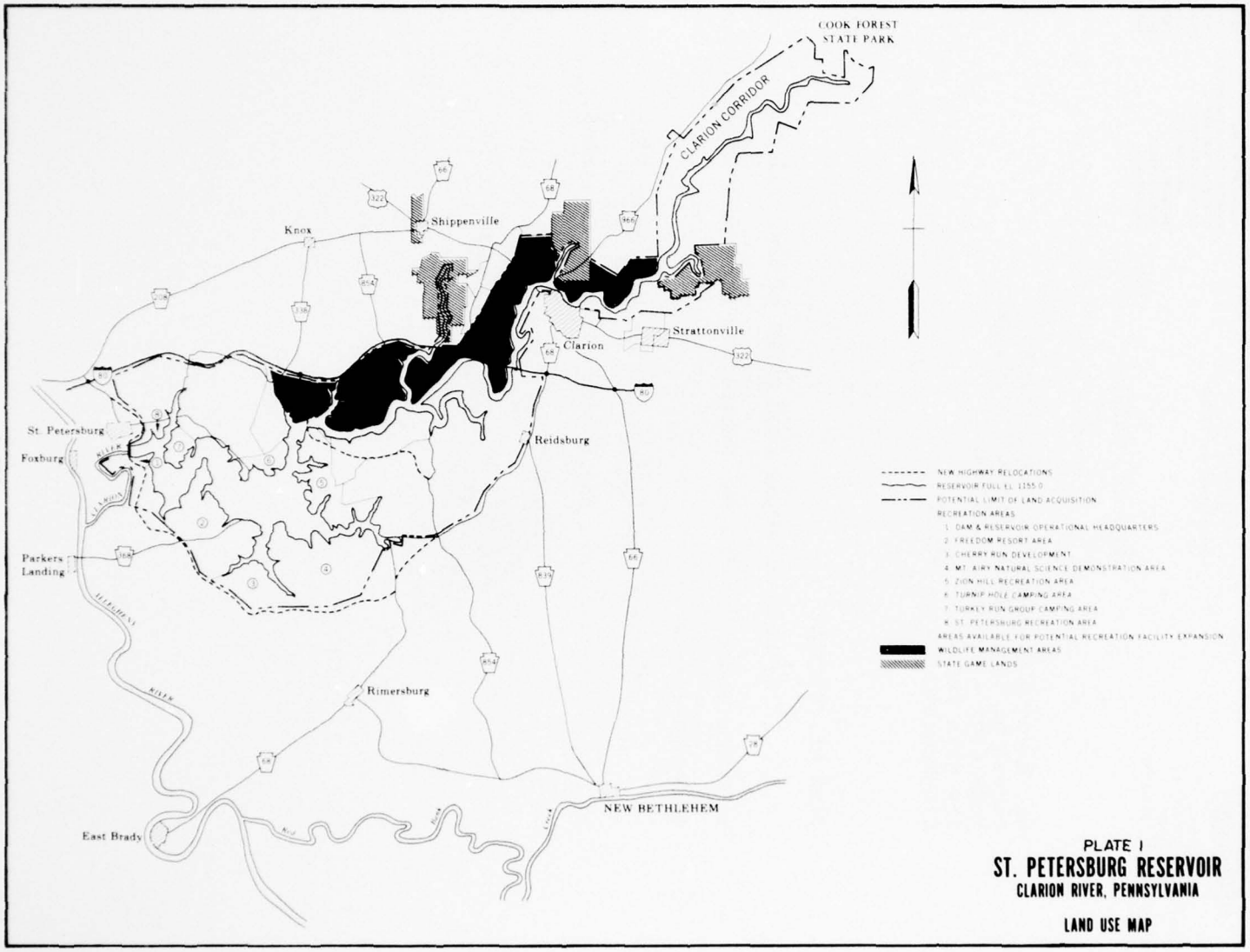


PLATE I

ST. PETERSBURG RESERVOIR

CLARION RIVER, PENNSYLVANIA

LAND USE MAP

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
P. O. BOX 1567
HARRISBURG, PA 17120

OFFICE OF
EXECUTIVE DIRECTOR
TELEPHONE
AREA CODE 717 - 787-3633

ADMINISTRATIVE DIVISIONS:

ACCOUNTING	787-3676
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LAND MANAGEMENT	787-6818
REAL ESTATE	787-6568
MINERALS	787-2162
PROPAGATION	787-6711
RESEARCH	787-5529

May 24, 1968

Mr. Raymond G. Oberst, Acting Chief
Bureau of Sport Fisheries and Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have reviewed your draft of the Fish and Wildlife Report on the St. Petersburg Reservoir Project, in Pennsylvania.

The Game Commission concurs with your Fish and Wildlife plan, and the recommendations as stated.

Very truly yours,

Glenn L. Bowers
Executive Director

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
HARRISBURG 17120

EXECUTIVE DIRECTOR

May 23, 1968

Mr. Raymond G. Oberst, Acting Chief
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
Room 6405 - Federal Building
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

We have read the review draft of your report on the St. Petersburg Reservoir project, Pennsylvania, and have the following comments.

We do not believe a worthwhile fishery can be developed in this reservoir with pH values as low as 5. In our experience waters affected by mine acid and having a pH of 5 have supported practically no fish life. The outflow of East Branch Clarion River Reservoir has shown pH values consistently above pH 5, but this reservoir has little to offer as far as fishing is concerned. We strongly urge therefore that if a satisfactory and productive fishery is to be developed, Point 5 of your Recommendations be rewritten to read: "The acid mine drainage abatement program be complete enough to sufficiently reduce the acid load of the streams in the Basin so that the reservoir will never have a pH of less than 6."

We request that consideration be given in the planning stages to (a) the installation of fishing piers to increase fishing opportunities for non-boaters, and to (b) establishing spawning marshes at suitable locations for esocid fishes.

Otherwise, we concur with your report.

Sincerely yours,

Robert J. Bielo/GLT

Robert J. Bielo
Executive Director

B:GLT:p

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

December 26, 1968

District Engineer
U. S. Army Engineer District, Pittsburgh
Corps of Engineers
2032 Federal Building
1000 Liberty Avenue
Pittsburgh, Pennsylvania 15222

Dear Sir:

This letter is a supplement to our conservation and development report, dated May 28, 1968, concerning your plan for flood control and allied purposes at the St. Petersburg Reservoir site on the Clarion River, Pennsylvania. The project is being studied by your office pursuant to the Appalachian Redevelopment Act of 1965 (Public Law 89). This supplementary report has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 incl.) in cooperation with the Pennsylvania Game and Fish Commissions. It has the concurrence of those agencies as indicated by letters dated December 3, 1968 and December 5, 1968 respectively.

This report is provided at the request of Mr. Benjamin Netzer of your staff and includes an analysis of the fish and wildlife resources of the Clarion River and tributaries extending 40 miles upstream from Cooksburg to Ridgway, Pennsylvania. We understand that the St. Petersburg Reservoir studies have been expanded to include the scenic river aspects along the extended portion of the stream.

Fishery resources in the Clarion River between Cooksburg and Ridgway are of low value. Recent studies indicate the presence of fish species such as stonerollers, minnows, chubs, shiners, brook lampreys, suckers, bullheads, yellow perch, rock bass, smallmouth bass, pumpkinseeds, darters, and sculpins. The water in the main stem of Clarion River is polluted with coal-mine acid and industrial wastes. The pH ranges between 6.0 and 6.9.

Several of the main tributaries such as East Branch Millstone Creek, Spring Creek, Bear Creek, and Big Mill Creek are stocked with trout and receive moderate to heavy fishing use. Total use of the four tributaries is estimated at 600 man-days annually, with a recreational value of $1,800. Annual fisherman-use in the 40-mile stretch of the Clarion River is estimated at 800 man-days, valued at $800.

Principal wildlife species found along the Clarion River and vicinity are squirrels, ruffed grouse, cottontail rabbits, black bear, and white-tailed deer. Waterfowl also frequent the Clarion River and adjacent small marsh impoundments.

There are approximately 111,000 acres of public hunting land adjacent to the Clarion River portion of the project area. Of this total, 49 percent are state-owned game lands; 8 percent are in state forests; and 43 percent are in the Allegheny National Forest. For purposes of this study the latter acreages were computed for Barnett Township, Forest County, and Millstone, Spring Creek, and Ridgway Townships, Elk County. Annual use of the above-mentioned public hunting areas is estimated at 8,000 man-days of big-game hunting and 29,000 man-days of small-game hunting, valued at $24,000 and $43,500, respectively.

Waterfowl-hunting along the Clarion River is performed by "jump shooting" or drifting the river by boat. The segments of the river near Hallton and Arroyo are popular waterfowl shooting areas. Estimated waterfowl hunting use is 100 man-days per season. Annual recreational value is about $200.

As mentioned in our May 28, 1968 report, the value of the fishing that develops in the St. Petersburg Reservoir as well as in the 40-mile stretch of the Clarion River to Ridgway will largely depend upon a combined mine acid and industrial waste abatement program. If the water quality is improved to the extent that game fish can be introduced and subsequent natural reproduction occurs, fishing pressure in this segment of the Clarion River would greatly increase over its present use. Access would also play an important role in the future fishery of the river. Parking and boat launching facilities near bridge crossings for fishermen should be included in the recreational planning for this area. Portage trails for float fishermen should be provided as well.

To attract and retain waterfowl along the Clarion River, food plots should be planted on the flat, fertile land at the oxbows. Construction of pot-holes and shallow impoundments on all public hunting lands adjacent to the river should be encouraged also.

In the interest of conserving and developing the fish and wildlife resources of the Clarion River and tributaries between Cooksburg and Ridgway, Pennsylvania, the Bureau of Sport Fisheries and Wildlife recommends the following measures be applied to the Clarion River recreation plan:

1. A mine acid drainage and industrial waste abatement program should be undertaken to improve water quality in the Clarion River and tributaries for fishery enhancement.

2. Parking and boat launching facilities for fishermen be provided at bridge crossings along the Clarion River.

3. Portage trails be constructed adjacent to the river for canoeing enthusiasts and "float" fishermen.

4. Food plots should be planted on oxbow "flats" to attract and retain waterfowl.

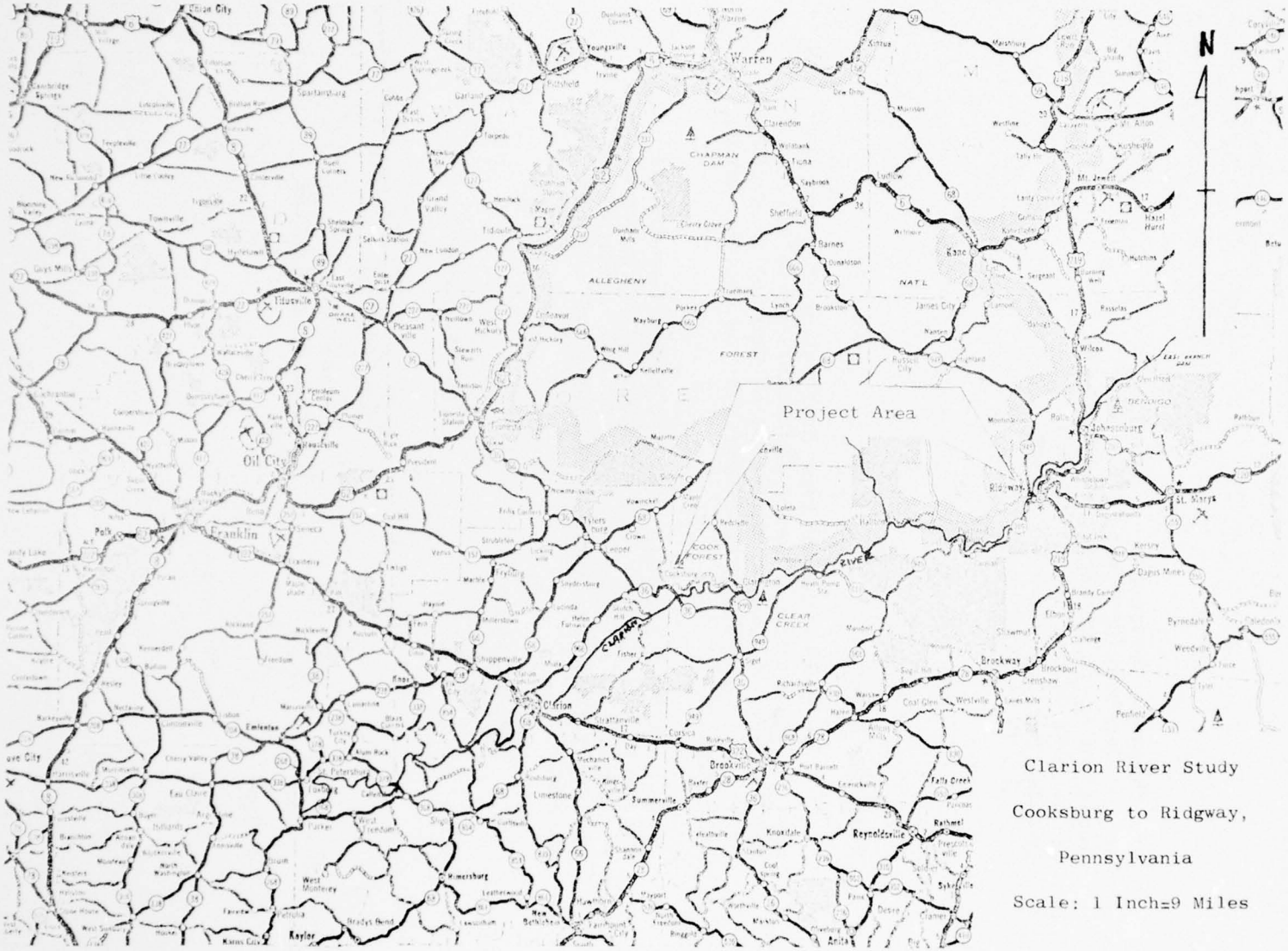
5. Construct potholes and shallow impoundments on all public lands adjacent to the Clarion River study area.

The opportunity to provide additional fish and wildlife information in connection with the extended portion of the St. Petersburg Reservoir site is appreciated.

Sincerely yours,

Richard E. Griffith

Regional Director


N
Project Area
Warren
Oil City
Franklin
Clarion
Brockway
Ridgway
St. Marys
Reynoldsville
ALLEGHENY
NAT'L
FOREST
CHAPMAN DAM
CLEAR CREEK
COOK FOREST
Clarion River Study
Cooksburg to Ridgway,
Pennsylvania
Scale: 1 Inch=9 Miles

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COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
HARRISBURG 17120

EXECUTIVE DIRECTOR

December 5, 1968

Mr. Thomas A. Schrader
Acting Regional Director
Bureau of Sport Fisheries and Wildlife
U. S. Post Office and Courthouse
Boston, Massachusetts 02109

Dear Mr. Schrader:

We have reviewed your draft copy of a supplement to the Bureau of Sport Fisheries and Wildlife's May 28, 1969 report on the Corps of Engineers' study of the St. Petersburg Reservoir site on Clarion River, Pennsylvania.

We strongly back your recommendation that a mine acid and industrial waste abatement program must be undertaken if water quality in the Clarion River and its tributaries is to be suitable for a significant fishery.

We approve your report.

Sincerely yours,

Robert J. Bielo
Executive Director

B:T:p

OFFICE OF
EXECUTIVE DIRECTOR
TELEPHONE
AREA CODE 717 - 787-3633

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
P. O. BOX 1567
HARRISBURG, PA. 17120

December 3, 1968

ADMINISTRATIVE DIVISIONS:

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LAND MANAGEMENT	787-6818
REAL ESTATE	787-6568
MINERALS	787-2162
PROPAGATION	787-6711
RESEARCH	787-5529

Mr. Thomas G. Schrader
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
U.S. Post Office and Courthouse
Boston, Massachusetts 02109

Dear Mr. Schrader:

We have received your draft of the fish and wildlife resources of the Clarion River and tributaries extending from Cooksburg to Ridgway. On Page 2, you discuss the principal wildlife species, however, you have omitted the Black Bear. The harvest of Black Bears in Jefferson, Forest, and Elk Counties totaled 88 for the 1967 hunting season. We believe this to be an important wildlife resource in the region. Of course, the above figure includes total county harvest. The area of your study is included in the bear range of the region.

The accepted spelling of Ridgway does not include the letter "e". We have no other comment.

Very truly yours,

Glenn L. Bowers
Executive Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 24, 1968

District Engineer
U.S. Army Engineers District, Charleston
P.O. Box 919
Charleston, South Carolina 29402

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Clinchfield Reservoir project, Rutherford and Polk Counties, North Carolina. The project is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89-4). This report is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.) in cooperation with the North Carolina Wildlife Resources Commission. It has the concurrence of that agency as indicated by letter, dated May 29, 1968. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

DESCRIPTION OF THE AREA

The Clinchfield Reservoir site is located on the Broad River, Rutherford and Polk Counties, North Carolina and about 5 miles north of Chesnee, South Carolina. The topography of the area is gently rolling to hilly with forests and scattered farms.

Highway access is good. Federal Highways 221 and 64 parallel the reservoir on the east and north while State Highways 9, 11, and 108 provide access to the western and southern portion of the reservoir.

DESCRIPTION OF THE PROJECT

The dam site for this multi-purpose project will be located at mile 130 on the Broad River, North Carolina. Although most of the reservoir will be in North Carolina, several arms will extend into South Carolina which will place it in water areas D-1 and D-2. The dam will be a

rolled-earth-fill type and will rise 153 feet above the elevation of the streambed. The releases through the spillway will be controlled by 10 Tainter Gates, each 30 feet wide and 20 feet high. A multiple 5-level intake will be incorporated into the outlet structure to permit flexible releases.

At sediment pool elevation of 721 feet, 1/ the reservoir will inundate 1,835 acres (table 1). The conservation pool at elevation 810.5 feet will cover 20,220 acres and at flood control pool (elevation 820 feet), the surface area will be 23,180 acres.

Table 1. Pertinent Engineering Data, Clinchfield Reservoir Project

Pool	Elevation (feet)	Capacity (acre-feet)	Area (acres)
Flood Control	820.0	205,500	23,180
Conservation	810.5	806,000	20,220
Sediment	721.0	24,500	1,835

Under normal project operation, 50 c.f.s. of water will be discharged downstream from the reservoir.

FISH AND WILDLIFE RESOURCES

Without the Project

Fishery Resources

Within the zone of project influence, the Broad and Green Rivers are moderate sized upper piedmont streams with sand, silt, and bedrock bottoms. High turbidities and siltation resulting from soil erosion and sand mining operations have had an adverse affect on stream fishery habitat. Consequently, fishery resources in the project area are of moderate to low value consisting mainly of largemouth bass and other sunfishes, catfishes, and suckers. An average of 8,900 man-days of fishing annually is expected to take place in the 45 miles of stream in the project area during the period of project analysis.

1/ All elevations refer to feet above mean sea level.

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DEVELOPMENT OF WATER RESOURCES IN APPALACHIA. VOLUME 22. APPEND--ETC(U)
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Wildlife Resources

Wildlife resources in the project area include moderate to low populations of deer, squirrel, rabbit, quail, dove, and fur animals. Of significant value to wildlife is the habitat afforded by woodlands and agricultural lands located in the flood plain. The acreage contained within the project area (flood pool) will support an average of 625 man-days of big game hunting and 5,620 man-days of small game hunting over the life of the project.

With the Project

Fishery Resources

Reservoir construction will result in a loss of about 45 miles or 540 acres of stream fishery habitat and create 20,220 acres of moderate quality warmwater reservoir fish habitat. The reservoir is expected to contain relatively the same species as now found in the river with the addition of white bass and crappie. With proper reservoir management and provision of adequate public access facilities the increase in habitat area will result in a net fishing benefit (table 2).

Wildlife Resources

Project construction will permanently inundate 13,595 acres of bottomland hardwood wildlife habitat and 6,075 acres of open farm game habitat. An additional 1,475 acres of low quality habitat will be lost due to reservoir timber clearing and peripheral developments. Waterfowl habitat provided by open water areas in the reservoir will consist primarily of resting areas. However, embayments in the upper edge of the conservation pool could be of moderate short term value to wood ducks and other migratory species provided that timber is left standing in these areas.

A total of approximately 5,700 man-days of hunting will be lost as a result of project effects on wildlife resources.

FISH AND WILDLIFE PLAN

The development of the Clinchfield Reservoir project would result in increased fishing opportunity and reduced hunting opportunity in the affected area. When the general design memorandum is prepared, several measures should be included in project plans to develop and preserve all aspects of project related fish and wildlife resources. These measures are discussed below.

Fishermen Access. Adequate fishermen access should be provided to project waters. We understand through informal contacts with the Charleston District minimum project facilities for public use, sanitation and safety will be provided in the event local interest participation in cost sharing is not forthcoming. A review of the tentative minimum base facilities which will be provided indicates that access will be sufficient to realize fishery benefits ascribed to this project. Therefore, it appears that no additional developments for fishermen access will be required which would necessitate cost sharing by local interests under P.L. 89-72.

The North Carolina Wildlife Resources Commission has not requested that fish and wildlife enhancement be included in plans for development of this project. However, the Commission and this Bureau request that mitigation features to reduce wildlife habitat losses be included in project plans.

Wildlife Mitigation. Our investigations indicate that the loss of hunting opportunities that will result from project construction can be compensated by acquisition of about 4,000 acres of land located outside the project area adjacent to the general purchase unit boundaries of the Green River Wildlife Management area. The management area is owned in fee by the North Carolina Wildlife Resources Commission. The exact location of this land should be determined by the North Carolina Wildlife Resources Commission, the Corps of Engineers, and this Bureau prior to preparation of the General Design Memorandum. The selected lands should be licensed to the Commission for management purposes as provided for in the Flood Control Act of 1962, Section 207, Public Law 82-874.

