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SOUTHERN COMPANY
Energy to Serve Your World℠

April 25, 2001

Docket Nos. 50-321
50-366

HL-6077

Andrew J. Kugler
Environmental Project Manager
U.S. NRC
Mail Stop O-11F1
Washington, DC 20555

Edwin I. Hatch Nuclear Plant
Additional Information for Draft NUREG-1437, Generic Environmental
Impact Statement for License Renewal of Nuclear Plants, Supplement 4
(65 Federal Register 67418 dated November 9, 2000)

Ladies and Gentlemen:

Southern Nuclear Operating Company (SNC) is providing staff requested additional information presented in the March 22, 2001 meeting with the NRC, National Marine and Fisheries Services and U. S. Fish and Wildlife Services. The information addresses questions raised on the draft NUREG-1437, Supplement 4, for Edwin I. Hatch Nuclear Plant, Units 1 and 2, published in 65 Federal Register page 67418, dated November 9, 2000. In addition, SNC has offered to participate in the Shortnose Sturgeon Recovery Team for the Altamaha River and has agreed to include a description of the shortnose sturgeon in plant training for the intake structure screen operation.

If you have any questions regarding this information, please contact this office.

Respectfully submitted,

Lewis Sumner

H. L. Sumner, Jr.

HLS/JTD

Enclosure 1 Biological Information Update (slide presentation)
Enclosure 2 Biological Information Update for USNRC
Edwin I. Hatch Nuclear Plant License Renewal

A083

cc: Southern Nuclear Operating Company
Mr. P. H. Wells, Nuclear Plant General Manager
Mr. C. R. Pierce, License Renewal Services Manager
SNC Document Management (R-Type A02.001)

U. S. Nuclear Regulatory Commission, Washington, D.C.
Mr. C. I. Grimes, Branch Chief, License Renewal and Standardization Branch
Mr. L. N. Olshan, Project Manager - Hatch
Mr. W. F. Burton, Project Manager - Hatch License Renewal
Ms. Brenda J. Shelton, Chief, Information and Records Management Branch

U. S. Nuclear Regulatory Commission, Region II
Mr. L. A. Reyes, Regional Administrator
Mr. J. T. Munday, Senior Resident Inspector – Hatch

Biological Information Update

March 22, 2001

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Points of discussion

- Update previous submitted information
- Review existing information
- Visit intake and discharge structure

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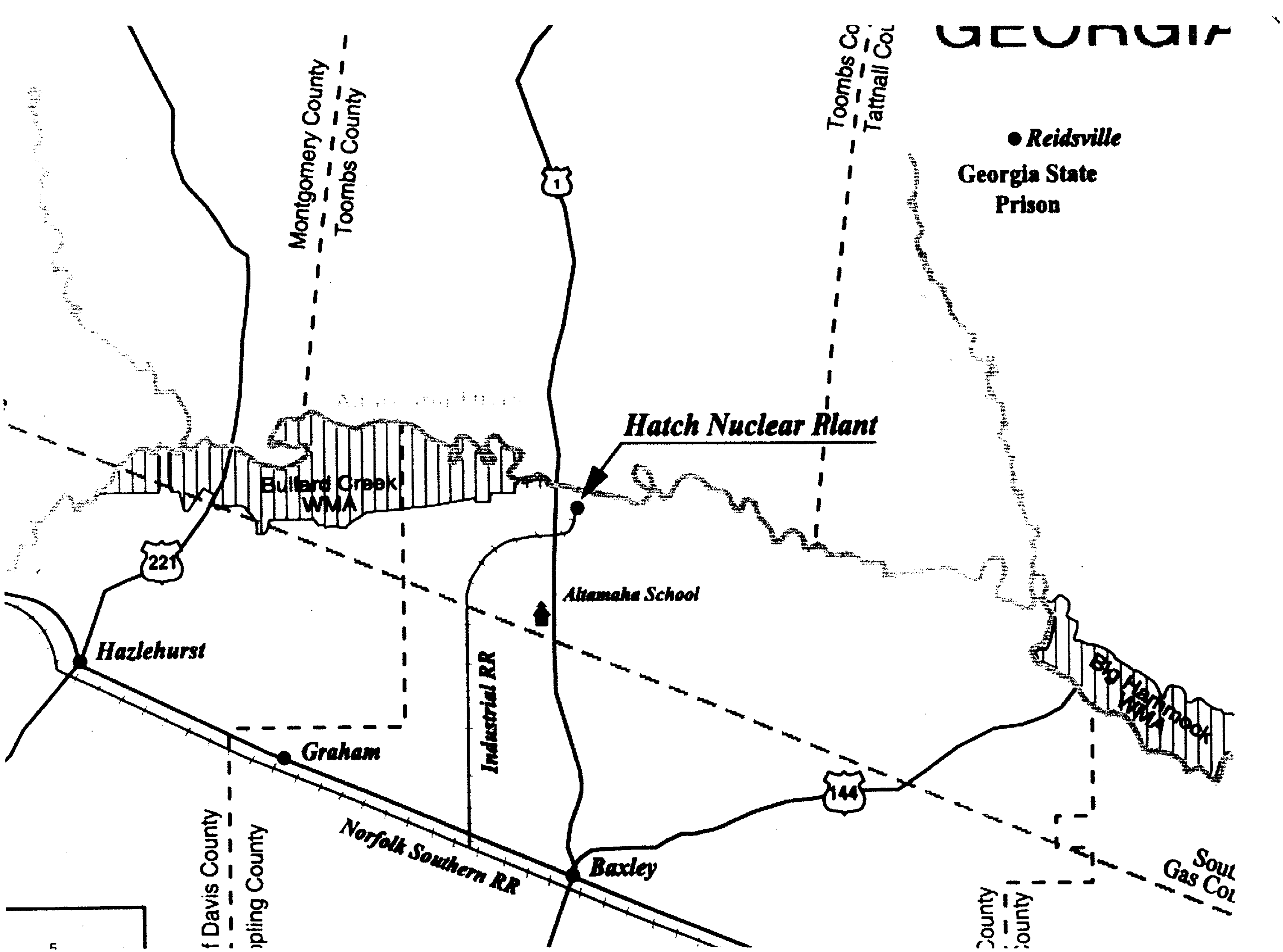

GEORGIA
Reidsville
Georgia State
Prison
Montgomery County
Toombs County
Hatch Nuclear Plant
Bullard Creek
WMA
221
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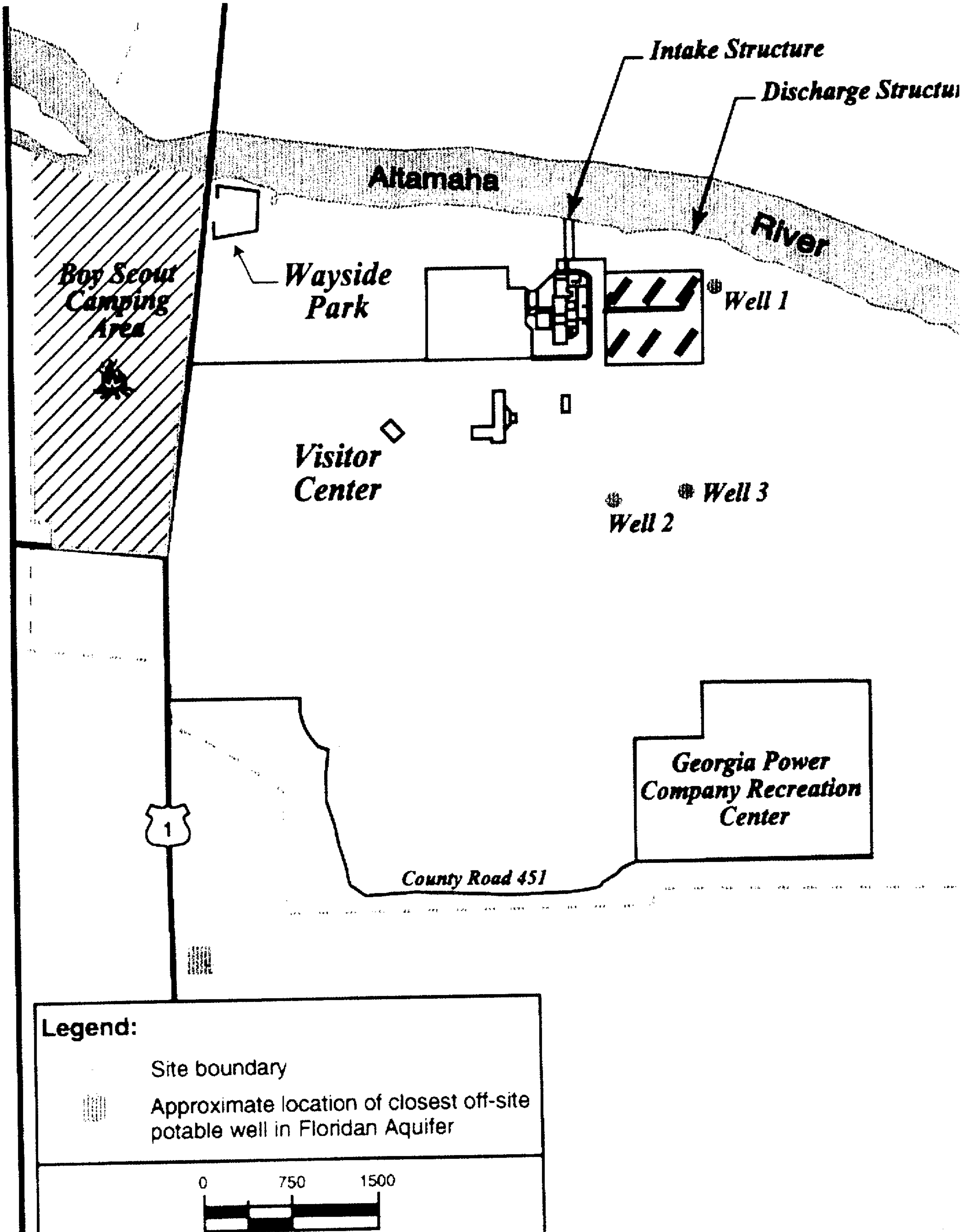
Altamaha School
Hazlehurst
Graham
Industrial RR
Norfolk Southern RR
Baxley
144
Big Hammock
WMA
Davis County
Appling County



