

PRELIMINARY
INVESTIGATION

NORTH AND SOUTH FORKS OF THE

EDISTO RIVER
SOUTH CAROLINA

ENVIRONMENTAL PROTECTION AGENCY



REGION IV
ATLANTA, GEORGIA

MAY 1972

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PRELIMINARY WATER QUALITY INVESTIGATION

INTO

THE NEED FOR FLOW REGULATION

NORTH AND SOUTH FORKS OF THE EDISTO RIVER

SOUTH CAROLINA

ENVIRONMENTAL PROTECTION AGENCY
WATER PROGRAMS BRANCH
REGION IV
ATLANTA, GEORGIA
MAY 1972

ENVIRONMENTAL PROTECTION AGENCY

REPLY TO
ATTN OF: 4AWW

DATE: July 31, 1972

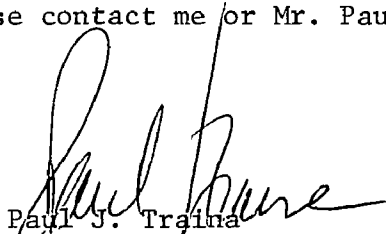
SUBJECT: Preliminary Investigation: North and South Forks of the Edisto River

TO:

- Mrs. Charlotte Folk, Librarian
Southeast Water Laboratory, Athens, Georgia

I am providing for your future use and information a copy of this office's publication, Preliminary Investigation: North and South Forks of the Edisto River. The study was performed in response to a request by the Charleston District Corps of Engineers in connection with their water resource development program in South Carolina.

If you have any questions, please contact me or Mr. Paul L. Wagner of our Water Quality Planning Section.


Paul J. Traina
Director, Water Programs Branch

Attachment (1)

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REPORT ON THE PROPOSED
IMPOUNDMENT OF THE NORTH AND SOUTH
FORKS OF THE EDISTO RIVER, SOUTH CAROLINA

I. Introduction

In a letter dated 23 September 1971, Colonel Robert C. Nelson, District Engineer for the Corps of Engineers, Charleston, South Carolina, requested the assistance of the Environmental Protection Agency in identifying the need for and value of flow regulation on the North and South Forks of the Edisto River in South Carolina. An earlier letter (21 May 1970) forwarded by the Charleston District Engineer, identified the Thackston Dam site on the North Fork and the Shaw Creek Dam site on the South Fork of the Edisto River as specific locations under investigation. It is our understanding that the Thackston site is located at approximately North Fork River mile 34.2 and the Shaw Creek site at South Fork mile 71.2. The earlier letter also requested information relating to the identification of the potential need for water supply which might be provided by these projects and an assessment of water quality in the vicinity of the projected damsites. This report will attempt to fulfill these requests. It should be emphasized that the comments here included are preliminary in nature and that a more thorough evaluation will be required, should the projects go forward for authorization or more detailed planning.

We would like to acknowledge the assistance of the South Carolina Pollution Control Authority and the South Carolina Water Resources Commission for their assistance in acquiring the data utilized in the preparation of this report.

II. Conclusions

Based upon the limited data presently available, the following preliminary conclusions have been drawn:

1. Water Quality in the upper Edisto Basin, in the vicinity of the proposed Thackston and Shaw Creek Damsites is generally good. Swamp drainage producing high color, low pH and relatively high BOD levels is the major water quality problem in the region. Excessively high fecal coliform counts also exist in both the North and South Forks of the Edisto River in the vicinity of the proposed reservoirs.

2. Construction of the reservoirs will necessitate the inundation of swampy marshlands, rich in organic material. This will result in leaching of oxygen consuming organics in the lower levels of the proposed impoundments. Extensive site preparation will be required to mitigate this effect.

3. The possibility of organic enrichment and accelerated eutrophication in the proposed impoundments should be more fully explored. Additional data is required to perform a satisfactory analysis to assess these items.

4. Evaluation of the need for flow regulation to assist in the maintenance of adequate dissolved oxygen concentrations below the two reservoirs, revealed the following:

- (a) On the North Fork of the Edisto River, a need exists at this time for flow regulation, such that a minimum flow of 284 cfs will be maintained below the City of Orangeburg, South Carolina, during the months of June, July, August and September. During the remainder

of the year no augmentation of normal flows will be required to meet dissolved oxygen standards. This need will no longer exist after the year 1990. Maintenance of the 7-day, 10-year low flow of 215 cfs at Orangeburg, South Carolina, after the year 1990 will provide adequate assimilative capacity to insure compliance with existing state water quality standards assuming adequate treatment is provided for all waste sources.

- (b) On the South Fork, maintenance of the 7-day, 10-year low flow of 191 cfs at Denmark, South Carolina, will be adequate to insure compliance with existing state water quality standards, assuming adequate treatment is provided for all waste sources.

5. Based upon preliminary estimates for water consumption, it is likely that surface water and ground water supplies will be sufficient to fullfill water supply needs through the year 2020.

III. General Basin Description

The upper Edisto River Basin encompasses portions of five South Carolina counties, including Lexington, Aiken, Orangeburg, Bamberg, and Barnwell Counties. Major towns in the basin are Orangeburg, Leesville, Batesburg, North Denmark, Bamberg, Williston, Blackville and Branchville. The total 1970 population of the five county region, residing within the Edisto River Basin is estimated to be approximately 90,250 of which over 35% reside in the nine towns noted. The largest settlement within the region is the City of Orangeburg, with a 1970 population estimated at 13,252.⁽¹⁾ Orangeburg is also the center of commerce for the region and has further become its industrial center. Orangeburg was one of five "urban growth centers" envisioned in the study, with the assumption made for the purposes of this study that a centralized waste collection and treatment system would be constructed for each center within the study period. The centers, with their respective population projections are shown in Table 1. Since community population projections were not available, growth was assumed equal to the growth of the county population in which each center is located. Of the five centers, the communities of Orangeburg, "Bam-den" and "Will-Black" could potentially benefit from water quality storage in the proposed Thackston and Shaw Creek Reservoirs while all centers could derive water supply and recreational benefits to varying degrees.

