Information technology and business are becoming inextricably interwoven. I don't think anybody can talk meaningfully about one without talking about the other.

BILL GATES, FOUNDER OF MICROSOFT

When Gus Norwood completed SEPA’s first history in 1990, the agency had only recently abandoned the use of punched cards for data compilation. As new desktop computers were purchased during the early 1990s, SEPA held regular workshops to introduce computer operations and programs. Later, the agency interconnected computer terminals through networks, introduced email, and eventually each staff member had their own desktop computer. The hydro projects were virtually connected through remote terminal units for real-time and accurate generation and scheduling information. In two short decades, SEPA transitioned from analog to digital operations. Information Technology (IT) was embraced and woven into all operational and functional aspects of the organization.

Prior to automation, all of the maps, charts, and forms used by SEPA for operations, billing, and hydrology studies, were developed by hand. To develop rates for repaying the Federal Treasury, SEPA had to first determine the energy (MWH) and, more importantly, the dependable capacity (MW) available for sale at the projects. This was accomplished by calculating historic streamflows at each project using a desk calculator (Friden or Marchant) and a desk adding machine.

This cumbersome and time-consuming process changed in 1962. At that time, a number of SEPA employees met with computer personnel at the University of Georgia Computer Center to see if the newly emerging computer era could perform these tedious hand-developed project simulations. As a result, several SEPA engineers, Elbert Rucker, Harold Jones, and Clifford Bond, took computer classes offered at the University.

Left: A SEPA employee uses an IBM key punch machine, late 1960s.
At first, a program language called Symbolic Programming was used. Soon thereafter, two much more sophisticated computer languages became available – FORTRAN and COBOL. Eventually, all of SEPA’s simulated project operations were written in FORTRAN, while customer billing was better suited to COBOL. All of these programs used punch cards for program and data entry. Programs integrating many projects required thousands of statements (cards).

During the 1960s, the agency began ‘automating’ data first with an IBM 1401 (and later an IBM 7094) mainframe computer owned by and housed at the University of Georgia, thirty miles away in Athens. The University’s IBM 7094 was a large, bulky machine that monopolized an entire room and was used by the University to run grades and student schedules. In addition to the University and SEPA, other organizations used the machine as well, including the National Aeronautics and Space Administration (NASA) and the Georgia Department of Transportation (GDOT). SEPA had to ‘get in line’ with everyone else!

The computer itself operated by virtue of programs and data written on punched cards, which were inserted by stacks into the machine. During the 1960s and 1970s, punched cards were the most common method of developing programs and calculating data. The cards, punched on a separate key punch machine, typically included 80 columns and 12 rows of numbers (labeled 1-9). The number combinations were used to develop binary coding for the computer. Writing a program to the cards was tedious and could realistically require hundreds or even thousands of individual cards, but the process represented the latest computer technology at the time.

Crash Course in Computer Programming

When I came to work here [in 1968], I had never punched a card. I didn’t know how to operate a punch machine. About 1969, SEPA’s computer programmer left. My boss came in, handed me two books on FORTRAN [programming] and said ‘You’re it!’ I said, ‘I don’t know this.’ He said, ‘You’ve got to learn it.’ So, I had to learn computer programming on my own.

Wade Gaines, SEPA’s First IT Manager

While the agency had not yet purchased its own primary computer, SEPA did own an IBM key punch machine. Employees wrote all of the computer programs in Elberton, including programs for stream flow studies, billing, and power operations. Once the programs were finalized, the staff drove boxes of cards to Athens and calculated the data on the UGA computer. “Sometimes we’d dump [the cards] out of the seat [of the car] into the floor,” Donnie Cordell remembered. “That was a mess.” Another employee remembered the cards absorbing moisture from the air when it rained, “and the card reader would sometimes jam and chew up 20 to 30 cards and cause real problems!” Because of the number of users on the one computer system, SEPA might only get two or three opportunities per day. According to Cordell, “Some days you wouldn’t get much done. Some days you would. That’s just how it was.”