The 4,000 acres of additional land needed to offset hunting losses will require certain initial costs for hunter parking facilities, access roads, equipment, land posting, and food patches. These costs would approximate $20,000. Cost of land acquisition including contingencies is about $460,000. All of these costs should be borne by the project and be non-reimbursable. These costs would total $480,000, which when reduced to an appropriate annual equivalent is $16,300. Costs of annual operation and maintenance would be about $3,700.

Downstream Flows. We understand multiple level intakes will be provided in the outlet works for this project. This feature should be operated so as to maintain adequate water quality for warmwater fish populations in downstream areas. Summer water temperatures should fall within the range of 75° - 85° F. It is also essential that a continuous minimum flow be provided to avoid damages to fish habitat during periods of low flow. Adequate minimum flow is defined as that quantity of water required to insure bank to bank coverage of the food-producing riffles and shoals in the downstream reaches.

Timber Clearing. Some modification of Corps policy for clearing timber from the reservoir area may be desirable. This plan should provide for standing timber in embayments at tributary outlets and in the upper part of the conservation pool. The presence of standing timber in these areas may aid in the harvest of sport fish and improve angler success. If timber clearing plans are modified, standing timber areas would improve expected waterfowl habitat by providing nesting habitat for wood ducks and resting areas for migrant waterfowl. The standing timber areas can be selected in subsequent project planning stages by representatives of this Bureau, the Corps, North Carolina Wildlife Resources Commission, and the North Carolina Department of Health.

Reservoir Impoundment and Operation. To favor establishment of a more valuable sport fishery, initial reservoir impoundment should occur during late fall or winter, and water level fluctuations should be kept at a minimum during early spring months. When reservoirs are impounded during late spring or summer, spawning and survival of more desirable species is discouraged, and survival of less desirable and undesirable species is encouraged. An over-abundance of forage fish, particularly those forage species which grow rapidly and attain a size which prevents them from being utilized as forage and allows them to compete for food and space with more desirable species, is encouraged, thus causing a loss in sport fish production.

Reservoir surface level fluctuations should be minimized as much as possible during the spring months because excessive surface level fluctuations could dewater and destroy largemouth bass spawning beds during this period. This fluctuation would inhibit spawning or would result in the destruction of the eggs, thus causing a reduction in the reproduction success of this species. Reservoir operation should avoid drawdowns in excess of two feet for a 30-day period after water temperatures reach 60 degrees Fahrenheit. These procedures would favor development of a more desirable reservoir sport fishery.

Seasonal Maintenance of Maximum Conservation Pool. Maintenance of the maximum conservation pool during the recreational season would provide a larger, more attractive reservoir for public use. The larger reservoir area would contribute toward a more valuable reservoir fishery and the inundation of mud flat areas would improve the aesthetic value of the reservoir for general recreation. The maximum conservation pool acreage should also be maintained for the longest time possible when recreational use is high and flood expectancy is low to facilitate greater realization of the project-occasioned benefits.

The reservoir fishery which will be formed will support about 226,400 fishermen days; assuming implementation of the Fishery Plan. This represents a reservoir benefit of 217,500 man-days having a net recreational value of $221,100.

Table 2. Effects of Clinchfield Reservoir Project on Fishery Resources Assuming Implementation of the Fish and Wildlife Plan

Resource Unit	Without Project		With Project		Net Benefits	
	Man-days	Dollar Value	Man-days	Dollar Value	Man-days	Dollar Value
Stream (45 miles or 540 acres)	8,900	5,300	--	--	--	--
Reservoir (19,800 Ac. average pool size)	--	--	226,400	226,400	217,500	221,100

The full commercial fishery potential of Clinchfield Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be feasible in the future. The North Carolina Wildlife Resources Commission shall determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with the Commission's responsibility for good game-fish management. Such commercial harvesting would utilize for food and possibly industrial use a fishery potential through reduction of rough fish populations. The reservoir's commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 303,000 pounds of food and industrial fishes per year.

RECOMMENDATIONS

On basis of the foregoing, the Bureau recommends that:

1. Adequate fisherman access be provided to project waters.

2. Approximately 4,000 acres of land located outside the project area adjacent to the general unit boundaries of the Green River Wildlife Management area be acquired at project cost, and be licensed to the North Carolina Wildlife Resources Commission for management purposes as provided for in the Flood Control Act of 1962, Section 207, Public Law 82-874.

3. Water quality control and a continuous minimum flow be provided to the tailwater area to avoid damages to fish habitat during periods of low flow.

4. Standing timber be left in embayments at tributary outlets and in the upper part of the conservation pool to provide improved fish and wildlife habitat. The standing timber areas be selected by representatives of this Bureau, Corps of Engineers, North Carolina Wildlife Resources Commission, and the North Carolina Department of Health in subsequent project planning stages.

5. The initial reservoir impoundment occurring during late fall or winter and water level fluctuations be kept at a minimum during early spring months.

6. The maximum conservation pool be maintained during the recreational season to provide a larger, more attractive reservoir for public use and to facilitate greater realization of the project-occasioned benefits.

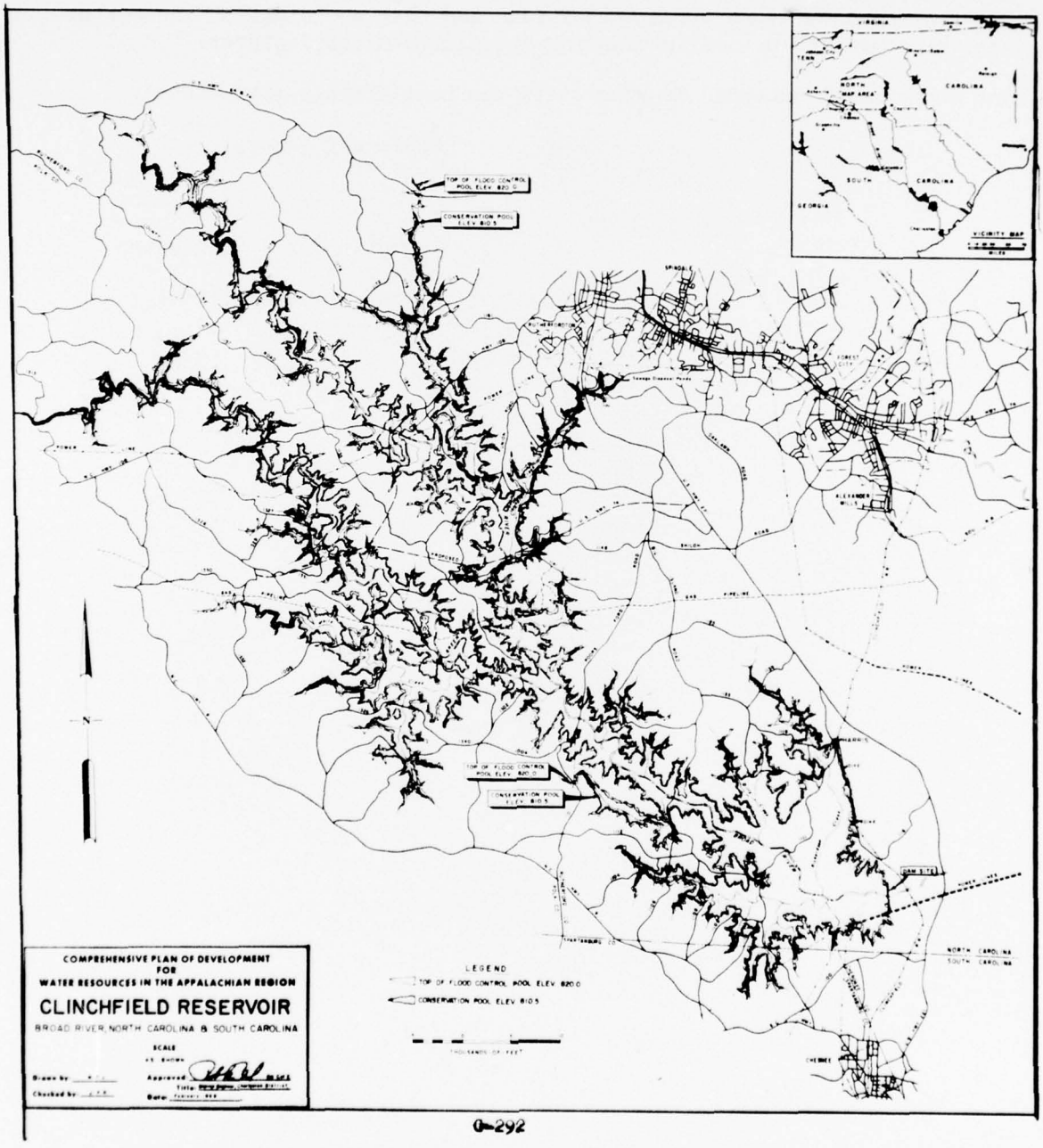
The Bureau's study and recommendations are based on project plans as currently developed. Should your study of the Clinchfield Reservoir project be authorized for advanced engineering and design, it is requested the engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

(Sgd) Thomas A. Schrader

Acting Regional Director


TOP OF FLOOD CONTROL POOL ELEV. 820.0'
CONSERVATION POOL ELEV. 810.5
TOP OF FLOOD CONTROL POOL ELEV. 820.0
CONSERVATION POOL ELEV. 810.5
VICINITY MAP
COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
CLINCHFIELD RESERVOIR
BROAD RIVER, NORTH CAROLINA & SOUTH CAROLINA
SCALE
Drawn by
Checked by
Approved
Title
Date
LEGEND
TOP OF FLOOD CONTROL POOL ELEV. 820.0
CONSERVATION POOL ELEV. 810.5
THOUSAND OF FEET

State of North Carolina
Wildlife Resources Commission
RALEIGH, N. C. 27602

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O. L. WOODHOUSE, GRANDY

May 29, 1968

Mr. Raymond G. Oberst, Acting Chief
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

Thank you for giving us an opportunity to comment on a revised draft of the Bureau's report on the Clinchfield Reservoir project study prepared by the U. S. Corps of Engineers.

The Wildlife Resources Commission approves the revised draft of the report and concurs in the statements made therein.

Very truly yours,

Eugene E. Schwall
Assistant Director

EES/gh

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 23, 1968

District Engineer
U.S. Army Engineers District, Charleston
Corps of Engineers
P.O. Box 919
Charleston, South Carolina 29402

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Roaring River Reservoir project, Wilkes County, North Carolina. The project is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89-4). This report is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.) in cooperation with the North Carolina Wildlife Resources Commission. It has the concurrence of that agency as indicated by letter dated May 29, 1968. It also has been coordinated with and represents the views of the Bureau of Commercial Fisheries.

DESCRIPTION OF THE AREA

The proposed Roaring River Reservoir project will be located approximately 3 miles above its confluence with the Yadkin River. The topography consists generally of rolling hills with steep, narrow valleys.

Highway access to the reservoir is good. State Highway 268 crosses the reservoir area to the south while a number of township roads parallel and intersect the reservoir proper.

DESCRIPTION OF THE PROJECT

The dam site for this multi-purpose project will be located at mile 2.9 on the Roaring River, North Carolina. The project area lies northeast of Wilkesboro and northwest of Elkin, North Carolina, in water area D-1. The dam will be constructed of earth-fill and will rise 159 feet above the elevation of the streambed. The concrete saddle-type spillway will be located at elevation 1,092 and will be uncontrolled. A multiple

level intake tower will be incorporated into the outlet structure.

At sediment pool elevation of 1008.8 feet, 1/ the reservoir will inundate 292 surface acres (table 1). The conservation pool at elevation 1,053 will cover 821 surface acres and at flood control pool (elevation 1,092), the surface area will be 1,740 acres.

Table 1. Pertinent Engineering Data, Roaring River Reservoir Project

Pool	Elevation	Capacity (acre-feet)	Area (acres)
Flood Control	1,092.0	48,200	1,740
Conservation	1,053.0	23,160	821
Sediment	1,008.8	5,940	292

FISH AND WILDLIFE RESOURCES

Without the Project

Fishery Resources

Roaring River is a moderately swift tributary of the Yadkin River flowing through a narrow valley off the eastern slope of the Blue Ridge Mountains in northwestern North Carolina. This watershed lies adjacent to and east of the Reddies River watershed. Fishery resources in the upper reaches consist primarily of coldwater species such as rainbow trout while the lower reaches provide habitat for warmwater species such as smallmouth bass, rock bass, bluegill, catfishes, and suckers. In addition, the North Carolina Resources Commission stocks adult trout in the upper reaches of the stream. Fishing pressure is moderate throughout its entire run. An average of 1,200 man-days of fishing, annually, is expected to take place in the 9.5 miles of stream in the project area during the period of project analysis.

1/ All elevations refer to feet above mean sea level.

Wildlife Resources

The immediate reservoir and downstream areas consist largely of woodlands and occasional interspersion of open farm and pasture lands. These areas provide habitat for low to moderate populations of such forest and farm game species as deer, rabbit, squirrel, fox, raccoon, opossum, grouse, quail, and dove. Hunting pressure in the affected area is moderate.

With the Project

Fishery Resources

Construction of the Roaring River project will inundate approximately 80 acres of warmwater fish habitat in 9.5 miles of the lower stream reach. This loss will be replaced by an 821-acre reservoir providing habitat for species similar to those found in existing stream habitat in addition to largemouth bass and crappie. The increase in habitat area will result in a net fishing benefit of 15,200 man-days, valued at $15,200 (table 2).

Wildlife Resources

Project construction will cause a complete loss of existing farm and forest game habitat in the conservation pool and partial loss of similar habitat in the flood pool. Waterfowl habitat provided by the project is expected to be of poor quality and consist mainly of resting areas.

A total of approximately 300 man-days of hunting will be lost as a result of project effects on wildlife resources.

FISH AND WILDLIFE PLAN

The development of the Roaring River Project would result in increased fishing opportunity and reduced hunting opportunity in the affected area. When the general design memorandum is prepared, several measures should be included in project plans to develop and preserve all aspects of project related fish and wildlife resources. These measures are discussed below.

Fishermen Access. Fishermen access should be provided to project waters. We understand through informal contacts with the Charleston District minimum project facilities for public use, sanitation and safety will be provided in the event local interest participation in cost sharing is not forthcoming. A review of the tentative minimum base facilities which will be provided indicates that access will be sufficient to realize fishery benefits ascribed to this project. Therefore, it appears that no additional developments for fishermen access will be required which would necessitate cost sharing by local interests under P.L. 89-72.

The North Carolina Wildlife Resources Commission has not requested that fish and wildlife enhancement be included in plans for development of this project. However, the Commission and this Bureau request that mitigation features to reduce wildlife habitat losses be included in project plans.

Wildlife Mitigation. Our investigations indicate that the loss of hunting opportunities that will result from project construction can be compensated by acquisition of about 200 acres of land located outside the project area adjacent to the general purchase unit boundaries of the Thurmond Chatham Wildlife Management Area. The management area is owned in fee by the North Carolina Wildlife Resources Commission. The exact location of this land should be determined by the North Carolina Wildlife Resources Commission, the Corps of Engineers, and this Bureau prior to preparation of the General Design Memorandum. The selected lands should be licensed to the Commission for management purposes as provided for in the Flood Control Act of 1962, Section 207, Public Law 82-874.

The 200 acres of additional land needed to offset hunting losses will require certain initial costs for hunter parking facilities, access roads, equipment, land posting, and food patches. These costs would approximate $1,000. Cost of land acquisition is about $23,000. All of these costs should be borne by the project and be non-reimbursable. These costs would total $24,000, which when reduced to an appropriate annual equivalent is $800. Cost of annual operation and maintenance would be about $200.

Downstream Flows. We understand multiple level intakes will be provided in the outlet works for this project. We have investigated potential fishery values resulting from water quality control in downstream areas of Yadkin River and found that no significant benefits to this resource would occur from this aspect of reservoir operation. However, there may be need for water quality control in the immediate tailwater area as a result of reservoir impoundment. It is also essential that a continuous minimum flow be provided to avoid damages to fish habitat during periods of low flow. Adequate minimum flow is defined as that quantity of water required to insure bank to bank coverage of the food-producing riffles and shoals in the downstream reaches. A minimum continuous flow would prevent de-watering downstream fish habitat and should be provided if releases would not in turn dewater reservoir fish habitat to the extent that significant amounts of reservoir fishery would be damaged.

Timber Clearing. Some modification of Corps policy for clearing timber from the reservoir area may be desirable. This plan should provide for standing timber in embayments at tributary outlets and in the upper part of the conservation pool. The presence of standing timber in these areas may aid in the harvest of sport fish and improve angler success. If timber clearing plans are modified, standing timber areas would improve

expected waterfowl habitat by providing nesting habitat for woodducks and resting areas for migrant waterfowl. The standing timber areas can be selected in subsequent project planning stages by representatives of this Bureau, the Corps, North Carolina Wildlife Resources Commission, and the North Carolina Department of Health.

Reservoir Impoundment and Operation. To favor establishment of a more valuable sport fishery, initial reservoir impoundment should occur during late fall or winter, and water level fluctuations should be kept at a minimum during early spring months. When reservoirs are impounded during late spring or summer, spawning and survival of more desirable species is discouraged, and survival of less desirable and undesirable species is encouraged. An over-abundance of forage fish, particularly those forage species which grow rapidly and attain a size which prevents them from being utilized as forage and allows them to compete for food and space with more desirable species, is encouraged, thus causing a loss in sport fish production.

Reservoir surface level fluctuations should be minimized as much as possible during the spring months because excessive surface level fluctuations could dewater and destroy largemouth bass spawning beds during this period. This fluctuation would inhibit spawning or would result in the destruction of the eggs, thus causing a reduction in the reproduction success of this species. Reservoir operation should avoid drawdowns in excess of two feet for a 30-day period after water temperatures reach 60 degrees Fahrenheit. These procedures would favor development of a more desirable reservoir sport fishery.

Seasonal Maintenance of Maximum Conservation Pool. Maintenance of the maximum conservation pool during the recreational season would provide a larger, more attractive reservoir for public use. The larger reservoir area would contribute toward a more valuable reservoir fishery and the inundation of mud flat areas would improve the aesthetic value of the reservoir for general recreation. The maximum conservation pool acreage should also be maintained for the longest time possible when recreational use is high and flood expectancy is low to facilitate greater realization of the project-occasioned benefits.

The reservoir fishery which will be formed will support about 16,400 fishermen days; assuming implementation of the Fishery Plan. This represents a reservoir benefit of 15,200 man-days having a net recreational value of $15,200.

Commercial Fishery. The full commercial fishery potential of Roaring River Reservoir may be limited. However, technological developments indicate that utilization of the commercial fishery potential of individual reservoirs as part of an overall interlocking system may be

feasible in the future. The North Carolina Wildlife Resources Commission shall determine the need and feasibility of such harvesting as well as control of all such projects in order to insure compatibility with other reservoir activities. Such commercial harvesting would utilize for food and possibly industrial use a fishery potential through reduction of rough fish populations. The reservoir's commercial fishery potential should be retained as an open item for planning consideration. The reservoir commercial fish potential is 12,300 pounds of food and industrial fishes per year.

Table 2. Effects of Roaring River Reservoir Project on Fishery Resources Assuming Implementation of the Fish and Wildlife Plan

Resource Unit	Without Project		With Project		Net Benefits	
	Man-days	Dollar Value	Man-days	Dollar Value	Man-days	Dollar Value
Stream (9.5 miles or 80 acres)	1,200	1,200	---	---	---	---
Reservoir (821 Ac.)	---	---	16,400	16,400	15,200	15,200

RECOMMENDATIONS

On basis of the foregoing, the Bureau recommends that:

1. Adequate fishermen access be provided to project waters.

2. Approximately 200 acres of land located outside the project area adjacent to the general purchase units of the Thurmond Chatham Wildlife Management Area be acquired at project cost and be licensed to the North Carolina Wildlife Resources Commission for management purposes as provided for in the Flood Control Act of 1962, Section 207, Public Law 82-874.

3. Water quality control and a continuous minimum flow be provided to the tailwater area to avoid damages to fish habitat during periods of low flow.

4. Standing timber be left in embayments at tributary outlets and in the upper part of the conservation pool to provide improved fish and wildlife habitat. The standing timber areas will be selected by representatives of the Bureau, Corps of Engineers, North Carolina Wildlife Resources Commission, and the North Carolina Department of Health in subsequent project planning stages.

5. The initial reservoir impoundment occur during late fall or winter and water level fluctuations be kept at a minimum during early spring months.

6. The maximum conservation pool be maintained during the recreational season to provide a larger, more attractive reservoir for public use and to facilitate greater realization of the project-occasioned benefits.