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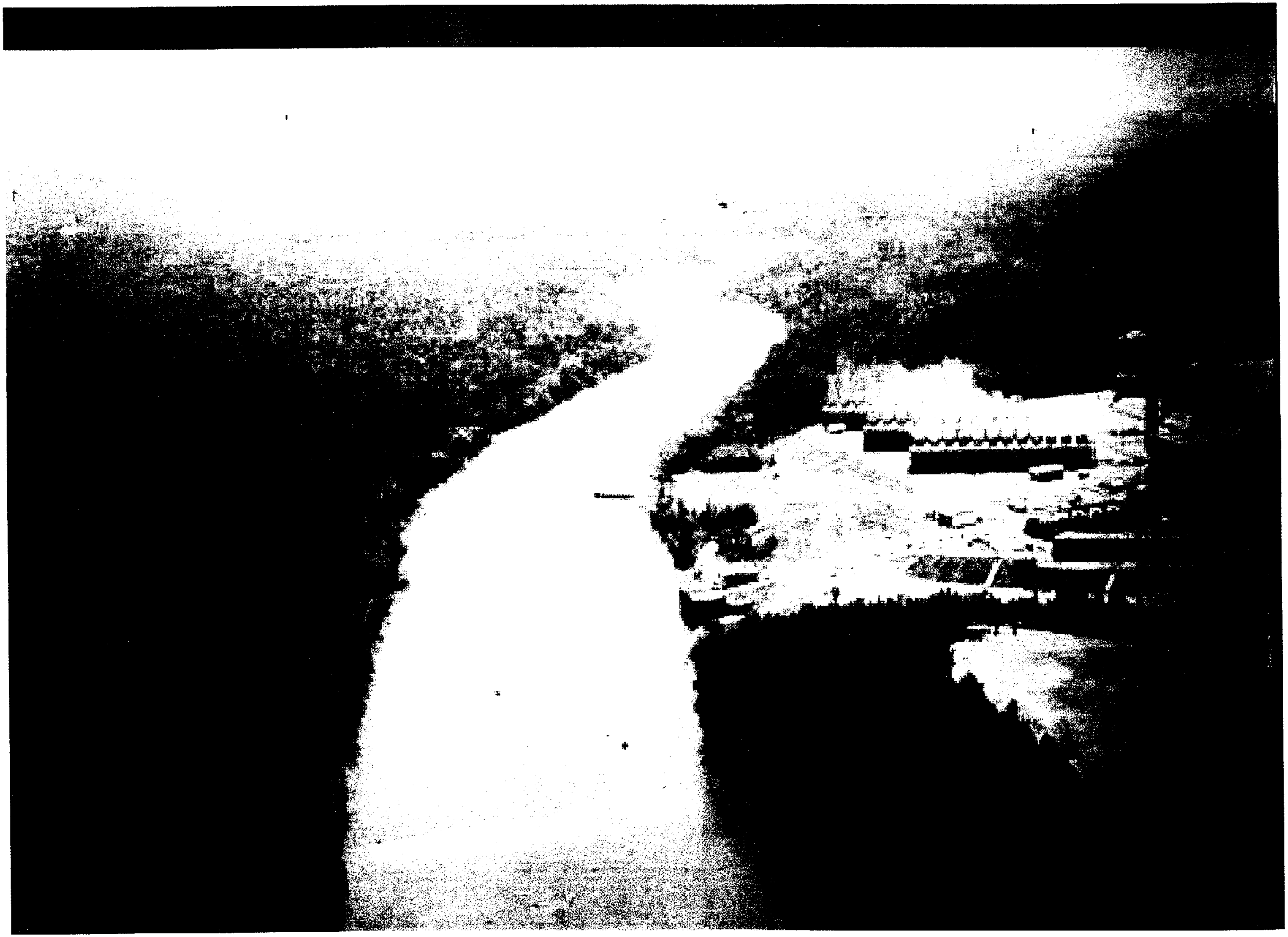

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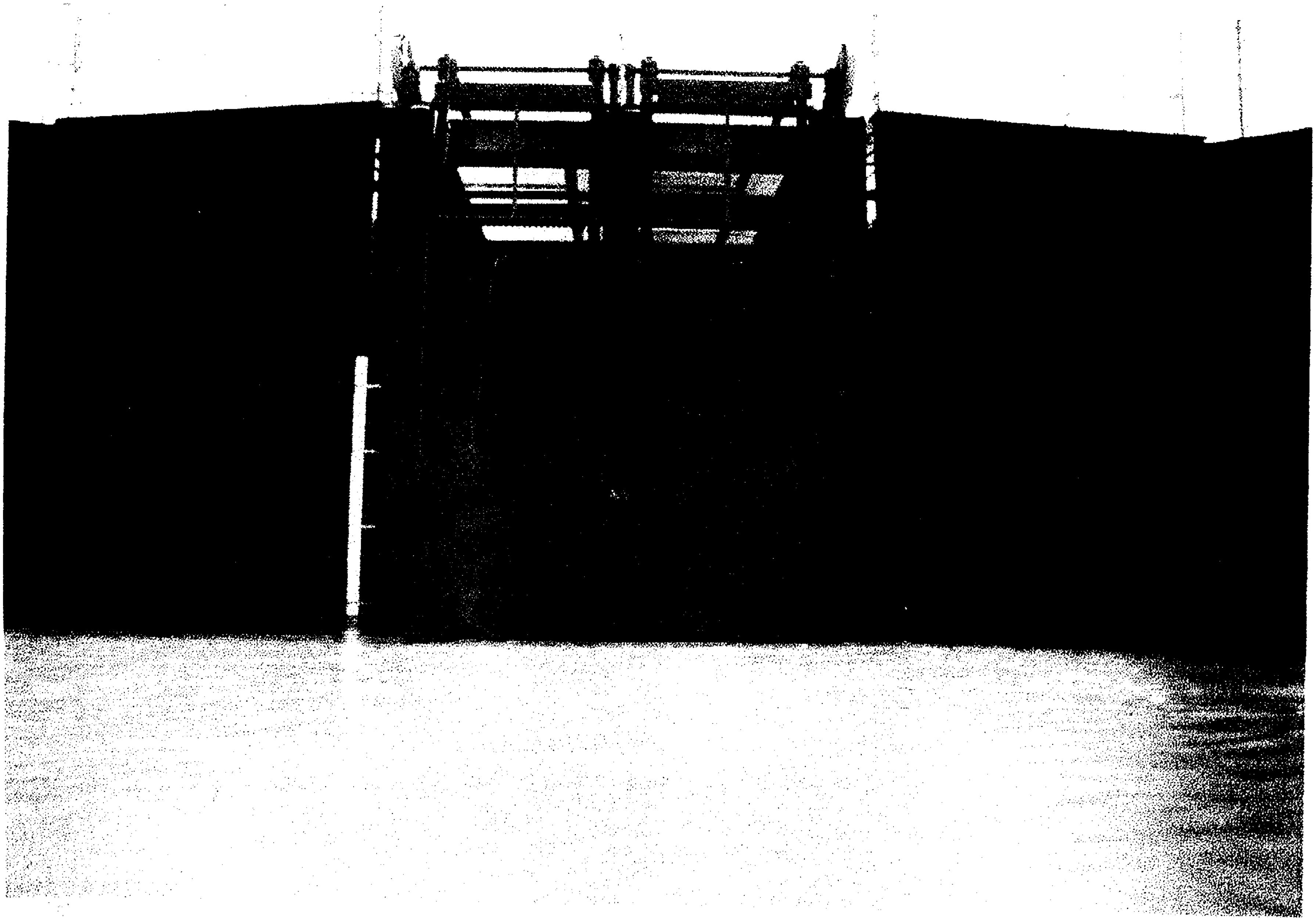

Intake structure velocities

- Intake velocities were calculated using 100 cfs pumping capacity and the cross section of the intake structure.

$$V = \frac{Q}{Area} \ ft/\sec$$

- Q = pumping rate in cubic feet per second
- Area = cross section area of intake

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Intake velocities at specified river elevations, 2 unit operation

Velocity = Q/A

Pump data from Table 3-2 HNP surface water use, 1989-1997

Average	57.2 MGD	Maximum	85.31 MGD
	89 cfs		132 cfs

River Elevation	Velocity fps	Velocity fps
62	0.80	1.20
62.4	0.75	1.12
63	0.69	1.03
64	0.60	0.90
65	0.54	0.80
66	0.48	0.72
67	0.44	0.65
68	0.40	0.60
69	0.37	0.55
70	0.34	0.51
71	0.32	0.48
72	0.30	0.45
73	0.28	0.42
74	0.27	0.40
75	0.25	0.38
76	0.24	0.36
76.25	0.24	0.36

Measured versus predicted intake velocities

Date 3/19/01

Depth from surface (feet)	Intake 1A Velocity (feet/sec)	Intake 2A Velocity (feet/sec)
3	0.22	0.45
6	-0.16	0.76
9	-0.22	-0.80
12	-0.17	-0.77
15	0.20	-0.20
18	0.54	0.56

River Stage	76.25 feet	
Pump Rate	36.8 thousand gallon/minute	
	53 MGD	
Average Measured		0.03 feet / sec
Standard Approach Velocity		0.22 feet / sec

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Historic Data

- Adult fish collection
- Juvenile fish collection
- Drift surveys
- Impingement collection
- Thermal Plume surveys

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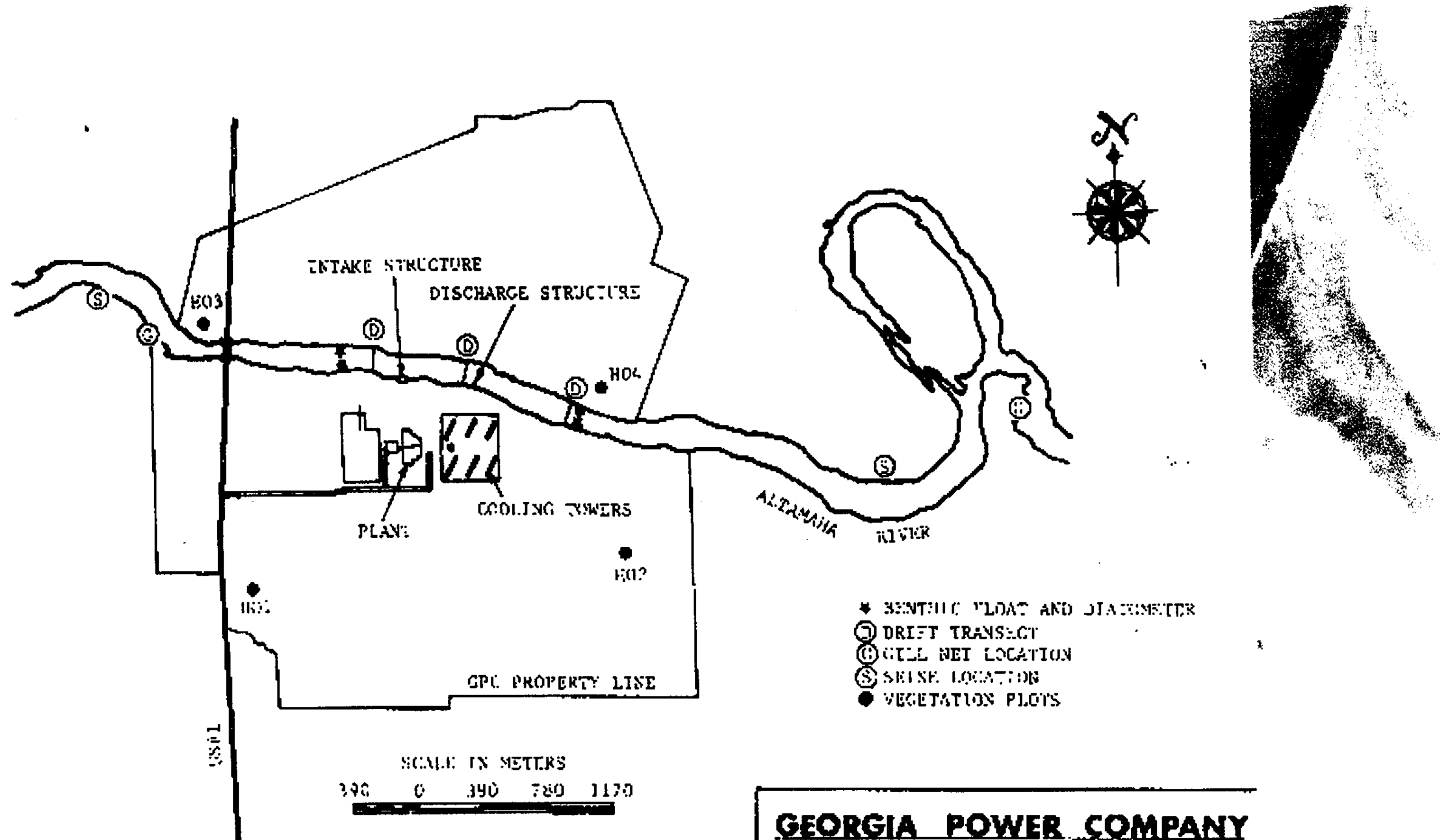

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EDWIN I. HATCH NUCLEAR PLANT
ANNUAL REPORT 1976

LOCATION OF BIOLOGICAL
MONITORING STATIONS DURING 1976

FIGURE 4.3-1

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Fish Collections

- Adult fish collected 1972 to 1976
- Consisted of 18 collection periods
- River Mile 113.4 (downstream) and RM 117.4 (upstream)
- Four 200x8 foot monofiliment gill nets (2, 3, 4, and 5 inch stretched mesh)
- 12 hour sets
- Supplemented by electrofishing

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Fish Collections

- Juvenile fish collected 1974-1976
- 14 collection periods, primarily April - Sept.
- 100 foot 0.25 inch bar mesh seine
- Above and below Plant Hatch

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Drift Collections

- Preoperational
  - Weekly February-May, 1973, every 6 weeks June-Dec, 1973
  - Weekly February-June, 1974
- Unit 1 operation
  - Weekly February- June, 1975
- Unit 1 and 2 operation
  - monthly in 1979 and 1980

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Entrainment

- Calculated from density of drift, river discharge, and pumped volume
- All drift densities combined because of low numbers

$$Entrainment_{month} = \frac{VolumePumped_{month}}{RiverVolume_{month}} \cdot Density_{month} * RiverVolume_{month}$$

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Impingement Collections

- Used 3/8 inch basket to collect all backwash for 24 hours
- Weekly collections 1975, 1976, and 1977
- Monthly collections 1979 and 1980

Temperature Monitoring

- Continuous monitoring in mixing zone for 1975, 1976, 1978, and 1979.
- Weekly surveys of intake, mixing chamber, downstream edge of mixing zone during 1977, 1978, 1979, 1980.

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Thermal Plume Modeling

- Verification surveys in 1976 (7), 1977 (2), 1979 (3), 1980 (12).
- In some cases, surveys conducted when conditions not appropriate for model verification:
  - only one set of cooling towers discharging
  - no measurable thermal discharge
  - extent of plume not definable due to solar heating of sandbar

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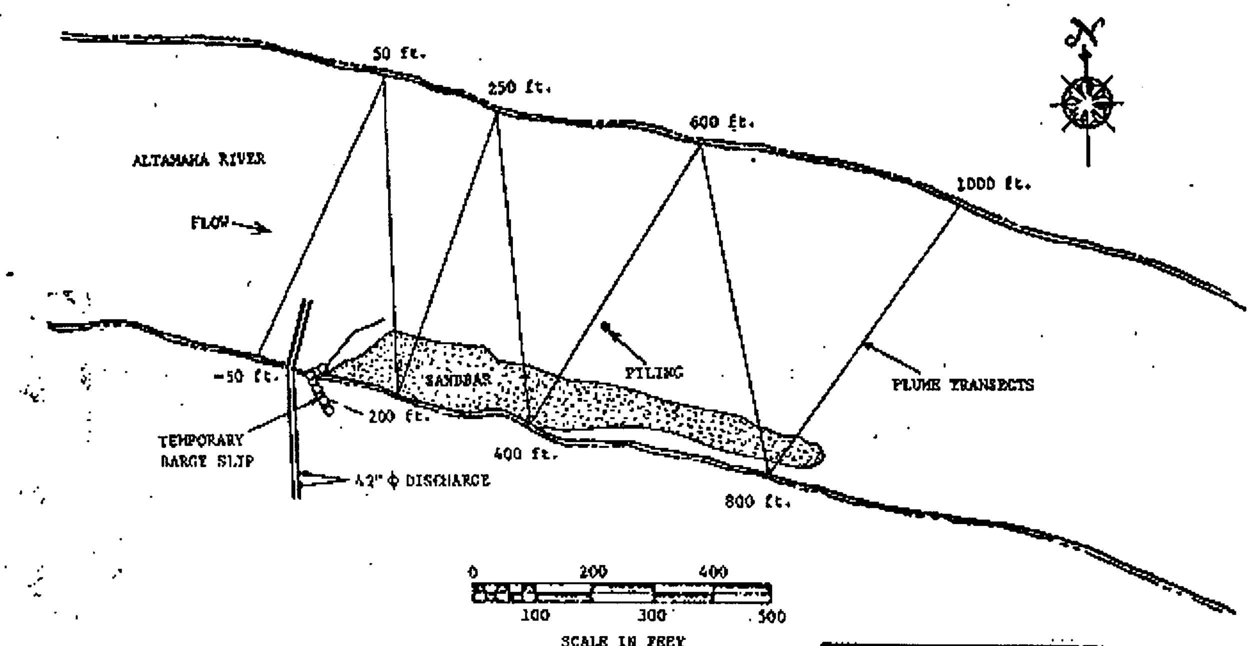

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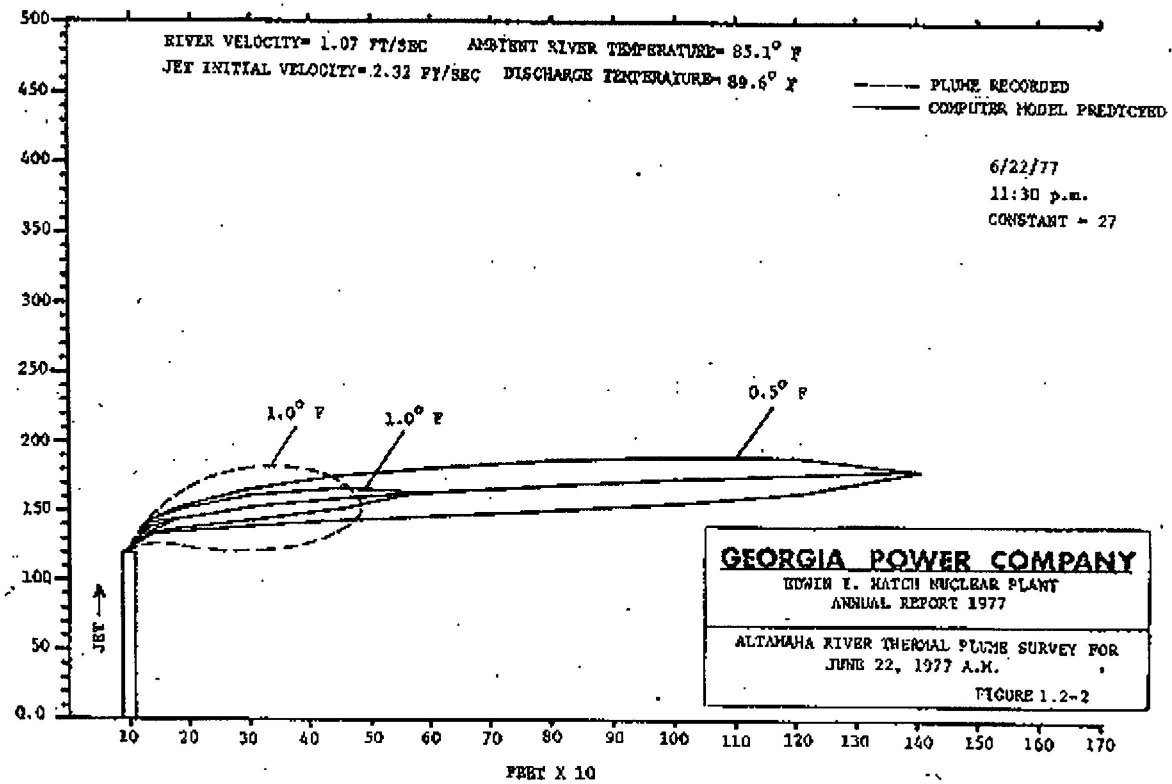
EDWIN I. HATCH NUCLEAR PLANT
ANNUAL REPORT 1977

ALTAMAHA RIVER
THERMAL PLUME TRANSECTS

FIGURE 1.2-1



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EDWIN I. HATCH NUCLEAR PLANT
ANNUAL REPORT 1977

ALTAMAHA RIVER THERMAL PLUME SURVEY FOR
JUNE 22, 1977 A.M.