To complicate matters, the University periodically upgraded its computer and users, including SEPA, had to re-learn the system. Each computer upgrade required learning special Job Control Language (JCL), which could prove more difficult to master than the programming language. Also, much like modern computer systems,
the early variants were limited to a certain amount of memory. One of the early computers at UGA was limited to 128 kilobytes, a miniscule amount of space compared to gigabytes found on modern computers. Some of SEPA’s programs operated on so many kilobytes that the agency used the University’s system at night so as to not interfere with other users.\(^5\) During the early 1980s, SEPA purchased an in-house computer capable of running most programs needed for accounting, power sales, and power operations. This new computer used tapes akin to cassettes or reels. Data was written to the tapes, re-wound, and read back because the memory system was limited.\(^6\) In 1984, the same year that SEPA disposed of using punch cards, the agency purchased a Texas Instruments (TI) 990 that served until a new Prime computer was installed in 1990. During the late 1980s, SEPA purchased two ‘desktop’ or micro-computers, one for power sales and one for power operations. These included a Macintosh II (heralded as having the new feature of a color monitor) and a Compaq 386 PC, with five megabytes of Random Access Memory (RAM) and a processing speed of 20 megahertz. The new technology required instruction and classes were held in Disk Operating System (DOS), database management, word processing, graphics, spreadsheet, and telecommunications. Some training was conducted internally by SEPA employees, while other courses required bringing in outside experts from Athens Technical College, the University of Georgia, and Clemson University.\(^7\) The agency was entering the IT era, but all administrative work was still largely conducted on calculators and typewriters.

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**A Tedium Job**

**Before we came off the punch card system [in the early 1980s], we were up to 12,000 statements [cards] for both power operations and power sales. We took four or five boxes to the University of Georgia several days a week. You would spend all day with it because the University was running other things and had to work us in. We would turn the cards in, the University would run them through the machine, and we would wait for the output. Sometimes you’d get it back and everything would look pretty good except for one little glitch, so you’d have to sit down for an hour or so trying to correct it. It was not too hard to make an error because the machine was real particular – if you punched the wrong thing on the card it made it completely invalid. It was rather tedious.**

Harold Jones, SEPA (1952-1995)
John Mixon and Harold Jones working with the old UGA computer, 1970s.

Training for new computers in the early 1990s (pictured: Blanche Adams, Gail Dickerson, Mirtie Clark, Martha Hewell, and Frances Mixon).
Billy Neal, Wade Gaines, and Bob Goss led SEPA’s IT program in its infancy. With the increasing number of desktop computers, one of their early tasks included developing a server and integrating the machines into a ‘network’. SEPA designed the system in addition to laying the required cables for a dedicated server room on the fourth floor of the old Samuel Elbert Hotel, then the agency’s headquarters. “There was no looking back,” remembered Gaines. “Networks came to be the most popular thing.” SEPA installed its first NOVELL operating network in 1990, which interfaced with a Prime mini-computer. In 1994, the agency migrated to a Microsoft Windows network, dominating the market at the time, which was also used by other DOE organizations.8

Once the agency’s computers were connected internally, SEPA tapped into external networks. During the early 1990s, the City of Elberton had no fiber optic internet capability and SEPA requested a T-1 line from the nearest availability in Athens. Therefore, the agency was connected to the internet before its host city. The external network enabled SEPA to participate in electronic mail (email) systems. During the early 1990s, both SEPA and SWPA connected with WAPA, which had tapped into the DOE network (DOE-Net), for email access. SEPA’s first email had wapa.gov tag, but the agency received its own email tags in 1995. At that time, the internet was a dial-up system, accessed through a traditional phone cable. The agency “went online” at regular intervals to retrieve and transmit outside emails, although all internal emails were sent instantaneously. Further, in the early limited email environment at SEPA, employees shared computers for email access. It was a cumbersome, but effective, early system. SEPA even had email capability a full year before the Corps of Engineers.9

Beyond interconnecting traditional desktop computers, the agency recognized the importance of using the networks to communicate with the hydroelectric projects to obtain instant and accurate information on generation and scheduling. While each of the hydropower plants had computers at the time, none of the computers were connected externally or with each other. By having real-time data, SEPA could better monitor generation at the projects to ensure they met the contractual obligations of the customers.