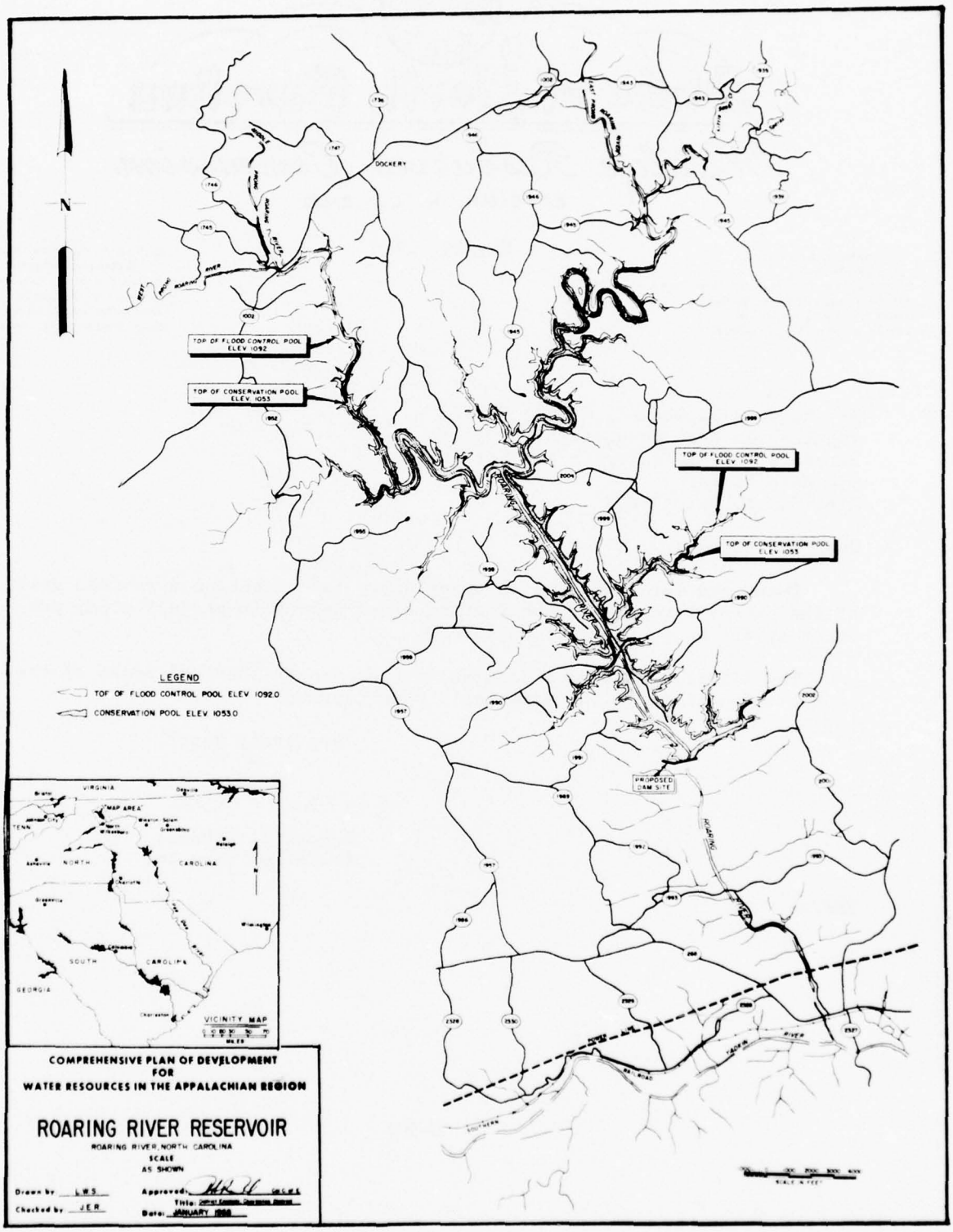
The Bureau's study and recommendations are based on project plans as currently developed. Should your study of the Roaring River Reservoir project be authorized for advanced engineering and design, it is requested the engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

(Sgd) Thomas A. Schrader

Acting Regional Director


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TOP OF FLOOD CONTROL POOL ELEV 1092
TOP OF CONSERVATION POOL ELEV 1053
TOP OF FLOOD CONTROL POOL ELEV 1092
TOP OF CONSERVATION POOL ELEV 1055
DOCKERY
ROARING RIVER
PROPOSED DAM SITE
LEGEND
TOP OF FLOOD CONTROL POOL ELEV 1092.0
CONSERVATION POOL ELEV 1053.0
VIRGINIA
TENN.
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
"MAP AREA"
VICINITY MAP
COMPREHENSIVE PLAN OF DEVELOPMENT
FOR
WATER RESOURCES IN THE APPALACHIAN REGION
ROARING RIVER RESERVOIR
ROARING RIVER, NORTH CAROLINA
SCALE
AS SHOWN
Drawn by L.W.S.
Checked by J.E.R.
Approved:
Title:
Date: JANUARY 1968

State of North Carolina
Wildlife Resources Commission
RALEIGH, N. C. 27602

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O. L. WOODHOUSE, GRANDY

May 29, 1968

Mr. Raymond G. Oberst, Acting Chief
Appalachian Area Development Program
Bureau of Sport Fisheries and Wildlife
550 Main Street
Cincinnati, Ohio 45202

Dear Mr. Oberst:

Thank you for giving us an opportunity to comment on a revised draft of the Bureau's report on the Roaring River Reservoir project study prepared by the U. S. Corps of Engineers.

The Wildlife Resources Commission approves the revised draft of the report and concurs in the statements made therein.

Very truly yours,

Eugene E. Schwall
Assistant Director

EES/gh

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 21, 1968

Col. William D. Falck
District Engineer
U.S. Army Engineer District
Huntington
P.O. Box 2127
Huntington, West Virginia 25721

Dear Colonel Falck:

This is our detailed fish and wildlife report on the proposed White Oak Creek Reservoir in Brown County, Ohio. The project is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89-4, 89th Congress, 1st Session). It has been prepared in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661, et. seq.). Our studies were made in cooperation with the Ohio Department of Natural Resources, Division of Wildlife; and the report has received the general concurrence of the Department as is indicated by the attached copy of a letter of April 30, 1968 from Director Fred E. Morr.

This report supersedes our detailed report dated May 13, 1963, takes modifications into account, and also reflects a more refined review of the fish and wildlife resources and potential associated with this project. Project analysis is based on data supplied by Mr. Barnes' letter of May 28, 1962, Mr. Brown's letter of October 20, 1967, Mr. Johnson's letter of November 16, 1967, and by further communication with members of your staff by telephone. Evaluations have been made in accordance with the procedures set forth in Senate Document Number 97, Supplement 1, 87th Congress, 2nd Session, entitled Evaluation Standards for Primary Outdoor Recreation Benefits.

DESCRIPTION OF THE AREA

White Oak Creek is in southwestern Ohio. It is formed by the junction of North Fork and East Fork, which begin in Highland County and join in Brown County. The stream falls 592 feet in 49 miles or 12 feet per mile. The watershed is 234.3 square miles in size, and 30 miles long and 15 miles wide in the upper portion, where relatively broad plains are occupied by farms. In the lower 12 miles, the watershed is three to four miles wide, with the flood plain averaging only about 600 feet

in width. Here, the valley is flanked by wooded hills that abruptly rise 150 to 200 feet. Including tributaries, there are approximately 138 miles of stream in the watershed, which eventually discharges its waters into the Ohio River at Higginsport.

A glacier once covered the basin, and the stream has cut through the glacial drift and reached bedrock in the lower reaches. Bedrock consists of interbedded clay shales and limestone in horizontal strata, both of which are relatively impervious. White Oak Creek has a low dry-weather flow, and there have been short periods in several years when there was no flow in the stream.

The basin population is predominantly rural. Brown County, in which most of the drainage area lies, has a population of about 25,000. Agriculture is the leading source of income; and the chief products are tobacco, corn, hay, cattle, and hogs.

In the east of the White Oak Creek Basin is the least populated section of Ohio, with an economy based primarily on agricultural and forest production. The Ohio River forms a natural barrier to the south. Forty to fifty miles to the west and north is the large Cincinnati-Dayton urban complex, which has a population of about 900,000.

DESCRIPTION OF THE PROJECT

The dam site is in Brown County, 9.8 miles above the mouth of White Oak Creek and about 1.0 miles northwest of the town of Georgetown. The dam will control the drainage from 214 square miles of the watershed. The purposes of the project are flood control, water supply, water quality control, fish and wildlife conservation, general recreation, and economic expansion.

The dam will be a rolled earth structure 200 feet high and 1650 feet long at its crest. Its outlet works will consist of a tower structure with two gated sluices having dimensions of 5'8" by 10'. One low flow sluice, 30 inches in diameter, will discharge into a stilling basin by means of a circular tunnel, 14 feet in diameter, in the right abutment. The invert level of the lower sluice will be at elevation 715. 1/ An uncontrolled spillway, with crest elevation at 860, will be constructed in the right abutment.

The project provides for a minimum pool of 320 acres at elevation 786, a winter pool of 741 acres at elevation 814, a seasonal pool of 931 acres at elevation 826, and a flood control pool of 1,764 acres at elevation 860.

1/ All elevations used in this report refer to feet above mean sea level.

Pertinent engineering data are shown in table 1. The seasonal pool will be subject to substantial drawdown late in the life of the project to satisfy needs for water supply and water quality control. At that time, minimum instantaneous releases from the reservoir will be nearly 15 c.f.s. On the basis of hydrologic studies, it appears that a minimum instantaneous flow of 5 to 7 c.f.s. could be provided initially without undue drawdown.

Table 1. Pertinent Engineering Data - White Oak Creek Reservoir, Ohio

Pool	Elevation (Feet)	Capacity (acre-feet)	(inches)*	Area (Acres)	Stream Inundated (Miles)
Minimum	786	9,500	0.8	320	4.4
Winter	814	24,400	2.1	741	6.6
Seasonal	826	34,500	3.0	931	7.5
Flood Control	860	78,200	6.8	1,764	11.2

*Runoff

DESCRIPTION OF FISH AND WILDLIFE

Fishery Resources

White Oak Creek varies considerably in nature in different reaches. In the upper portions of the project, where the stream has not cut through to bedrock, habitat is more conducive to game fish production. In reaches further downstream most of the stream bottom consists of limestone bedrock, and the fish habitat is poor. Pools are scarce and are shallow. A number of shallow rapids and low falls impede the progress of fish moving upstream in some areas even during normal flows.

The town of Georgetown takes its water supply from the stream just below the project area. From this point on downstream, there is practically no flow during dry summer months. Commercial sand and gravel operations also degrade fish habitat and limit fishing use of this area.

There are a number of privately-owned farm ponds that provide fishing to owners and their friends. One commercial pond is open to the fishing public on a fee basis. The present use of these ponds by fishermen has not been considered in this report.

The major kinds of fish taken by anglers are smallmouth bass, spotted bass, rockbass, suckers, catfishes, and various sunfish. The stream

fishing use in the area to be influenced by the project amounts to about 760 man-days annually, valued at $760 (Table 2).

Wildlife Resources

About 75 percent of the reservoir site is in crops and pasture and 25 percent is covered by woodland. Trees are mainly confined to the steep slopes of the stream valley. The bottomlands and upland plateaus are farmed.

Rabbits and squirrels are the most sought after of game animals, and good populations are present in the area. Quail are abundant, but they are not on Ohio's list of game birds. Quail hunting is permitted only on state-controlled lands and private lands on which there are management agreements between the landowners and the Ohio Division of Wildlife. Fox and raccoon hunting are popular sports. Some trapping is done for minks and muskrats. A few ducks are killed along the stream and around the farm ponds, but the amount of hunting provided by waterfowl is negligible.

The overall hunter use of the project area amounts to about 1,550 man-days annually, valued at $2,320 (Table 2).

Table 2. Existing Hunter and Fisherman Use on Area of Influence - White Oak Creek Reservoir, Ohio

Category	Acres or Miles	Annual Man-Days of Use	Annual Value
Fishery			
Stream	19.0 Mi.	760	$ 760
Wildlife			
A. Upland Hunting	1/		
1. In Proposed Mgt. Unit	7900A	890	$1330
Out of Proposed Mgt. Unit	2/ 6000A	660	$ 990
B. Waterfowl Hunting	---- 3/	---	----

1/ To include approximately 5,500 acres of extra land acquisition for wildlife purposes.
2/ To include approximately 4,000 acres of extra land acquisition for general recreation purposes.
3/ Insignificant

FISH AND WILDLIFE PLAN
(With the Project)

The following discussion of project effects and evaluations depend upon the full implementation of a Fish and Wildlife Plan for development and use of the resources. They are also predicated on the assumption that the proposed relocation of the White Oak Valley Road in a wildlife unit will not be necessary.

Fishery Benefits

The seasonal pool, at elevation 826 feet, will destroy approximately 7.5 miles of stream habitat on White Oak Creek. Another 3.7 miles of stream will be unfavorably altered as a result of periodic inundation. Although the reaches which will be either destroyed or detrimentally affected are in the more productive portions of the stream, the losses incurred there will be more than offset by increased fishing use on the reservoir tailwater due to improved accessibility and more stable flows.

The reservoir will provide a moderately productive warm-water fishery, supporting largemouth bass, bluegill, channel catfish, crappies and forage fish. Muskellunge and walleyes may be stocked.

The reservoir and tailwater fisheries of the White Oak Creek Reservoir project should be placed under the management of the Ohio Department of Natural Resources. Adequate access facilities must be provided to make possible the full use of these fisheries.

Providing suitable access to the reservoir would require parking and launching facilities for a design load of 75 automobiles. These areas should be placed at several strategic locations on the reservoir with a minimum facility access being established in the upper (closed) area of the reservoir. Parking areas should be large enough to accommodate 45 boat trailers in addition to the automobiles. These facilities would be needed for fisherman and hunter use and do not take the needs of general recreationists into account.

Satisfactory access to the tailwater would be provided through joint-use development of streamside lands from the dam downstream to State Route 125. Parking facilities should be provided along the tailwater for a design load of 5 cars in addition to those required to accommodate general recreation.

To provide water of suitable quality for a downstream fishery, the dam should be designed with multiple-level outlets consisting of three separately controlled gated intakes at elevations 815, 800, and 750.

This feature would be of benefit to other project purposes as well as fish and wildlife and would provide needed flexibility for release in water chemistry control.

The tailwater area of White Oak Creek is scenically attractive, and this attribute undoubtedly will contribute to its use for recreation. However, it does not presently have the necessary physical requirements to provide an outstanding warmwater fishery. Too, the proposed minimum release of from 5 to 7 c.f.s. will not provide a sufficient volume of water to support an important fishery below the dam. Developing one or two deep pools in the stream reach above State Route 125 bridge would greatly improve this situation and they could be realized by excavation or by the construction of low-head dams. Such fishery enhancing features should be considered during advanced engineering studies.

In the interest of making the best use of fishery resources, several other aspects of project development and operation should be considered. Prior to reservoir clearing, studies should be made to determine needs for fish attractors in various parts of the reservoir. Standing trees have proved especially useful in this respect, and a similar use may be made of felled trees, anchored down in selected areas. Clearing plans should be coordinated with the Ohio Department of Natural Resources, the Bureau of Outdoor Recreation, and the Bureau of Sport Fisheries and Wildlife.

Fishing should be permitted along the upstream face of the dam and up to the dam in the tailwater, including the stilling basin. The general conformation and physical features of dams, causeways, and similar structures effectively concentrate fish and increase the fisherman's chances for success. Fishing platforms could be provided, with stairway access from the top of the dam. Platforms should not be less than 3 feet wide. Four hundred feet of platform space would receive about 3,000 man-days of use annually. Such a facility would be especially desirable at the White Oak Creek Reservoir since shore fishing sites will be limited, due to the steepness of the reservoir banks. The locations of the platforms should be determined in advanced planning studies.

If the Ohio Department of Natural Resources considers pre-impoundment fish-control measures necessary for proper reservoir development, the eradication program should be considered an initial fisheries development. The reservoir should be stocked with selected species to establish a quality fishery; while at the same time giving due consideration to species consistent with the extensive day-use general recreation facilities being planned in the lower portion of the project area.

To prevent possible conflict of use on the impoundment, a zoning plan should be developed cooperatively through post-authorization studies by the Corps of Engineers, the Ohio Department of Natural Resources, the Bureau of Outdoor Recreation, and the Bureau of Sport Fisheries and Wildlife.

Under the Fish and Wildlife Plan, only 646 acres of the reservoir area would be open to fishing, reducing fishery benefits somewhat. It is estimated that, together, the reservoir and tailwater would provide 14,320 man-days of fishing annually. This amounts to a net increase of 13,560 man-days, valued at $13,560.

Wildlife Benefits

The seasonal pool will inundate 931 acres of upland game habitat, resulting in an annual loss of about 110 man-days of hunting use. Additional lands within the flood control pool will be subject to periodic flooding. Opening certain project lands to the public, however, would increase upland game hunting use to the extent that compensation for these losses would be provided. It is expected that this can be accomplished through non-conflicting hunting use of those general recreation lands upon which development is not too intensive.

To provide a highly desirable and significantly remunerative wildlife development at White Oak Creek Reservoir, it is proposed that a wildlife management unit be established on lands and waters in the upper portions of the project area. The unit would serve as a wildlife refuge and public hunting area. Goose management features would be emphasized, although the wildlife unit will also be managed for ducks. Additional land acquisition would be required. The Ohio Department of Natural Resources would develop and operate the unit under provisions of a Fish and Wildlife General Plan.

The White Oak Creek site is between a major waterfowl flyway crossing southwestern Ohio and a minor flyway crossing central Ohio, generally along the Scioto River Basin (Figure 1). Both of these flyway segments can sustain additional harvest. The management unit, which would consist of an area operated as an inviolate state refuge and other areas operated for food production and public hunting, should attract geese from both the Mississippi Valley and the Southeastern populations. From breeding grounds in the James Bay and Hudson Bay areas, geese of the Mississippi Valley population migrate southwestwardly across Ohio and on to their winter range in the lower Mississippi Valley. Migrating birds of the Southeastern populations come from the same Canadian regions, generally, but pass southward and southeastward through Ohio to Tennessee, Alabama, the Carolinas and Florida (Figure 2).

The proposed White Oak Creek wildlife unit would be a major step forward in the state's waterfowl management program. It fits into the long-established concept of stepping-stone wildlife units to facilitate the orderly movement up and down the flyways. The Bureau of Sport Fisheries and Wildlife has determined that it would be valuable in carrying out the National Migratory Bird Management Program.

By providing intermediate sanctuary and food to migrating waterfowl, the unit would contribute to the preservation and expansion of the waterfowl resource. At the same time, better use of the resource would be realized through the improved distributional pattern achieved and the provision of more recreational opportunity. Ultimately, the area would attract a peak population of approximately 15,000 migrating geese each fall. Also, under the program of state management, the area would make a contribution in the production of waterfowl. There would be a resident breeding flock capable of raising 2,500 to 3,000 geese annually.

Moreover, the wildlife managed unit would provide unique recreational values for the people of southern Ohio, other than the hunter. Experience at managed waterfowl areas has shown that there is tremendous interest in viewing large concentrations of waterfowl. This is especially true in the case of the Canada goose. In addition, areas such as this foster participation in other activities associated with wildlife such as wildlife photography, nature walks, and bird watching. Wildlife species other than waterfowl would find the unit attractive, adding much to the recreational values offered.

The Division of Wildlife of the Ohio Department of Natural Resources operates four goose management areas, only one of which presently offers hunting opportunities (Figure 1). Three are in northwestern Ohio; one is in the northeast. Fully one-third of Ohio's waterfowl hunters dwell in southern Ohio and there are as yet no significant acreages of public-owned waterfowl management areas provided for them.

Although used extensively by migrating waterfowl, the Ohio River offers little to the Ohio hunter since it is under the control of the State of Kentucky, requiring an out-of-state license to hunt. Other public waters, either available now or planned for the near future, fall far short of meeting even existing needs. It is estimated that the public waterfowl habitat now available in the 22-county area of influence, in southwest Ohio, supports only 12,250 man-days of waterfowl hunting annually. Public upland game hunting opportunity is considerably more abundant, sustaining 41,700 man-days annually. By way of comparison, it should be noted that existing and planned public water-based general recreation opportunity in southwestern Ohio (not including the Ohio River capabilities) totals an estimated 8,650,000 man-days annually under conditions of initial development. These same recreational facilities possess a design capability of sustaining 13,380,000 man-days use under ultimate development.

Since a rather large area is required for goose management, it would be necessary to acquire approximately 5,500 acres of lands additional to those being proposed for acquisition for other project purposes. Most of the lands required for the management unit are bounded on the south by White Oak Valley Road; on the west by State Route 774; on the north by State Route 774, Fite Road, and Sterling Road; and on the east by U.S. Route 68. One other parcel

of the main unit, consisting of approximately 92 acres, lies between Sterling Road and U.S. Route 68, above the intersection of these roads, and extends north about 0.6 miles. The attached outline map of the reservoir delineates the proposed wildlife management area in relation to the balance of the project area.

The wildlife management unit, in its entirety, would comprise approximately 7,900 acres of lands and waters. About 5,150 acres of this area, including a 285-acre portion of the reservoir, would be in the state refuge. The remaining 2,750 acres would be devoted to food production, controlled hunting, and wildlife-associated uses. Controlled wildlife-associated use would also be permitted on the refuge portion of the unit.

The lands designated above are well suited for management because of the large amount of relatively flat cropland lying inside the unit boundaries. These acreages will be needed to produce the large quantities of corn, wheat, and other forage crops required for goose flock management. Numerous small tributary streams and draws are distributed throughout the area, making it relatively easy to construct a number of satellite impoundments to supplement the small portion of the main reservoir within the unit's limits. In order to provide suitable and attractive waterfowl habitat on the wildlife unit during fall migration, and to enhance the area's fall sight-seeing potential, it will be necessary to delay fall drawdown of the reservoir to late fall or early winter.

By the acquisition and development of additional lands adjacent to the upper reaches of the project area, a major enhancement of wildlife resources can be achieved. Implementation of the Fish and Wildlife Plan (Table 3) would result in an annual net increase of approximately 50,000 man-days of hunting and wildlife associated use, with a value of $124,600. There will be additional benefits in waterfowl production and preservation directly attributable to the plan amounting to $124,300 annually.

Expansion Benefits

Benefits treated previously in this report have dealt with user benefits, and primarily those of a tangible nature. A second broad category in assigning benefits in accordance with Public Law 87-27 are those classed as "expansion" benefits.

The expansion benefits attributable to the proposed wildlife management unit include both redevelopment and development benefit values. The wages of all employees associated with the unit as well as the purchasing power inherent in the operation and maintenance of the managed area can be credited as redevelopment benefits, regional account. The average

annual value of these redevelopment benefits amounts to an estimated $53,000.

