INSTREAM FLOW STUDY

Phase I:

Identification and Priority Listing of Streams in
South Carolina for which Minimum Flow Levels Need to be Established

A Report to the South Carolina General Assembly

by

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SUMMARY

South Carolina contains an extensive river system which supports diverse populations of fish and wildlife and serves as an important resource to man. Man's interests in streams include both instream and offstream use activities. Instream uses occur within the natural stream channel and are dependent upon flows of adequate volume and depth. These uses and interests include navigation, recreation, wastewater assimilation, water quality maintenance, habitat for fish and wildlife resources, hydroelectric power generation, and aesthetics. Offstream uses remove water from the stream channel and include such activities as water withdrawals for industrial, municipal, agricultural, and thermoelectric power generation purposes.

Streamflows are affected by both natural factors and man's activities in the river basin. Extreme reductions in streamflows adversely impact or eliminate instream uses. In South Carolina, instream use problems have been identified in portions of some streams, and result from regulated releases from hydroelectric power plants, and diversions and withdrawals of large portions of flow. Projected growth in offstream water demands will further limit available streamflows and impact flow dependent uses.

Many eastern states, including Virginia, North Carolina, and Georgia, have recongnized the need to protect instream uses and have initiated studies, developed policy, and enacted legislation to ensure the maintenance of adequate flows to support these important uses. The protection of instream uses has also been of concern in South Carolina during recent years. Reports by the U.S. Water Resources Council (1981), the Governor's State Water Law Review Committee (1982), and the S.C. Water

Resources Commission (1983) recommend that the State address the need to protect instream uses. In 1983, the General Assembly passed a Joint Resolution (R115, H2549) recognizing the importance of instream uses to the State and the need for their protection. The Joint Resolution directed the S.C. Water Resources Commission to "...identify and list the streams and watercourses of the State for which minimum flows need to be established and prepare proposed streamflow standards..." for those streams.

In response to the General Assembly's directive, the S.C. Water Resources Commission initiated the Instream Flow Study which is composed of two phases. Phase I includes the identification and listing of streams for which minimum flows need to be established, and Phase II includes the determination of minimum flow standards to protect instream uses in streams identified in Phase I. A 23 member Instream Flow Advisory Committee, with representation from public natural resources agencies and all major water use interests, was established to provide input and review the study during its progress. This report is the result of Phase I.

A mathematical procedure was developed to rank streams in priority order based on their potential for instream use problems due to low flows. Natural and man-induced impacts on flows and the relative importance of each stream were considered in the ranking process. Over 500 stream segments were evaluated, of which 15 were identified as having the greatest need for streamflow protection. These priority stream segments include Whippy Swamp, Black Mingo Creek, Jeffries Creek, Combahee River, Sparrow Swamp, South Saluda River, and portions of Waccamaw River, Saluda River, Coosawhatchie River, Wateree River, Catawba River, and Broad River.

Stream segments included on this list do not necessarily exhibit current instream flow problems, but the potential for flow related problems is greater for these streams than for other streams in the State. Identification of these priority segments is an important first step in addressing the maintenance of instream uses; however, to provide adequate long-term protection of instream uses, a system to manage flows in all streams must be considered.

INTRODUCTION

South Carolina has over 8000 miles of rivers and streams. These flowing waters support diverse plant and animal populations in and along their channels. Streams also serve as a vital resource to man for water supply, waste removal, power generation, recreational opportunities, and aesthetic enjoyment. Man's use of streams falls into two general categories, offstream uses and instream uses. Offstream uses remove water from the stream channel and, depending on the use type, may return some portion back to the channel. Offstream water uses include such activities as industrial processing, municipal drinking water supply, agricultural irrigation, and condenser cooling for thermoelectric power plants. Instream uses include such activities-and interests as navigation, recreation, wastewater assimilation, water quality maintenance, aesthetics, hydroelectric power generation, and maintenance of fish and wildlife resources. The maintenance of instream uses requires the presence of a sufficient amount of water in the stream channel.