Internally, SEPA assigned an ad-hoc team (SEPA-Corps Control Area Team [SCCAT]) to issue recommendations on the communication needs of the new Operations Center that would enable communication with six of the Corps’ power projects (Hartwell, Thurmond, Russell, Carters, Millers Ferry, and Walter F. George). Because
many of the long-term customer contracts were being re-negotiated at the time, an upgraded operations center became a priority effort to develop a more cost-effective service. The SCCAT provided specific recommendations on the types of connections (T-1 or 56kb) required for each of the six plants and estimated a total of approximately $50,000 for procurement and installation of the equipment.10

A Wide Area Network (WAN) was developed to link the projects and the concept was presented to the Corps. “[They] told us it wouldn't work,” remembered Gaines, “and it wasn't easy due to the locations of some of the powerhouses.” The SEPA IT Team designed the proposed network and set up a prototype mini-network at its headquarters in Elberton to prove the viability of the software. One of the first plants connected through SEPA's network was the Walter F. George project on the Chattahoochee River. Because the local telecommunications system in the nearby town of Fort Gaines, Georgia was so limited at the time, SEPA contracted with Sprint to install a T-1 line to a small building on the Georgia side of the dam. With the T-1 line in place, the IT Team installed the fiber optics in the dam and the powerhouse for the final connection.11

After installing computer terminals at the individual plants, SEPA used an early remote access software to link into the computer. “Today, it wouldn't come close to
meeting security requirements,” Gaines noted, “but at the time nobody knew how to use it.” The local Corps operators were instructed to put the generation schedule on their computer screen, and SEPA’s operators could see the real-time data on their computers back in Elberton. Operators also used the notepad function to exchange messages.12

The remote terminal units were centrally linked to SEPA’s Operation Center. When the Operations Center came online in 1994, it was originally located on the Fourth Floor of the old Samuel Elbert Building, and shared a single server with the entire organization. By 2010, SEPA had over seventy-five computers, multiple servers, and an emergency offsite center for continued operations.13

When John McAllister arrived at SEPA in 1990, he took charge of an agency, not unlike other federal organizations, that still largely used adding machines and typewriters. SEPA’s computers were large, but still able to fit on desktops. Automatic data processing was still in its infancy. “I saw the agency go from an analog entity to a digital entity,” he recalled. “[Technology] was fully embraced.”

Importantly, technology has allowed, and in some cases facilitated, improved business practices. With the hydro projects now virtually connected to SEPA through an Energy Management System (EMS), operators have access to real-time information in regard to generation, storage, switchyards, and even weather conditions. In scheduling power, SEPA receives a declaration from the Corps, or specifically the amount of energy available for an upcoming week (Saturday-Friday), compiles the capacity by system and estimates a percentage for the customers. With that information in hand, the customers schedule their energy for the week based on estimated peak demands. By 2010, all scheduling takes place electronically in the form of spreadsheets exchanged across the internet, a much quicker process even by 1994 standards when the Control Area went operational.14

Technology has become an even more critical asset as more individual preference customers elected to self-schedule their power declarations rather than receiving credits for government power through another parent power company. Since the Operations Center went online, more customers have chosen to schedule power individually, with SEPA providing transmission services. Coordinating additional weekly schedules resulted in an increased workload for SEPA operators, but one that is made far easier with real-time information. Additionally, the e-tagging process, specifically creating point-to-point identifiers for individual power transactions, is conducted entirely through an internet interface. Just as technology allowed for more precise energy storage information, it has also allowed for better accuracy in determining availability on the grid when SEPA requests transmission capability.15

In addition to benefitting power operations, the new electronic interfaces have expedited even the more basic tasks associated with power sales. Because of the expanding usage of the internet and availability of electronic interconnections, in 2001, the US Office of Management and Budget launched an “Electronic Government” (E-Government) initiative. An E-Government Task Force identified numerous ways to
We are in a paperless age. At one time we had to coordinate everything through phone calls, print it out on paper, and then fax it to everyone. Now everything is automated. When the schedule is set up, our software emails it to the appropriate people. Technology has really changed the way we access information.