Commercial investment related to hunters, fishermen, and visitors will provide new income to the region in the form of wages and salaries and profits. It is estimated that hunters using the wildlife management unit at White Oak Creek will contribute a minimum of $75,000 to the adjacent economy, through annual expenditures in the project area. It is estimated that non-hunting use of the management unit by recreationists would result in $285,000 in increased expenditures. 1/ Hunter use of the portion of the project area not directly associated with the wildlife management unit would contribute $13,400 in annual expenditures, while similar expenditures associated with fisherman use of the project area would amount to $68,000 annually. 2/ Values associated with these annual expenditures of $441,400 could be allocated as development benefits, regional account. These benefits are not included in Table 3.

Cost of Fish and Wildlife Plan

The initial cost of developing the reservoir and tailwater fisheries is estimated at $63,000, with an annual equivalent of about $2,150. This would include the costs of pre-impoundment management, fish establishment, parking lots, launching ramps, and fishing platforms. These costs should be shared according to the formula set out in the Federal Water Project Recreation Act (P.L. 89-72).

Annual operation and maintenance costs for the reservoir and tailwater fisheries would be about $1,600 and would be borne entirely by the Ohio Department of Natural Resources.

The total initial cost of wildlife developments at the White Oak Creek Reservoir would be approximately $3,024,000 with an annual equivalent of $102,600. This estimate includes $2,844,000 for the acquisition of approximately 5,500 acres of land, complete with buildings. This figure also includes associated real estate costs such as resettlement and administration costs plus a 25 percent contingency fund. The costs of land acquisition and improvements appear high, and possibly may be reduced to comply with post authorization findings. The balance, amounting to $178,000, is for equipment and the construction of the satellite ponds, parking lots, and other basic facilities needed in the waterfowl management program. Residences and out-buildings in the interior purchase unit will accommodate the permanent staff and provide the needed storage space for unit management.

1/ Based on Expenditure Studies developed in ORRRC Study Report 24, Economic Studies of Outdoor Recreation, Washington, D. C., 1962

2/ Based on expenditure data developed in 1965 National Survey of Fishing and Hunting, Resource Publication 27, U.S.D.I., Bureau of Sport Fisheries and Wildlife, Washington, D. C., 1966.

Table 3. Estimated Benefits and Cost of Fish & Wildlife Plan - White Oak Creek Reservoir, Ohio

Category	With the Project and Plan: Acres or Miles	Man-Days of Use	Increase Man-Days	Net Ann. Value	Cost of Plan: Ammort. Initial Cost	Annual O & M
Fishery						
A. Stream & Tail-water	11.5	820	60	$ 60		
B. Impoundment	646 A1/	13500	13500	13,500		
				$13,560	$ 2,1502/	$ 1,600
Wildlife						
A. Upland Hunting						
1) In Mgt. Unit	79003/	-----	-----	-----	-----	-----
2) Out of Mgt. Unit	19004/	1900	-----	-----	-----	500
B. Waterfowl Hunting						
1) In Mgt. Unit						
a) Hunter Days	2750 A	6000	6000	$36,000		
b) Wildlife Assoc. Days	7900 A	435005/	43500	$87,000		
c) Production & Preservation Value of Refuge Area	5150 A	-----	-----	$124,3006/	$102,6007/	$13,4008/
2) Out of Mgt. Unit	646	500	500	$ 1,600	-----	-----
				$248,900	$102,600	$13,900

1/ Seasonal pool of 931 acres, minus 285 acres in goose refuge closed to fishing.
2/ Includes cost of development for fisherman access, initial stocking, surveys, and fishing platform.
3/ Closed to any upland hunting, initially.
4/ Estimated general recreation lands open to hunting according to Ohio Department of Natural Resources Policies.
5/ To include sight seeing, nature study, and photography on goose unit.
6/ Based on acquisition and development costs of Ottawa and Muscatatuck National Wildlife Refuges, Ohio and Indiana.
7/ Cost of extra land acquisition (5500 acres) plus cost of initial equipment and facilities.
8/ Estimated annual O & M of $53,400 less credits in hunter fees and share cropping.

The annual cost of operation and maintenance of the wildlife management unit is estimated to amount to $53,400. About $30,000 of this cost would be defrayed by hunter fees, with another $10,000 by share-cropping. There would be an additional operation and maintenance cost of about $500 on wildlife developments on associated upland hunting lands. These will be State costs.

Initial enhancement costs allocated to the refuge portion of the management unit are estimated to amount to $1,527,000 and, under the authority of the Federal Water Project Recreation Act (P.L. 89-72), are to be considered non-reimbursable project costs under the provisions of Subsection 6 (e) of the Act. The costs associated with the balance of the management unit, estimated at $1,497,000 and including the costs of lands and other needed facilities and equipment, will be subject to the cost-sharing formula described in the Federal Water Project Recreation Act.

Fish and Wildlife Alternative Plans

In order to aid in the determination of the alternative justifiable expenditure for use as a limitation on the benefits of the waterfowl management unit in the cost allocation process, a cost analysis of each of two alternatives was made:

1. That of a single-purpose, wildlife management unit considered to be justified which would provide benefits comparable to those expected from the water use project under study; and

2. That associated with the inclusion of a comparable unit in the Soil Conservation Service's proposed plan for watershed management in the Upper White Oak Creek Watershed.

The estimated costs of the proposed wildlife management unit at the White Oak Creek Reservoir project (CE) amounts to $3.01 million. Corresponding costs of a relocated single purpose unit is estimated at $4.18 million. It is assumed that the per-unit acquisition and development costs of the relocated single purpose development are similar and that the biological, physical, sociological and economic expansion conditions or values of the alternative unit are also comparable to the proposed Corps of Engineers development at White Oak Creek. The difference of $1.17 million is attributable to the utilization of joint-use (F.C., W.S., W.Q.C.) land and waters of the proposed White Oak Reservoir (CE). The annual equivalent of this difference is $40,000.

The difference in cost between the proposed development at White Oak Creek (CE) and the second alternative (SCS) formulated under the same assumptions as above is estimated to be $894,000; with an annual equivalent of $30,000. The difference is attributable to the increased amount of joint use land available in the Corps of Engineers' plan for flood

control and allied purposes.

The least costly alternative is represented by the development proposed in this report to be included in the plan of the Corps of Engineers for the basin.

RECOMMENDATIONS

In the interest of insuring full development of fish and wildlife resources at the proposed White Oak Creek Reservoir, it is recommended that:

1. Conservation and development of fish and wildlife resources be one of the purposes for which the project is authorized.

2. Joint-use lands, from the dam downstream to the State Route 125 bridge, be developed to provide fishing access, and that parking facilities be provided for a design load of 5 angler cars in addition to those required for general recreation purposes.

3. A multiple-level outlet structure, with intake elevations at 815, 800, and 750 be provided to insure that reservoir releases will be of satisfactory quality for fish and other downstream uses.

4. The minimum discharge of water from the reservoir be not less than 5 c.f.s. at any time.

5. The bed of the stream in the tailwater be used as a source of fill for project purposes, and in so doing, effect the deepening of a series of tailwater pools to provide increased fish habitat.

6. Project land and water upstream from the White Oak Valley Road be licensed to the Ohio Department of Natural Resources under the terms of a Fish and Wildlife General Plan, except the area shown on the attached project outline map where the boundary line is undetermined and subject to future zoning regulations.

7. A reservoir zoning plan be developed in conjunction with preconstruction studies to insure that certain areas (or certain periods) will be available for fishing, hunting and other wildlife purposes, and that the plan be developed cooperatively by the Ohio Department of Natural Resources, the Corps of Engineers, the Bureau of Outdoor Recreation and the Bureau of Sport Fisheries and Wildlife.

8. Reservoir clearing plans be coordinated with the Ohio Department of Natural Resources and the Bureau of Sport Fisheries and Wildlife and that certain embayments be left virtually uncleared and other off-channel clearing be modified to provide in-reservoir fish habitat.

9. Parking and launching facilities for a design load of 75 automobiles and 45 boat trailers be provided for hunters and fishermen at various suitable locations on the reservoir in addition to the needs of general recreationists. One minimum facility access should be located on the refuge portion, the design and location of which to be decided during advanced engineering studies.

10. Public fishing be permitted along the upstream face of the dam and in the tailwater and stilling basin, and that fishing platforms be constructed on the face of the dam to facilitate use of that area.

11. All lands below flood pool elevation plus those below an additional 300 feet on the horizontal or the succeeding five foot contour above the top of the flood pool, whichever is greater, be acquired in accordance with the provisions of the 1962 Joint Policy of the Departments of the Interior and the Army.

12. Approximately 5,500 acres of land be acquired and developed for wildlife enhancement and, together with approximately 2,400 acres of project land and waters and necessary initial developments, be turned over to the Ohio Department of Natural Resources for operation as a wildlife management unit under the provisions of a Fish and Wildlife General Plan.

13. Joint-use project lands, north of the White Oak Valley Road and east of U.S. 68, be turned over to the Ohio Department of Natural Resources under a General Plan for fish and wildlife to serve as contingency land for the proposed wildlife management unit.

14. The costs of lands, facilities, and project modifications on the refuge portion of the management unit be considered nonreimbursable under the authority of Sub-section 6 (e) of the Federal Water Project Recreation Act, and that the lands and facilities on the balance of the management unit be cost-shared as set out by the above Act.

15. The major fall drawdown of the reservoir be delayed until November 15, or later, to facilitate waterfowl management.

16. To compensate for upland game losses, Federal recreation lands which are not too intensively developed be open to public hunting in accordance with policies of the Ohio Department of Natural Resources.

17. The following language be incorporated in the recommendations of the report of the Corps of Engineers: "That additional fish and wildlife studies be conducted as necessary after project authorization, and that such modifications be made in the authorized project facilities as may be agreed upon by the Chief of Engineers and the Director of the Bureau of Sport Fisheries and Wildlife."

18. The following language be incorporated in the recommendations of the report of the Corps of Engineers: "That federal lands and waters in the project area be open to public use for hunting, fishing, and wildlife-associated uses so long as title to the lands and structures be held by the Federal Government, except for sections reserved for safety, efficient operation, or protection of public property."

19. The following language be incorporated in the recommendations of the report of the Corps of Engineers: "That leases of federal land in the project area reserve the right of public use of such land for hunting and fishing."

We appreciate the opportunity to assist in the planning of the White Oak Creek Reservoir Project. Please comment on the acceptability of our recommendations.

Sincerely yours,

(Sgd) Thomas A. Schrader

Acting Regional Director

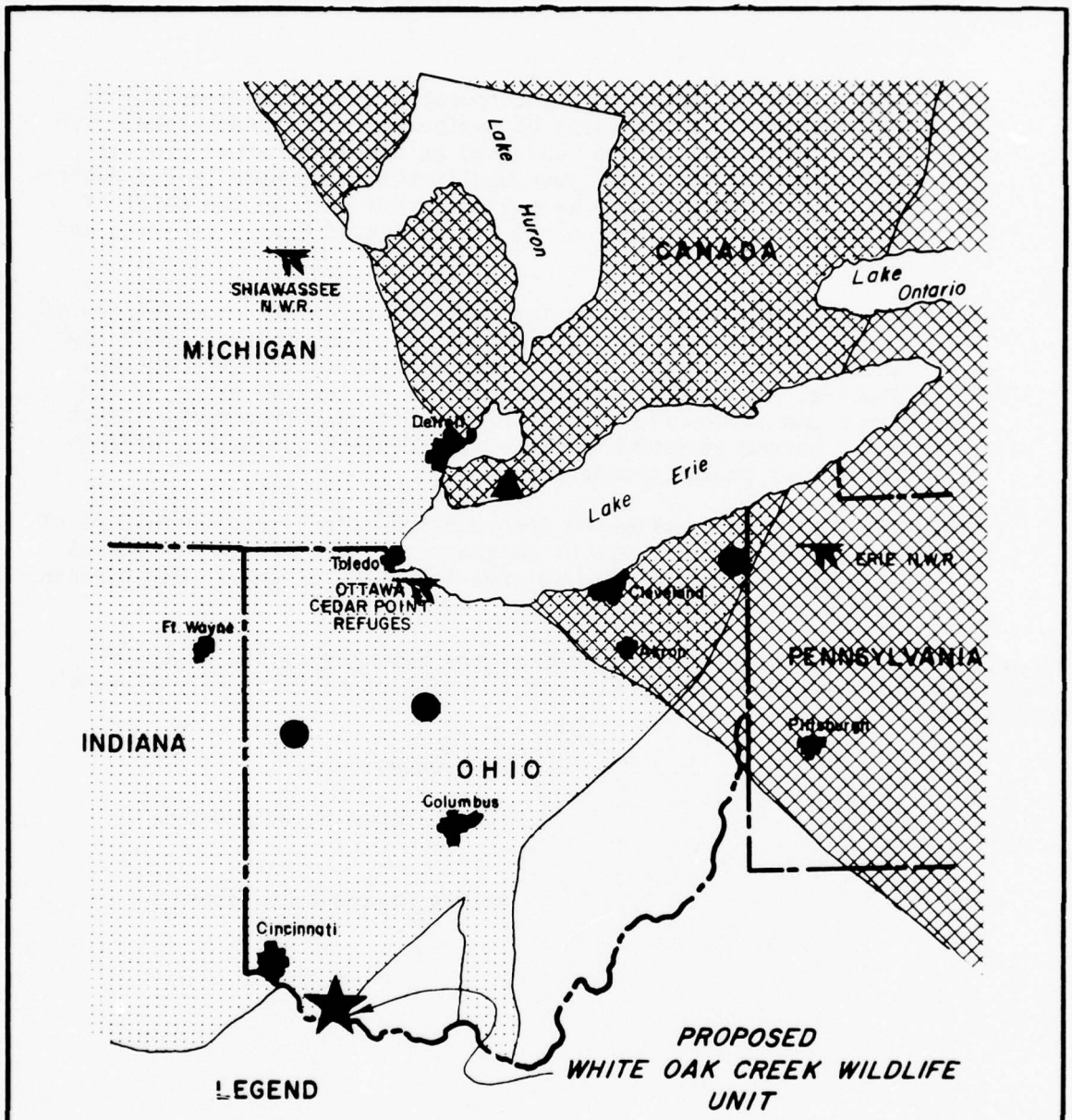


FIGURE 1

WHITE OAK CREEK RESERVOIR, OHIO

REGIONAL CANADA GOOSE FLYWAY PATTERNS

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE
REGION 3 MINNEAPOLIS, MINNESOTA

RPD 680416

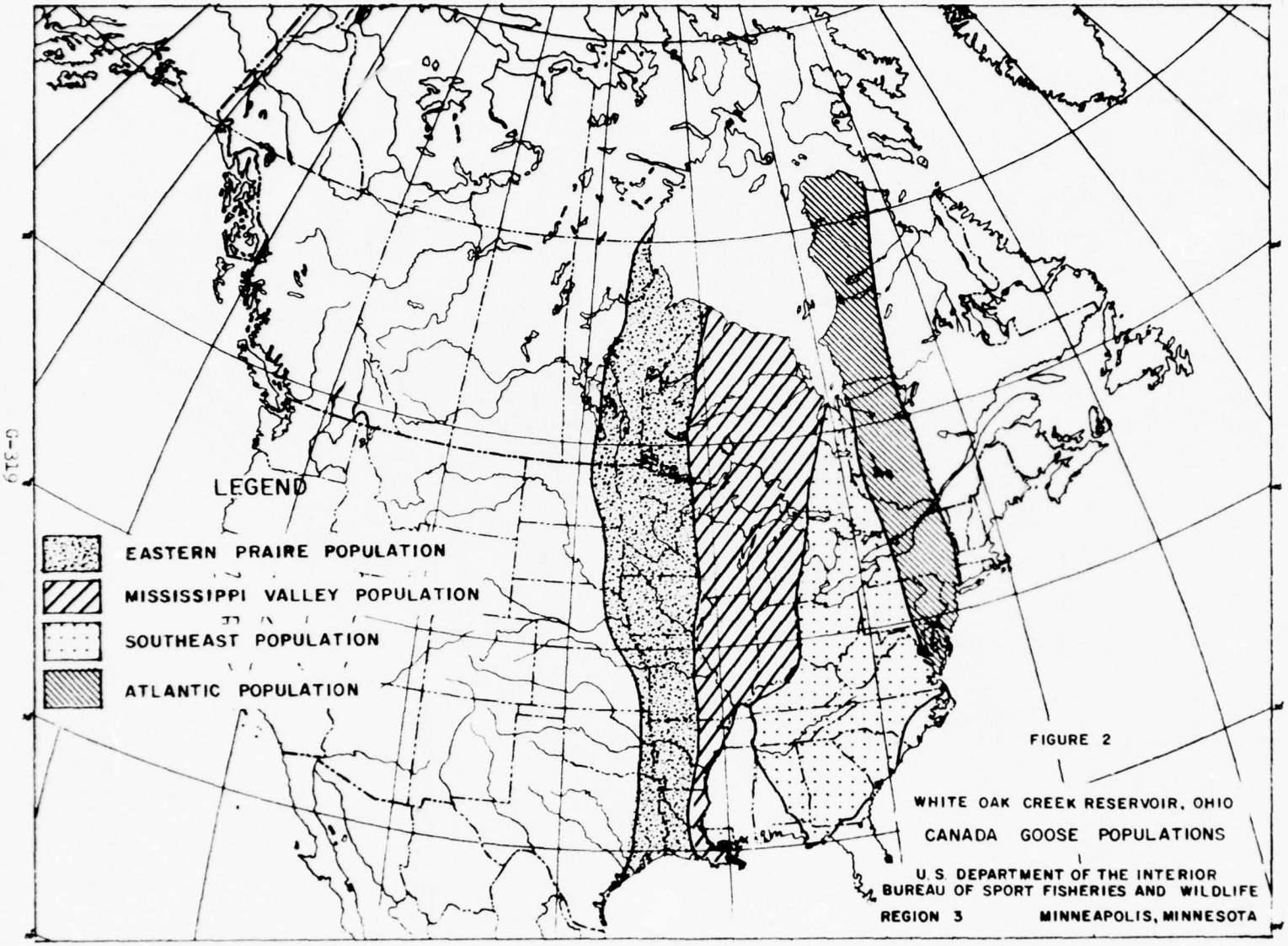
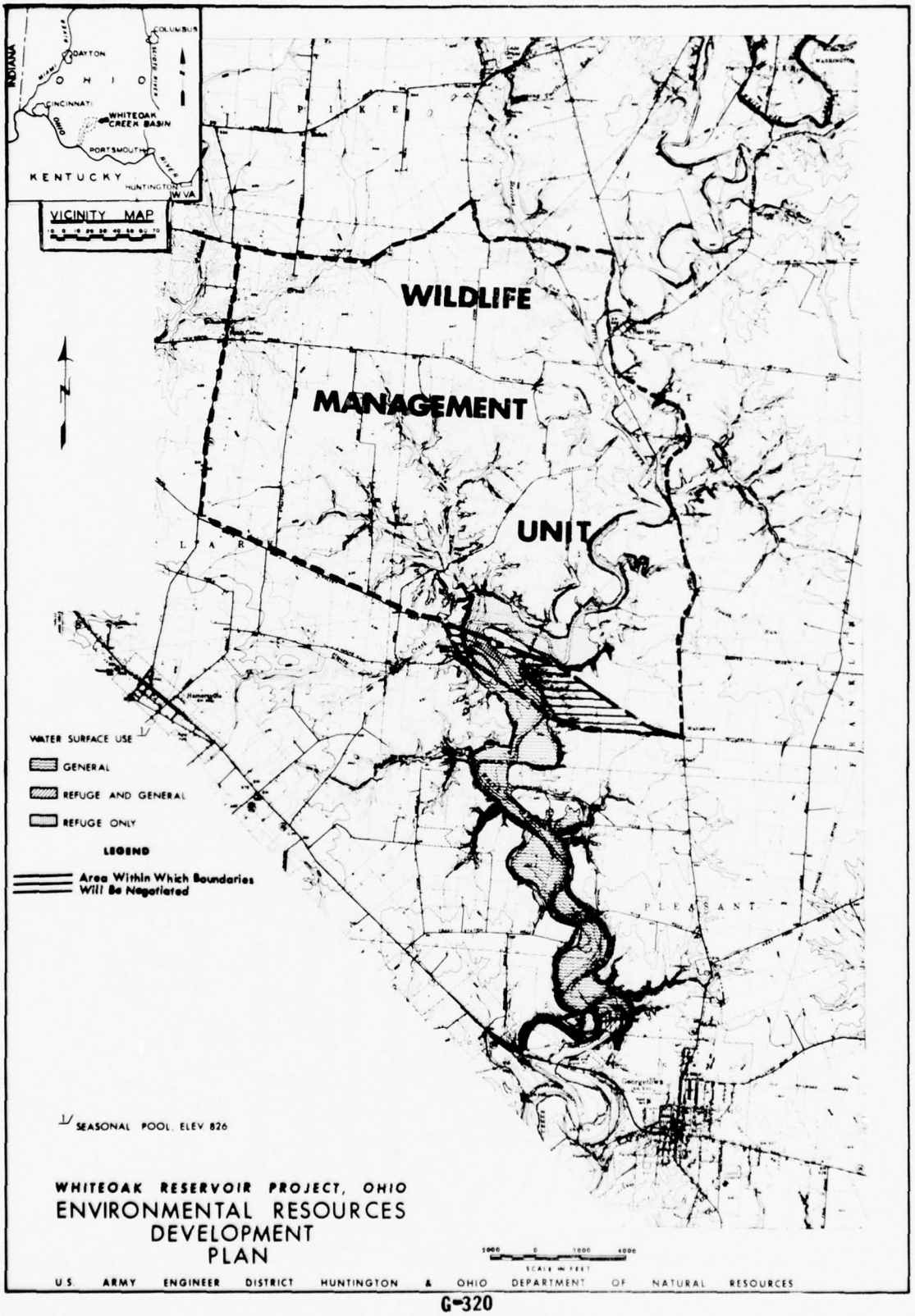


FIGURE 2

WHITE OAK CREEK RESERVOIR, OHIO

CANADA GOOSE POPULATIONS

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE
REGION 3 MINNEAPOLIS, MINNESOTA


INDIANA
COLUMBUS
DAYTON
OHIO
CINCINNATI
WHITEOAK CREEK BASIN
PORTSMOUTH
KENTUCKY
HUNTINGTON
WVA
VICINITY MAP
WILDLIFE
MANAGEMENT
UNIT
PIKE
LAR
PLEASANT
WATER SURFACE USE 1/
GENERAL
REFUGE AND GENERAL
REFUGE ONLY
LEGEND
Area Within Which Boundaries Will Be Negotiated
1/ SEASONAL POOL, ELEV 826
WHITEOAK RESERVOIR PROJECT, OHIO
ENVIRONMENTAL RESOURCES DEVELOPMENT PLAN
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT HUNTINGTON & OHIO DEPARTMENT OF NATURAL RESOURCES

JAMES A. RHODES
GOVERNOR

STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
OHIO DEPARTMENTS BUILDING
COLUMBUS 43215

April 30, 1968

Mr. S. E. Jorgensen
Assistant Regional Director
U. S. Department of the Interior
Bureau of Sport Fisheries and Wildlife
1006 West Lake Street
Minneapolis, Minnesota 55408

Whiteoak Creek Reservoir
Fish and Wildlife Report

Dear Mr. Jorgensen:

Reference is made to your fish and wildlife report on Whiteoak Creek Reservoir furnished for our review and comments with your letter of April 19, 1968.