Current and projected population and economic growth is placing increasing demands on streams for offstream uses and instream uses alike. However, as withdrawals of water escalate, streamflows become limited, and instream uses may become degraded or eliminated. Instream use problems have been identified in several streams in South Carolina but the full extent of such problems is not actually known. Many low-flow problems in South Carolina occur in streams where flows are regulated by hydroelectric power facilities which generate power during periods of peak electric demand. Water is released through these facilities to generate

electricity only when power demands are high. Such releases typically occur during brief periods each day and result in highly variable flows and frequent low-flow conditions downstream. Large withdrawals from small- to medium-sized streams has also resulted in excessively low flows which adversely impact instream uses. In addition, the diversion of large portions of flow from major stretches of some streams has greatly impaired, and sometimes eliminated, important instream uses in the affected stream channels.

Concern for protecting instream water uses first developed in western states where water supplies are limited and water is allocated to users under the appropriation doctrine of water rights. Historically, water was allocated to withdrawal uses based on economic benefit and chronology of use, with"little consideration of instream uses. Many western states have since recognized the need to protect instream uses and have developed provisions to reserve a portion of streamflow for these uses. While eastern states generally have abundant supplies of water, the concern for protecting instream uses has intensified because rapidly growing offstream water use demands have increased the frequency of instream use conflicts. Many states in the East have recognized the need to protect instream uses and have initiated studies, developed policy, and enacted legislation to ensure the maintenance of suitable flows to support these important uses. In the Southeast the State of Georgia currently includes minimum flow requirements to protect instream uses as a condition to surface water withdrawal permits; North Carolina has developed policies and procedures to address instream flow considerations; and Virginia is conducting a study to determine how to establish and administratively implement minimum flows to maintain instream uses.

In South Carolina, the importance of maintaining instream water uses was recognized in a management plan for the Yadkin-Pee Dee River Basin which recommended that the States of North Carolina and South Carolina "...develop criteria for protecting all instream uses of water" (U.S. Water Resources Council, 1981). The Water Law Review Committee appointed by Governor Richard W. Riley in 1982 also recognized the importance of instream uses, stating that: "A minimum amount of water should be maintained to support instream needs in rivers, streams and lakes. The State should, giving due consideration to existing uses, determine instream flow needs and consider those needs in reviewing present and future development" (Governor's State Water Law Review Committee, 1982).

The Water Law Review Committee submitted the following specific recommendations regarding instream flow needs.

1. That the State adopt a.policy recognizing the need to maintain minimum stream flows;

2. That an agency, or agencies, be directed to determine the appropriate procedures for the establishment of instream flow requirements;

3. That the State agencies be directed to consider the maintenance of minimum stream flows under their existing authority until comprehensive instream flow legislation can be developed and implemented;

4. That legislation to provide for the establishment and maintenance of instream flows be developed and implemented in a timely manner;

5. That all future construction affecting the flow of a stream or river be designed to accommodate minimum instream flow needs."

The S. C. Water Resources Commission further addressed the issue of instream flows in the State Water Assessment (S.C. Water Resources Commission, 1983). In addition to identifying existing and potential areas with instream flow conflicts, the Commission concluded that:

1. "There is a general lack of recognition of the significance of instream flow needs." and

2. "Adequate legal and institutional bases do not exist for the management of instream flows."

In 1983, the General Assembly further recognized the importance of instream uses by enacting a Joint Resolution (R115, H2549) authorizing a study of the instream flow problem in South Carolina (Appendix). In the Joint Resolution, the General Assembly recognized that instream uses are "individually and collectively linked to the continued economic well-being of industries, the health, safety, and welfare of all South Carolinians, and the general attractiveness of South Carolina for future development." In addition, the General Assembly found that "the effects upon and need for protection of instream uses of water ... will increase."

The resolution directs the S. C. Water Resources Commission to "identify and list the streams and watercourses of the State for which minimum flow levels need to be established, and prepare proposed streamflow standards."

Study Plan

In response to the Legislative directive, the S.C. Water Resources Commission initiated the Instream Flow Study. The study is divided into two phases. Phase I entails the identification and listing of streams for which minimum flows need to be established. Phase II entails the determination of minimum flow standards to protect instream uses in the priority streams identified in Phase I.

During Phase I, the Commission must list those streams which are "significant" and explain why they were selected. In addition, streams must be ranked in priority order based on need for instream flow protection, and current and projected water use information must be compiled for each ranked stream. This report is the result of Phase I of the investigation.