Dee Smith, SEPA Power Operator

use IT to create efficiencies and facilitate citizens’ and customers’ interaction with the federal government. A variety of individual proposals for all branches of the government resulted from the initiative, including e-dockets for filing official paperwork, online grant submissions, web-based training seminars, and electronic records systems to name just a few. For an agency like SEPA that manages countless individual customer transactions on a daily basis, one of the most beneficial programs was Pay.gov, a web-based electronic funds transfer (EFT) system that allows customers to make payments online, allowing for quicker deposits into the Treasury. In February 2005, SEPA was the first DOE entity to institute the Pay.gov system.16

The IT revolution has even made the most mundane of tasks and communication more efficient, reliable, and user-friendly. In 2004, SEPA launched its first website. In addition to providing basic agency information, news releases, hydropower data, and copies of annual reports, the website facilitates procurement processes by directing users to DOE and federal acquisition websites. SEPA also uses the interface to collect Freedom of Information Act (FOIA) requests, information regarding proposed and finalized rate schedules, as well as employment opportunity links.

SECURED AND CONTINUED OPERATIONS

Because SEPA operates within a broader bulk electrical system, the DOE requires the agency to have an offsite Continued Operations (COOP) center should its primary control facility become dysfunctional. From a federal agency standpoint, SEPA also has contractual obligations that must be met on an hourly basis; a default on these obligations would result in substantial financial losses to both the federal government and the preference customers.17

COOP standards were established by NERC and compliance is achieved through routine audits and inspections. Each operations backup center must meet minimum standards for data communications, voice communications, physical and cyber security, as well as a source of power supply. According to current NERC standards, backup control areas must be capable of full operation within two hours of a primary system failure.18

SEPA established an initial COOP site in 1999. That first backup center was located in a one-room facility in Bogart, Georgia, west of Athens. Then, in 2002, SEPA moved the offsite center to Chase Street in Athens. The COOP center remains unmanned unless there is an emergency, but has all of the essential redundant components to become fully functional within a few hours. The facility has two T-1 data lines, a
conventional (land-based) phone system, generator, and networks to accommodate Doe.net and Corps.net electronic communications. The backup systems are identical to those in the primary control area and are designed to provide replicated information that is immediately available to emergency system staff.

SEPA developed Standard Operating Procedures (SOP) to staff the facility with selected employees. The primary staff would include a power operations manager, power system operators (one or two per shift as needed), and a power operations specialist for accounting. Other staff that might be called in as needed include, a lead power operations specialist, an information technology specialist, contracting specialist, an accountant and an accounting technician. If the offsite center is required for a sustained period, other staff may be required for payroll, billing or supplies.

Maintaining a COOP center is essential to both SEPA operations and ensuring reliability within the larger electrical power supply. SEPA conducts announced and unannounced evacuation drills at least twice per year. As part of the drills, operators are required to prepare a report identifying problems encountered during the mock evacuations as well as provide suggestions for improvement. The SEPA IT staff also conducts weekly equipment and communication checks on the primary systems.

When terrorists launched multiple attacks against homeland assets of the United States on September 11, 2001, the federal government required all of its agencies and organizations to take a fresh look at their procedures for physical security. Further, with the nation and the world more interconnected than ever through computers and the World Wide Web, cyber-attacks remain an imminent threat. Though it is a small organization with few physical assets, SEPA remains vigilant about cyber and physical security.

SEPA operates within a bulk electric power system. Unauthorized access to critical energy information (facilities, equipment, or systems) could have disastrous results. A breach in cyber-security resulting in interference of service could even affect the broader electrical power grid and put other critical infrastructure (military and civil) at further risk. Disruption could also cause the government to default on contractual loads of power to the preference customers. The SEPA IT Team established internal procedures and protocols to follow the applicable cyber-security standards administered by the DOE, NERC, SERC, FRCC, the National Institute of Standards and Technology (NISC), and Federal Information Processing Standards (FIPS). SEPA developed a Program Cyber Security Plan (PCSP) in 2005 to formalize its cyber-
security policies. Additionally, the agency supplies annual reports to NERC, SERC, and the FRCC, and is audited on a regular basis to check for compliance with security standards. These standards are designed to prevent unwarranted access to data, hardware, software, or any part of the electrical system.\(^{22}\)