We have reviewed your report and concur in general with its content. However, our specific comments pertinent to the numbered recommendations found on pages 21 through 24 of your report are as follows:

Recommendation 5
We are not opposed to the creation of "fishing holes" in the tailwater area. However, we offer no recommendation relative to the utilization of the spoil materials being used for project purposes.

Recommendations 6 and 13
In order to provide for a balance between Wildlife interests and General Recreation interests of this project the southern boundary of the Goose Management Area has been relocated as indicated on the attached sketch. In addition, as an enhancement feature to the Goose Management Program the reservoir waters as indicated in cross-hatch will be restricted to preclude boating and so marked by a line of buoys at the southern boundary.

Recommendation 8

In accordance with present procedures, reservoir clearing and other pertinent matters will be coordinated between the Department of Natural Resources and the Corps of Engineers.

Recommendation 10

With reference to fishing platforms and bank fishing from the upstream face of the dam it must be realized that this area of the project lands will not be under the lease agreement with the Ohio Department of Natural Resources. However, it is our opinion that fishing platforms should not be provided on the upstream face of the dam nor should fishing be permitted from the upstream face of the dam.

We appreciate the opportunity to review this report on the Whiteoak Creek Reservoir Project.

Sincerely,

Fred E. Morr

FRED E. MORR
Director

FEM:bg

United States Department of the Interior

FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

IN REPLY REFER TO:

RB

May 21, 1969

Col. Maurice D. Roush
District Engineer
U. S. Army Engineer District
Huntington
P. O. Box 2127
Huntington, West Virginia 25721

Dear Col. Roush:

This Fish and Wildlife Report on the proposed Logan Dam and Reservoir, Ohio has been prepared in response to your letter of April 23, 1969, to our Ohio Area Office. It supplements the Logan Reservoir portion (Hocking and Fairfield Counties) of our Fish and Wildlife Report of March 30, 1965, on the Hocking River Basin and the planning aid letter of March 5, 1969.

This report has been prepared under the authority and in accordance with, the provisions of the Fish and Wildlife Coordination Act. The Ohio Department of Natural Resources does not concur with this report. A major point of difference relates to the location of Logan Dam. Copies of this report will be furnished the Department.

Our studies are in cooperation with the Ohio Department of Natural Resources, Ohio Division of Wildlife and the Huntington District, Corps of Engineers. Fish and Wildlife evaluations are based on (1) the planning proposal for Logan Reservoir, Ohio outlined in the January 1969 report, Development of Water Resources in Appalachia, 1st and 2nd Draft, Main Report - Part III, Chapter 15); and, (2) your letter of April 23, 1969.

At the time of our March 30, 1965, report, two plans were being studied for the construction of Logan Reservoir on Clear Creek in Hocking County, Ohio. One plan placed the dam at mile 3.1 (drainage area 84.1 square miles) and the other plan at mile 5.7 (drainage area 75.6 square miles). After consulting with the Ohio Department of Natural Resources, Ohio Division of Wildlife, we recommended that a 3,490 acre wildlife management unit be included in either plan of construction, regardless of site selection.

The plan of development (Main Report draft of January 1969) indicated that the site at 3.1 mile had been selected for dam construction and no lands were specifically designated for intensive wildlife management. Our letter of March 5, 1969, reaffirmed that we favored selection of the 5.7 mile dam site for fishery, wildlife, and ecological reasons; and that we could not evaluate project wildlife net benefits or losses without review of actual acreage of land to be managed for wildlife and hunting purposes.

Col. Roush's letter of April 23, 1969, stated in part: "consideration of . . . incorporating an intensive wildlife management area into the 'Environmental Resources Development Plan' for the proposed project is now possible . . .". Approximately 2,200 acres (exclusive of the estimated 240-acre pool) would be available for intensive wildlife management. We are pleased that a wildlife management unit is now included in project plans. We will work closely with the Ohio Division of Wildlife in development and management plans that are consistent with the provisions of the Coordination Act cited above, as well as P. L. 89-4 and other regulations under which your agency is operating in relation to this project.

Due to the existing uncertainty regarding the Logan Reservoir Project, we realize that a degree of flexibility exists concerning final selection of a dam site and acreages for a wildlife management unit; therefore, the fish and wildlife evaluations must be of a preliminary nature. When project engineering data are finalized, we will furnish you a detailed fish and wildlife report on the project.

Clear Creek is characterized by excellent water quality and good sustained summer flows. The stream supports a good smallmouth bass-rock bass sport fishery. Largemouth bass and flathead catfish are caught in the lower stream reach. Bluegills, green sunfish, bullheads and suckers also contribute significantly to the stream fishery.

Fishermen use on the stream is estimated at approximately 400 annual man-days with a total value of $400. Stream bordered land, posted against trespassing, inhibits full utilization of potential fishery.

The operation of Logan Reservoir at elevation 854 would inundate 9.7 miles of Clear Creek with an annual loss of approximately 250 angler days. The 1,825-acre seasonal pool would provide a productive impoundment fishery. With the development of adequate use facilities and management, the fishery would support about 30,850 net annual use-days, valued at $30,850. Evaluations are based on contemplated drawdowns, average project life and are conditional, subject to provisions of adequate access, parking, and boat launching facilities and an adequate fishery management program.

Biologists from the Ohio Division of Wildlife share our opinion that, with a properly designed multiple outlet feature in the dam, the Logan Reservoir tailwater could sustain a productive trout fishery. Such development would provide Ohio anglers with a fishing experience unique in Ohio. The

Note: All elevations used in this report refer to feet above mean sea level.

potential trout fishery is estimated to support about 30,000 net man-days of annual use. If the dam is located at the upper site (mile 5.7), trout fishing benefits would be increased accordingly.

Approximately 60 percent of project area consists of forest game habitat and the remaining acreage is suitable for farm game. The great majority of farm game habitat lies west of the terminus of the Wisconsin glacier, where the rolling agricultural land favors the production of cottontail rabbits, bobwhite quail, and ring-necked pheasants. Farm woodlots also produce huntable populations of fox squirrel, raccoon, and white-tailed deer. East of the limit of Wisconsin glaciation, the steeply dissected terrain is not adaptable for intensive agriculture. Most of the area is heavily wooded, except for the narrow Clear Creek flood plain. Indigenous forest game species include gray squirrel, racccon, white-tailed deer and ruffed grouse. Despite the good forest-game populations, hunter use of the resource has been reduced because of group camp development and extensive posting against trespassing.

Without-the-project, game resources are estimated to support approximately 2,000 hunter days use annually, valued at $3,500. Construction of Logan Reservoir would destroy 1,825 acres of habitat, primarily used by upland game. Accordingly, approximately 280 man-days use would be lost.

The proposed 2,200 acre wildlife management unit would be well suited for intensive farm-game management. It also would provide a moderate amount of forest-game hunting. Good hunter utilization of the wildlife management unit could be expected as the project lies within easy travel distance of Columbus, Newark, Zanesville, Athens, Chillicothe, and other smaller communities. Favorable game populations and habitat capabilities exist and intensive management is possible. Implementation of the intensively managed wildlife unit not only would offset wildlife losses due to inundation but would result in a net annual increase of 3,400 man-days of project upland game hunting use, valued at $7,300. This value does not include potential hunting use on general recreation use lands during off-season.

Important waterfowl habitat would develop in the seasonal pool and subsequent hunting opportunity estimated at 1,100 annual man-days use valued at $3,300 would result. Such potential is based on no annual drawdowns, adequate management and public hunting.

With-the-project, wildlife evaluations are contingent upon development of an intensive wildlife management unit administered by the State of Ohio under the provisions of a Fish and Wildlife General Plan.

Table 1. Fish and Wildlife Values - Logan Reservoir, Ohio (Mile 3.1)

Resource	Without-the-Project		With-the-Project (Fish and Wildlife Plan Included)			
	Miles or Acres	Day Use	Miles or Acres	Day Use	Net Day Use	Net Value
FISHERY						
Stream 1/	15.0	400	5.3	30,400	30,000	$90,800
Reservoir	--	--	1,825 2/	31,100	30,850	$30,850
WILDLIFE						
Upland and Forest Game	16,266	2,000	--	--	--	--
Wildlife Mgmt. Unit	--	--	2,200	5,400 3/	3,400 4/	$7,300 4/
Waterfowl	Trace	Trace	1,825 2/	1,100	1,100	$3,300

1/ Including tailwater

2/ Evaluations based on anticipated drawdowns over project life.

3/ Assuming intensive management by the Ohio Department of Natural Resources.

4/ Not including other project lands which might be opened to public hunting after advanced engineering studies.

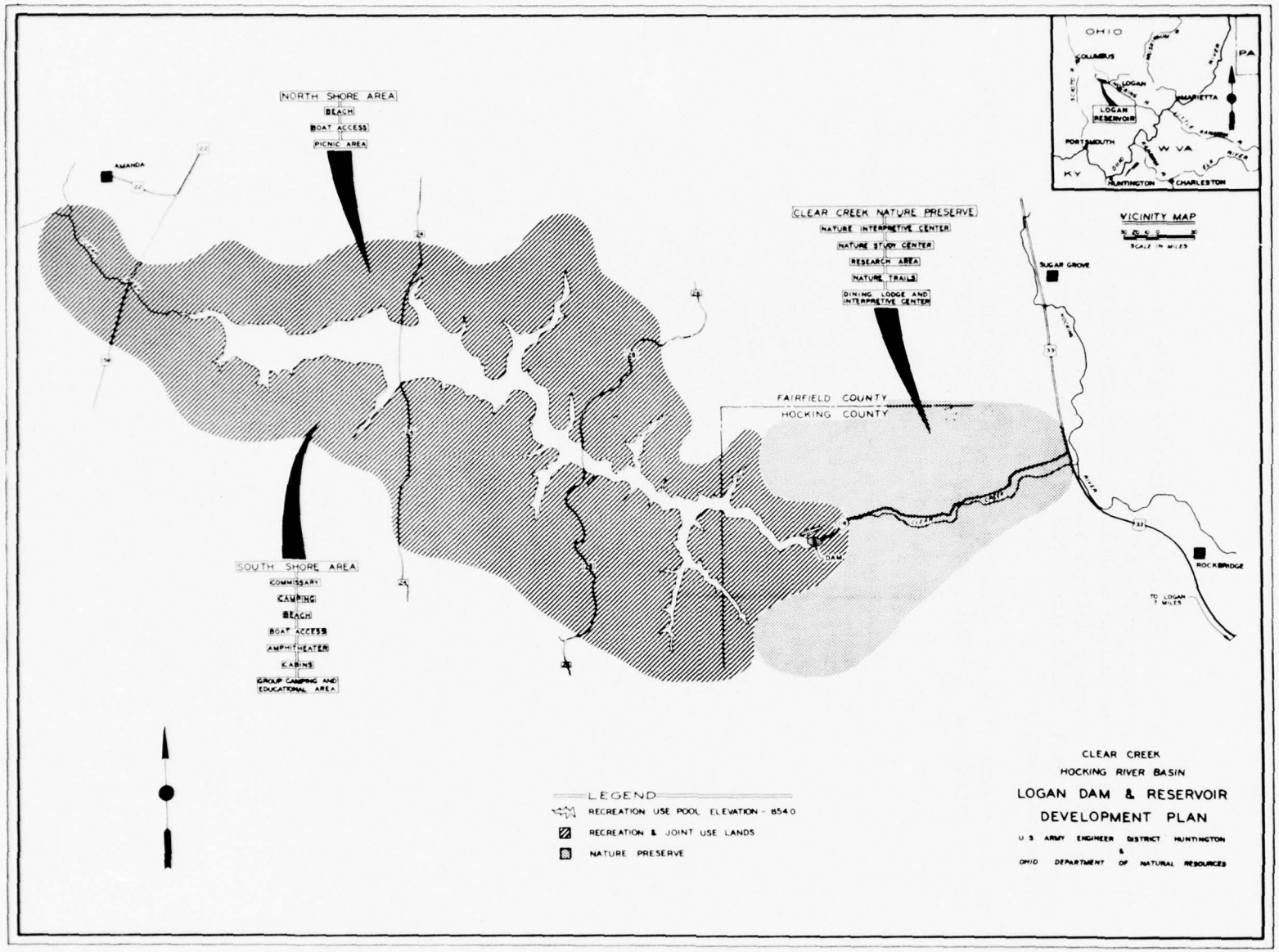
The Bureau of Sport Fisheries and Wildlife again reiterates its position of opposing the construction of the dam at mile 3.1. An upper site could preserve the unique ecological community existing in Clear Creek Gorge and Rhododendron Valley, as opposed to dam construction at the lower site (mile 3.1) which would result in irreparable loss of the priceless ecosystem.

Please advise us of any changes in project planning. The cooperation and assistance of you and your staff is greatly appreciated.

Sincerely yours,

John R Langenbach

John R. Langenbach
Acting Regional Director


NORTH SHORE AREA
BEACH
BOAT ACCESS
PICNIC AREA
AMANDA
CLEAR CREEK NATURE PRESERVE
NATURE INTERPRETIVE CENTER
NATURE STUDY CENTER
RESEARCH AREA
NATURE TRAILS
DINING, LODGE AND INTERPRETIVE CENTER
FAIRFIELD COUNTY
HOCKING COUNTY
SUGAR GROVE
ROCKBRIDGE
TO LOGAN 7 MILES
DAM
SOUTH SHORE AREA
COMMISSARY
CAMPING
BEACH
BOAT ACCESS
AMPHITHEATER
CABINS
GROUP CAMPING AND EDUCATIONAL AREA
OHIO
COLUMBUS
LOGAN
LOGAN RESERVOIR
MARIETTA
PORTSMOUTH
W VA
KY
PA
HUNTINGTON
CHARLESTON
VICINITY MAP
SCALE IN MILES
LEGEND
RECREATION USE POOL ELEVATION - 854.0
RECREATION & JOINT USE LANDS
NATURE PRESERVE
CLEAR CREEK
HOCKING RIVER BASIN
LOGAN DAM & RESERVOIR
DEVELOPMENT PLAN
U.S. ARMY ENGINEER DISTRICT HUNTINGTON
&
OHIO DEPARTMENT OF NATURAL RESOURCES

G-328

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

April 26, 1968

District Engineer
Huntington District
U. S. Army Corps of Engineers
P. O. Box 2127
Huntington, West Virginia

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Greenbrier River Appalachian Project, West Virginia, which is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89-4, 89th Congress, 1st Session). This report is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.) in cooperation with the West Virginia Department of Natural Resources. It has the concurrence of that agency as indicated by letter dated February 9, 1968.

Findings and conclusions are based on preliminary engineering data made available by your agency and are predicated on a 100-year projected period of analysis.

Greenbrier River Basin is located in the east-central section of West Virginia within the Appalachia province. It encompasses 1,656 square miles within Greenbrier, Monroe, Summers, and Pocahontas Counties. Greenbrier River originates in the northern end of Pocahontas County at elevation 2675 1/, approximately, and flows in a southeasterly direction to Bellepoint, West Virginia, where it empties into the New River at elevation 1360; a fall of about 1,315 feet in 150 miles.

The river, picturesque in a wilderness setting, possesses exceptional esthetic qualities. Its broad valley is bordered by steep, heavily-wooded mountain slopes. The river varies in width between 175-350 feet in the lower 112 miles. Long pools alternate with shallow riffles in a river bed covered with gravel, rubble, and boulders. Tributaries have steep gradients with short pools and frequent riffles. Water quality is generally excellent and moderately fertile. Pollution from a tannery affects the river a short distance downstream from Marlinton but is otherwise insignificant in the basin.

1/ All elevations in this report refer to feet above mean sea level.

Principal tributaries of the Greenbrier River and the approximate areas of their watersheds are: Muddy Creek, 127 square miles; Second Creek, 120 square miles; Anthony Creek, 148 square miles; Knapps Creek, 110 square miles, and Deer Creek, 66 square miles.

Flows in the Greenbrier River are characterized by rapid rises to flood stage and extended periods of low flow. Highest flows usually occur during the months of December thru May, while July, August, September, and October are the normal low-flow months. Flow measurements of the Greenbrier River at Hillsdale, West Virginia (watershed, 1,625 square miles), covering the 24-year period 1936-1960, indicated an average discharge of 2,158 cubic feet per second (c.f.s.). Flow extremes ranged from 39 c.f.s. to 47,800 c.f.s. while the flow equaled or exceeded 1,027 c.f.s. 50 percent of the time and was less than 143 c.f.s. 10 percent of the time.

Recorded flows for two tributaries, Knapps Creek and Second Creek, indicate an average discharge of 149 c.f.s. in Knapps Creek and 78 c.f.s. in Second Creek, while a flow equal to or exceeding 62.6 c.f.s. and 30.3 c.f.s. occurred 50 percent of the time in Knapps Creek and Second Creek, respectively. Flow records of other tributaries are unavailable.

Topography of the basin is mountainous with steep hills and mature valleys. Most of the basin is covered with mixed-hardwood forest, dominated by oak. Conifers such as hemlock and spruce occur at higher elevations and white pine is distributed throughout the watershed. Cropland, producing small grains, is limited to the bottom lands, while livestock graze the steeper terrain.

The basin is primarily rural, with most of the population centered in Lewisburg, the largest city, and a few small towns. The 1960 population of Lewisburg was 2,259. Population of the four counties in the Greenbrier basin totalled 71,800 in 1960, which represented a decrease of about 15 percent from 1950. Projected estimates based on Appalachian Benchmarks portend continuing population decreases amounting to approximately 9.2 percent between 1960 and 1980, 3.5 percent from 1980 to 2000, and 3.2 percent from 2000 to 2020.

Economic enterprises consist primarily of light industry (including tanneries, lumbering, and agriculture) and businesses serving recreation. The basin is a popular recreation area containing numerous resorts and attracts vacationists from throughout West Virginia and neighboring states. Hunting and fishing and other recreation support a major recreation business in the basin. Public recreation lands are abundant. The Monongahela National Forest occupies 422 square miles or about 26 percent of the basin, while the Watoga State Park (10,000 acres), Greenbrier State Forest (5,000 acres), Calvin Price

State Forest (9,500 acres) and Seneca State Forest (11,500 acres) total an additional 36,000 acres of public lands within the Greenbrier watershed.

Highway access to the basin is served by partially completed Interstate Highway 64 and U. S. Highways 219, 250, and 60. These mountain highways are beautiful and interesting, but their winding courses naturally increase the time required to go a given distance. Completion of Interstate Highways 64 and 79 will considerably improve travel to the basin from the heavily populated areas north and west of it.

Project Description

The project plan contemplates two reservoirs, one of which (Site 87) will be situated on Greenbrier River above Marlinton and the other (Site 40) will be on a tributary, Anthony Creek (plate 1). Project purposes as stated are flood control, water quality control, and recreation.

Reservoir Site 87, Greenbrier River

The dam site, which controls flow from an area of 350 square miles, is 111.4 miles upstream from the river's mouth - about five miles upstream from Marlinton. The surface elevation of maximum summer pool will be 2430. This pool will contain 485,000 acre-feet. Its surface acreage will be 4,810 and its maximum depth, 275 feet. The minimum pool, with surface at elevation 2206, will contain only 10,000 acre feet; its surface area will be 400 acres.

Reservoir Site 40, Anthony Creek

The dam site controls a watershed of 143 square miles. It is located about three miles upstream from the mouth of Anthony Creek. The surface area at maximum summer pool elevation 2043 will be 4,510 acres. The capacity of this pool will be 268,000 acre-feet; its maximum depth, 173 feet. Surface area of the minimum pool, at elevation 1910, will be 200 acres. Minimum pool capacity will be 3,000 acre-feet.

We are pleased to note that project plans include multi-level outlets in each dam to provide control of temperatures and dissolved oxygen for the preservation of downstream fisheries.

Project lands to be acquired within reservoir sites 40 and 87 for recreational development have not been determined. However, any lands acquired pursuant to the Fish and Wildlife Coordination Act by any Federal agency within the exterior boundaries of a national forest shall, upon acquisition, be added to and become national forest lands, and shall be administered as a part of the forest within which they are situated. Pertinent engineering data are presented in table 1.