TABLE 1

SERVICE CENTERS IN THE UPPER EDISTO BASIN

	<u>Population Projections</u>	<u>1970</u>	<u>1990</u>	<u>2020</u>
1.	<u>Bates - Lee</u> (Batesburg, Leesville)	5,220	6,440	9,210
2.	<u>Nor-Swan-Wood</u> (North, Swansea, Woodford)	1,990	2,320	3,060
3.	<u>Bam-den</u> (Bamburg, Denmark)	6,300	7,080	8,370
4.	<u>Will-Black</u> (Williston, Blackville)	4,620	5,180	6,080
5.	<u>Orangeburg</u>	13,850	16,150	21,270

IV. Water Quality

The South Carolina Pollution Control Authority has collected and analyzed samples from a number of locations in the upper Edisto River Basin since 1958, and has provided this office with much of the data which they have accumulated over the testing period. This information is presented in summarized form in Table 3.

Generally, it is apparent from Table 3 that water quality in the upper basin is good. The major water quality problem of the region results from swamp drainage into both the North and South Forks of the Edisto River. Quality indicators which reveal the impact of swamp drainage include significantly elevated color concentrations, pH values consistently below 7.0, and the slightly elevated BOD levels measured in reaches relatively unaffected by man-made sources of pollution. Color concentrations observed during the testing period averaged in the range of 84 to 187 units and pH ranged from 5.8 to 6.5. Five-day biochemical oxygen demand concentrations averaged above 1.66 mg/l at all stations sampled and frequently exceeded 2.0 mg/l even at stations unaffected by point waste sources. The low relief of the upper portion of the drainage basin has produced extensive swamp land terrain in the flood plain zone of both the North and South Forks. The richly organic nature of the sediments of these swamplands provides a continuous source of color and dissolved biochemical oxygen demand which is leached into the tributaries of the two rivers. Although the detrimental

impact of swamp drainage is not significant in flowing streams, it does represent a potential problem should these streams be impounded.

Dissolved oxygen levels are generally acceptable throughout the basin. Above major waste sources, dissolved oxygen concentrations averaged 7.0 mg/l and higher, while below these sources, concentrations rarely diminished to less than 5.0 mg/l. Dissolved oxygen levels varied on a seasonal basis from about 55 to 80 percent of saturation during the spring months of April-June to about 70 to 85 percent during the fall months of October-December. Turbidity was consistently low, averaging less than 10 Jackson Candle Units at all stations sampled. The relatively low alkalinity of the streams can be attributed in part to the depressed pH of these waters.

Fecal coliform concentrations were consistently above recommended levels for contact recreation. Excluding samples collected below the City of Orangeburg sewage treatment plant outfall (station NF-5), fecal coliform concentrations ranged from geometric means of 197/100 ml at station SF-2 on the South Fork, to 410/100 ml at station NF-3, above Orangeburg, South Carolina. Waters classified for primary contact recreation in the State of South Carolina (Class A) are required not to exceed fecal coliform levels of 200/100 ml. Since contact recreation will be a likely objective at the Thackston and Shaw Creek sites, this factor becomes an important consideration and should receive closer scrutiny should these projects go forward for more detailed planning.

Nutrient information in the upper Edisto Basin is very limited. Data which are available has been tabulated in Table 4. Although the number of observations presented is not statistically adequate to draw any definite conclusions, it should be noted that of the eleven phosphate observations in the two rivers over the past year, four exceeded the 50 $\mu\text{g}/\text{l}$ (0.050 mg/l) PO_4 expressed as P level suggested as a guideline by the National Technical Advisory Committee for impounded waters.⁽²⁾ This concentration is thought to generally set the minimum level at which eutrophication is likely to occur assuming other conditions are not limiting. The "blackwater" character of the North and South Forks of the Edisto will have the effect of reducing light penetration below the water surface, thereby lessening the probability of unrestrained algal growth. The net effect of these two factors upon the proposed reservoirs is, at this time, unknown.

In summary, it is concluded that water quality in the reaches proposed for impoundment is generally good. Swamp drainage does represent a problem in both the North and South Forks of the Edisto River, but under the present flow regimen, it has not produced a significant deterioration of water quality which has affected present water uses. Should one or both of the rivers be impounded, it is likely that a much more severe impairment of water quality will result. This will occur due to the reduced reaeration capacity of the river in impounded reaches which will lessen the ability of the streams to assimilate the elevated "natural" BOD levels. If impoundment takes place in the basin's swampland areas, dissolved oxygen depletion will likely

occur near the deepest levels of the water column as a result of the unsatisfied oxygen demand of richly organic swampland sediments.

Eutrophication problems are a possibility in any impoundment in the upper Edisto Basin as a result of apparently excessive phosphate concentrations. Excessively high coliform concentrations also pose a potential problem in upstream reservoir areas and will require attention if the full recreational potential of the proposed impoundments is to be realized.

The present and potential water quality problems envisioned in both the North and South Forks of the Edisto River will demand further study and will necessitate positive action to minimize adverse effects resulting from the proposed reservoir construction.

TABLE 2
DESCRIPTION OF WATER QUALITY SAMPLING STATIONS

<u>Station</u>	<u>Description</u>
NF-1	North Fork Edisto River, U. S. Hwy. 321, 3 miles west of North, S. C.
NF-2	North Fork Edisto River, S. C. Hwy. 394, 1.9 miles west-southwest of North S. C.
NF-3	North Fork Edisto River at Orangeburg, S. C., city water supply intake
NF-4	North Fork Edisto River, S. C. Hwy. 601 at Orangeburg, S. C.
NF-5	North Fork Edisto River, 100 yds. below ACL RR Bridge below Orangeburg, S. C.
SF-1	South Fork Edisto River, S. C. Hwy. 215, 3 miles northwest of Wagener, S. C.
SF-2	South Fork Edisto River, U. S. Hwy. 321, between Denmark and Norway, S. C.

Water Quality Data

Table 3

Station No.	Temperature (°C)				D. O. (mg/l)				BOD ₅ (mg/l)				F. Coli. (col./100 ml)			
	No. Obs.	Max.	Min.	Mean	No. Obs.	Max.	Min.	Mean	No. Obs.	Max.	Min.	Mean	No. Obs.	Max.	Min.	Geo. Mean
NF-1	55	26.0	2.5	17.6	55	12.5	5.0	7.8	7	4.10	0.60	1.86	11	9180	20	197
NF-2	12	24.0	19.5	22.4	12	7.1	5.8	6.7	12	2.90	0.90	1.66	10	1300	110	374
NF-3	57	28.0	3.0	18.1	57	12.4	4.8	7.5	49	4.05	0.0	2.20	7	5400	40	410
NF-4	78	26.5	4.0	18.5	78	12.5	4.5	7.1	69	5.15	0.55	2.14	27	9180	80	211
NF-5	17	25.0	16.0	21.4	17	8.7	5.0	6.7	17	7.40	1.40	4.42	3	240x	160x	187x
SF-1	11	25.0	14.0	21.4	11	9.6	6.8	7.7	11	2.45	0.90	1.66	9	1400	70	197
SF-2	22	26.0	14.0	22.6	21	7.9	4.5	6.3	22	3.60	.70	1.88	7	790	70	248

NOTE: 160x = 160,000 col./100 ml

Summary of Data collected by South Carolina Pollution Control Authority, 1958-1971

Water Quality Data

Table 3(cont'd)

Station No.	pH				Color				M. O. Alk. (mg/l)				Turb. (JCU)			
	No. Obs.	Max.	Min.	Mean	No. Obs.	Max.	Min.	Mean	No. Obs.	Max.	Min.	Mean	No. Obs.	Max.	Min.	Mean
NF-1	53	7.2	4.4	6.4	14	160	15	84	47	180	2.0	30.8	12	14	3	8
NF-2	12	6.9	5.0	5.8	12	190	40	90	12	22.5	4.0	11.5	10	14	4	8
NF-3	54	8.0	4.6	6.5	8	220	70	122	54	380	1.0	30.5	5	8	3	6
NF-4	78	7.4	4.4	6.3	33	220	35	99	78	220	5.0	15.3	30	10	1	5
NF-5	14	7.2	5.4	6.4	3	250	140	187	14	25.0	6.0	11.7	3	15	5	10
SF-1	6	6.9	5.4	6.1	5	190	70	124	11	20.0	4.0	10.1	6	19	6	12
SF-2	22	7.3	5.2	6.4	10	170	40	107	22	27.0	6.0	13.5	9	12	6	7

NOTE: Summary of Data collected by South Carolina Pollution Control Authority, 1958-1971

Nutrient Concentrations

Table 4

Station	Date of Collection	<u>NH₃-N</u> mg/l	<u>NO₂+NO₃-N</u> mg/l	<u>Ortho PO₄-P</u> mg/l	<u>Total PO₄-P</u> mg/l
NF-1	8-26-71	---	---	<0.010	---
NF-2	8-23-71	---	---	0.090	---
	10-8-71	---	<0.05	0.033	---
NF-3	6-14-71	0.28	---	0.030	---
	8-24-71	---	---	0.160	---
NF-4	6-14-71	0.27	---	0.040	---
	9-13-71	---	0.05	0.030	---
	9-14-71	---	0.07	0.115	---
NF-5	9-13-71	---	0.06	0.040	---
SF-1	None	---	---	---	---
SF-2	10-8-71	---	<0.05	0.015	---
	8-25-71	---	---	0.140	---

V. Water Quality Standards and Uses

Stream classifications for the North and South Forks and the main stem of the Edisto River are shown in Tables 5 and 6. It should be noted that water quality standards for these streams were established in 1960 or earlier and are presently being reviewed jointly by the Environmental Protection Agency and the State of South Carolina. It is probable that reaches presently classified as "class C" will be upgraded to "class B" in 1972 to provide for a higher level of water use where the maintenance of higher standards is possible.

The Edisto River and its two major tributaries, the North and South Forks of the Edisto River are situated entirely within the State of South Carolina. The standards which apply to these waterways are intra-state classifications developed by the South Carolina Water Pollution Control Authority. The North Fork has been classified as a "Class A" stream from its headwater to the City of Orangeburg and "Class C" below the city to its confluence with the South Fork. The entire length of the South Fork has been classified as a "Class B" waterway. The main stem of the Edisto River carries a "Class A" designation for its entire length.

STREAM CLASSIFICATION

Upper Edisto Basin

Table 5

NORTH FORK EDISTO: from its headwaters within Lexington, Aiken and Orangeburg Counties to the point of discharge of municipal sewage at Orangeburg classified as Class A; from this point to the point of confluence of the North Fork Edisto and South Fork Edisto within Bamberg and Orangeburg Counties, Class C. Hearing held in St. George on April 27, 1956. Adopted by the Authority on June 28, 1956. Filed with the Secretary of State on July 13, 1956.

SOUTH FORK EDISTO: from its headwaters in Edgefield County to its junction with U. S. #1 in Aiken County classified as Class B; from this point to that portion beginning three-fourths mile upstream of the Atlantic Coastline Railroad crossing and extending downstream to its confluence with the North Fork of the Edisto River in Bamberg and Orangeburg Counties reclassified as Class B. Hearing held in Bamberg on December 4, 1959. Adopted by the Authority on January 14, 1960. Filed with the Secretary of State on January 20, 1960. (This supersedes the classification of this portion of the South Fork Edisto River in Bamberg and Orangeburg Counties adopted by the Authority on June 28, 1956, and filed with the Secretary of State on July 13, 1956.)

EDISTO RIVER (Main Stem): the entire stream within Orangeburg, Bamberg, Colleton, Dorchester and Charleston Counties classified as Class A. Hearing held in St. George on April 27, 1956. Adopted by the Authority on June 28, 1956. Filed with the Secretary of State on July 13, 1956.

TABLE 6

WATER QUALITY STANDARDS - SOUTH CAROLINA

ESTABLISHED CLASSES FOR FRESH SURFACE WATERS AND THE STANDARDS OF QUALITY
AND PURITY WHICH SHALL BE APPLIED THERETO:

CLASS AA

Water suitable for use for domestic and food processing purposes with disinfection and pH adjustment as the only treatment required. Suitable also for trout survival where so specified and for uses requiring water of lesser quality.

QUALITY STANDARDS FOR CLASS AA WATERS

<u>Items</u>	<u>Specifications</u>
1. Sewage, treated waste, thermal discharges, or other waste effluents.	None
2. Dissolved oxygen.	Not less than 6 mg/l with a daily average of 7 mg/l.
3. Toxic wastes, deleterious substances, colored or other wastes.	None in amounts to exceed limitations set forth in the latest edition of U. S. Public Health Service Drinking Water Standards.
4. Fecal coliform.	Not to exceed 20/100 ml as a monthly arithmetic average.

CLASS A

Waters suitable for use as swimming waters. Suitable also for other uses requiring waters of lesser quality.

QUALITY STANDARDS FOR CLASS A WATERS

<u>Items</u>	<u>Specifications</u>
1. Fecal coliform.	Not to exceed a geometric mean of 200/100 ml nor shall more than 10% of the total samples during any 30 day period exceed 400/100 ml.

<u>Items</u>	<u>Specifications</u>
2. Phenolic compounds	Not greater than 1 microgram per liter, unless caused by natural conditions.
3. pH.	Range between 6.0 and 8.0, except that swamp waters may range from pH 5.0 to pH 8.0
4. Dissolved Oxygen	Not less than 5 mg/l, except that swamp waters may have an average of 4 mg/l

CLASS B

Waters suitable for domestic supply after complete treatment in accordance with requirements of the South Carolina State Board of Health. Suitable also for propagation of fish, industrial and agricultural uses and other uses requiring water of lesser quality.

QUALITY STANDARDS FOR CLASS B WATERS

<u>Items</u>	<u>Specifications</u>
1. Fecal coliform	Not to exceed a log mean of 1000/100 ml based on five consecutive samples during any 30 day period; nor to exceed 2000/100 ml in more than 20% of the samples examined during such period (not applicable during or following periods of rainfall).
2. pH.	Range between 6.0 and 8.5, except that swamp waters may range from pH 5.0 to pH 8.5.
3. Dissolved Oxygen.	Daily average not less than 5 mg/l with a low of 4 mg/l, except that swamp waters may have an average of 4 mg/l.
4. Phenolic compounds.	Not greater than 1 microgram per liter unless caused by natural conditions.

CLASS C¹

Waters suitable for fish survival*, industrial and agricultural uses and other uses requiring water of lesser quality.

QUALITY STANDARDS FOR CLASS C WATERS

<u>Items</u>	<u>Specifications</u>
1. pH.	Range between 6.0 and 8.5, except that swamp waters may range between 5.0 and 8.5
2. Dissolved Oxygen.	Not less than 3 mg/l, except that swamp waters may have a low of 2.5 mg/l.
3. Fecal Coliform	Not to exceed a log mean of 1000/100 ml based on five consecutive samples during any 30 day period; nor to exceed 2000/100 ml in more than 20% of the samples examined during such period (not applicable during or immediately following periods of rain-fall)

* "Fish Survival" as used in this standard means the continued existence of individual fish normally indigenous to water of this type.

1 To apply only to streams receiving waste prior to May 4, 1950, and not be applied to streams with a seven-day once in ten years occurrence flow of more than 22.5 mgd nor shall this classification be assigned to interstate streams.

VI. WATER QUALITY CONTROL NEEDS

A. General

An analysis was performed to determine the present and projected need for flow regulation in the Edisto River Basin as a technique for assisting in the maintenance of acceptable water quality conditions. At present, a total of 14 major waste sources, collectively, discharge in excess of 6,000 pounds/day BOD₅ into the upper Edisto River and its major tributaries, the North and South Forks of the Edisto. Storage of water in the proposed Thackston and Shaw Creek Reservoirs, with releases to coincide with critical water quality conditions, has been evaluated as a means of increasing the organic assimilative capacity of receiving streams below these dam sites. Table 7 shows the location, treatment process, and discharge volume of the major dischargers in the region.

The Federal Water Pollution Control Act (33 USC, 466 et seq., sec 3(b))⁽³⁾ provides for the utilization of federally constructed multipurpose reservoirs to regulate stream flow to assist in maintaining acceptable water quality. However, the Act states that flow augmentation shall not be provided as a substitute for "adequate treatment and control." Although the phrase "adequate treatment and control" is not defined in the Act, it is understood that adequate treatment shall reflect the maximum practicable level of treatment available. Moreover, in predicting the need for stream regulation for future dates, the likelihood of improved treatment technology should be considered.

The Environmental Protection Agency is currently re-evaluating its policy with regard to flow augmentation, and may provide more detailed guidance within the near future. However, at this time, recommendations relating to the need for water quality storage must be considered as preliminary in nature. For the purposes of this study, treatment levels of 85 percent BOD reduction for the year 1970, 95 percent for 1990, and 99 percent for 2020 were considered as adequate levels of treatment, which are believed to be both technically and economically feasible.

B. Analytical Procedure

Waste discharge, water use, and stream parameters utilized in the analysis are presented in Tables 8 and 9. A brief derivation of each term is provided as follows:

1. BOD discharge - Domestic waste discharge expressed as five-day biochemical oxygen demand (BOD) was assumed equal to 0.17 #/capita/day. Five-day BOD was converted to ultimate carbonaceous BOD using a "k rate" of 0.15 1/day. Ultimate nitrogenous BOD was computed based upon the assumption of 0.146 lbs of nitrogenous BOD per capita per day and added to the domestic carbonaceous BOD rate. Industrial waste discharge/^{was}extrapolated from 1970 industrial waste discharge rates, assuming an annual increase of 3.0 percent per year. Domestic and industrial waste discharge was summed for each value reported. Predicted waste production and treated waste discharge rates are presented in Table 8. Waste discharges listed under the "treated" column

reflect the highest degree of waste treatment thought to be practical for each date specified.

2. Water Use - Domestic water use was assumed equal to 120 gpcd for 1970; 140 gpcd for 1990; and 160 gpcd for 2020. These factors are commonly used per capita consumption rates.⁽⁴⁾

Industrial water use was based upon information made available by the South Carolina State Development Board in connection with the Department of Agriculture's Ashley-Combahee-Edisto River Basin Study. A value of 1431 gpd per employee in water-using industries was utilized with appropriate employment projection factors. A return factor of 80 percent of the water use was assumed.

3. Water Quality Parameters - Values for initial dissolved oxygen concentration and background BOD were computed, based upon stream analyses performed by the South Carolina Pollution Control Authority between 1958 and 1971 using data for the months of June-September. Temperature values represent maximum observed temperatures during this period.

4. Reaction Coefficients - A value of 0.15 /day (base 10) was utilized for the deoxygenation rate in the stream ($k, @20^{\circ}\text{C}$) which is a frequently observed rate for stabilized sewage. Gradient measurements suggest that both the North and the South Forks of the Edisto River have little elevation relief. The swampy nature of these streams further suggests that they may be classified as "sluggish," and as such would likely have a

limited reaeration capability (5). A " k_2 " value (reaeration coefficient) was estimated to be 0.225 /day at 20°C.

5. Water Quality Objective - The North Fork of the Edisto River from its headwaters in Lexington, Aiken, and Orangeburg Counties to the City of Orangeburg has been classified as a Class A waterway. Below Orangeburg, to its confluence with the South Fork in Orangeburg County, the North Fork has been designated as Class C. The entire length of the South Fork of Edisto River, from its headwaters in Edgefield County to its confluence with the North Fork, has been classified as Class B. Current dissolved oxygen standards require a minimum of 5.0 mg/l for Class A; a daily average of 5.0 mg/l and a minimum of 4.0 mg/l for Class B; and a minimum of 3.0 mg/l for Class C waterways in the State of South Carolina. Although the reach of the North Fork below Orangeburg is presently Class C, it is likely that the State will upgrade this designation to Class B when it can be shown that this standard can be practicably achieved. For this reason a target of 5.0 mg/l was utilized for both the North and South Forks of the Edisto River.

Dissolved oxygen concentration was selected in this study as representing the most critical standard to be maintained. Other water quality indices such as coliform concentration, nutrient concentration, etc., would likely be improved below waste discharge points under flow augmented conditions. However, it is not considered economically practicable to

achieve desirable water quality through dilution of these contaminants.

C. Analytical Results

The following is a summary of the minimum flow requirements in the North Fork of the Edisto River, below Orangeburg, and the South Fork, below "Will-black" (Williston and Blackville) for the period June through September:

	<u>Minimum Flow Requirements</u>		
	<u>1970</u>	<u>1990</u>	<u>2020</u>
North Fork Edisto below Orangeburg	284 cfs	143 cfs	40 cfs
South Fork Edisto below "Will-Black"	55 cfs	<50 cfs	<50 cfs

Minimum low flows occurring for a consecutive 7-day period, with a frequency of occurrence of once in ten years, are 215 and 191 cfs, respectively, for critical reaches of the North and South Forks of the Edisto River. (.6) It is apparent that flow augmentation is required in the North Fork only under the present circumstances (1970), and as higher levels of treatment become practicable, the need for flow augmentation will no longer exist. It is estimated that no water quality storage will be required at the Thackston site on the North Fork after the year 1990 beyond that released to maintain the 7-day, 10-year minimum flow. Results of the analysis reveal no need for water quality storage at the Shaw Creek Reservoir on the South Fork of the Edisto River above that required to maintain the 7-day, 10-year minimum flow. Additionally, any flows released for other project purposes,

e.g., fishing or power, would be available over and above the 7-day, 10-year minimum and would further minimize the need for water quality flows.

- (1) Efficiencies estimated based upon similar installations.
- (2) Discharge approximated based upon population.
- (3) Flow approximated based upon population.

NOTE: Table based upon data provided by the South Carolina
Pollution Control Authority.

Major Waste Sources in the Upper Edisto River Basin

Table 7

Waste Source	County	Treatment Process	Treatment Efficiency	Discharge Enters	Flow (mgd)	Discharge BOD ₅ (#/day)
Batesburg, S. C.	Lexington	Trickling Filter	75-85%	North Fork Edisto	0.40	165
Leesville, S. C.	Lexington	Pond	70-80% ⁽¹⁾	North Fork Edisto	0.16	50 ⁽²⁾
Swansea, S. C.	Lexington	Pond	70-80% ⁽¹⁾	North Fork Edisto	0.16	50 ⁽²⁾
J. B. Martin Co. (Leesville, S. C.)	Lexington	Aerated Lagoon - Polishing Pond	80-90%	North Fork Edisto	0.13	25
North, S. C.	Orangeburg	Trickling Filter	75-85%	North Fork Edisto	0.15	105
Orangeburg, S. C.	Orangeburg	Trickling Filter	75-85%	North Fork Edisto	2.36	1345
Wamsutta Towel Mills (Orangeburg, S. C.)	Orangeburg	Extended Aeration	80-90%	North Fork Edisto	1.55	295
Ethyl Corporation (Orangeburg, S. C.)	Orangeburg	Aerated Lagoon - Polishing Pond	80-90%	North Fork Edisto	2.00	2900
Azalea Meats, Inc. (Orangeburg, S. C.)	Orangeburg	Package Plant	85-95%	North Fork Edisto	0.15	25
Fabric Services, Inc. (Orangeburg, S. C.)	Orangeburg	Unknown	80-90%	North Fork Edisto	2.05	435
Bamburg, S. C.	Bamburg	Ponds	80-90%	South Fork Edisto & Combahee River	0.50	85
Denmark, S. C.	Bamburg		70-80%	South Fork Edisto	0.50	80
Williston, S. C.	Barnwell		70-80%	South Fork Edisto	0.80	490
Blackville, S. C.	Barnwell		70-80% ⁽¹⁾	South Fork Edisto	0.19 ⁽³⁾	40
Branchville, S. C.	Barnwell	None	0	Edisto River	0.12	30
Rockland Bamberg Ind. (Bamburg, S. C.)	Bamburg	None	0	Combahee River	0.08	2380

Table 8

Waste Discharge Projections*

Service Area		1970		1990		2020	
		Untreated	Treated(1)	Untreated	Treated(2)	Untreated	Treated(3)
Bates-lee	Dom.	1,837		2,266		3,242	
	Ind.	205		330		510	
	Tot.	<u>2,042</u>	<u>306</u>	<u>2,596</u>	<u>130</u>	<u>3,752</u>	<u>38</u>
Nor-swan-wood	Dom.	700		817		1,077	
	Ind.	0		0		0	
	Tot.	<u>700</u>	<u>105</u>	<u>817</u>	<u>41</u>	<u>1,077</u>	<u>11</u>
Orangeburg	Dom.	4,875		5,685		7,487	
	Ind.	<u>29,755</u>		<u>47,500</u>		<u>74,300</u>	
	Tot.	34,630	5,194	53,185	2,569	81,787	818
Bam-den	Dom.	2,218		2,493		2,945	
	Ind.	<u>5,783</u>		<u>9,252</u>		<u>14,457</u>	
	Tot.	8,001	1,200	11,745	587	17,402	174
Will-black	Dom.	1,626		1,822		2,140	
	Ind.	0		0		0	
	Tot.	<u>1,626</u>	<u>243</u>	<u>1,822</u>	<u>91</u>	<u>2,140</u>	<u>21</u>

(1) 85 percent reduction.

(2) 95 percent reduction.

(3) 99 percent reduction.

* Reported as pounds per day of ultimate biochemical oxygen demand.

DATA TABULATION

TABLE 9

River	Reach Begins	BOD _L Discharge (#/day)	Flow Return (cfs)	D. O. Deficit (mg/l)	BOD _L Background (mg/l)	K ₁ (20°C) (1/day)	K ₂ (20°C) (1/day)	Temperature (°C)	Velocity (Fps)	Projection For	Flow Required
North Fork	Orangeburg	5,194	2.8	2.22	2.90	0.15	0.225	26	0.295	1970	284
North Fork	Orangeburg	2,659	4.5	2.22	2.90	0.15	0.225	26	0.295	1990	143
North Fork	Orangeburg	818	5.6	2.22	2.90	0.15	0.225	26	0.295	2020	40
South Fork	Bam-den	1,200	1.1	2.12	2.47	0.15	0.225	26	0.295	1970	55
South Fork	Will-black	243	0.6	2.12	2.50	0.15	0.225	26	0.295	1970	12

Projections for 1990 and 2020 in the South Fork were not completed as no need was apparent.

VII. WATER SUPPLY

Although neither time nor resources were available to complete a detailed evaluation of the water supply needs for the upper Edisto River Basin, information gathered by this office should be valuable in the preparation of a thorough water supply study. Tables 10 and 11 tabulate the industries and municipalities which currently either operate independent water supply systems or purchase water from other systems. The present water use for the region is approximately 13.341 million gallons per day (mgd), with a maximum consumption rate of 19.290 mdg⁽⁷⁾. These estimates exclude private residential wells and surface supplies which at present account for a small proportion of the total water utilization in the region. The average daily water supply needs projected by the South Carolina Water Resources Commission for the year 1980 is estimated at 20.278 mgd, amounting to a 15.2 percent increase over the 1970 rate.

Preliminary estimates by the South Carolina Development Board⁽⁸⁾ prepared for the Ashley-Combahee-Edisto River Basins indicate that average industrial water consumption in the three-basin region is equal to approximately 1431 gallons per day (gpd) per person for employees in wet-process industries. Employment in wet-process industries amounts to 8.52 percent of the total employment force of the Ashley-Combahee-Edisto Basin. Total employment of the region is estimated to include 36.4 percent of its total population. Considering these factors, the calculated industrial consumption at the 1970 rate, is equal to approximately 44.4 gpd per capita for the total basin population. This factor has been found to be fairly

representative of industrial water use in the upper Edisto region.

Present domestic water use for the upper Edisto study area was calculated to equal approximately 95.1 gpd per capita, excluding private residential water supplies.

Discussions with geologists employed by the State of South Carolina have revealed some important factors relating to the availability of ground water in the upper Edisto Basin.

1. Ground water data in the Edisto Basin is quite limited. However, a study is underway by the South Carolina Water Resources Commission to identify ground water yields of aquifers in the region. This information should be available from the state during 1972.

2. In general, it is known that ground water is relatively plentiful below a line generally following the route of U. S. Highway 1 as it traverses the basin. Above this line the predominant geological formation of the region is granite, yielding considerably less ground water. It is estimated by the Water Resource Commission's staff geologists that below the U. S. 1 demarcation, dependable yields might exceed 100 gpm, while above, yields would rarely exceed 5-15 gpm.

3. Ground water quality is somewhat questionable. Iron is common where pH values are less than 7.0, and hardness becomes a problem for those aquifers traversing limestone formations. Iron concentrations in the range of 0.3 mg/l are common.

At present, there are only four major withdrawals from the surface waters of the area for water supply, totaling slightly over 7.6 mgd (11.7 cfs). Both the North and South Forks of the Edisto River are known to have excellent low flow characteristics due to the high ratio of retention in the upper basin. The North Fork has a recorded minimum

low flow of 190 cfs at Orangeburg for a 30-year period of record, and the South Fork has a minimum low flow of 146 cfs at Denmark, South Carolina, for a 37-year period of record. It is apparent that this source of supply has been relatively untapped to date. River water is admittedly more expensive to treat for domestic and industrial process consumption. However, the historical success of the City of Orangeburg in producing an acceptable product suggests that this is not a major obstacle to utilization of surface water supplies. In general, it is tentatively concluded that water supplies appear to be adequate to meet the projected needs of the upper Edisto Basin.

Industries and Municipalities⁽¹⁾
Operating Water Systems in the Upper Edisto Basin

Table 10

County and Name of Municipality/Industry	Surface Water		Ground Water			Total Daily Use (mgd)	Maximum Daily Use (mgd)	Storage (mgd)	Project Use 1980 (mgd)
	Name of Source and Number of Withdrawals	Average Daily Use (mgd)	No. of Wells	Yield (mgd)	Average Daily Use (mgd)				
<u>Aiken County</u>									
Aiken	Shaw Creek Spring	3.30	-	---	---	---	---	---	---
Salley	---	---	3	1.000	0.040	0.040	0.075	0.075	0.068
Wagener	---	---	3	0.750	0.225	0.225	0.225	0.075	0.300
<u>Lexington County</u>									
Batesburg	Duncan Creek Reservoir and Lightwood Knot Creek	0.626	-	---	---	0.626	1.200	0.775	0.650
Leesville	---	---	7	1.072	0.775	0.775	0.800	0.250	1.500
<u>Barnburg County</u>									
Barnburg	---	---	4	1.116	0.350	0.350	0.550	0.600	0.392
Denmark	---	---	5	1.440	0.800	0.800	0.850	0.600	0.850
<u>Barnwell County</u>									
None									
<u>Orangeburg County</u>									
Ethyl Corporation	North Fork Edisto	1.500	1	0.300	0.200	1.700	2.000	---	1.900
Fabric Services	---	---	3	4.300	2.000	2.000	2.390	2.180	4.200
Orangeburg	North Fork Edisto	3.200	-	---	---	3.200	5.100	2.250	6.557
Norway	---	---	2	0.072	0.055	0.055	0.060	0.075	0.055
Branchville	---	---	2	0.180	0.075	0.075	0.080	0.075	0.086
Springfield	---	---	2	0.748	0.100	0.100	0.100	0.075	0.120
North	---	---	3	1.482	0.100	0.100	0.160	0.075	0.100
TOTAL		10.126	35	12.460	4.720	13.341	19.290	9.605	20.278

(1) From "Water Uses in South Carolina, 1970," South Carolina Water Resources Commission

Industries and Municipalities⁽¹⁾
Purchasing Water in the Upper Edisto Basin

Table 11

County and Name of Industry/Municipality	Name of System from Which Water is Purchased	Average Daily Use (mgd)	Maximum Daily Use (mgd)	Projected Use 1980 (mgd)
<u>Bamberg County</u>				
Rockland Bamberg, Inc.	Bamberg	0.065	0.065	0.300
<u>Orangeburg County</u>				
Azalea Meats, Inc.	Orangeburg	0.090	0.120	0.090
Ethyl Corp.	Orangeburg	0.110	0.110	0.110
Fabric Services	Orangeburg	0.110	0.110	0.110
Palmetto Baking Co.	Orangeburg	0.100	0.100	0.159
U. S. Plywood	Orangeburg	0.019	0.019	0.019
Utica Tool Co., Inc.	Orangeburg	0.390	0.408	0.448
Sunbeam Corp.	Denmark	0.067	0.100	0.080
TOTAL		0.951	1.032	1.316

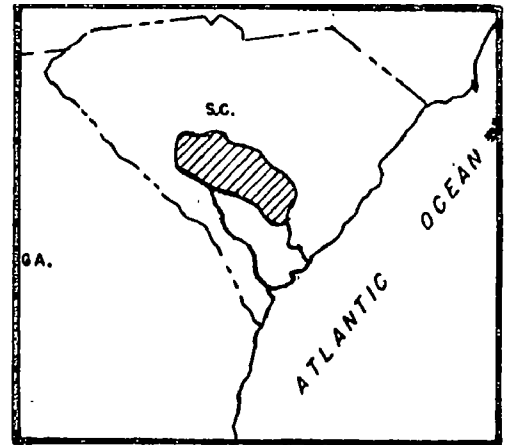
(1) From "Water Use in South Carolina, 1970," South Carolina Water Resources Commission

VIII. RECREATION

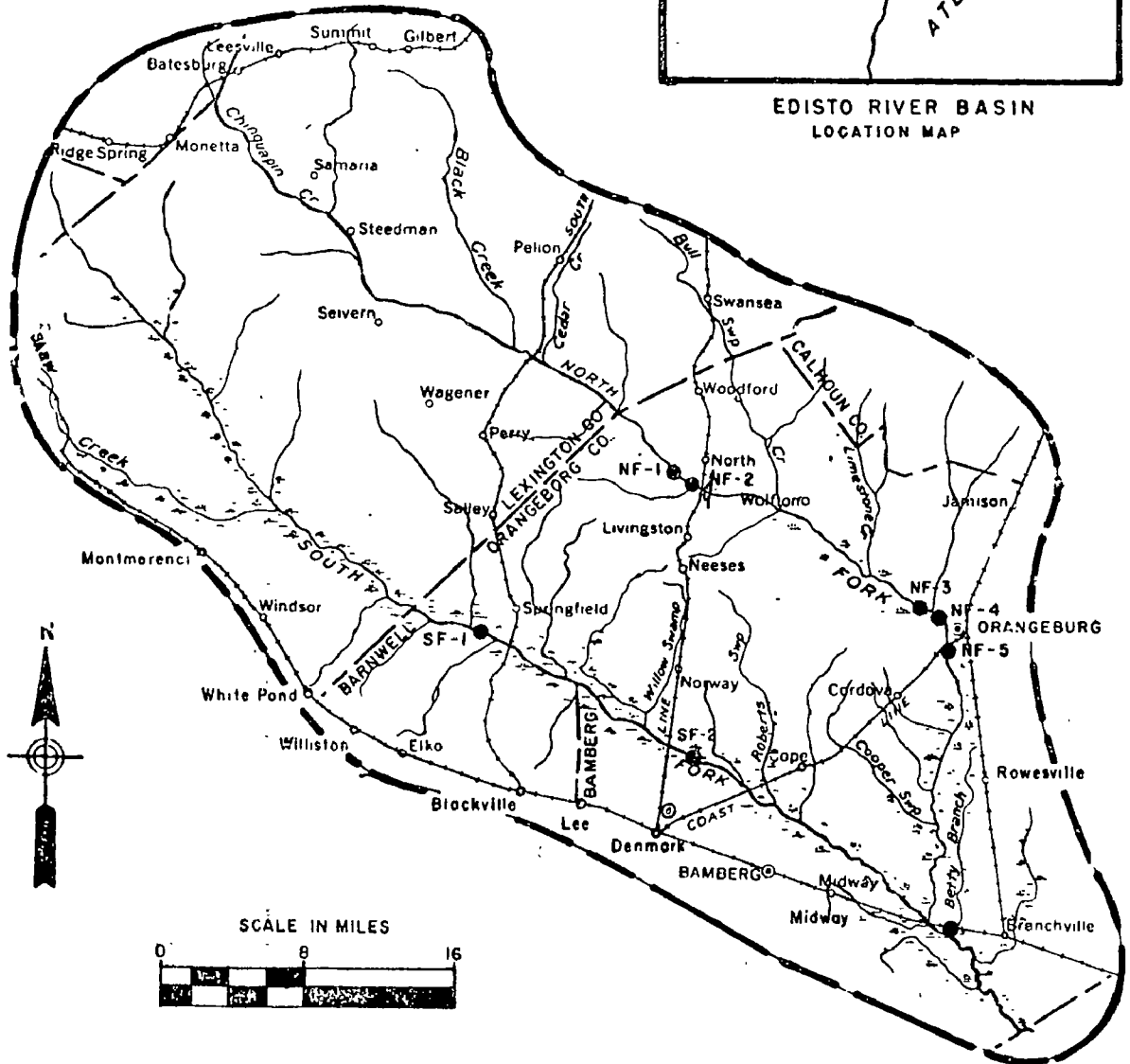
The upper Edisto Basin currently supports extensive recreational use including fishing, pleasure boating, and swimming. Shad fishing has become a popular pastime for residents and travelers alike. The upper reaches of both the North and South Forks of the Edisto are largely undisturbed by man and feature a wide variety of wildlife, including the endangered alligator. The South Carolina Water Resources Commission has recommended designation of 18.22 miles of the North Fork of the Edisto (beginning about two miles above U. S. Highway 301 and 601) and the upper portion of the South Fork (above S. C. Highway 70 to S. C. Highway 3) as "Wild Rivers" under the Wild and Scenic Rivers Act. Much of the remainder of the upper basin is being considered as "Scenic", under the same Act.⁽⁹⁾

The impact of the construction of the Shaw Creek and Thackston Reservoirs may be predicted to have an undesirable affect upon the current recreational use of the stream system. Construction of the dams would certainly conflict with plans to designate portions of the streams as wild. As previously noted, impoundment in the swampy marshland region of the basin would likely result in deterioration of water quality in the reservoir unless extensive procedures were followed to prepare the region to be flooded. The question of eutrophication in the proposed reservoirs is, as yet, undecided. These factors would likely have an adverse effect upon the fish population and detract from the present value of the region as a fishery. Finally, it is questionable whether contact recreation could be pursued throughout the proposed reservoir sites until the bacterial contamination of the rivers can be reduced to acceptable levels.

FIGURE 1



EDISTO RIVER BASIN
LOCATION MAP



UPPER EDISTO RIVER BASIN