SEPA also instituted additional protections for the physical security of its facilities. Traditional keys were replaced with secured electronic entries, and staff are required to escort approved visitors. The Operations Center, located within the headquarters building, is recognized as “critical energy infrastructure” by the DOE, and has additional security restrictions, limited access, and twenty-four hour monitoring systems.\(^{23}\)

Ensuring cyber security requires constant vigilance as threats change and become more sophisticated. With the Corps owning the hydropower facilities and SEPA managing the Operations Center, it was critical for the two agencies to develop an agreement supporting the framework for cyber and physical security. In 2005, SEPA and the Corps signed an MOA in regard to hybrid system communications between SEPA’s Operations Center and the Savannah and Mobile districts’ Supervisory Control and Data Acquisition (SCADA) System. The document specified roles and responsibilities for each agency for security patch management, intrusion detection systems, network security (firewalls), physical access and clearance for personnel, software protection (spyware, anti-virus, and malware), and general system support.\(^{24}\)
The Legal Library at SEPA

SEPA's Record Archive
ENDNOTES

1 McAllister interview.
2 Information provided by Harold Jones via email, September 13, 2012.
3 Jones email, September 13, 2012.
4 Cordell interview; also, personal communication via email with Wade Gaines, July 25, 2012.
5 Interview with Wade Gaines (SEPA-Retired), March 4, 2010.
6 Gaines interview; Jones interview.
7 SEPA Newsletter, December 1988; also Gaines interview.
8 Gaines interview.
9 John Sewell, the IT Manager at WAPA, designed the email system that covered SEPA, SWPA, and WAPA; Gaines interview.
11 Gaines interview.
12 Ibid.
13 Gaines interview; Seymour interview. For a detailed discussion of the creation of the Operations Center, see Chapter 5.
14 Heard interview.
19 Gaines interview.
20 “Emergency Plan,” SEPA Archives; also Seymour interview.
23 Gaines interview.
24 SCADA systems monitor conditions and provide information for distributed networks of infrastructure or processes. See “Memorandum of Agreement Between US Army Corps of Engineers and the Southeastern Power Administration,” 2005.
A Note on Sources

In conducting the archival research for this history, the Southeastern Power Administration Public Affairs Office proved instrumental in gathering existing information, including files, briefings, news releases, fact sheets, and photographs. These materials are organized by record groups in the general SEPA archives housed in Elberton, Georgia. Unless noted in the text, all photographs were provided through the Public Affairs Office.

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Coleman, Lori I. “Our Whole Future is Bound up in this Project: The Making of Buford Dam.” Master’s Thesis, Georgia State University, Atlanta, 2008.


152


Radin, Alex. “Public or Private Power.” The Rotarian (November 1954).


Simpson, Donald E., Marilyn Phipps, and Arturo L. Resi di Cervia, “Constructing a Cutoff Wall in Front of Walter F. George Dam in 100 Feet of Water.” Hydro Review (March 2006).


SYSTEM MAPS and DATA
**BARKLEY DAM**
Initial Year of Operation: 1966
- Generating Units: 4
- Plant Capacity: 148 MW
- Summer Pool: 359 ft. MSL.
- Average Energy: 601,000 MWh

**CHEATHAM DAM**
Initial Year of Operation: 1959
- Generating Units: 3
- Plant Capacity: 41 MW
- Summer Pool: 385 ft. MSL.
- Average Energy: 163,000 MWh

**OLD HICKORY DAM**
Initial Year of Operation: 1957
- Generating Units: 4
- Plant Capacity: 116 MW
- Summer Pool: 444 ft. MSL.
- Average Energy: 470,000 MWh

**J. PERCY PRIEST DAM**
Initial Year of Operation: 1970
- Generating Units: 1
- Plant Capacity: 30 MW
- Summer Pool: 490 ft. MSL.
- Average Energy: 71,000 MWh

**CORDELL HULL DAM**
Initial Year of Operation: 1973
- Generating Units: 3
- Plant Capacity: 114 MW
- Summer Pool: 504 ft. MSL.
- Average Energy: 355,000 MWh

**CENTER HILL DAM**
Initial Year of Operation: 1950
- Generating Units: 3
- Plant Capacity: 156 MW
- Summer Pool: 648 ft. MSL.
- Average Energy: 370,000 MWh