Table 1

Engineering Data, Greenbrier River Appalachia Project, West Virginia

Item	Elevation (Ft. m.s.l.)	Capacity (Acre-feet)	Surface Acres
Site 87			
Greenbrier River			
Minimum Pool	2,206	10,000	400
Maximum Summer Pool	2,430	485,000	4,810
Maximum Flood Control Pool	2,445	561,000	5,420
Site 40			
Anthony Creek			
Minimum Pool	1,910	3,000	200
Maximum Summer Pool	2,043	268,000	4,510
Maximum Flood Control Pool	2,050	301,000	4,830

Project Operation

The project will be operated to provide maximum storage of flood waters during the period of high runoff (winter-spring season) and to provide releases during summer and fall to augment low flows in the Greenbrier River and improve water quality in the Kanawha River.

Two phases of project operation are planned, predicated upon anticipated demands on reservoir storage for water-quality improvement in the Kanawha River. During the initial phase or the first 30 years of operation, the project will utilize up to 295,000 acre-feet from storage at Site 87 and 206,000 acre-feet from Site 40 for water-quality improvement downstream. Reservoir releases will be regulated so that Kanawha River demands during June, July, and August will be served from storage at Site 40, until depleted, thereby permitting a more stable summer recreation pool at Site 87.

According to information provided by the Corps of Engineers, minimum flows in Greenbrier River at Buckeye (12.0 miles downstream from Site 87) and at Alderson (30.5 miles downstream from Anthony Creek) during the initial 30 years will be as shown in the following tabulation. These are also the flows recommended as minimums by the Bureau of Sport Fisheries and Wildlife. For comparison, the historical average minimum flows for comparable seasons of the year are also tabulated. These were taken from U.S.G.S. water supply papers for 1961-1965. No data were furnished by the Corps of Engineers as to minimum flows in the ultimate phase of project operation.

Table 2 - Minimum Stream Flows Planned for Greenbrier River during Initial Phase of Project Operation

Period	Location, Greenbrier River			
	Buckeye (Mile 98.5)		Alderson (Mile 27.2)	
	With the Proj.1/	1961-65 data	With the Proj.	1961-65
April - May	400 c.f.s.	368 c.f.s.	650 c.f.s.	806 c.f.s.
June, July, August	420 c.f.s.	60 c.f.s.	1,000 c.f.s.	161 c.f.s.
September - October	400 c.f.s.	34 c.f.s.	650 c.f.s.	95 c.f.s.
November - March	180 c.f.s.	318 c.f.s.	300 c.f.s.	728 c.f.s.

1/ During initial 30 year period of operation.

Beginning with full summer pools at the first of June, seasonal reservoir drawdowns during the initial phase of operation will range between 50 feet and 64 feet by the end of August at Site 40 and 6 to 34 feet at Site 87.

The ultimate operational phase, beginning after 30 years, will require utilization of additional amounts of water from the two reservoirs, amounting to 180,000 acre-feet at Site 87 and 59,000 acre-feet at Site 40. The total ultimate supply to be utilized for water-quality control is 740,000 acre-feet. Data as to stream flows and reservoir drawdowns under ultimate operation were not provided.

Fishery Resources

Fishery Resources Without-the-Project

Greenbrier River is the most popular fishing stream in West Virginia. It is one of the rare free flowing and relatively unpolluted streams in the State. These aspects, plus its location in picturesque natural surroundings, contribute to its excellent fisheries and high esthetic values. The river attracts anglers from long distances to enjoy the exceptionally fine float fishing afforded. Fishing from banks or by wading is also popular. Excellent water quality, extensive shoals and pools, and gravel and rubble bottom materials contribute to the river's high value as spawning and nursery habitat for sport fishes. Periodic extremes of high and low flows, however, are factors limiting increased fish production and fishing in the river. Principal fishes harvested include smallmouth, spotted, and largemouth bass, walleye, rock bass, sunfish, crappie, catfish, and suckers.

Tributary streams provide trout fishing at higher elevations; warmwater fishing predominates in the lower reaches.

Approximately 26 miles of warmwater stream fisheries are provided by Greenbrier River and its tributaries which lie within the perimeter of the maximum flood pool at elevation 2445 in Site 87. Present use of these streams is 13,800 fisherman-days, annually. Within the perimeter of the maximum flood pool at elevation 2050 in Site 40, there are five miles of warmwater streams and 11.5 miles of trout streams. These are currently being used annually to the extent of 1,300 and 8,600 fisherman-days, respectively.

Downstream from Site 40, Anthony Creek provides three miles of warmwater fishery which presently receives annual use in the amount of 500 fisherman-days. The warmwater fishery in Greenbrier River from Site 87 to Anthony Creek (54 miles) now is fished to the extent of 28,500 days per year, while the reach from Anthony Creek to New River (57.7 miles) is currently used to the extent of 43,000 fisherman-days, annually.

Current fishing pressure on warmwater fisheries is estimated to be about 60 percent of the maximum which the streams could support on a sustained yield basis.[1/] Much of this fishing use is by fishermen from outside the basin who generally spend several days per visit. It is anticipated that maximum annual use will develop by the year 1990 and continue thereafter, due principally to construction of improved highways now on the planning boards which will give much speedier access to these fisheries from centers of population. As for trout streams, they are already being fished to maximum capacity.

By 1990, therefore, it is expected fishing use will amount to 23,000 fisherman-days on streams within Site 87; 1,600 man-days of warmwater and 8,600 man-days of trout fishing within Site 40; 46,600 on the 54 miles of Greenbrier River from Site 87 to Anthony Creek; and 71,800 in the 57.7 miles from Anthony Creek to New River.

After 1990, good management of these fisheries will limit use to the above maximums. Projections of use without the project, as shown in table 2, are predicated upon two periods, an initial one of 30 years and the other of 70 years, to facilitate comparison with the initial and ultimate phases of project operation.

On the basis of established net dollar values of recreation per fisherman-day[2/], the average annual fishing use during the initial thirty years, 133,900 fisherman-days, represents a monetary value of $522,400;

1/ Maximum fishing use based on capability of habitat to produce harvest of one pound of game fish per fisherman-day
2/ Net recreational value of fishing is based upon schedule of values in Supplement No. 1, Senate Document No. 97

Table 3 - Annual Fishing Use and Dollar Values Without-the-Project
in Fisheries Affected by
Greenbrier River Appalachian Project, West Virginia

Project Unit	Area of Project Influence	Fisheries Affected: Streams Miles	Fisheries Affected: Streams Acres	Type of Fishery	Annual Use in Fisherman-Days: Present Use	Max. Use Capability	Aver. Use Init. 30 yrs.	Aver. Use Last 70 yrs.	$ Value per Fisherman Day	Aver. Annual $ Value: Initial 30 Years	Aver. Annual $ Value: Ultimate 70 Years
Site 87	Streams in Res. Site	26.0	551.0	W.W.	13,800	23,000	19,900	23,000	$ 4.00	$ 79,600	$ 92,000
	Greenbrier River (Site 87 to Anthony Creek)	54.0	1,144.8	W.W.	28,500	47,500	40,900	47,500	$ 4.00	163,600	190,000
Site 40	Streams in Res. Site	5.0	46.0	W.W.	1,300	1,600	1,500	1,600	$ 2.00	3,000	3,200
	" " " "	11.5	44.4	Trout	8,600	8,600	8,600	8,600	$ 3 00	25,800	25,800
	Anthony Creek (Site 40 to Greenbrier River)	3.0	27 3	W.W.	500	900	800	900	$ 2.00	1,600	1,800
Site 87 & 40	Greenbrier R. (Anthony Crk. to New River)	57.7	1,731.0	W.W.	43,000	71,800	62,200	71,800	$ 4.00	248,800	287,200
	Total Warmwater	145.7	3,500.1		87,100	144,800	125,300	144,800		496,600	574,200
	Total Trout	11.5	44.4		8,600	8,600	8,600	8,600		25,800	25,800
	Grand Totals	157.2	3,544.5		95,700	153,400	133.900	153,400		522,400	600,000

Note: Average use during initial 30 years is based upon a weighted average, 1970 - 2000, assuming use will increase from present levels to maximum consistent with stream productivity between 1970 and 1990 and remain at maximum level thereafter.

the amount of use during the remaining 70 years of the period of analysis represents an annual value in the amount of $600,000. These are the estimated annual fishery values without the project.

With-the-Project

Construction and operation of the project will inundate stream fisheries within the maximum summer pools of each reservoir. In addition, stream fisheries within the flood pools of the reservoirs will be reduced in quality due to high sedimentation and competition with less desirable reservoir-produced fishes. Stream-fishing opportunities remaining within the reservoir sites with the project are estimated to be 2,600 fisherman-days at Site 87 and 3,000 fisherman-days at Site 40, of which 2,900 days are trout fishing.

The lakes created, 4,810 surface acres at Site 87 and 4,510 surface acres at Site 40 at maximum summer pool elevations, will greatly increase the area of fishing waters within the Greenbrier River watershed and the State, particularly during the initial period of 30 years. Water quality of both reservoirs will be excellent, although alkalinity, which is an indication of fertility, varies from 100 ppm at Site 87 to 60 ppm at Site 40. Depths will vary considerably between the two impoundments. Average depths of the maximum summer pools will be 100 feet at Site 87 and 59 feet at Site 40. The reservoir fisheries will be moderately productive. Largemouth, spotted and smallmouth bass, black crappie, sunfish, and catfish will constitute the principal gamefish species.

Fishing use of the reservoirs will vary. The relatively stable pool which it is planned to maintain at Site 87 will continue to attract considerable use throughout both the initial and ultimate phases of project operation. During the initial 30 year period annual use is expected to increase from 66,100 fisherman-days to 110,200 days within 20 years after construction is completed. Average annual use during the initial 30 years is estimated at 95,500 fisherman days.

Site 40 is also expected to receive considerable fishing use during the initial period, even though it will fluctuate a great deal more during the fishing season than Site 87. Use of this reservoir is expected to begin at about 31,900 fisherman-days and to increase to 53,200 man-days during the first 20 years after operation begins. Average annual use during the initial phase is estimated at 46,100 fisherman-days.

Under the ultimate plan of operation, Site 87 will undergo some increase in fluctuation but this is expected to cause only a moderate decrease in fishing use, annually. The average annual use of Site 87 during the ultimate phase of operation is estimated to be 88,100 fisherman-days.

At Site 40, however, fluctuation under the ultimate plan of operation will become so great as to reduce the fishery and fishing use to insignificance. It is considered that this reservoir will provide no fishing opportunity after the initial 30 year period.

Downstream from the dams conditions also will vary. At Site 87, the tailwater will extend about one mile and within that reach an intensive fishing use is expected to develop during the first 30 years. Use is expected to begin at 13,400 fisherman-days, increase to 22,400 during the first 20 years of project operation, and average 19,400 man-days annually during the initial phase. Due to the adverse effect of increased discharges during the ultimate phase, average annual use will be reduced to 10,100 fisherman-days.

Downstream from Site 40, increased flows will be such as to reduce fishing-use from the outset of project operation. Annual use of the three mile reach of Anthony Creek downstream from the dam will drop to 50 fisherman-days when operations begin. It will rise to 90 days during the first 20 years and average about 80 days during the first 30 years. During the ultimate phase, conditions for fish and fishing in this reach are expected to be even less favorable and estimated annual use will average only 50 days. (In the rounding process, the 80 became 100 days; the 50-day figure was eliminated).

During the first 30 years, project operation as planned will provide nearly optimum flows in the Greenbrier river from the tailwater at Site 87 to Anthony Creek (53 miles) and from Anthony Creek to New River (57.7 miles). The Corps of Engineers has advised that the flows we requested can be maintained during the initial period of project operation as shown in table 2. While these are stated to be the minimum flows it is anticipated that maximum flows during the first 30 years will not be greatly in excess of the minimums. It is assumed that maximum flows will not be adverse to fishery productivity and use, while the minimum flows will produce a great improvement over existing conditions.

Analysis of with-the-project conditions in the reach from Site 87 tailwater to Anthony Creek indicates that the improved conditions beginning with project operation will bring about an increased fishing use of 31,900 fisherman-days annually as compared with current use amounting to 28,000 days. It is expected that use will continue to increase, reaching maximum stream capability, 61,800 fisherman-days, within 20 years. Average annual use during the initial phase of operation will be 53,600 man-days as compared to 40,100 man-days for a similar period without the project.

Similarly, project operation during the initial phase is expected to improve low flow conditions in the reach from Anthony Creek to New River (57.7 miles) by maintaining the minimums shown in table 2 and avoiding maximums which

might be detrimental. Use of this reach at the outset of project operation will increase to 61,000 man-days, annually, compared to current use amounting to 43,000 man-days. Within the first 20 years, use will reach the maximum compatible with the capability of the stream to support fishing, that is, 101,500 man-days. Over the initial 30 years of operation, annual use is expected to average 88,000 man-days as compared to an average of 62,200 man-days during the same period without the project.

Under the ultimate phase of project operation, the foregoing benefits are expected to be nearly eliminated due to increased stream flows required to meet increasing demands for water quality control in Kanawha River. No hypothetical pattern of flows in Greenbrier River was provided by the Corps of Engineers to guide evaluation of the fishery that would exist under ultimate operating conditions. Evaluation, therefore, was based on certain known factors and assumptions, namely:

1. The total amount of additional water to be supplied from storage during the ultimate phase of project operation (180,000 acre-feet from Site 87 and 59,000 acre-feet from Site 40).

2. The assumption that 100 percent of the additional demand (239,000 acre-feet) will occur during the period June 1 through August 31, annually.

3. The assumption that Kanawha River water quality demands during the ultimate period will continue to be met by releases from Site 40 during June, July, and August until the supply in that reservoir (265,000 acre-feet) is exhausted, so that project operation will continue to favor recreation at Site 87 insofar as possible.

The impact of the ultimate plan of operation will be to increase the volume of flow in Greenbrier River beyond the point of improving the fishery.

In fact, there is the possibility that releases in early June may be so high that smallmouth bass would be unable to successfully reproduce and that species might be eliminated from the Greenbrier River fishery downstream from Site 87. Assuming that this is not permitted to happen, fishing use of the reach from Site 87 tailwater to Anthony Creek will be reduced to 27,800 fisherman-days, commensurate with maximum capability of the stream to support fishing use under the ultimate plan of operation. Within the reach from Anthony Creek to New River, use will be reduced to 68,100 fisherman-days, annually. This reflects considerably less capability than these stream reaches have under existing conditions, that is, 46,600 and 71,800 fisherman-days, respectively (see table 3). Considering that the initial phase

Table 4 - Summary of Average Annual Fishing Use and Net Recreational Values in Dollars
Without and With
Greenbrier Appalachian Project, West Virginia

Project Unit	Area of Project Influence	Average Annual Use in Fisherman-Days				Net $ Value per Fisherman Day	Average Annual Recreational Value in $$			
		Without-the-Project		With-the-Project			Without-the-Project		With-the-Project	
		Initial Phase	Ultimate Phase	Initial Phase	Ultimate Phase		Initial Phase	Ultimate Phase	Initial Phase	Ultimate Phase
Site 87	Streams in Res. Site (26 mi.)	19,900	23,000	2,600	2,600	$ 4.00	$ 79,600	$ 92,000	$ 10,400	$ 10,400
	Greenbrier River Tailwater (1 mi.)	800	900	19,400	10,100	4.00	3,200	3,600	77,600	40,400
	To Anthony Crk.(53 mi.)	40,100	46,600	53,600	27,800	4.00	160,400	186,400	214,400	111,200
	Reservoir Lake (4810 A.)	--	--	95,500	88,100	1.50	--	--	143,200	132,200
Site 40	Streams in Res. Site									
	Warmwater (5 mi.)	1,500	1,600	100	100	2.00	3,000	3,200	200	200
	Trout (11.4 mi.)	8,600	8,600	2,900	2,900	3.00	25,800	25,800	8,700	8,700
	Anthony Creek Tailwater (3 mi.)	800	900	100	--	2.00	1,600	1,800	200	--
	Reservoir Lake (4510 A.)	--	--	46,100	--	1.50	--	--	69,100	--
Sites 87 & 40	Greenbrier R. (57.7 mi.) (Anthony Crk. to New R.)	62,200	71,800	88,000	68,100	4.00	248,800	287,200	352,000	272,400
	Totals									
	Warmwater Fishery	125,300	144,800	305,400	196,800		496,600	574,200	867,100	566,800
	Trout Fishery	8,600	8,600	2,900	2,900		25,800	25,800	8,700	8,700
	Grand Total	133,900	153,400	308,300	199,700		$522,400	$600,000	$875,800	$575,500

Note: All figures rounded to nearest 100.

of operation represents a project in place, the loss of fishing opportunity caused by ultimate operations will cause serious problems in meeting needs for fishery resources.

Fishing use and related monetary values for three sets of conditions; namely, without the project and with the two phases of operation with the project, are summarized in table 4.

Wildlife Resources

Without-the-Project

The project areas contain some of the best wildlife habitat within the State. The fertile bottomlands, situated in stream valleys surrounded by steep, heavily wooded mountains, provide the necessary feeding and wintering areas to support a large variety of big-game and small-game species. Practically all of the principal game animals of the area utilize all or portions of the bottomlands, while farm-game species are almost entirely restricted to the "bottoms". Principal game animals include deer, turkey, grouse, squirrel, cottontail, quail, raccoon, woodcock, groundhog, and fox. A few black bear occur in the general area but harvests are insignificant. Waterfowl afford some hunting along the Greenbrier River during migration periods but harvests are small. A few wood ducks nest in the area.

Hunting pressure is moderate to high at present. With a large percentage of hunters coming from the heavily populated areas in the Kanawha River valley. Most lands are available to the general public for hunting. Within Site 87, it is estimated that average hunting pressure throughout the life of the project will be 4,100 hunter-days and within Site 40, 3,800 hunter-days. Approximately 17 percent of the hunter use at either reservoir site will be for deer hunting; the remainder will be for upland game. The net dollar value of this hunting recreation will average $15,600 annually without the project.

With-the-Project

The project will permanently inundate 9,330 acres of terrestrial wildlife habitat, much of which consists of highly productive bottomlands. Periodic flooding of lands within the flood pools will reduce the value of wildlife habitat in those areas. Further reduction of habitat value and hunting opportunity will occur as a result of intensive recreational use and facilities developed on lands contiguous to the reservoir perimeters. As a result, hunter use within Sites 87 and 40 with the project is expected to average 1300 man-days at Site 87 and 1,000 at Site 40, throughout the period of analysis. It is expected that the proportionate amounts of big-game and upland-game hunting will be the same as under without-the-project conditions.

Table 5 summarizes annual use in hunter days and the net recreational monetary value assigned to this use.

Table 5 - Summary of Average Annual Hunter-Use and Related Monetary Values 1/ Greenbrier River Appalachian Project, West Virginia

Animals Hunted	Without-the-Project		With-the-Project	
	Hunting days	$Value	Hunting days	$Value
Deer	1,400	4,200	400	1,200
Upland Game	6,500	11,400	1,900	3,300
TOTALS	7,900	$15,600	2,300	$4,500

1/ Net recreational value of hunting is based upon schedule values in Supplement No. 1, Senate Document No. 97.

Discussion and Conclusions

Fish and wildlife resources of the Greenbrier River subbasin are abundant and provide fishing and hunting opportunities of excellent quality. Hunters and fishermen utilizing these resources are the principal contributors to a large recreation business which supports a major segment of the subbasin's economy. Expenditures of hunters and fishermen within the subbasin amount to several million dollars annually. In recognition of the high natural resource values of the subbasin, the West Virginia Departments of Natural Resources, Commerce, and other State agencies have established primary aims and objectives in planning for recreational development specifically directed toward preservation and enhancement of the subbasin's high quality resources and provision of diversified recreational opportunities.

Our studies of the Greenbrier River Appalachian project indicate that the impact of the initial phase of project operation will be favorable insofar as fishery resources and fishing use are concerned. The impact of operations in the ultimate phase would also appear favorable in terms of man-days of fishing use (153,400 without the project as compared to 199,400 with the project). The gain, however, would be at the expense of quality, since there would be, in the ultimate phase, a loss of 41,800 stream-fishing days. This is reflected in the comparison of annual dollar values: $600,000 without the project versus $575,500 with the project.

The impact on wildlife resources and hunting will be adverse throughout the period of project analysis.

During the initial 30 years of project operation, average annual use of stream fisheries amounting to 166,700 man-days is anticipated, of which a small proportion, 2,900 man-days, would be spent trout fishing. This stream use reflects a very satisfactory increase in overall fishing opportunity as compared with projected average use without the project -- 133,900 man-days -- during the same period. The latter figure includes 8,600 man-days of trout fishing; however, indicating a major reduction will occur in trout fishing opportunities. In addition to the overall increase in stream fishing potential, there will be added 141,600 man-days of fishing on the reservoir lakes created at Sites 87 and 40.

During the ultimate phase of operation, increased demands upon reservoir storage will cause increased reservoir fluctuations and send greater quantities of water coursing down Greenbrier River at increased velocities during the fishing season. This will undo the beneficial effects experienced during the initial phase (30 years). The anticipated average annual fishing use of streams will drop to 111,600 during the ultimate phase of project operations (covering period of 70 years) which compares very unfavorably with the 166,700 fisherman-days anticipated during the initial 30 years and also very unfavorably with the projected average annual use without the project -- 153,400 fisherman-days -- during the period comparable to the duration of the ultimate phase. Fishery benefits derived from Site 40 during the initial phase will be eliminated and use of the fishery in Site 87 will be reduced to 88,100 man-days.

Such a gross reduction in the capability of the subbasin's fishery resources to meet future needs would be a serious blow to the recreational business enterprises which will develop during the initial phase of operation in response to the improvements in resource capability and corresponding increase in fishing use. In view of the importance of such businesses in maintaining and improving economic conditions in the subbasin, the relative importance and value to the State of West Virginia of maintaining the levels of fishery productivity and use anticipated during the initial phase to promote the general welfare and economy of people in the Greenbrier River Subbasin as opposed to entering upon the ultimate plan of operation should be carefully weighed.