FIGURE 1.2-2

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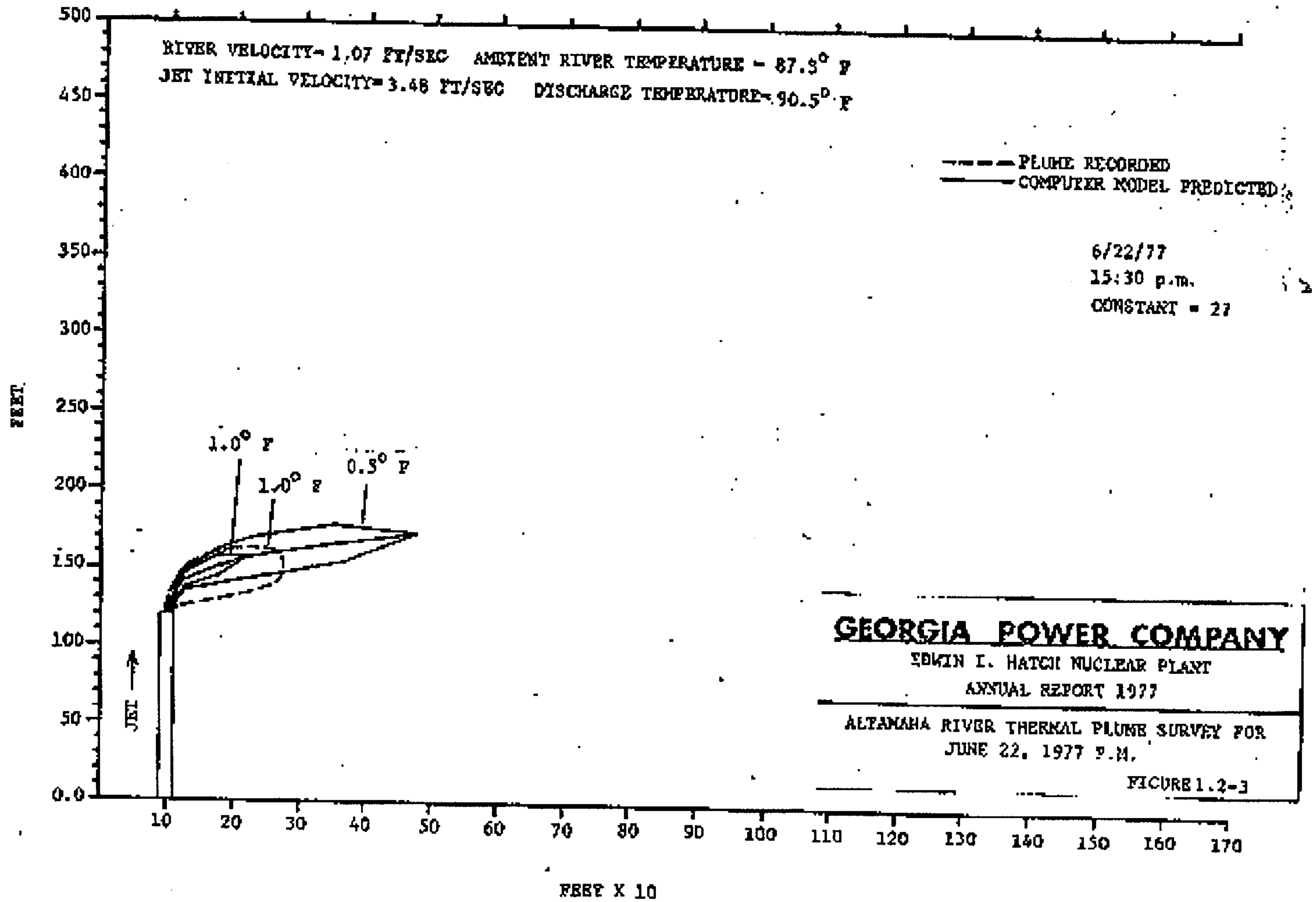

GEORGIA POWER
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Biological Information Update for USNRC
Edwin I Hatch Nuclear Plant
License Renewal

Prepared by:

J. T. Davis, Southern Nuclear

M. C. Nichols, Georgia Power

A. S. Hendricks, Georgia Power

T. C. Moorer, Southern Nuclear

March 30, 2001

Table of Contents

Biological Information Update
03/30/01

I. INTRODUCTION

The purpose of this report is to provide additional information concerning Edwin I. Hatch Nuclear Plant addressing concerns raised by U. S. National Marine Fisheries Service concerning the impacts of continued operation in relation to the shortnose sturgeon (*Acipenser brevirostrum*) and concerns raised by U. S. Fish and Wildlife Service regarding the impact of continued operation on the resident fish community. This information is provided as part of the informal consultation undertaken as part of the license renewal process. The report summarizes plant information and existing data and discusses the consequences of the proposed action.

II. PROPOSED ACTION

The proposed action is the renewal of existing NRC operating licenses for Edwin I. Hatch Nuclear Plant Units 1 and 2, which are operated in accordance with NRC operating licenses NPF-5 and DPR-57, respectively. HNP Unit 1 began commercial operation December 31, 1974, and is licensed to operate through August 6, 2014. HNP Unit 2 began commercial operation September 5, 1979, and is licensed to operate through June 13, 2018. NRC regulations (10 CFR Part 54) allow license renewal for periods of up to 20 years, which would extend the operation of Unit 1 through August 6, 2034 and extend the operation of Unit 2 through June 13, 2038.

III. SITE DESCRIPTION

A. General Plant Information

The Edwin I. Hatch Nuclear Plant (HNP) is a steam-electric generating facility operated by Southern Nuclear Operating Company (SNC). The Plant is located in Appling County, Georgia, at river kilometer (rkm) 180, slightly southeast of the U.S. Highway 1 crossing of the Altamaha River. It is approximately 11 miles north of Baxley, Georgia; 98 miles southeast of Macon, Georgia; 73 miles northwest of Brunswick, Georgia; and 67 miles southwest of Savannah, Georgia. The Universal Transverse Mercator coordinates of the Unit 2 reactor (to the nearest 100 meters) are Zone 17R LF 3,533,700 meters North and 372,900 meters east. These coordinates correspond to latitude 31 degrees, 56 minutes, and 4 seconds North and longitude 82 degrees, 20 minutes, and 39 seconds west. Figures V-1 and V-2 illustrate the HNP location.

The HNP is a two-unit plant. Each unit is equipped with a General Electric Nuclear Steam Supply System that utilizes a boiling-water reactor with a Mark I containment design. Both units were originally rated at 2,436 megawatt-thermal and designed for a power level corresponding to approximately 2,537 megawatt-thermal. Both units are now licensed for 2,763 megawatt-thermal (63 FR 53473-53478, October 5, 1998).

The Plant uses a closed-loop system for main condenser cooling that withdraws from and discharges to the Altamaha River via shoreline intake and offshore discharge structures. Descriptions of HNP can be found in documentation submitted to U.S. Nuclear Regulatory Commission (NRC) for the original operating license and subsequent license amendments. Georgia Power Company (GPC) submitted environmental reports for the construction stage and operating license stage for HNP in 1971 and 1976, respectively (References 2 and 3). In 1972, the Atomic Energy Commission (AEC)[1] issued a Final Environmental Statement (FES) for Units 1 and 2 (Reference 4), and in 1978 issued a FES for Unit 2 (Reference 5). The FESs evaluates the environmental impacts from plant construction and operation in accordance with the National Environmental Policy Act (NEPA).

The property at the HNP site totals approximately 2,240 acres and is characterized by low, rolling sandy hills that are predominantly forested. A property plan is shown in Figure V-3. Figure V-4 provides a more detailed site plan. The property includes approximately 900 acres north of the Altamaha River in Toombs County and approximately 1,340 acres south of the River in Appling County. All industrial facilities associated with the site are located in Appling County. The restricted area, which comprises the reactors, containment buildings, switchyard, cooling tower area and associated facilities, is approximately 300acres (Figure V-4). Approximately 1,600 acres are managed for timber production and wildlife habitat.

B. Surface Water Use

The evaluation of surface water use in the FES concluded that the consumptive losses would be approximately 46 percent of the total water withdrawn from the River. In NRC's environmental assessment for an extended power uprate (Volume 63 Number 192 FR pages 53473-53478, at page 53474), NRC concluded that the necessary increase in makeup water to support the higher heat load would be insignificant and that cooling tower blowdown would decrease by approximately 626 gallons per minute (1.4 cfs). As evaluated by NRC, consumptive water use for the plant operating at the extended power level is expected to be 57 percent of the total withdrawal (Reference 7) yielding an average total return flow of 19,388 gallons per minute (27.9 million gallons per day or 43 cfs).

C. Intake structure

For both Units 1 and 2, cooling tower makeup water is withdrawn from the Altamaha River through a single intake structure. The Altamaha River is the major source of water for the plant. Water is withdrawn from the river to provide cooling for certain once-through loads and makeup water to the cooling towers. SNC is permitted (GADNR Permit 001-0690-01) to withdraw a monthly average of up to 85 million gallons per day with a maximum 24-hour rate of up to 103.6 million gallons. As a condition of this permit, SNC is required to monitor and report withdrawals. Table

---

[1]. Predecessor agency to NRC.

III-1 provides the annual average daily withdrawal and the maximum daily withdrawal for the years 1989 through 1997. As shown in Table III-1, HNP withdraws an annual average of 57.18 million gallons per day (88 cfs).

The intake structure is located along the southern shoreline of the Altamaha River (Figure V-3) and is positioned so that water is available to the plant at both minimum flow and probable flood conditions. The main river channel is located closer to the northern shoreline. The intake is approximately 150 feet long, 60 feet wide, and the roof is approximately 60 feet above the water surface at normal river level. The water passage entrance for the combined bays is 18.35 feet wide and extends from 16 feet below to 33 feet above normal water levels. Trash racks remove large debris, while small debris is removed by vertical traveling screens with a 3/8 inch mesh. Small debris is removed from the vertical traveling screens by periodically backwashing the screens, the backwash returned to the river downstream of the intake structure.

Standard approach velocities for the intake structure are calculated by dividing the intake flow rate by the intake cross section area (Reference 35). The approach velocities are calculated as a function of river elevation. Standard approach velocities using 57.2 MGD (88 cfs), the average withdrawal rate for 1989 through 1997 (see Table III-1), are presented in Table III-2. In addition, the through screen velocities, estimated by dividing the pumping rate by the screen open area, are also provided. Two low flow estimates were used in previous evaluations of intake flow velocities: a 900 cfs extrapolated low flow; and a 1200 cfs historical low flow (Reference 4). A through screen velocity of 1.9 feet per second occurs under the extrapolated low flow condition with a corresponding standard approach velocity estimated to be 0.8 feet per second. Under normal river elevation (71.5 feet) and the average pumping rate (88 cfs) the standard approach velocity is estimated to be 0.31 feet per second. The range of intake velocities for the average pumping rate (88 cfs) is from 0.28 feet per second at flood stage (river elevation 73 feet) to 0.75 feet per second at the historic low flow of 1200 cfs (river elevation 62.4 feet).

Table III-1. HNP surface water use 1989-1997.

Year	Average Daily Withdrawal (MGD)[a]	Maximum Daily Withdrawal (MGD)[a]	Average Daily Loss From Evaporation (MGD)[b]
1989	55.48	70.43	31.62
1990	56.88	80.50	32.42
1991	56.94	81.40	32.46
1992	58.02	82.73	33.07
1993	58.74	85.31	33.48
1994	57.30	83.61	32.66
1995	59.29	78.23	33.80
1996	57.07	78.03	32.53
1997	54.93	75.02	31.31
Average	57.18		32.59

MGD = million gallons per day.

Table III-2. Approach velocity and screen velocity as a function of river elevation.

River Elevation ft	Approach Velocity fps	Screen Velocity fps
62	0.80	1.87
62.4	0.75	1.75
63	0.69	1.60
64	0.60	1.40
65	0.54	1.25
66	0.48	1.12
67	0.44	1.02
68	0.40	0.93
69	0.37	0.86
70	0.34	0.80
71	0.32	0.75
71.5	0.31	0.72
72	0.30	0.70
73	0.28	0.66
74	0.27	0.62
75	0.25	0.59
76	0.24	0.56
77	0.24	0.55

Pump data from Table III-1 HNP surface water use, 1989-1997 based on 57.2 MGD (88 cfs)
Extrapolated low flow 900 cfs at river elevation of 62 feet.
Historic low flow 1200 cfs at river elevation of 62.4 feet.

D. Heat Dissipation System and Discharge Structure

Cooling water flowing through the condensers and the service water system absorbs the excess heat produced by HNP's two nuclear units. Main condenser cooling is provided by mechanical draft cooling towers. Each HNP circulating water system is a closed-loop cooling system that utilizes three (Reference 3) cross-flow and one counter-flow mechanical-draft cooling towers for dissipating waste heat to the atmosphere.

Water is returned to the Altamaha River via a submerged discharge structure that consists of two 42-inch lines extending approximately 120 feet out from the shore at an elevation of 54 feet mean sea level. The point of discharge is approximately 1,260 feet down-river from the intake structure and approximately 4 feet below the surface when the river is at its lowest level (Figure V-3).

The National Pollutant Discharge Elimination System (NPDES) Permit for HNP (GA0004120) issued by the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (GA DNR) in 1997 requires weekly monitoring of discharge temperatures, but does not stipulate a maximum discharge temperature or maximum temperature rise across the condenser. Maximum discharge temperatures measured at the mixing box, which are reported to EPD on a quarterly basis, range from 62°F in winter to 94°F in summer (see Table III-3).

To control biofouling of cooling system components such as condenser tubes and cooling towers, an oxidizing biocide (typically sodium hypochlorite or sodium bromide) is injected into the system as needed to maintain a concentration of free oxidant sufficient to kill most microbial organisms and algae. Historically when the system was being treated, blowdown was secured to prevent the discharge of residual oxidant into the river. After biocide addition, water was recirculated within the system until residual oxidant levels are below discharge limits specified in the NPDES permit (GA0004120). In 1999, a dechlorination system was added which allows chemical treatment without isolation of blowdown.

Table III-3. HNP 1997-1998 Weekly Discharge Temperatures.

		Unit 1		Unit 2	
Month/Year		Average discharge temperature (°F)	Maximum discharge temperature (°F)	Average discharge temperature (°F)	Maximum discharge temperature (°F)
January	1997	63.0	68.0	63.8	67.0
February	1997	68.8	71.0	66.0	68.0
March	1997	71.6	79.0	70.0	80.0
April	1997	77.5	82.0	76.0	84.0
May	1997	78.3	85.0	78.3	86.0
June	1997	82.2	86.0	83.0	86.0
July	1997	88.0	91.0	87.5	90.0
August	1997	84.3	86.0	88.0	93.0
September	1997	84.6	88.0	86.6	86.6
October	1997	76.5	84.0	77.5	77.5
November	1997	62.3	68.0	62.0	62.0
December	1997	67.6	75.0	68.4	73.0
January	1998	61.8	69.0	62.7	69.0
February	1998	67.8	77.0	67.8	77.0
March	1998	71.4	77.0	71.0	77.0
April	1998	74.5	75.0	74.5	75.0
May	1998	83.8	89.0	81.8	86.0
June	1998	87.0	91.0	87.6	91.0
July	1998	89.8	92.0	90.3	92.0
August	1998	90.0	94.0	90.4	94.0
September	1998	87.5	89.0	85.0	91.0

Source: Reference 6.

E. Historic Temperature Data And Evaluations

The current NPDES permit conditions are based on extensive data collected during the period from 1975 through 1980 (References 27 through 33). During 1975, 1976, 1978, and 1979, continuous monitoring was performed from a piling located 500 feet downstream of the discharge at the end of the permitted mixing zone. Continuous monitoring showed that the permitted limits of 90°F or a delta T of 5 °F were met during all monitoring periods. Weekly surveys were also conducted to measure temperatures at the intake, mixing chamber, and downstream edge of the mixing zone and have been reported for the years 1977, 1978, 1979, and 1980. Weekly monitoring showed that the permitted limits of 90°F or a delta T of 5 °F were met during all monitoring periods.

The thermal discharge plume has been modeled using the Motz-Benedict model for horizontal jet discharges. The predictive thermal plume model was field verified over the period from 1976 through 1980 using 24 field surveys. These results were reported in the respective Annual Environmental Surveillance Reports (References 27 through 33). The surveys during 1980 followed commencement of Unit 2 operation and are typical of surveys reported earlier (Reference 33). Twelve thermal plume monitoring surveys were conducted during 1980 and compared to model predictions. During each of the twelve surveys, temperatures were taken at depths of one foot, three feet, and five feet. All temperatures measurements were made from a boat moving along a pre-selected transect in the river using a temperature probe and continuous recorder. Monitoring equipment was calibrated in the laboratory before each survey and rechecked in the field before and after each survey. The average projected fully mixed excess temperature under average summer conditions (average river flow of 3000 cfs, ΔT of 4.7 °F) is 0.09 °F (Reference 4). During the 1980 field surveys, the period of lowest river flow and greatest cooling tower heat rejection (3220 cfs, and ΔT of 4.5 °F, respectively) resulted in a fully mixed excess temperature of 0.05 °F. The NRC modeled average expected thermal conditions and extreme thermal conditions under conservative assumptions in the E. I. Hatch Unit 1 and 2 Environmental Impact Statement. They independently noted the small size of the thermal plume even under conservative assumptions, and the lack of the possibility of thermal blockage in the Altamaha River from the plant discharge (Reference 5).

F. Existing Fish Monitoring Data for Plant Hatch

Extensive monitoring data is available for the period prior to and immediately following commencement of operation. This section briefly describes the methods and results of previous studies conducted at Plant Hatch.

Preoperational drift surveys where conducted weekly from February through May in 1973, and every 6 weeks June through December 1973. In addition, weekly drift collections were made from February through June 1974. Samples were collected at four quadrates for transect above and below the plant intake and two locations close to the plant intake. Typical sample sets consisted of 14 individual samples from 15-minute collections. Drifting organisms were collected with a one-meter diameter 000-mesh nylon plankton net, set 6-12 inches above the river bottom. Samples were washed into a quart container and preserved with formalin.

Cataostomids, cyprinids, and centrarchids were the dominant ichthyoplanton families collected. Commercially important fish in these collections included *Alosa sapidissima* eggs, with mean densities approaching 0.3 per 1000 m3 in March. *Alosa sapidissima* larvae were present in drift samples from May through June, with the density never exceeding 0.03 individuals per 1000 m3. Two sturgeon larvae were collected during this sampling and sent to Dr. Donald Scott for identification of species, but could not be identified beyond the genus *Acipenser*. These were the only records of sturgeon larvae found in the vicinity of Plant Hatch.

Entrainment samples at Plant Edwin I. Hatch were collected for the years 1975, 1976, 1979 and 1980. Samples were collected weekly during 1975 and 1976, and monthly in 1979 and 1980. The results of these surveys are summarized in Table III-4.

Table III-4 Entrainment Sample Summary. Total number of fish larvae and eggs with percent composition.

Year	1974	1975	1976	1979	1980
Total Number Larvae	2562	1712	2793	151	442
	%	%	%	%	%
Aphredoderidae	2.11	2.98	1.11	-	5.89
Catostomidae	61.75	12.38	56.18	17.7	29
Centrarchidae	5.27	21.85	14.46	23.2	17.6
Clupeidae	5.23	2.39	2.54	1.3	10.19
Cyprinidae	13.66	37.21	18.65	48.4	29
Esocidae	1.33	0.53	0.11	0.7	1.4
Ictaluridae	0.16	11.57	0.29	2.7	6.6
Percidae	6.83	4.21	4.21	6	2.9
Other	0.12	1.05	1.05	-	1.8*
Unidentified	3.54	5.83	5.83	-	1.4

Total Number Eggs	258	258	1033	-	25
	%	%	%		%
Alosa sappidissima	51.2	52.7	86.16	-	44
Other	48.8	47.3	13.84	-	56

* Includes Belonidae (0.7%) and Soleidae (0.2%).

Monthly entrainment data for each taxon for 1975 and 1976 were used for Unit 1 entrainment estimates. The 1980 data were used for Unit 1 and Unit 2 operation entrainment estimates. Entrainment rates based on drift densities in the river have been low. The differences in entrained numbers of fish eggs and larvae are due to differences in species abundance from year to year, spawning activity upstream from the plant, river discharge, and time of year. The differences in hydrologic regime are apparent in Figure V-5, which provides daily discharge measured at USGS gauge 02225000, just upstream from the plant site.

It was noted in the Edwin I. Hatch Nuclear Plant Annual Environmental Surveillance Report No. 3, January 1 - December 31, 1976, (reference 29) that densities of fish and fish eggs during the spawning seasons in 1975, and 1976 fluctuated directly with spawning intensity and inversely with river flow. Discharge was greater in 1975 than in 1976 with the average discharge during the first five months 89% greater in 1975 than 1976. Similar conditions occurred during the 1979 and 1980 studies. Relative abundance of fish families varied during the five years of study, but the Catostomidae and Cyprinidae were the most abundant taxa each year. Clupeidae comprised only a small percentage of the total fish collected with 1980 being the highest (10.9%). The density of most fish groups was greater in night samples than in similar day samples. No sturgeon larvae were found in any entrainment samples.

The entrainment estimates assume a uniform distribution of fish eggs and larvae, while the cross section measurements suggest that the greater densities would occur in the channel furthest from the intake (See reference 34, Figure 9). Impingement data are available for five years, including 1975, 1976, 1977, 1979, and 1980. Impingement samples include weekly samples in 1975, 1976, and 1977 and monthly samples for 1979 and 1980. All backwashes were collected in a 3/8 inch mesh basket for at least a 24-hour period. The contents were removed and sorted, and any fish measured for length and weight and then preserved for identification if needed. Impingement data by week are available in references 27, 28, and 29. The highest number impinged per year, 61 fish, was in 1975, while the lowest, 14 fish, was in 1980. The data indicates low impingement estimates per day and per year. The 1975 estimates are 1.2 fish per day and 438 per year; 1976 estimates are .4 fish per day and 146 per ear; 1977 estimates are 1.1 fish per day and 401.5 per year; 1979 estimates are 1.3 fish per day and 474.5 per year; and 1980 estimates are 1.2 fish per day and 438 per year. The hogchoker, Trinectes maculatus, was the most abundant and the only species collected consistently each year. Most species were collected only once during the five years. No sturgeon was collected in impingement samples during five years of sampling. In addition, no adult sturgeon has been reported impinged by the intake structure during the operation of the plant.

Adult fish were sample quarterly from 1972 through 1976 to establish the fish species composition above and below the plant site. This data set includes 18 collection periods and consists of collections from river mile 113.4 (1 mile above the plant site, above the Highway 1 bridge) and river mile 117.4 (3 miles below the plant site, below the first downstream oxbow). The collections used four 200 by 8 foot monofiliment gill nets each with 2, 3, 4, and 5 inch stretched mesh set with the largest mesh adjacent to the channel and the smallest further from the channel. The gill nets where set in slower waters areas out of the main stream flow. The nets were set overnight. The number of individuals and percent composition by sampling period are reported in References 28, and 29 for 1975 and 1976, respectively. Reference 27 includes a summary of adult fish data from 1972 through 1974. No shortnose sturgeon was collected during this period. Additional information is available in these reports regarding annual landings of shad from the Altamaha River covering the period from 1964 through 1976. Annual landings from 1977 through 1980 are reported in references 29 through 33.