**DALE HOLLOW DAM**
Initial Year of Operation: 1948
- Generating Units: 3
- Plant Capacity: 62 MW
- Summer Pool: 651 ft. MSL.
- Average Energy: 121,000 MWh

**WOLF CREEK DAM**
Initial Year of Operation: 1951
- Generating Units: 6
- Plant Capacity: 312 MW
- Summer Pool: 723 ft. MSL.
- Average Energy: 899,000 MWh

**LAUREL DAM**
Initial Year of Operation: 1977
- Generating Units: 1
- Plant Capacity: 70 MW
- Summer Pool: 1,018 ft. MSL.
- Average Energy: 64,000 MWh
<table>
<thead>
<tr>
<th>#</th>
<th>DAM NAME</th>
<th>INITIAL YEAR OF OPERATION</th>
<th>GENERATING UNITS</th>
<th>SUMMER POOL</th>
<th>PLANT CAPACITY</th>
<th>AVERAGE ENERGY</th>
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<tbody>
<tr>
<td>1</td>
<td>MILLERS FERRY DAM</td>
<td>1970</td>
<td>3</td>
<td>80 FT. MSL.</td>
<td>90 MW</td>
<td>384,000 MWh</td>
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<td>2</td>
<td>ROBERT F. HENRY DAM</td>
<td>1975</td>
<td>4</td>
<td>125 FT. MSL.</td>
<td>82 MW</td>
<td>335,000 MWh</td>
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<tr>
<td>3</td>
<td>WALTER F. GEORGE DAM</td>
<td>1963</td>
<td>4</td>
<td>190 FT. MSL.</td>
<td>168 MW</td>
<td>438,000 MWh</td>
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<tr>
<td>4</td>
<td>WEST POINT DAM</td>
<td>1975</td>
<td>3</td>
<td>635 FT. MSL.</td>
<td>87 MW</td>
<td>202,000 MWh</td>
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<td>5</td>
<td>ALLATOONA</td>
<td>1950</td>
<td>3</td>
<td>840 FT. MSL.</td>
<td>82 MW</td>
<td>151,000 MWh</td>
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<td>6</td>
<td>CARTERS DAM</td>
<td>1975</td>
<td>2</td>
<td>1,074 FT. MSL.</td>
<td>606 MW</td>
<td>405,000 MWh</td>
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<td>7</td>
<td>BUFORD DAM</td>
<td>1957</td>
<td>3</td>
<td>1,071 FT. MSL.</td>
<td>127 MW</td>
<td>186,000 MWh</td>
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<td>8</td>
<td>J. STROM THURMOND DAM</td>
<td>1953</td>
<td>7</td>
<td>330 FT. MSL.</td>
<td>364 MW</td>
<td>707,000 MWh</td>
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<td>9</td>
<td>RICHARD B. RUSSELL DAM</td>
<td>1985</td>
<td>4</td>
<td>475 FT. MSL.</td>
<td>664 MW</td>
<td>685,000 MWh</td>
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<td>10</td>
<td>HARTWELL DAM</td>
<td>1962</td>
<td>5</td>
<td>660 FT. MSL.</td>
<td>432 MW</td>
<td>470,000 MWh</td>
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MONTHLY AVERAGE FLOWS OF RIVERS BELOW WOODRUFF DAM

CHATTahooCHEE RIVER PROFILE
JIM WOODRUFF DAM

INITIAL YEAR OF OPERATION
1957

GENERATING UNITS
3

SUMMER POOL
77 FT. MSL.

PLANT CAPACITY
43 MW

AVERAGE ENERGY
233,000 MWh
MONTHLY AVERAGE FLOW OF ROANOKE RIVER BELOW JOHN H. KERR DAM

ROANOKE-DAN-SMITH RIVER PROFILE
1. **John H. Kerr Dam**
   - Initial Year of Operation: 1952
   - Generating Units: 7
   - Plant Capacity: 267 MW
   - Summer Pool: 299.5 ft. MSL
   - Average Energy: 437,000 MWh

2. **Philpott Dam**
   - Initial Year of Operation: 1953
   - Generating Units: 3
   - Plant Capacity: 15 MW
   - Summer Pool: 973.5 ft. MSL
   - Average Energy: 25,000 MWh