If the primary aims and objectives of the State agencies mentioned previously are to be achieved, the following modifications would appear desirable:

1. Limit the ultimate demand upon waters of Greenbrier Subbasin for water quality improvement in Kanawha River to the 501,000 acre-feet to be supplied during the initial period i.e. eliminate the contemplated ultimate operating conditions from the project plan.

2. Regulate withdrawals from Sites 87 and 40 so that 73 percent of the annual releases for water quality control in Kanawha River during June, July, and August would be made from Site 87 and 27 percent from Site 40.

Adoption of these modifications would maximize annual fishery benefits over the 100-year period of project analysis. As shown in table 6, overall fishing use under the plan of operation recommended by this Bureau would amount to 330,500 fisherman-days, annually, throughout the life of the project, as compared to an average annual use of 308,300 during the initial phase and 199,700 during the ultimate phase of the Corps' plan.

The alternative recommended by the Bureau would also maintain a maximum of high quality stream fishing opportunities. Stream fishing use under this schedule of operations would average 218,700 fisherman-days, annually, over the life of the project, while under the Corps' plan, average stream fishing use would amount to 166,700 man-days, annually, during the initial period and only 111,600 man-days a year during the ultimate phase.

Lake fishing opportunities would be distributed between Sites 87 and 40 under the Bureau's plan - that is, an average annual use amounting to 56,800 fisherman-days at Site 87 and 55,000 fisherman-days at Site 40. Under the Corps' plan, the use at Site 87 would be appreciably more - an average of 95,500 fisherman-days, annually, during the initial 30 years and 88,100, thereafter. But at Site 40, fishing use would be boom and bust. That is, use at Site 40 during the initial phase would average 46,100 a year, but would amount to nothing thereafter. The smoothing out of use and distributing it between the two sites would encourage greater recreational development and give a more firm, better distributed resource base to support recreational business ventures.

A strong supporting feature would be the improved tailwater fishery habitat conditions and opportunities for fishing use. Good tailwater fisheries are known to be extremely attractive to fishermen. The mile of tailwater fishery downstream from Site 87 would receive under the Bureau's plan an amount of average annual use (14,100 fisherman-days) intermediate between the initial 30-year phase (19,400 fisherman days) and the ultimate 70-year phase (10,100 fisherman-days) of the Corps' plan. Average annual use of the tailwater downstream from Site 87, however, over the entire 100-year period of analysis would amount to only 12,900 fisherman-days under the Corps' plan as compared to the average of 14,100 under the Bureau's proposal.

At Site 40, tailwater use under the operational plan recommended by the Bureau would amount to 27,600 fisherman-days, as compared to 100 days per year under the Corps' initial phase of operations and none during the ultimate phase.

Fishery resources are contingent upon maintenance of aquatic habitat at all times. In order, therefore, to prevent loss of fishery resources downstream, minimum instantaneous discharges from Sites 87 and 40 should be not less than 50 c.f.s. and 12 c.f.s., respectively.

Conservation and development of downstream fisheries will require that reservoir releases be of suitable temperature and contain sufficient dissolved oxygen. This could be accomplished by controlled reservoir releases through multi-level outlets. Determination of the sizes and elevations of these outlets should be coordinated with the West Virginia Department of Natural Resources, the Federal Water Pollution Control Administration, and this Bureau.

In order to achieve maximum utilization of the additional fishery resources created by the project, well-distributed access points with boat launching and automobile parking facilities should be provided around each reservoir. The number of sites, each providing parking area for 40 automobiles and boat trailers, is figured at the rate of 1 per 300 surface acres of water at maximum summer pool elevation. This means that Site 87 will require 16 such access areas or their equivalent, and Site 40 will need 15. Land should be acquired for fisherman access on both sides of each tailwater area for at least one mile downstream from the dams.

The reservoirs are expected to be utilized by a variety of recreationists. To insure orderly use of the reservoirs for both fishermen and pleasure boaters a zoning plan should be developed in cooperation with the West Virginia Department of Natural Resources, U. S. Forest Service, Bureau of Outdoor Recreation, and this Bureau. Generally, fishing use should be given priority in the coves and narrower arms of the reservoirs.

Loss of valuable bottom-land habitat for big game and small game is especially critical within the project area since most of the lands are on steep slopes. In order to maintain habitat carrying capacity for species in both categories and thus preserve diversity of hunting opportunities, these losses should be mitigated through acquisition and intensive management of bottom-lands of similar quality to those lost. This would require purchase of 7,000 acres of suitable lands and initial development at Federal cost. Average cost of land is estimated to be $50 per acre, with allowance of an additional $50 per acre for related costs of acquisition.

Initial development costs are estimated at $4.00 per acre while costs for annual operation and maintenance estimated at $1.50 per acre would be borne by the Federal Government. These wildlife mitigation lands should

Table 6 - Comparison of Fishery Values: BSFW and Corps of Engineers Plans of Operation - Greenbrier Appalachian Project, West Virginia

Project Unit	Area Of Project Influence	Average Annual Use-Fisherman Days			Net $ Value Per Fisher-man Day	Average Annual Recreational Value: $$		
		Bureau Plan	Corps of Engineers Plan			Bureau Plan	Corps of Engineers Plan	
		Covering 100 years	Initial Phase (30 yrs.)	Ultimate Phase (70 yrs.)		Covering 100 years	Initial Phase (30 yrs.)	Ultimate Phase (70 yrs.)
Site 87	Streams in Res. Site (26 mi.)	8,100	2,600	2,600	$4.00	$ 32,400	$ 10,400	$ 10,400
	Greenbrier River Tailwater (1 mi.)	14,100	19,400	10,100	4.00	56,400	77,600	40,400
	To Anthony Crk. (53 mi.)	55,600	53,600	27,800	4.00	222,400	214,400	111,200
	Reservoir Lake (4,810 A.)	56,800	95,500	88,100	1.50	85,200	143,200	132,200
Site 40	Streams in Res. Site							
	Warmwater (5 mi.)	100	100	100	2.00	200	200	200
	Trout (11.5 mi.)	3,600	2,900	2,900	3.00	10,800	8,700	8,700
	Anthony Crk. Tailwater (3 mi.)	27,600	100	-	2.00	55,200	200	-
	Reservoir Lake (4,510 A.)	55,000	46,100	-	1.50	82,500	69,100	-
Sites 87 & 40	Greenbrier R.(57.7 mi) (Anthony Crk. to New R.)	109,600	88,000	68,100	4.00	438,400	352,000	272,400
	Totals							
	Warmwater Fishery	326,900	305,400	196,800		972,700	867,100	566,800
	Trout Fishery	3,600	2,900	2,900		10,800	8,700	8,700
	Grand Totals	330,500	308,300	199,700		$983,500	$875,800	$575,500

be selected and developed in cooperation with the Department of Natural Resources and the U. S. Forest Service. Since Site 40 is entirely within the Monongahela National Forest and Site 87 almost all inside National Forest exterior boundaries, all project lands within each reservoir area will be administered by the U. S. Forest Service in accordance with an agreement between the Secretaries of Army and Agriculture. Wildlife Management practices on these lands, however, should be carried out by both the U. S. Forest Service and the West Virginia Department of Natural Resources under terms of a cooperative agreement, now in effect, between the two agencies.

Recommendations

In the interest of conserving and developing the fish and wildlife resources of Greenbrier River Subbasin and achieving maximum abundance and diversification of fishing and hunting opportunities therein, the Bureau of Sport Fisheries and Wildlife recommends the following measures be applied to the Greenbrier River Appalachian project plan:

1. That the ultimate demand upon waters of Greenbrier Subbasin for water quality improvement in main stem Kanawha River or for other purposes outside the Subbasin be limited to 501,000 acre-feet.

2. That the ultimate phase of project operation, based upon additional demands of 239,000 acre-feet for water quality control, be eliminated from the project plan.

3. That releases from Sites 87 and 40 to meet water quality control needs in main stem Kanawha River during June, July, and August be so regulated that 73 percent of the demand be supplied from Site 87 concurrently with supplying 27 percent of the demand from Site 40.

4. That the minimum instantaneous release from Site 87 be not less than 50 c.f.s.

5. That the minimum instantaneous release from Site 40 be not less than 12 c.f.s.

6. That outlets be provided at Sites 87 and 40 at various levels in each dam and in the number necessary to furnish water of desired temperature and dissolved oxygen content to the tailwater areas at all times.

7. That the sizes and elevations of the outlets in the dams at Sites 87 and 40 be determined in consultation with the West Virginia Department of Natural Resources, the Federal Water Pollution Control Administration, and this Bureau.

8. That the plan include provisions for 16 fishing access points at Site 87 and 15 such points at Site 40 (assuming that the Bureau's plan of operation is adopted), each providing parking space for 40 cars and boat trailers and ramps for launching boats, at a total estimated cost of $620,000, one-half of which would be non-Federal cost under provisions of Public Law 89-72, July 9, 1965.

9. That location of fishing access points and parking areas be determined in consultation with the West Virginia Department of Natural Resources, the U. S. Forest Service, the Bureau of Outdoor Recreation, and this Bureau.

10. That wildlife losses be mitigated by acquisition and initial development of 7,000 acres, selected in consultation with the West Virginia Department of Natural Resources, the U. S. Forest Service, and this Bureau, at a total Federal cost of $700,000 for land and costs related to acquisition, $28,000 for initial development for wildlife management, and $10,500 for Operation and Maintenance.

11. That all project lands within the reservoir areas, excluding State Forest lands or lands which may be reserved for safety, efficient operation, or protection of public property, be made available for administration by the U. S. Forest Service. The wildlife management practices on these lands should be carried out by both the U. S. Forest Service and the West Virginia Department of Natural Resources under terms of a cooperative agreement, now in effect, between the two agencies.

12. That you include in your report language recommending that additional detailed studies of fish and wildlife resources be conducted, as necessary, after the project is authorized, in accordance with the Fish and Wildlife Coordination Act and that such reasonable modifications be made in authorized project facilities as may be agreed upon by the Director, Bureau of Sport Fisheries and Wildlife; the Chief of Engineers; and the Director of the West Virginia Department of Natural Resources for the conservation and improvement of these resources.

The foregoing report represents an analysis of fish and wildlife resources and their uses in relation to one plan of development for Greenbriar River waters and related land resources. This is the plan which the Corps of Engineers has selected for inclusion in the Appalachian Regional Program, at least insofar as the immediate future (1970 to 2000) is concerned.

The Fish and Wildlife Service, in cooperation with the West Virginia Department of Natural Resources, provided some basic data on needs and preliminary analyses of effects of several reservoir sites in the subbasin, data which the Corps of Engineers used in formulating the selected plan. The Service did not, however, participate directly in considering with the Corps the relative merits of various alternative sites or combinations

thereof, nor did it participate directly in reaching the decision that the combination of sites 40 and 87 does, in fact, represent the best plan for development and use of the water resources of Greenbrier Subbasin both with the confines of its own valley or after it has joined the Kanawha River.

We appreciate the fact that the plan you are recommending for the initial period does reflect a great deal of consideration for conservation, development, and use of fish and wildlife resources. Accordingly, our findings show considerable benefits would accrue from construction and operation as indicated for the 30 years from 1970 to 2000. We cannot say from our knowledge and understanding of other possibilities, however, that use of other reservoirs or combinations of reservoirs in the Greenbrier Subbasin would not afford greater benefits. The role of this Service has been that of a consultant, an information source - not a partner in plan formulation.

In addition to the possibility that even more favorable conditions might result from use of alternative facilities or combinations of facilities in Greenbrier Subbasin, we believe a decision as to any development in that subbasin would be premature pending compilation of data which would permit careful weighing of alternative plans taking into account the facilities which could be used and the water supplies available from other subbasins in the Kanawha Basin. We are particularly interested in possibilities for meeting a considerable part of the low-flow augmentation needs in the Charleston-Huntington reach of Kanawha River during the next thirty years from supplies available in the Gauley and Elk River Subbasins, since the releases made in these streams would enter the Kanawha River closer to the area of need than would releases from Greenbrier River and avoid what well might prove to be a condition of having too much water in New River for optimum fishing use.

In short, we believe that the agencies responsible for planning for the use and development of water resources have the responsibility to do so in such a way as to:

1. Satisfy the predicted needs of the immediate future, but

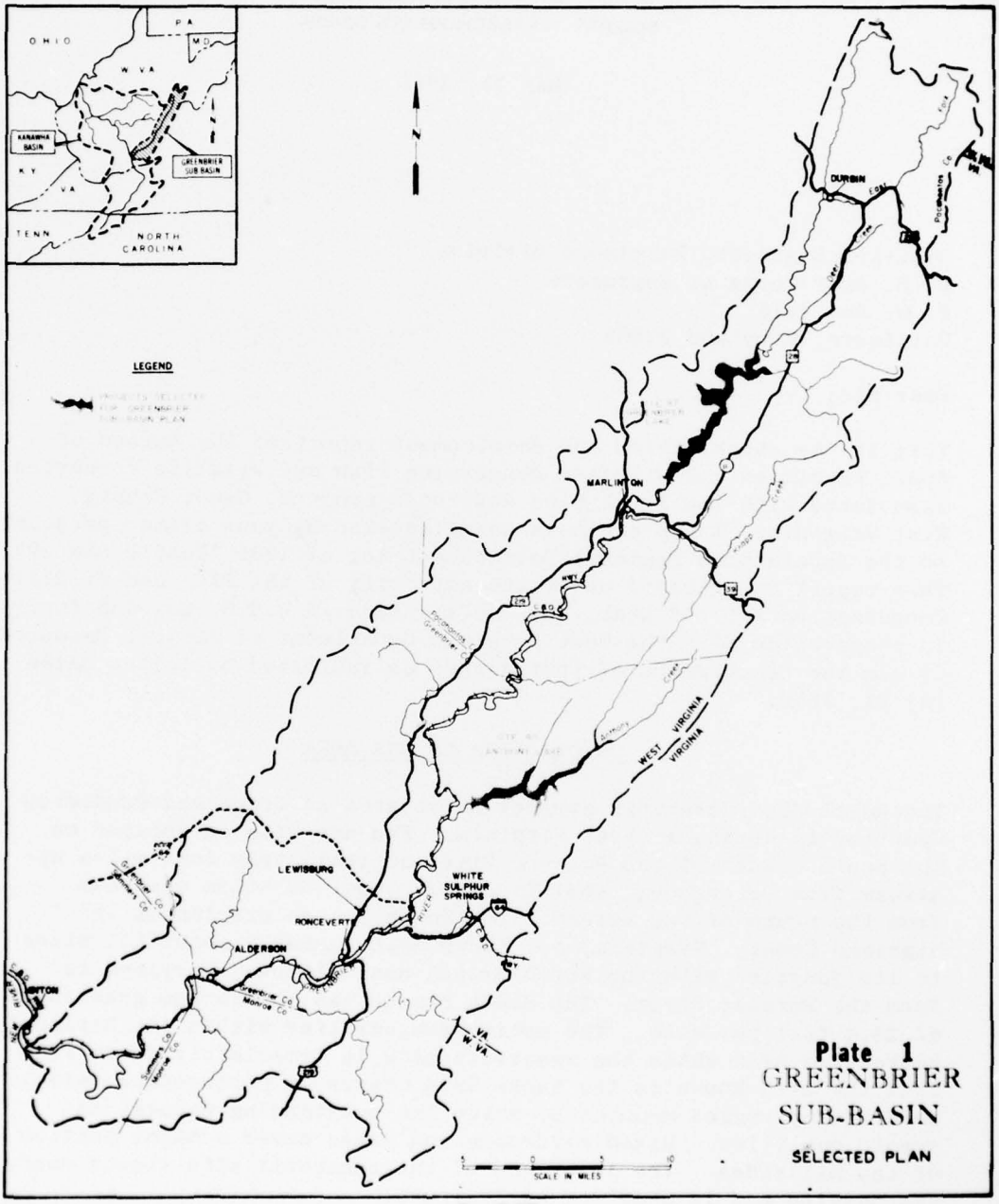
2. Satisfy those needs by means and measures, insofar as possible, which will not foreclose the capability of existing resources or future resource development to meet needs beyond the immediate future and, in fact, beyond the period of analysis used for this project.

We do not believe that the present Greenbrier River Appalachian project is an acceptable plan under these criteria.

Sincerely yours.

Eugene E. Crawford

G-348 Acting Regional Director


OHIO
PA
MD
W VA
KANAWHA BASIN
GREENBRIER SUB BASIN
KY
VA
TENN
NORTH CAROLINA
LEGEND
DURBIN
MARLINTON
WEST VIRGINIA
VIRGINIA
LEWISBURG
WHITE SULPHUR SPRINGS
RONCEVERTE
ALDERSON
VA
W VA
SCALE IN MILES
Plate 1
GREENBRIER
SUB-BASIN
SELECTED PLAN

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

May 23, 1969

District Engineer, Baltimore District
U. S. Army Corps of Engineers
P. O. Box 1715
Baltimore, Maryland 21203

Dear Sir:

This is the conservation and development report of the Bureau of Sport Fisheries and Wildlife concerning fish and wildlife resources associated with the Royal Glen Reservoir project, Grant County, West Virginia. The project is being studied by your office pursuant to the Appalachian Regional Development Act of 1965 (Public Law 89). This report is prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.) in cooperation with the West Virginia Department of Natural Resources. It has the concurrence of that agency as indicated by letter dated May 21, 1969.

DESCRIPTION OF THE AREA

The Royal Glen Reservoir project is located in Grant and Pendleton Counties in northeast West Virginia. The dam site is located on the South Branch of the Potomac River approximately four miles upstream from Petersburg, West Virginia, about 69 miles upstream from the mouth of the stream. The South Branch originates in Highland County, Virginia, and flows northeasterly about 131 miles to its junction with the North Branch near Oldtown, Maryland to form the Potomac River. The South Branch has an average gradient of 23.4 feet per mile. The entire project lies within the National Recreation Area while the reservoir site is immediately downstream from the area known as the Smoke Hole Canyon, a picturesque valley bordered by rugged mountains, which has outstanding natural and scenic qualities. Mixed hardwoods and pines cover a major portion of the hillsides. The lower end of the reservoir site widens near the damsite and is used for agriculture.

Flows of the South Branch, based on records obtained at Petersburg, West Virginia, averaged 679 cubic feet per second during the period 1928-1950. Flows recorded at this point have ranged from 43 to 62,000 cfs and equalled or exceeded 360 cfs 50 percent of the time. Throughout the low flow period, June-October, the median monthly flows of the South Branch averaged 250 cfs. During this period, daily flows less than 100 cfs occurred 10 percent of the time and these averaged 79 cfs. The planned Appalachian Highway Corridor "H" will pass near the reservoir to connect Petersburg and Weston, West Virginia at Interstate 79.

DESCRIPTION OF THE PROJECT

The project plan under consideration consists of a dam and reservoir which will provide for flood control, general recreation, fish and wildlife, and sediment deposition. The dam will be a concrete-gravity type structure, 643 feet long and 172 feet high. The earth dike will be 940 feet long and 25 feet high. The spillway design will consist of three 42-foot wide by 47-foot high tainter gates. Two sluices with two 7-foot wide by 12-foot high gates in each sluice will make up the outlet works. The project plan also includes approximately 2.4 miles of channel improvement (clearing and widening) on the South Branch Potomac River within the vicinity of Petersburg, West Virginia. Pertinent engineering data are presented in table 1.

It is our understanding that the reservoir will be operated to maintain a stable reservoir pool during the summer season and will provide a minimum discharge of 100 cubic feet per second at all times. All reservoir inflows in excess of 100 cfs will be released except during refill periods, with the further exception that during April and May, reservoir releases will not be less than 360 cfs. We also understand that multi-level outlets will be included to provide suitable oxygen and temperatures in reservoir releases for the maintenance of downstream fisheries.

Lands within the reservoir site will be acquired in fee title. The total area will consist of 4,340 acres which includes 740 acres for recreation. An additional 700 acres will be acquired for mitigation of wildlife habitat flooded by the impoundment.

Project plans also include provisions for five lanes for boat launching ramps initially and five additional ramps in the future to permit boat access for fishing and recreational use of the reservoir. Distribution of access sites have not been fully determined.

Table 1. Pertinent Engineering Data,
Royal Glen Reservoir Project,
West Virginia.

Pool	Elevation (ft. m.s.l.)	Incremental Capacity (Ac. Ft.)	Area (Acres)
Flood Control	1,117	90,000	2,000
Conservation	1,060	37,000	1,150
Minimum	1,007	1,000	145

FISH AND WILDLIFE RESOURCES

Without the Project

Fishery Resources

Streams within the project area provide fishing of exceptional quality which is enhanced by outstanding aesthetic values of the area. Upstream from the reservoir conservation pool the South Branch extends into the famous Smoke Hole area. In recognition of its high natural values, the Upper South Branch was selected by the West Virginia Department of Natural Resources for inclusion in the State Protected Rivers Bill for the purpose of preserving the stream in its natural and undeveloped state for recreational enjoyment and aesthetic pleasure of the public. It was excluded, however, prior to final passage of the Bill.

The streams have excellent water quality and are characterized by occasional long deep pools separated by riffles covered with coarse gravel and rubble. Stream widths average 100 feet.

Upstream from the dam, fishing consists of both warmwater species and trout while the downstream fishery is warmwater. High harvests of trout are sustained through heavy stockings of hatchery-reared fish. Float fishing is highly popular throughout the South Branch River which is considered one of the finest fishing streams for smallmouth bass in the eastern United States. Other game fish harvested include rock bass, channel catfish, and sunfish.

During the period of analysis, average annual fisherman-use of the eight miles of streams within the reservoir site is estimated at 8,100 fisherman-days. The 68.8 miles of South Branch downstream from the dam provides an estimated 35,600 fisherman-days annually.