Instream Flow Advisory Committee

At the beginning of the study, the Instream Flow Advisory Committee (Table 1) was established to help advise the Commission during the study. The Committee is composed of 23 members representing a broad spectrum of water-related interests including local, State, and Federal government agencies and entities, industry, electric power companies and environmental and professional organizations. Committee members are kept informed of study progress and are requested to review and comment on major aspects of the study through written correspondence and periodic meetings. While members have no voting authority, their input is highly valued and generally incorporated into the study process.

Table 1. Organizations and associated representatives composing the Instream Flow Advisory Committee.

Organization	Representative
S.C. Department of Health and Environmental Control	Russ Sherer
S.C. Wildlife and Marine Resources Department	Ed Duncan
S.C. Coastal Council	Jack Smith
S.C. Parks, Recreation and Tourism	Bill McMeekin
S.C. Land Resources Conservation Commission	Steven Bradley
Governor's Office	Bill Marshall
S.C. Department of Agriculture	William H. Busbee
S.C. State Development Board	Truman Safford
U.S. Geological Survey	Bill Carswell
U.S. Army Corps of Engineers	Ronnie Catoe
Charleston District	
U.S. Army Corps of Engineers	Jim Gallagher
Savannah District	Paul Metz
U.S. Fish and Wildlife Service	Diane Duncan
Soil Conservation Service	Norman Shuler
State Farm Bureau	Larry McKenzie
Electric Utilities	Jim Hendricks
	(Duke Power Company)
Environmental Groups	Betty Spence
	(S.C. Wildlife Federation)
State Chamber of Commerce	Nick Odom
	(Springs Mills, Inc.)
State Council of Governments	Bill James
Water Pollution Control Federation	Doug Wendel
	(Grand Strand Water
	and Sewer Authority)
S.C. Electric & Gas Company	Jack Preston
Municipalities	Dawkins Dennis
	(City of Newberry)
Municipal Water Supply	John Bettis
	(Charleston Commission of Public Works)

METHODS

Stream segments in need of streamflow protection were identified and ranked in priority order using the following methods and procedures.

Stream Segment Delineation

Streams and water courses evaluated in this study included all permanent, freshwater streams depicted on the U.S. Geological Survey 1:500,000 scale Hydrologic Unit Map of South Carolina and possessing a U.S. Environmental Protection Agency river reach identification number. Streams that satisfied these criteria were divided into discrete segments, named, and numerically coded based on the U.S. Environmental Protection Agency Reach File Hydrologic Segment Plot. Most of the smaller streams were represented by a single segment; however, larger streams were subdivided into two or more segments based on segment length and significant tributary inflow. A total of 503 stream segments were identified, with segments averaging 15 miles in length and ranging up to 67 miles in length.

Data Management

The stream evaluation process required the accumulation and manipulation of a large amount of data for each stream segment. Data requirements included stream identification information, streamflow data, water use data, and several values calculated for the stream ranking

process (use impact, dam impact, flow variability, protection need, significance, and overall values). An IBM-PC with dBASE II software was used for all data storage and manipulation functions.

The study also required the use of streamflow data (average and 7Q10) for each stream segment. However, gaged (measured) flow data was not available for all streams. Flows on ungaged streams, therefore, were simulated using a computer assisted procedure of estimating flows based on gaged flows in neighboring streams. The Social and Behavioral Sciences Laboratory at the University of South Carolina assisted in developing simulated streamflow data.

Stream Ranking Procedure

A mathematical procedure was developed to rank streams in need of flow protection. For each stream segment in the State, two numerical values were determined, (1) the protection need value and (2) the significance value. The protection need value is an indicator of the relative need for low-flow protection based on natural streamflow conditions and man's activities within the segment. The significance value indicates the relative importance of each segment based on instream and offstream use activities occurring on the segment. The derivation of these values is discussed in more detail later.

The product of multiplying these two values together equals the overall rating value of a stream. The potential for a stream to experience instream flow problems is proportional to the magnitude of its overall rating value.

Therefore, the higher the overall rating value, the greater the need for streamflow protection. Stream segments were ranked in decending order based on their overall rating value. The highest priority streams were selected by identifying a significant break point in the ranking of overall rating values. All streams listed above this point were determined to be of greatest need of streamflow protection. Water use activities, flow characteristics, and existing water use problems of each stream were also considered in selecting the highest priority streams.

In the final analysis, the ranking process was limited to streams with average annual flows greater than 200 cubic feet per second (cfs) or with known instream flow problems. The adjustment was made because a preliminary ranking of all 503 segments resulted in a large number of very small streams, supporting limited uses, ranking high on the list. To ensure that the most significant streams were prioritized and since low flows generally impact a greater number of instream use activities on larger streams, the smaller streams were not ranked unless they had known instream flow conflicts.

A draft list of priority streams was reviewed by the Instream Flow Advisory Committee. Based on comments from Committee members and others, overall rating values were recalculated using actual gaged values for stream segments where they were available, instead of using only simulated values for all segments as previously done. A final priority ranking of streams was then developed.

Determination of Protection Need Values

The evaluation of streams for need of flow protection incorporated two basic impacts on flow, (1) natural flow variability of the stream, and (2) potential impacts from man's activities in and along the stream (i.e. dams, diversion, withdrawals). Streams with poorly sustained flows and/or relatively extensive offstream water use compared to flow, are at a high risk of having instream use conflicts. Based on this premise, an empirically derived equation was used to evaluate all stream segments using the best available data. The need for flow protection was determined by the equation:

$$P = A \times (1 + B + C)$$

where:

P = Protection Need Value

A = Average Flow/7Q10

B = Total Water Withdrawal/7Q10 x 100

C = Reservoir Storage/7Q10

The higher the protection need value the greater the need for streamflow protection. Average annual flow and 7Q10 flow values were used because they are readily available for numerous streams throughout the State and can be simulated for ungaged streams. The 7Q10 flow is the lowest average flow expected to occur during seven consecutive days on the average of once in 10 years. This flow statistic is also important because of its widespread use as a low-flow value in wastewater treatment requirements and water withdrawal design considerations.

Determination of Significance Values

The ranking and selection of streams in need of minimum flow protection must include streams determined to be significant. For the purposes of this study, significance was defined as relative importance based on the extent of instream and offstream use occurring within each stream segment.

Each stream segment was assessed for the occurrence and extent of use for each of the following water use categories:

1) Industrial Water Withdrawals
2) Municipal Water Withdrawals
3) Agricultural Water Withdrawals
4) Thermoelectric Power Water Withdrawals
5) Hydroelectric Power Water Use
6) Commercial Fishery
7) Recreational Fishery
8) Commercial Navigation
9) Recreational Navigation
10) Maintenance of Endangered or Threatened Species
11) Wastewater Assimilation (water quality)
12) Unique Aesthetic and Ecological Characteristics

A separate water use value (see below) was determined for each use category for all stream segments. The significance value for a given stream segment was equal to the sum of all water use values determined for that segment (Table 2).

Water Use Values

Because the 12 water use categories have different units of measure (million gallons per day, class, cfs-miles), a means to directly compare and quantify the extent of use in these categories was developed. A common scale of water use values, ranging from 0 to 5, was applied to all use categories. A single water use value was determined.for each of the 12 use categories occurring on each stream segment (Table 2).

The water use value for each use category indicates the relative importance of that use within a given stream segment to that same use in all other stream segments. The greater the relative degree of use, the higher the water use value.

Water use values were determined for a given use category by first determining the degree of that use for each stream segment. Then for each use category, stream segments were ranked from lowest to highest. If no use occurred a value of zero (0) was assigned to the segment. Use values of 1-5 were evenly assigned to the segments with use by assigning a value of one (1) to the first 20 percent of segments with the lowest use for that category, then a value of two (2) for the next highest 20 percent of segments, and so on (Table 3). Segments with the same degree of use always received the same water use value.

Table 2. Example of the application of water use values and determination of the significance value for a stream segment (Saluda River 4).

Water Use Category	Extent of Use	Water Use Value
Industrial	0	0
Municipal	.O1 MGD	I
Agricultural	0	0
Thermoelectric	158 MGD	4
Hydroelectric	1240 MGD	3
Commercial Fishery	0	0
Recreational Fishery	19098 cfs-miles	4
Commercial Navigation	0	0
Recreational Navigation	19098 cfs-miles	5
Endangered/Threatened Species	0	0
Wastewater Assimilation	Class B	5
Aesthetics and Ecology	0	0
Significance Value		22

Table 3., Example of the determination of water use values for one use category (hydropower).

Segment Name	Water Use (MGD)	Water Use Value
Horse Creek	18	1
South Pacolet River	28	1
Rocky River	125	1
Pacolet River 1	170	1
Enoree River 1	175	2
Saluda River 5	181	2
Reedy River 1	376	2
Pacolet River 2	680	2
Saluda River 4	1240	3
Broad River 1	1380	3
Saluda River 2	1597	3
Saluda River 3	1644	3
Broad River 4	1694	3
Chatooga River	1775	4
Broad River 2	2739	4
Broad River 3	2993	4
Wateree River 1	3643	4
Savannah River 4	3930	5
Catawba River 1	4507	5
Congaree River 1	5031	5
Catawba River 2	11811	5

Sources and Determination of Water Use Data

The water use data for this study was collected from various sources with the assistance of several State and Federal agencies. The source and determination of water use data for each stream segment was determined for each water use category as follows:

1)Industrial, Municipal, Agricultural, and Thermoelectric Power

The locations and amounts of water withdrawal for these uses were compiled from the Water Use Reporting Program files at the S.C. Water Resources Commission. All users withdrawing more than 100,000 gallons per day must report their total monthly use to the Commission in compliance with the Water Use and Coordination Act of 1982. Water use values for each use category were based on average water use (million gallons per day) reported for 1983.

2) Hydroelectric Power

Water use data for this category was also derived primarily from the Commission's Water Use Reporting Program files for 1983 and 1984. Water use data for hydropower facilities that are technically located in Georgia (on the Savannah River) or have not reported their use for 1983 and 1984, came from the 1980 water use report (Lonon and others, 1983). Water use was reported in million gallons per day. Since hydropower generation is dependent on inflow to the facility, use values were assigned to the segment in which the use occurs or to the major upstream segment if a stream segment terminated at a hydro-power impoundment. If more than one segment was a major contributor to flows, the percent of water use was allocated to each segment based on its contribution to total flow. The appropriate water use values were then assigned to those segments based on their adjusted water use contributions.

3) Wastewater Assimilation

Water use values for wastewater assimilation were based on the S.C. Department of Health and Environmental Control's Water Classification and Standards System. Under this system all freshwater streams are designated as one of three classes, B, A, or AA. Water quality standards and wastewater discharge treatment requirements are progressively more stringent with increasing classification from B to AA. Based on this management strategy and after consultation with the Department of Health and Environmental Control, it was assumed that streams with lower classifications were more readily used for waste-water assimilation than streams of higher use classifications. Therefore, streams used most extensively for wastewater assimilation would require greater flow protection to maintain that use without degrading water quality. Use classifications were identified for each stream segment, and water use values were assigned based on the following scale:

Class B - 5
Class A - 3
Class AA - 1

4) Other Instream Uses (Fishery, Navigation, Endangered and Threatened Species, Aesthetic and Ecological Characteristics)

Stream segments in which these uses occur were identified by the appropriate State and Federal agencies as follows:

Commercial Fishery	- S.C. Wildlife and Marine Resources Department
Recreational Fishery	- S.C. Wildlife and Marine Resources Department

Commercial Navigation	- U.S. Army Corps of Engineers
Recreational Navigation	- S.C. Water Resources Commission
Maintenance of Endangered and Threatened Species	- S.C. Wildlife and Marine Resources Department
Unique Aesthetic and Ecological Characteristics -	- S.C. Wildlife and Marine Resources Department, S.C. Department of Parks, Recreation and Tourism

These agencies were provided maps of the State and were requested to highlight segments supporting a particular use. From these maps, the uses were identified for each stream segment.

Water use values were assigned to each segment by ranking segments for each use category based on the average annual flow (cubic feet per second, cfs) and length (miles) of the segments. The multiple of the two, in units of cfs-miles, provided a measure of significance in that the larger the cfs-mile value, the greater the relative degree of use for each instream use category.

Current and Projected Water Use

As directed in the Joint Resolution, current and projected water use information was compiled for each priority stream segment. All current water use data is based on surface water withdrawals of 100,000 gallons per day or greater reported to the S.C. Water Resources Commission in compliance with the Water Use Reporting and Coordination Act of 1982. Four major categories of use were identified, 1) industrial

(self-supplied), 2) municipal (public supply for domestic, commercial, and industrial use), 3) agricultural (irrigation), and 4) thermoelectric power (cooling water). Current water use represents the average water use (million gallons per day; mgd) calculated for reported use during 1984.

Projected water use was determined for the years 1990 and 2000. Projected use was calculated for existing uses only and no additional types of use were predicted to occur on the stream segments. At best, projections are only a general estimate and are highly dependent on many factors including the economy, implementation of conservation practices, and population growth. Projected water use for the individual water use categories were based on trends noted by the Water Use Reporting Program and assumed a steady increase in the State's economy. Municipal water use was projected based on conversations with the individual public utilities. The following factors were used to project water use for the other categories:

Industrial use - 5 percent increase per 10 years.

Agricultural use - 20 percent increase per 10 years.

Thermoelectric use - 5 percent increase per 10 years.

RESULTS

Stream segments in South Carolina in greatest need of establishing minimum flow levels are presented in priority order in Table 4 and their location in the State is identified in Figure 1. The inclusion of a stream segment on this list does not necessarily.. -indicate that instream use problems occur, but rather that the potential for such problems is greater for these streams than for most other streams in the State. As Figure 1 indicates, priority segments are located throughout the State with seven segments occurring in the Coastal Plain, seven occurring in the Piedmont region, and one in the Blue Ridge (mountain) region. Current and projected water use data are summarized in Table 5 for each stream segment.

Table 4. Priority ranking of stream segments in South Carolina for which minimum flow levels need to be established.

Ranking	Segment Name	Overall Rating Value
1	Whippy Swamp	625
2	Waccamaw River 1	336
3	Black Mingo Creek	230
4	Saluda River 1	207
5	Coosawhatchie River 1	88.0
6	Wateree River 1	35.7
7	Saluda River 4	27.0
8	Jeffries Creek	25.9
9	Wateree River 2	20.7
10	Catawba River 2	15.5
11	Combahee River	13.2
12	Sparrow Swamp	11.6
13	Saluda River 2	10.5
14	Broad River 2	9.5
15	South Saluda River	7.6

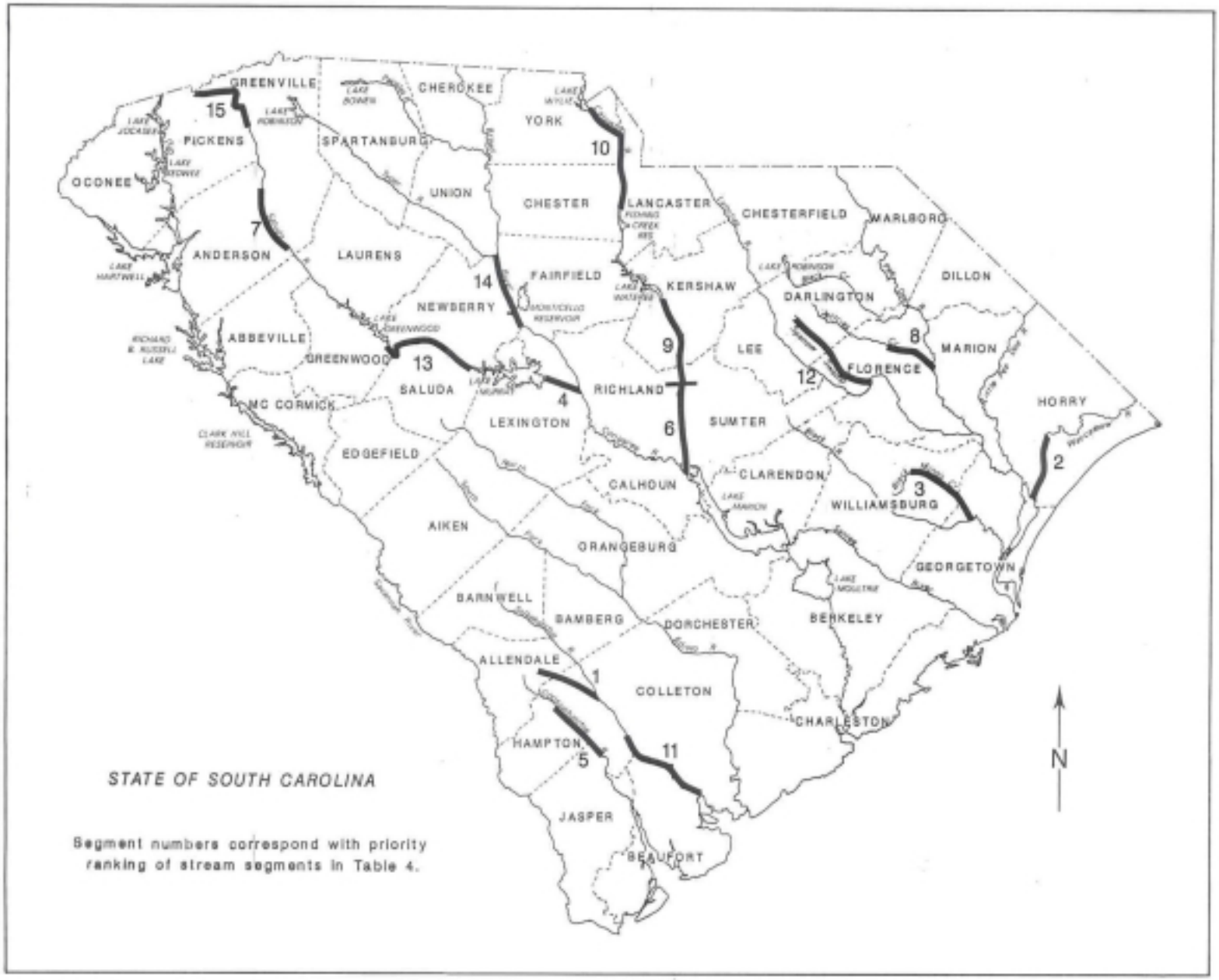

Figure 1. Location of priority stream segments in South Carolina for which minimum flow levels need to be established.

Table 5.Current and projected water use for priority stream segments for which minimum flow levels need to be established.

Segment Name	Types Use	Water Use (mid) 1984	1990	2000
Whippy Swamp	Agr	3.91	4.30	5.16
Waccamaw River 1	Thermo	91.85.	94.2	98.8
Black Mingo Creek	NW	-	-	-
Saluda River 1	Ind	27.91	28.6	30.0
Coosawhatchie River 1	NW	-	-	-
Wateree River 1	Ind	4.32	4.43	4.65
	Thermo	424.38	435	457
	Total	428.70	439.43	461.65
Saluda River 4	Mun	2.02	3.0	4.0
	Thermo	74.08	75.9	79.7
	Total	76.10	78.9	83.7
Jeffries Creek	NW	-	-	-
Wateree River 2	Ind	1.69	1.73	1.82
Catawba River 2	Ind	45.84	47.0	49.4
	Mun	6.09	0.0	0.0
	Age	0.07	0.08	0.1
	Total	52.00	47.08	49.5
Combahee River	NW	-	-	-
Sparrow Swamp	Agr	0.16	0.18	0.22
Saluda River 2	Mua	2.75	4.5	7.0
Broad River 2	Thermo	1.88	1.9	2.0
South Saluda River	NW	-	-	-

a Ind = Industrial, Mun = Municipal, Agr a Agricultural,

Thermo = Thermoelectric Power, NW = no existing water withdrawals.

DISCUSSION

Water use conflicts due to low flows can occur on streams located throughout South Carolina (Figure 1). While the identification of these stream segments does not necessarily indicate that they exhibit instream flow problems, flow related problems have been reported on several of the segments. Excessive withdrawals from Whippy Swamp for agricultural irrigation have caused extreme low-flow conditions and adversely impacted navigation, aquatic habitat, and withdrawals downstream. Regulated releases from hydroelectric power facilities on the Catawba and Wateree Rivers limit the assimilative capacity of these streams and restrict some water withdrawals during periods of no or low discharge from the hydropower plants. Similar regulated releases-on the Saluda River below Lake Greenwood restrict recreational navigation activities and reduce -available aquatic habitat during controled low flows.

Stream segments identified in Table 4 are important in that they are potentially more suseptible to instream flow conflicts than most other streams in the State. However, while these priority streams are an important first step in addressing the protection of instream uses, protection measures can not be limited to these 15 segments alone, as if they are isolated from the rest of South Carolina's river system. By the very nature of flowing waters, actions which affect flows in any single segment will also affect flows downstream. Consumption of flows in small headwater streams may not greatly impact uses on each individual stream, but the cumulative loss of water from several small streams may severely impact flows and flow dependent uses in larger downstream segments.

In addition, some instream interests, such as recreational fisheries and water quality, are important in virtually all streams in the State. Therefore, in order to provide adequate long term protection of instream uses and interests, a statewide approach to manage flows in all streams, regardless of size, must be considered.

In the second phase of the Instream Flow Study, the streams identified in this report will be individually studied in more detail to determine minimum flow levels that will adequately assure the "continued viability" of recognized uses within their channels. In addition, existing methods for determining instream flow needs will be tested and a procedure will be developed for determining minimum instream flows for streams in South Carolina. The results of Phase II will be presented in a final report to be completed by January 1987.

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APPENDIX

Joint Resolution (R115, H2549)

(R 115. 112549)
A JOINT RESOLUTION TO REQUIRE THE SOUTH CAROLINA WATER RESOURCES COMMISSION TO IDENTIFY AND LIST THE STREAMS AND WATERCOURSES OF THE STATE FOR WHICH MINIMUM FLOW LEVELS NEED TO BE ESTABLISHED AND PREPARE PROPOSED STREAMFLOW STANDARDS.

Be it enacted by the General Assembly of the State of South Carolina:

Legislative findings

SECTION 1. The General Assembly finds:
(a) A substantial increase has occurred in the number of significant withdrawals of water from the various streams and watercourses of this State.
(b) These withdrawals, if continued without due regard for their cumulative effect on streamflows, could adversely affect, to a serious and significant degree uses dependant upon those streams and watercourses, including fish and wildlife resources, recreation, water quality, hydropower generation, aesthetics, navigation, and ecosystem maintenance.
(c) Fish and wildlife resources, recreation, water quality, hydropower generation, aesthetics, navigation, ecosystem maintenance, agriculture, and other concerns are individually and collectively linked to the continued economic well-being of industries, the health, safely, and welfare of all South Carolinians, and the general attractiveness of South Carolina for future development.
(d) As greater demands are placed upon South Carolina's water resources to meet off-stream uses such as industrial, agricultural, and domestic water supply, the effects upon and need for protection of in-stream uses of water identified hereinabove will increase.

Commission must Identify and list streams and water courses

SECTION 2. The South Carolina Water Resources Commission must identify and list those streams and watercourses throughout the State for which minimum flow levels need to be established in order to assure the continued viability of stream-related use as identified in Section 1. In determining the the criteria to be used to identify the above streams, the Commission must consult with the Wildlife and Marine Resources Department, the Department of Health and Environmental Control, the Department of Parks, Recreation and Tourism, the Department of Agriculture, the State Development Board, the Coastal Council, and with all affected state and local governments. The Commission must include this identification list those streams and watercourses the Commission determines are significant, along with a statement of findings as to why that stream or watercourse was selected. The identification list required by this section must rank the streams and watercourses beginning with those in which the need for establishing minimum flow levels is the greatest. The Commission must compile information for each watercourse as to current and projected water use. The Commission, in its discretion, may revise the list and may add or delete streams or watercourses as circumstances require following notice of such proposed action by publication in a newspaper of general circulation in the affected area. The initial identification list required by this section must be completed no later than January 1, 1985.

Streamflow standards

SECTION 3. The Commission must prepare proposed streamflow standards for each stream or watercourse determined to have a significant need for regulation. In developing the standards for each stream the Director must consult with those governmental entities identified in Section 2. The Commission must also consult with any private individuals, groups, or organizations as deemed advisable by tile Commission. The Commission must complete the preparation of proposed standards for all streams on the initial identification list no later than January 1, 1987.

Time effective

SECTION 4. This act shall take effect upon approval by the Governor.

In the Senate House the 24th day of May
In the Year of Our Lord One Thousand Nine Hundred and Eighty Three
Michael R. Daniel.
President of the Senate
Ramon Schwartz. Jr.,
Speaker of the House of Representatives

Approved the 26th day of May, 1983

Richard W. Riley