IV. STATUS REVIEW OF SHORTNOSE STURGEON

A. Life History

The shortnose sturgeon *Acipenser brevirostrum* is a member of the family Acipenseridae, a long-lived group of ancient anadromous and freshwater fishes. The species is currently known by at least 19 distinct population segments inhabiting Atlantic coast rivers from New Brunswick, Canada to northern Florida (Reference 15). Most shortnose sturgeon populations have their greatest abundance in the estuary of their respective river (Reference 14). The species is protected throughout its range.

The distribution of shortnose sturgeon strongly overlaps that of the Atlantic sturgeon, but life histories differ greatly between the two species. The Atlantic sturgeon is truly anadromous with adults and older juveniles spending large portions of their lives at sea. Shortnose sturgeon, however, are restricted to their natal streams. Shortnose sturgeon are not known to move among or between different river drainages (References 13 and 15).

Seasonal migration patterns and some aspects of spawning may be partially dependent on latitude. In northern rivers, shortnose sturgeon moves to estuaries in summer months. In southern rivers, movement to estuaries usually occurs in winter (Reference 15. Shortnose sturgeon spawn in freshwater like the Atlantic sturgeon, but then return to the estuaries and spend much of their lives near the fresh/salt water interface. Fresh tidewaters and oligohaline areas serve as nurseries for shortnose sturgeon (Reference 11). Availability of spawning and rearing habitats may be limited throughout the range of shortnose sturgeon (Reference 14).

Shortnose sturgeon exhibit faster growth in southern rivers but will reach larger adult size in northern rivers (Reference 15). Thus, shortnose sturgeon will reach sexual maturity (45-55 cm FL, (Reference 14)) at a younger age in southern rivers. Spawning by individual fish may only occur at intervals with frequencies of a few to several years. Dadswell et al. (Reference 16) composed a detailed summary of the known biology of shortnose sturgeon.

Rivers of the deep south are on the edge of the natural range of the shortnose sturgeon and present somewhat unique problems for the species. The majority of southern rivers and estuaries regularly reach temperatures unfavorable to shortnose sturgeon. Intolerant of saline environments and limited to riverine habitats, shortnose sturgeon must seek thermal refuges during most summers in the south. The refuges are found in lower river reaches and consist usually of a few deep holes, possibly cooled by springs or seeps. The fish concentrated in a few of these thermal refuges quickly exhaust local food supplies and appear to just be surviving the summer (Reference 11). A life history that restricts the species to individual drainages, combined with seasonally restricted use of habitats, may be directly related to the species'current endangered status. Sturgeons have long been commercially important species, which may be a leading cause in their rapid decline worldwide. For more than a century, Atlantic and shortnose sturgeon populations were subjected to extensive fishing, likely contributing to the massive population declines along the east coast (Reference 15). Prior to 1900, sturgeon catches were averaging over 3.0 million kg per annum, but this harvest was sustained for less than a decade. Prior to the closure of most east coast fisheries during the 1980s, catches had decreased to less than 1% of historical levels (Reference12).

Although the shortnose sturgeon was severely overharvested in the past, the greatest threats to survival presently include barriers to its spawning grounds created by dams, loss of habitat for other life history stages, poor water quality, and incidental capture in gill net and trawl fisheries targeting other species (Reference 11). Shortnose sturgeon was listed as endangered in 1967 by the US Fish and Wildlife Service. In 1974, the National Marine Fisheries Service reconfirmed this decision under the Endangered Species Act of 1973 (Reference 14).

B. Status in Altamaha River

The Altamaha River is large, with the largest watershed east of the Mississippi River. The Altamaha River is located entirely within the state of Georgia. It flows over 800 km from its headwaters to the Atlantic Ocean. The main body of the Altamaha is formed by the confluence of the Oconee and Ocmulgee rivers in the central coastal plain at Altamaha rkm 212 (Reference 13).

The incidences of catch and overharvest of sturgeons from Georgia rivers paralleled the trends of other states. From 1888 through 1892, sturgeon catches in Georgia averaged 71,000 kg per annum (Reference 18 as presented in Reference 12). "As recently as 49 years ago, a dealer in Savannah (GA) was shipping 4,500 kg of carcasses per week (6,500 kg in the round) during the peak three to five weeks of the spring run"(Reference 19 as presented in Reference 12). Similar harvests were recorded from the Altamaha River (Reference 12).

Catch rate data for sturgeons in Georgia is just as startling. In 1880, and average seasonal catch was 100 fish per net. During a 20 year period from the late 1950s through the late 1970s, net fishermen in the lower Altamaha River caught just 1.1 to 3.2 fish per net per season ((Reference 20) as presented in (Reference 13)). These data indicate a 97-99% decline in the sturgeon fishery (Reference 13).

There is a continuing high demand for sturgeon roe and flesh. From 1962 to 1994 the source of the majority of sturgeon catches has shifted among the Savannah, Ogeechee, and Altamaha rivers. The Altamaha River has been the focus of a "much-throttled" fishery from 1982 to present. Certain recent events have kept prices for sturgeon products high or rising, fueling commercial fisheries and some poaching (Reference 12). Some of these events were an increasing US domestic demand for all seafood products, decreased supplies of sturgeon products as fisheries closed in the US, and sturgeon stocks worldwide were becoming more depleted by overharvest and habitat degradation, particularly in the republics of the old Soviet Union (Reference 12).

The Altamaha River population of shortnose sturgeon has been the focus of much recent research to assess abundance and distribution, determine migration patterns, and describe habitat utilization. Some authors suggested the Altamaha River population of shortnose sturgeon was in better shape than the population in the Savannah River, Georgia-South Carolina (Reference 12). Another study indicated shortnose sturgeon in the Altamaha River may be experiencing lower juvenile mortality rates than in the Ogeechee River, Georgia (Reference 15). The Shortnose Sturgeon Recovery Team indicated that the Altamaha River population was the largest and most viable population south of Cape Hatteras, North Carolina (Reference 15). Relative abundance data from one sampling station during 1986-1991 appears to demonstrate a relatively stable population with little trend in the abundance of juveniles (Reference 11).

Telemetry studies have revealed much information about the seasonal migrations of shortnose sturgeon in the Altamaha River and the importance of certain habitats. During summer in the Altamaha River, most fish ages 1+ and older are concentrated at or just upstream of the fresh/salt water interface in physiological refugia. Cooling water temperatures in the fall spur a movement of all sizes of fish to generally more saline waters. Some adult and most large juvenile fish move back to fresh tidewater near the end of autumn to overwinter with little movement or activity. In preparation for spawning in late winter-early spring, some adults will move upstream to locations near spawning sites. The majority of adults and a few large juveniles remain in oligohaline waters near the fresh/salt water interface and may be very active (Reference 13)

Several suspected spawning sites for shortnose sturgeon have been located within the Altamaha River system. Much of the spawning activity occurs in a 70 kilometer section of the Altamaha River centered about Doctortown Georgia. Spawning is also suspected in the lower Ocmulgee River (Ocm rkm 4-16), which is several kilometers upstream of the shoals marking the transition to the upper coastal plain (Reference 14). This reach is about 40 rkm upstream of Plant Hatch.

Suspected spawning areas in the Altamaha River system were often adjacent to river bluffs with gravel, cobble, or hard rock substrate (Reference 13). Shortnose sturgeon eggs are demersal and adhesive after fertilization, sinking quickly and adhering to sticks, stones, gravel, and rubble on the stream bottom.

Shortnose sturgeon, especially juveniles, appear severely restricted to certain habitats near the fresh/salt water interface of the lower Altamaha River. During summers when the water temperature exceeds 28°C, the fish are further restricted to a few deep holes near the interface. Recaptures of tagged fish indicate that the fish move little and lose weight during this time, which indicates the oversummering habitat is very important, and that food resources may be quickly exhausted (Reference 11). Reference 11 proposed that shortnose sturgeon were using a few deep holes in the lower Altamaha as physiological refuges, and that these holes may constitute critical habitat. Flournoy et al 1992 further hypothesized that the Altamaha River population of shortnose sturgeon existed only because the physiological refugia were available.

The Shortnose Sturgeon Recovery Team has identified numerous factors that may affect the continued survival and potential recovery of the species. Some of these factors may be habitat degradation or loss from dams, bridge construction, channel dredging, and pollutant discharges, as well as mortality from cooling water intake systems, dredging, and incidental capture in other fisheries (Reference 15). Recent evidence of illegal directed take of shortnose sturgeon in South Carolina indicate that poaching may also be a significant source of mortality (D. Cooke, personal communication in Reference 15).

All of the above factors may contribute to mortality in shortnose sturgeon populations, and the significance of each may vary with latitude and individual circumstances. However, the prevailing evidence seems to indicate, at least for the Altamaha River, that the primary threats to the population are commercial harvest and limited oversummering habitat. Dahlberg and Scott (1971) recognized that shortnose sturgeon were often caught in gill nets by shad fishermen in the Altamaha River. The threat of bycatch remains real as many of the individual shortnose sturgeon used in recent studies were captured or recaptured with shad fishing gear. Reference 13 stated that at least one of their tagged fish released in the estuary was captured in commercial shad gear, and six of the 36 individuals telemetered were initially collected with shad gear. Even if the fish are recognized as protected shortnose sturgeon and returned to the river, the capture may result in abandonment of spawning activity (Reference 14).

Several authors suggested the Altamaha River population of shortnose sturgeon might be healthier than the Savannah River population. In comparing the two rivers, (Reference 14) found that both rivers have discharges of similar magnitude and neither is dammed below the fall line. Both the Savannah and Altamaha are moderately industrialized, including paper mills and nuclear generating stations along their reaches from the fall line to the coast. Only the Savannah, however, is heavily altered and industrialized in its estuarine zone (Reference 12).

Previous research has shown shortnose sturgeon ages one year and older aggregate in the Altamaha River at or just upstream of the fresh/saltwater interface during the summer. These fish appear to move downstream into more saline water at the end of summer. During late fall and early winter, movement to less saline water occurs and some adults may move upstream toward spawning areas. Spawning is thought to occur during February through March. Some spawning fish move downstream immediately, while other remain upstream (Reference13).

C. Low Potential for Plant Hatch to effect Shortnose Sturgeon

Biological, hydraulic, and physical factors affect the rates of impingement and entrainment. Southern Nuclear believes the shortnose sturgeon's known behavior and use of the Altamaha River indicates a low potential for impingement or entrainment with the cooling water for Plant Hatch. Southern Nuclear also believes the siting, design, and operational characteristics of Plant Hatch further reduces the potential for impingement and entrainment. This section presents information specific to this argument.

Available literature suggests there is little opportunity for shortnose sturgeon eggs or larvae to encounter the cooling water intakes at Plant Hatch. Much of the available spawning habitat for shortnose sturgeon in the Altamaha River is well downstream of Plant Hatch. Eggs and larvae from these spawning locations are not available for entrainment by Plant Hatch.

There is a suspected spawning area in the lower Ocmulgee River about 40 rkm upstream from Plant Hatch, but entrainment of eggs or larvae of from this site is also unlikely. Fertilized shortnose sturgeon eggs sink quickly and adhere tightly to rough substrates, even under high flow conditions. Shortnose sturgeon larvae seek bottom cover quickly upon hatching and seldom stray from cover (Reference 22). The larvae grow quickly and are able to maintain bottom contact without being swept downstream (Reference 22), and may linger near the spawning area for the first year of life (Reference 16). Some authors, after attempting to capture shortnose sturgeon larvae, speculated the larvae of shortnose sturgeon, contrary to larvae of Atlantic sturgeon, do not spend much time in the drift (References 22, 23). These early life history behaviors suggest a very low potential for entrainment effects at Plant Hatch.

The location of the cooling water intake at Plant Hatch should further reduce the potential for entrainment and impingement. The intake structure was constructed flush with the shallow, southern shoreline of the Altamaha River. The deep river channel hugs the northern bank opposite of the intake structure. Literature indicates that shortnose sturgeon migrate along the bottom of river channels, often seeking the deepest water available. This behavior and the cooling water intake location on the shoreline opposite the river channel should minimize the probability of shortnose sturgeon encountering the intake structure. The approach velocities for this intake have been estimated and presented in Table III-2. The approach velocities range from 0.75 feet per second at 1200 cfs, the historic low flow of record, to less than 0.31 feet per second at 71.5 feet, the normal river stage.

Entrainment and impingement effects are also a function of withdrawal rates, which are reduced for facilities with closed cycle cooling systems. Plant Hatch is operated using 3 mechanical draft cooling towers per unit as described in section III B. "Cooling towers have been suggested as mitigative measures to reduce known or predicted entrainment and impingement losses (see, for example, Reference 26). The relatively small volumes of makeup and blowdown water needed for closed-cycle cooling systems result in concomitantly low entrainment, impingement, and discharge effects. Studies of intake and discharge effects of closed-cycle cooling systems have generally judged the impacts to be insignificant (Reference 9)."

D. Comparison with other power generation facilities

For general comparison, the Hudson River, New York supports a large sturgeon population including both shortnose and Atlantic species. There are six fossil-fueled and one nuclear electricity generating plants located along the Hudson River, and much research has been conducted to address impingement and entrainment concerns. Results for entrainment and impingement at the power generation facilities Bowline, Indian Point, and Roseton are recently summarized for the period from 1972 through 1998 (Reference 24). These three facilities withdraw 62% of the maximum permitted water withdrawal from this reach of the Hudson River. Bowline Units 1 and 2 are two fossil fuel steam electric plants with combined capacity of 1200 MWe and utilizes an intake structure located on an embayment off of the Hudson River. The maximum pumping rate is 384,000 gpm. Indian Point Units 2 and 3 are separate pressurized water reactors with combined capacity of 2042 MWe utilizing two separate shoreline intake structures. Predicted condenser cooling water flow rates are 840,000 gpm and 870,000 gpm for Indian Point Units 2 and 3, respectively. Roseton is a two-unit fossil-fueled steam electric plant with combined capacity of 1248 MWe and utilizes a shoreline intake structure. Maximum pumping rate is 641,000 gpm. Unlike Plant Hatch, all three of these facilities use once-through cooling. For comparison, the maximum pumping rate for Plant Hatch is 72,000 gpm. The

USNRC notes that "Water withdrawal from adjacent bodies of water for plants with closed-cycle cooling systems is 5 to 10 percent of that for plants with once-through cooling systems, with much of this water being used for makeup of water by evaporation."(Reference 9). The operation of the Plant Hatch cooling system is consistent with this description.

One of the environmental impacts identified for these three facilities on the Hudson River is entrainment and impingement of aquatic organisms, including striped bass, white perch, Atlantic tomcod, American shad, bay anchovy, alewife, blueback herring, and spottail shiner. Other species were considered, including Atlantic sturgeon (*Acipenser oxyrhynchus*) and shortnose sturgeon. No shortnose sturgeon eggs or larvae were collected in entrainment samples for these facilities over periods ranging from 5 to 14 years. As a result, entrainment effects on shortnose sturgeon are believed to be negligible.

Adult shortnose sturgeon, however, were collected in impingement samples at these facilities. Indian Point Unit 2 reported shortnose sturgeon in impingement samples for 10 of 19 years reported (ranging from 1 to 6 individuals per year). Indian Point Unit 3 reported shortnose sturgeon in impingement samples for 7 of 15 years reported (ranging from 1 to 3 individuals per year). The size of impinged shortnose sturgeon ranged from 12 to 18 inches. The low rate of impingement and the return of impinged fish to the Hudson River alive lead to the conclusion that impingement effects were negligible (Reference 24). Even though sampling has documented large numbers of affected fish at intakes along the Hudson River, and a large resident population of sturgeon exists, shortnose sturgeon are a very small component of the impingement and entrainment mortality (Reference 24). In fact, some recent research suggests that the shortnose sturgeon population in the Hudson River has increased during the last ten years and is now more numerous than the commercially exploited Atlantic sturgeon (Reference 25).

SNC believes that the use of closed cycle cooling minimizes water withdrawals from the Altamaha River. As a result, the probability is much lower of impinging shortnose sturgeon compared to similarly situated facilities using once-through cooling systems. In addition, the existing monitoring data supports the finding that no impacts are known to occur to shortnose sturgeon from entrainment and impingement at Plant Hatch.

E. Consequences of Proposed Action

There are no planned construction modifications of the intake structure, effluent pipes, or changes in operation proposed for the license renewal period for Plant Hatch. Based on the life history characteristics of shortnose sturgeon, siting and operational characteristics of the plant, existing data for impingement and entrainment, and the known thermal plume characteristics there are no adverse impacts to shortnose sturgeon expected from E. I. Hatch Nuclear Plant during the license renewal period.

V. FIGURES

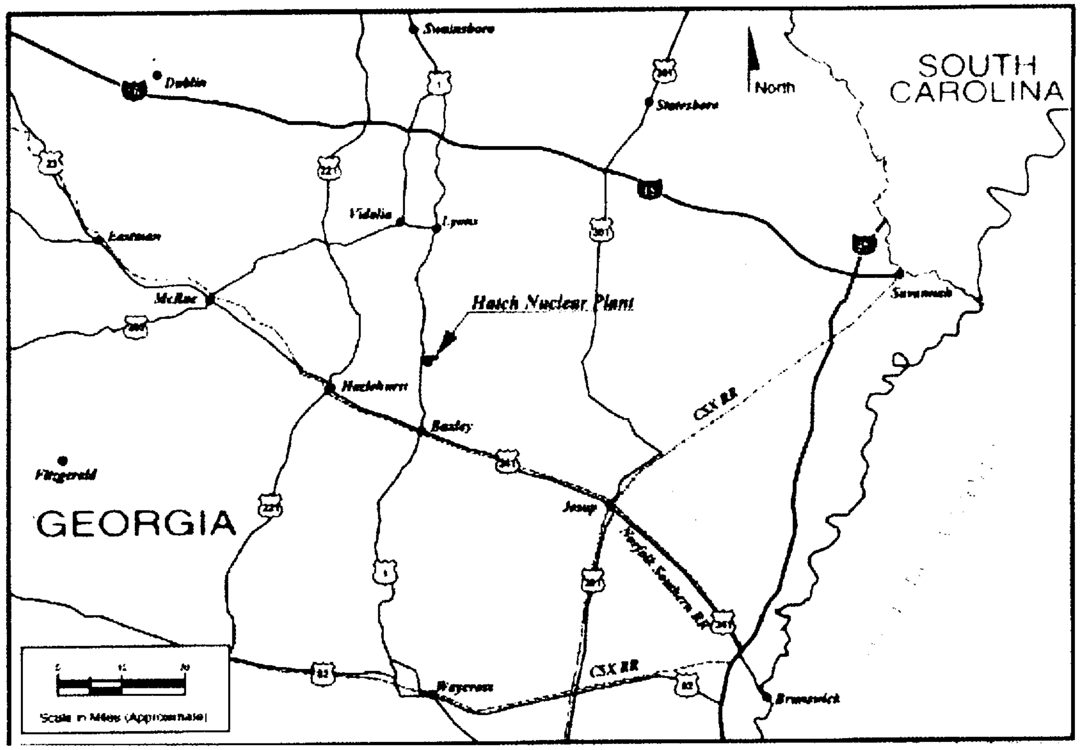

Figure V-1. HNP Edwin I. Hatch Nuclear Plant, 50 mile region

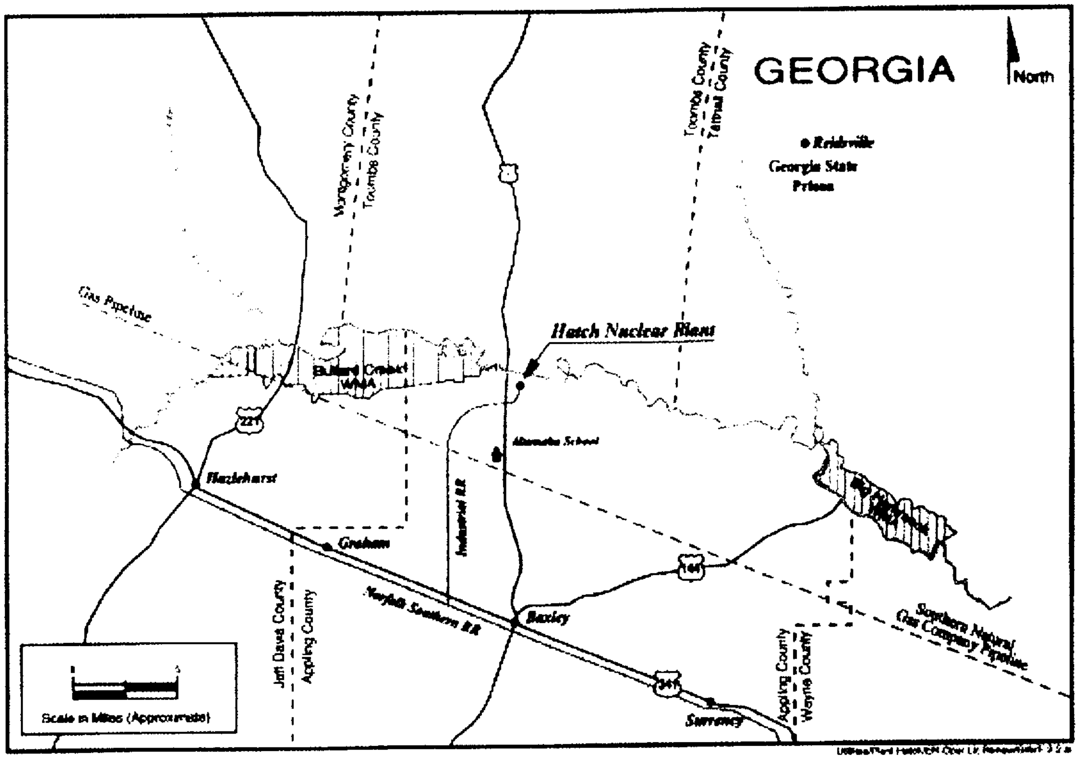

Figure V-2. HNP Edwin I. Hatch Nuclear Plant, 10 mile region

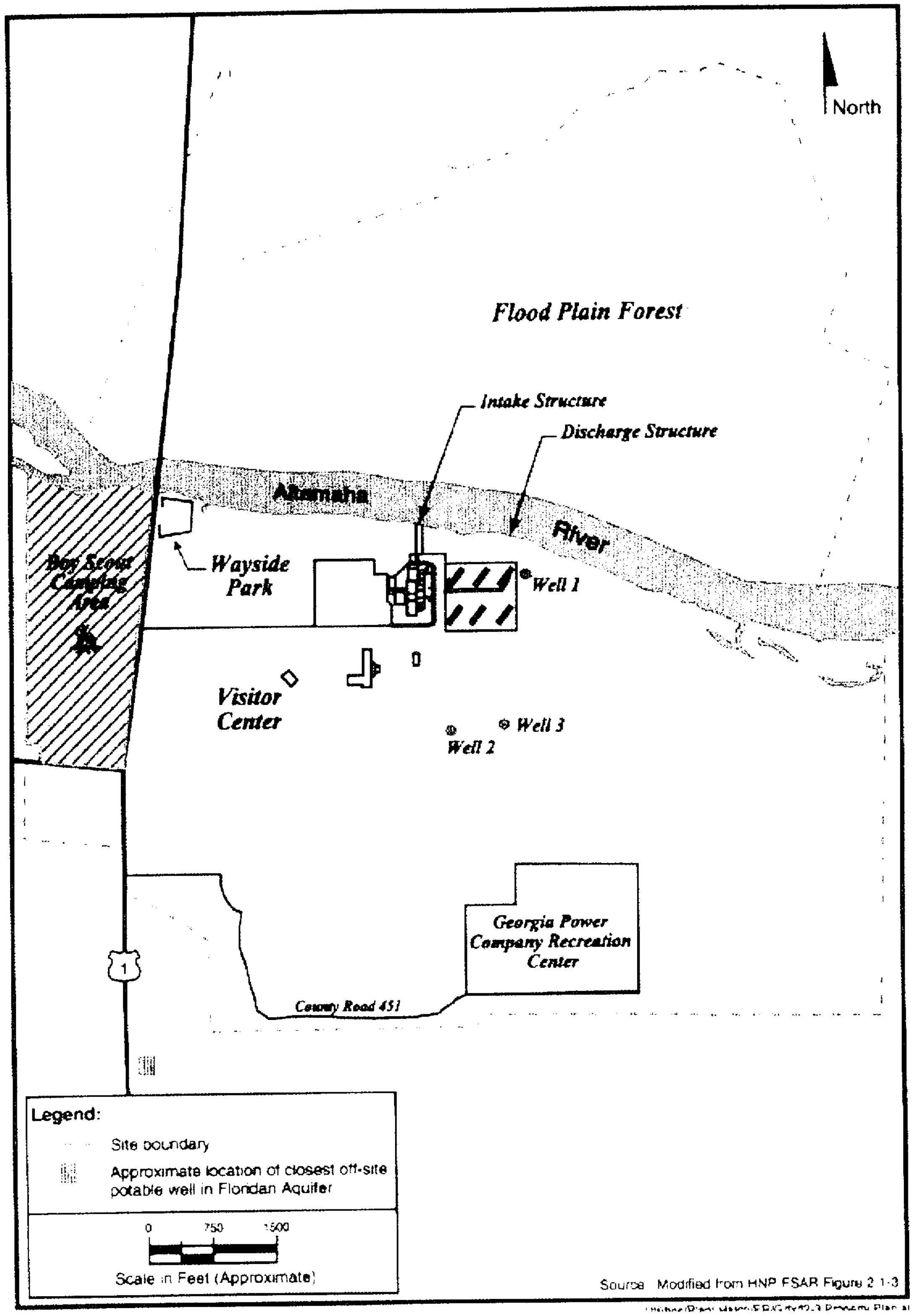

Figure V-3. HNP Edwin I. Hatch Nuclear Plant property plan

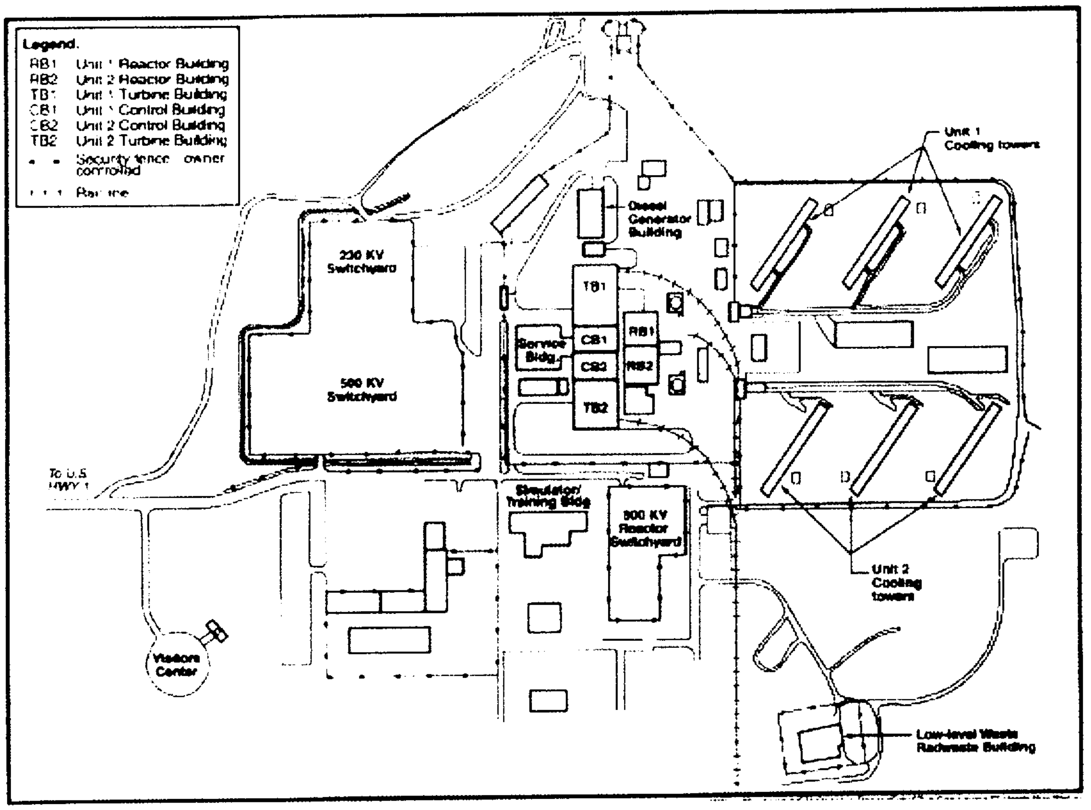

Figure V-4. HNP Edwin I. Hatch Nuclear Plant site plan

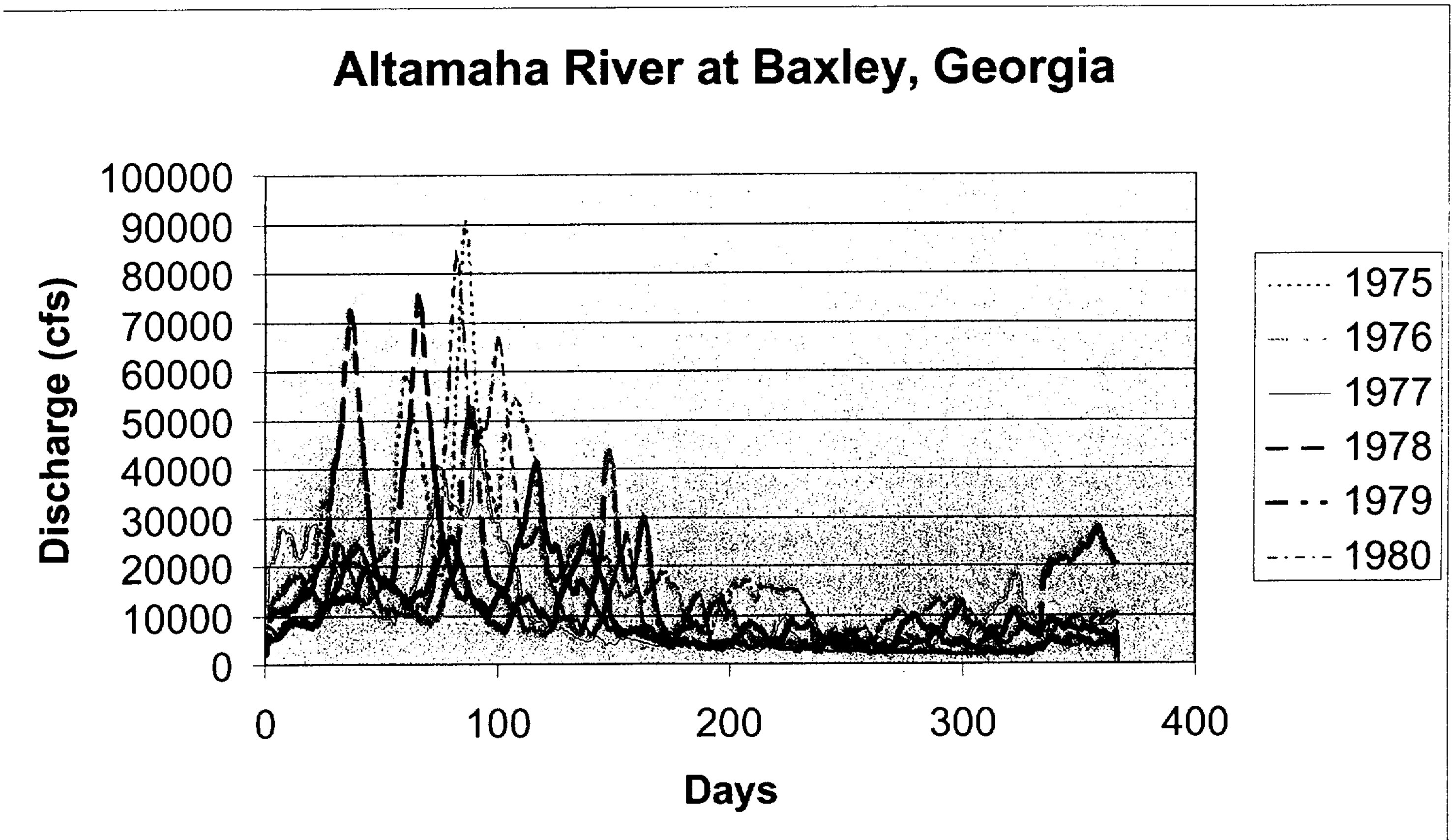

Figure V-5. Daily discharge at USGS gage 02225000, near Baxley, Georgia

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