Wildlife Resources

The 1,150 acres of wildlife habitat within the reservoir conservation pool is predominantly pasture and cultivated land. Forested slopes and stream borders in the project area are representative of an upland hardwoods complex on the hardwood-pine type. The flood plain area is principally farm-game habitat, however, land-use is sufficiently diversified to support most of the wildlife species indigenous to northeastern West Virginia. Principal resident species include black bear, deer, squirrels, rabbits, turkeys, grouse, bobwhites, raccoons, foxes, opossums, muskrats, minks, skunks, and weasels. Occasionally, bobcats are seen in the area. Migratory game birds are represented by mourning doves, woodcock, wood ducks, mallards, and black ducks, all of which nest in the area. Other species of waterfowl may utilize the area during

their spring and fall migration periods.

Rabbits, squirrels, bobwhites, and mourning doves afford the major sport harvest; however, deer, turkey, and ruffed grouse are of major importance on peripheral lands. A limited amount of hunting is afforded by the black bear population. Fox, raccoon, and opossum furnish hunting opportunities for a segment of the hunting public and have a limited commercial fur value. Only mink and muskrat are important economically as fur animals. Woodcock and waterfowl hunting is sporadic depending principally on weather conditions during the fall migration period.

Wildlife resources of the area considered (1,150 acres--conservation pool and 50 acres dam and appurtenances) will provide an estimated 100 man-days of big-game hunting and 220 man-days of small-game hunting annually during the period of analysis.

With the Project

Fishery Resources

Approximately 8 miles of high quality stream fisheries (4.6 miles of South Branch and 3.4 miles of North Fork) will be replaced by a reservoir-type fishery of greater quantity but of considerably reduced quality. In addition, the specialized values associated with the float fishing aspects will be eliminated within the reservoir site. No attempt was made, however, to evaluate the float fishing aspects.

Downstream from the dam, tailwater fisheries capable of sustaining trout during spring and early summer months, in addition to warmwater species, are expected to be developed. Maintenance of lowered water temperatures for trout is possible through use of the multi-level outlets planned for the project. The relatively small storage of deep, cold water, however, limits the seasonal length potential for a trout fishery.

Due to the presence of the dam, it is anticipated that public access to downstream areas will be considerably reduced on privately controlled areas, particularly in the proximity of the dam. Based on the foregoing, it is estimated that the reservoir tailwater and the remaining 67.8 miles of South Branch downstream will provide annual fishing uses of 1,400 fisherman-days and 35,100 fisherman-days, respectively.

The reservoir created will provide a warmwater fishery consisting of warmwater game and rough fish species with a preponderance of pan fish. The game fishes will include largemouth bass, black crappie, bluegills, pumpkinseeds, and channel catfishes with

isolated populations of smallmouth bass, rock bass, and redbreast sunfishes in areas of suitable habitat. Suckers are expected to be the predominant rough fish species. No significant commercial fisheries are expected within the reservoir. Due to its proximity to the heavily populated area of metropolitan Washington, D. C. the reservoir will attract many recreationists including fishermen. Fishing-use however, is expected to be limited similarly to that observed at other reservoirs where intensive competitive recreational use exists. It is estimated that average annual fishing-use of the reservoir will be 23,200 fisherman-days.

A summary of fishery resources and related recreational values without and with the project are presented in table 2.

Wildlife Resources

Construction and operation of the project will have no significant effect on wildlife habitat downstream from the dam site. Upstream a total of 2,100 acres will be inundated at maximum flood control pool elevation. Of this, 1,150 acres will be permanently lost through inundation by the conservation pool and the developments appurtenant thereto. This area is grazed and affords little protection to the stream banks. Habitat now afforded by the river banks will be replaced by a greater mileage of reservoir shoreline. This shoreline would be of a more stable character. It is unlikely that wetland habitat will develop in sufficient quantity to attract significant concentrations of waterfowl owing to the steepness of the reservoir banks. Periodic inundation of the remaining 950 acres may reduce its present carrying capacity, however, it has been assumed that no significant wildlife losses will occur. Average annual losses in hunting opportunities attributed to the project are estimated at 100 man-days of big-game hunting and 220 man-days of small-game hunting.

DISCUSSION AND CONCLUSION

Fish and wildlife resources within the project area provide fishing and hunting opportunities with exceptionally high aesthetic qualities which are derived from unique natural characteristics of the area. These aesthetic values cannot be adequately measured in monetary terms, but could greatly exceed the tangible values presented in this report. Recognition of the unique qualities of the streams is evidenced by the West Virginia Department of Natural Resources in its proposal that the Upper South Branch of the Potomac River be included in the States Protected Rivers Bill which provides for preservation of the stream in its natural state. South Branch, however, was deleted prior to passage of the bill.

Table 2. Summary of Average Annual Fisherman-Use and Related Recreation Values Associated with the Royal Glen Reservoir Project, West Virginia

Resource Unit	Without Project		With Project		Difference w/o & with the Project	
	Fisherman Days	Recreation Value $	Fisherman Days	Recreation Value $	Fisherman Days	Recreation Value $
Streams within reservoir site:						
South Branch (4.6 mi.)	3,800	9,000 1/	0	0	-3,800	Loss
North Fork South Branch (3.4 mi.)	4,300	12,900 2/	0	0	-4,300	Loss
South Branch downstream from dam (68.8 mi.)	35,600	71,200 3/	36,500	73,500 4/	900	2,300
Reservoir (1,150 Ac.)	--	--	23,200	23,200 5/	23,200	23,200
Totals	43,700	$93,100	59,700	$96,700	16,000	$3,600

1/ South Branch - 1,400 days trout fishing at $3.00 per day and 2,400 days, smallmouth bass fishing at $2.00 per day.

2/ Trout fishery @ $3.00 per day

3/ Smallmouth bass @ $2.00 per day

4/ Includes 500 days trout fishing @ $3.00 per day and 900 days warmwater @ $2.00 per day in reservoir tailwater

5/ Reservoir fishery evaluated as medium quality reservoir fishery at value for panfish - largemouth bass at $1.00 per fisherman-day

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Although the reservoir created will, due to its comparatively large area, provide increased fishing use, aesthetic qualities attributable to the natural upspoiled characteristics of the area will be considerably reduced due to the project's presence.

This Bureau concludes that the relatively minor gains in quantitative fishing use provided by the project cannot be adequately reconciled with the high quality fish and wildlife resources and aesthetic values which will be lost. We, therefore, cannot endorse the project in the interest of fish and wildlife conservation. In the event the project is authorized for other overriding considerations, however, additional measures should be incorporated into project plans which would achieve full realization of fishing and hunting potentials associated with the project.

The planned minimum reservoir releases of 100 cfs will not result in a significant improvement over existing stream flow conditions and the downstream fisheries. Our studies indicate, however, that minimum discharges of 250 cfs during the period April-October would substantially increase the downstream fishery potentials without causing severe reservoir drawdowns except during drought years. The minimum discharge of 100 cfs would be required to preserve the stream fisheries during the winter months.

In order to achieve maximum fishing use at the tailwaters, in accordance with the reservoir operation as planned, a one acre parking area would be required immediately downstream from the dam. In addition, land bordering each side of the stream for a distance of one mile downstream from the dam should be acquired for public fishing access. Annual fishery benefits resulting from these provisions are estimated at 7,100 fisherman-days (4,500 warmwater and 2,600 trout fishing) valued at $16,800. Annual operation and maintenance costs for the facilities are estimated at $600.

Based upon the provision of the minimum reservoir releases of 250 cfs as discussed above, additional downstream fishery benefits in the remaining 67.8 miles could be realized. Lack of suitable access also limits fishing use throughout this stretch. The provision of eleven one-acre parking areas spaced at 5 mile intervals throughout the downstream section will produce additional fishery benefits totalling 7,400 fisherman-days annually with a recreational value of $14,800. Annual operation and maintenance costs for these areas are estimated at $2,700.

To provide suitable temperatures and dissolved oxygen in reservoir releases to maintain the downstream fisheries, the elevation of the outlet portals of the multiple-level outlet works should be determined by future cooperative studies between the West Virginia Department of Natural Resources, U. S. Forest Service, Bureau of

Outdoor Recreation, Corps of Engineers, and this Bureau prior to preparation of a General Design Memorandum.

Care should be exercised during the clearing and widening operations of South Branch Potomac in the vicinity of Petersburg. Stream bank vegetation, small rocks, boulders, and gravel should be disturbed as little as possible during the process of debris removal. The vegetation provides resting and breeding places for an abundance of insects. These insects fall into the water and become an important source of fish food during the summer months. Snags which provide shelter in streams for fish should not be disturbed unless they cause serious scouring or erosion. Silt in streams smothers fish food organisms and fish spawn which results in lowered fishery productivity.

If a limited amount of excavation is necessary to obtain maximum protection, the work should be undertaken after the major fish production and fishing period or November through February. In any event, the West Virginia Department of Natural Resources should be appraised of clearing and widening operations prior to the construction phase so that possible damages to the fishery resources would be minimized.

The initial cost for establishing a suitable fish population in the reservoir which includes survey, pre-impoundment fish control and stocking is estimated at $5,800.

A plan for zoning the reservoir should be developed cooperatively by all of the agencies responsible for the recreation activities. Such a plan would be necessary to prevent possible conflicts with regard to the use of the impoundment.

Our investigations indicate that the losses in hunting opportunities resulting from the project can be compensated by intensive management of project lands to be acquired for mitigation of wildlife habitat provided that the lands are tillable and have less than an 8 percent slope. The exact location of the wildlife mitigation lands should be determined by the West Virginia Department of Natural Resources, the Corps of Engineers, the U. S. Forest Service, Bureau of Outdoor Recreation, and this Bureau prior to preparation of the General Design Memorandum. Since the administration of project associated land and resources will be the responsibility of the U. S. Forest Service, wildlife management practices on these lands should be carried out by both the U. S. Forest Service and the West Virginia Department of Natural Resources under terms of a cooperative agreement, now in effect, between the two agencies.

The 700 acres of land to be acquired to mitigate wildlife losses will require certain initial costs for hunter parking facilities, access roads, equipment, and land posting. These costs would approximate $4,200. Cost of land acquisition is about $70,000. Operation and maintenance costs would be about $1,000. All of the above costs should be borne by the project and be non-reimbursable.

The foregoing cost estimates are preliminary and are subject to change depending on the degree of management undertaken by the West Virginia Department of Natural Resources and the Forest Service, U. S. Department of Agriculture.

To promote compatability between hunting and other recreational use of the additional 740 acres of land to be acquired for recreation, it would be necessary to restrict hunting to those periods when conflicts would be at a minimum. Fortunately, most of the hunting would take place during October, November, and December; months of low, general recreation use. If this land is acquired, hunting should be permitted in areas not intensively developed for general recreation and during those periods when conflicts would be at a minimum.

RECOMMENDATIONS

On the basis of the foregoing, the Bureau of Sport Fisheries and Wildlife recommends that:

1. The Royal Glen Reservoir project not be authorized for the purpose of fish and wildlife conservation.

2. If the project is authorized, the following measures be incorporated into project plans:

   a. Minimum reservoir releases of 250 cubic feet per second be provided during the period April 1 through October 31 and 100 cubic feet per second from November 1 through March 31.

   b. Fisherman access sites be provided to improve fishing use downstream from the dam, consisting of a one-acre parking area located at the reservoir tailwaters plus acquisition of lands adjoining the stream banks a distance of one mile downstream from the dam, and eleven one-acre parking areas spaced approximately 5 miles

apart from the dam to the mouth of the South Branch Potomac River.

c. Design and operation of the multi-level outlet works be determined in cooperation with the West Virginia Department of Natural Resources, U. S. Forest Service, Corps of Engineers, Bureau of Outdoor Recreation, and this Bureau for the preservation of downstream fisheries.

d. Plans for clearing and widening be developed in cooperation with the West Virginia Department of Natural Resources and this Bureau and any channel excavation be limited to the period of November through February.

e. **A reservoir zoning plan be developed cooperatively with the West Virginia Department of Natural Resources, Bureau of Outdoor Recreation, U. S. Forest Service, and this Bureau to prevent conflicting recreational uses of the reservoir.**

f. Location of the wildlife mitigation lands be determined cooperatively by the West Virginia Department of Natural Resources, U. S. Forest Service, Bureau of Outdoor Recreation, the Corps of Engineers, and this Bureau.

g. Wildlife management practices on project lands be carried out by both the U. S. Forest Service and the West Virginia Department of Natural Resources under terms of a cooperative agreement, now in effect, between the two agencies.

The Bureau's study and recommendations are based on project plans as currently developed. Should your study of the Royal Glen project be authorized for advanced engineering and design, it is requested that engineering data be supplied this Bureau and that coordination and assistance be sought as needed in planning specific project features.

The cooperation extended by your staff has been greatly appreciated.

Sincerely yours,

Richard E. Griffith

Regional Director

STATE OF WEST VIRGINIA
DEPARTMENT OF NATURAL RESOURCES
CHARLESTON 25305

T. R. SAMSELL
DIRECTOR

May 21, 1969

DAVID C. CALLAGHAN
DEPUTY DIRECTOR

Mr. Richard E. Griffith
Regional Director
U. S. Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
U. S. Post Office and Courthouse
Boston, Massachusetts 02109

Dear Mr. Griffith:

We have reviewed your Bureau's third revised draft relative to the Royal Glen Reservoir project and concur with your recommendations on pages 14 and 15.

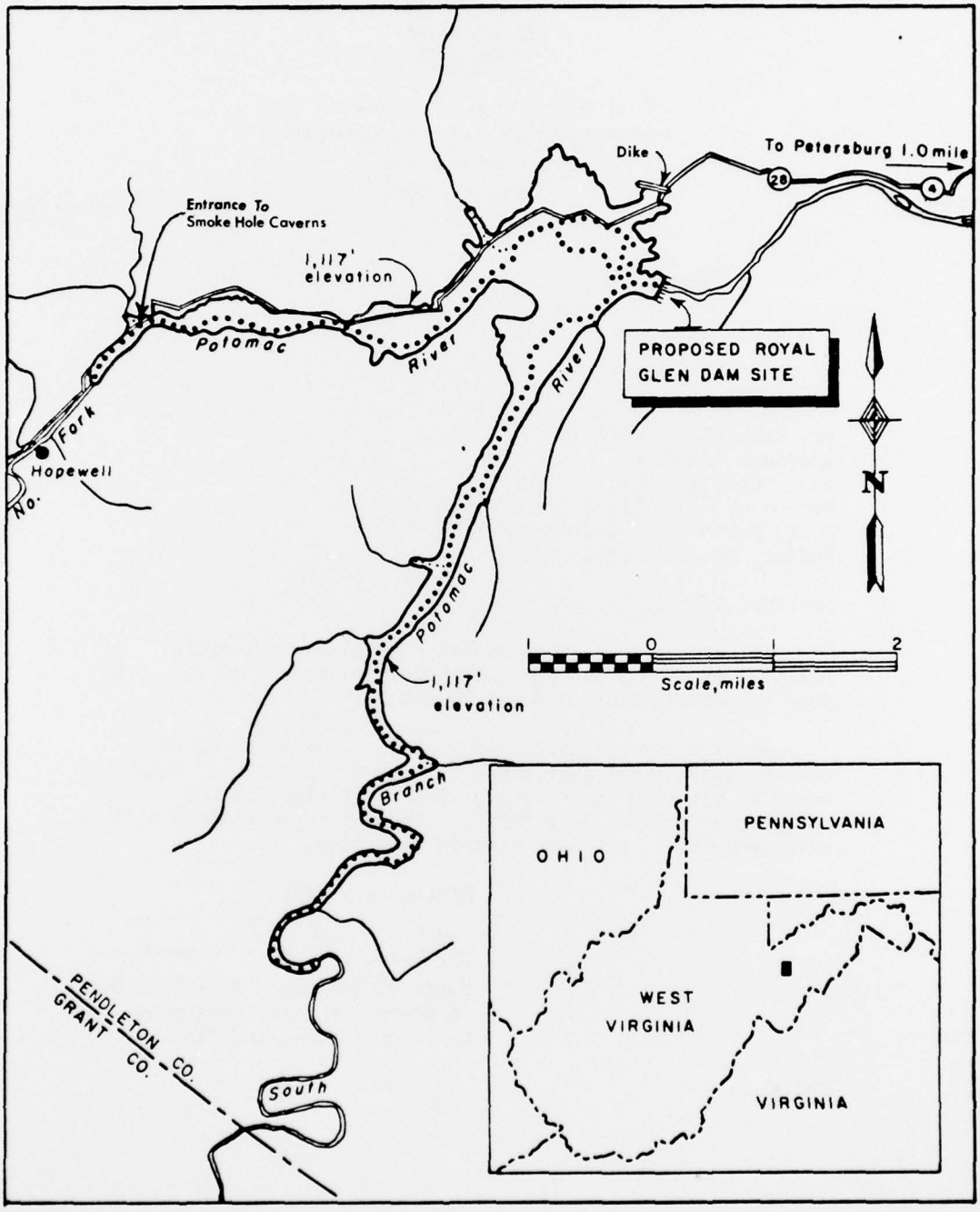
We were disappointed in the proposed doubling of the channel improvement provisions and the designation of this works as clearing and widening instead of clearing and snagging as previously reported. We feel these changes will adversely effect existing fishery resources.

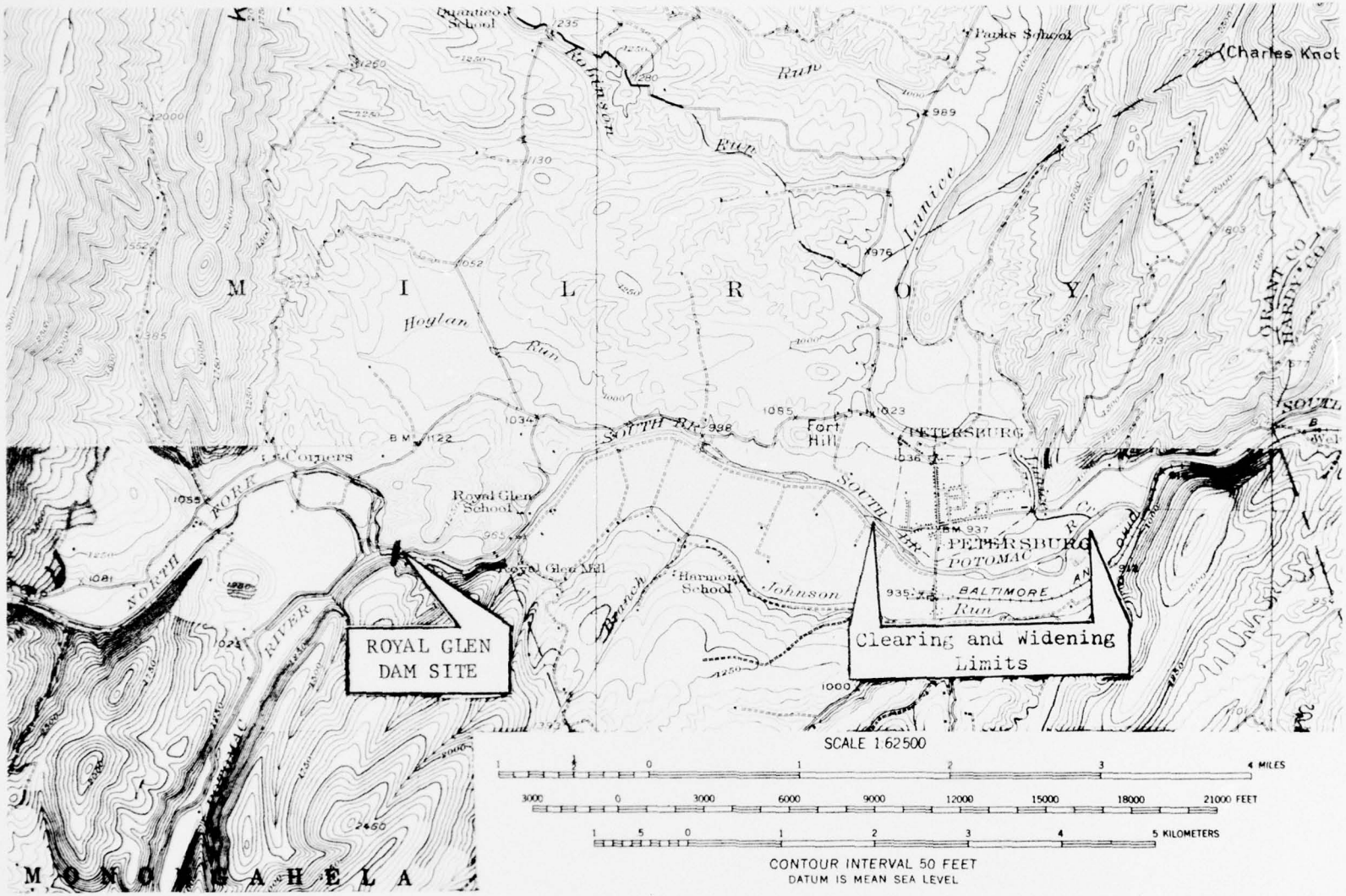
Sincerely yours,

David W. Robinson

David W. Robinson, Assistant Chief
In Charge of Fish Management
Division of Game and Fish

DWR:alg


Dike
To Petersburg 1.0 mile
28
Entrance To
Smoke Hole Caverns
1,117'
elevation
Potomac
River
PROPOSED ROYAL
GLEN DAM SITE
South
Fork
Hopewell
No.
N
Potomac
River
1
0
1
2
Scale, miles
1,117'
elevation
Branch
PENNSYLVANIA
OHIO
WEST
VIRGINIA
VIRGINIA
PENDLETON CO.
GRANT CO.
South


ROYAL GLEN DAM SITE
Clearing and Widening Limits
MILROY
PETERSBURG
Fort Hill
Royal Glen School
Harmony School
Parks School
Charles Knot
Robinson Run
Hoglan Run
Johnson Run
South Fork
South River
North Fork
Branch
Potomac
Baltimore
SCALE 1:62500
4 MILES
21000 FEET
5 KILOMETERS
CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL