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**Special
Environmental Analysis
for
Par Pond
at the
Savannah River Site**

APRIL 1992

**U. S. DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR DEFENSE PROGRAMS**

**SPECIAL
ENVIRONMENTAL ANALYSIS
for
PAR POND
at the
SAVANNAH RIVER SITE**

**U. S. DEPARTMENT OF ENERGY
SAVANNAH RIVER FIELD OFFICE
SAVANNAH RIVER SITE**

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1.0 PURPOSE

On March 14, 1991, a surface depression was discovered during a routine inspection of the downstream slope of Par Pond Dam that had the potential to weaken the dam. Although the immediate threat of a dam failure was predicted to be unlikely, the water level in the Par Pond impoundment was drawn down to approximately 181 feet mean sea level (msl) for safety considerations.

The Par Pond Dam is an earthen dam constructed across Lower Three Runs Creek on the U.S. Department of Energy (DOE) Savannah River Site (SRS) in South Carolina in 1958-59, and impounds approximately 2,640 acres at a normal water level of 200 feet msl. This Special Environmental Analysis assesses the potential environmental impacts of drawing down, repairing, and subsequently refilling Par Pond. This document was prepared by DOE to comply with the National Environmental Policy Act (NEPA) of 1969, as amended, and at the request of the Council on Environmental Quality (CEQ), as made during July 9, 1991 discussions regarding alternative arrangements pursuant to Section 1506.11 of the CEQ regulations for implementing NEPA (40 CFR 1506). The timeframe encompassed by this report was from the initiation of the drawdown until the end of July 1991.

2.0 NEED FOR ACTION

Since 1980, the Par Pond Dam has been inspected every other year. In addition to these inspections, wet areas near the downstream slope of the embankment have been inspected annually (WSRC, 1991). This surface depression, approximately 3-4 feet wide and 1-2 feet deep, was discovered on the downstream slope of the Par Pond dam during the March 1991 inspection (see Figure 2-1). It was located at an elevation of approximately 164 feet msl, 36 feet below the normal water level of 200 feet msl, and 19-15 feet above the east margin of a conduit that conveys water through the dam to Lower Three Runs Creek.

Further investigations have revealed a column of soft embankment material, located below the depression and extending downward from the bottom of the depression to near the top of the conduit. Because interconnecting voids have been discovered beneath the tailrace apron, SRS speculates that similar voids could exist further upstream and could be the reason for the depression. A new small depression appeared at the same locality where the original depression had been filled and compacted. Geotechnical investigations are currently underway to identify the exact cause of the depression, if possible.

In aggregate, the evidence indicates that the potential exists for a piping condition in the dam, but it can neither be confirmed nor denied. A piping condition exists when water passes through a dam at such velocity that the materials within the dam are susceptible to erosion. The subsequent erosion of materials within the dam first manifested itself by creating a pipe-like hole through the dam. This condition typically begins at the downstream side and propagates upstream. Such conditions, if allowed to continue or to accelerate,

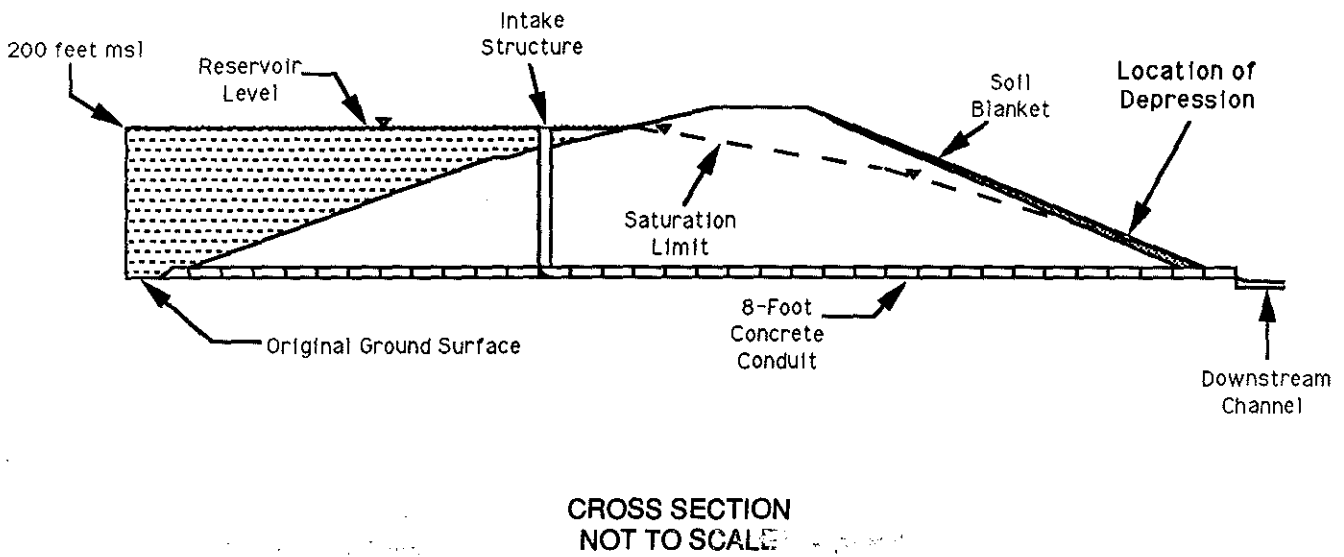


Figure 2-1. Schematic cross-sectional diagram of the Par Pond Dam and the location of the depression discovered in March 1991.

could result in dam failure. Historically, pipe holes have a tendency to form adjacent to conduits passing through a dam because embankment soils adjacent to conduits are usually not as thoroughly compacted as in other parts of the dam.

Although the immediate threat of a dam failure is predicted to be unlikely, the weakened dam condition is considered serious and potentially dynamic by geotechnical consultants, including the U.S. Bureau of Land Management and the U.S. Army Corps of Engineers (COE). Thus, a drawdown of the Par Pond impoundment was begun on June 21, 1991, to reduce the water level and lower the hydrostatic pressure on the dam and further reduce its potential for failure.

Lowering the water level of Par Pond by approximately 20 feet is expected to also significantly reduce the potentially destructive impacts downstream should the dam fail (WSRC, 1991). An emergency notification system, including 24-hour surveillance of the dam, is in place. If the dam should show signs of rapid degradation or impending failure, the system will notify affected offsite organizations and help mitigate any potential consequences. The following objectives are expected to be met by this action:

- Reduce threats to the public health and safety should the dam fail
- Lower flooding and downstream impacts to those of a 100-year storm event and contain damages within the federal lands encompassing the Lower Three Runs Creek corridor
- Prevent any loss of life, especially in the town of Martin, SC (12 miles downstream)
- Lower levels of cesium, mercury and tritium from Par Pond that would be transported offsite into the environment
- Lower destructive and scouring impacts on the biota and vegetation in Lower Three Runs Creek and the plant and animal populations in Par Pond should the dam fail

The anticipated and observed environmental impacts of drawing down, repairing, and subsequently refilling Par Pond are being analyzed and evaluated as they occur, including ecological and radiological impacts. All efforts are being made to mitigate the impacts to the environment. While some impacts, such as fish kills and loss of habitat, will be unavoidable, the goal is to keep them to a minimum.

3.0 IMPLEMENTED ACTION AND POSSIBLE FUTURE ACTIONS

3.1 Implemented Action

The implemented action is the current drawdown of the water level in Par Pond to approximately 181 feet msl for safety considerations and related mitigative actions to minimize any potential impacts. Most of the water is being pumped through the Par Pond pumphouse, Building 681-6G, to the following

outfalls (see Figure 3-1):

- Upper Steel Creek (Outfall P-013)
- L-Lake Outfall (Outfall L-007)
- Pen Branch (Outfall K-011)
- Four Mile Creek (Outfall C-004)

Additional pumps and siphons are being installed at the dam and are drawing water over the Par Pond Dam to Lower Three Runs Creek. Where possible, the water is to be withdrawn well below the surface of the impoundment to ensure that adequate oxygen levels are maintained within Par Pond. Rip rap is also being placed in the tailrace area to dissipate energy, reduce scouring, minimize mobilization of cesium-contaminated sediments, and ensure aeration for downstream aquatic life in Lower Three Runs Creek.

When the water level in the impoundment reaches approximately 190 feet msl, the pumps at the pumphouse are expected to become inoperative due to insufficient water pressure at the pump intakes. At that time, portable pumps will be put into operation at the dam to continue the drawdown to the desired water level of approximately 181 feet msl and all water withdrawn will go into Lower Three Runs Creek.

3.2 Possible Future Actions

Pending the completion of the geotechnical investigations and evaluation of alternative options for repair and refill, DOE is expected to repair and subsequently refill Par Pond. However, DOE has not made a decision about the specific repair, remedial, refilling, or mitigative actions that will be authorized. Dam repair or remedial options under consideration include the following:

- Extend, repair and grout around the outlet conduit
- Construct a downstream seepage berm and energy dissipation system
- Provide filters and drains along the downstream portion of the dam and the conduit to improve internal drainage
- Repair lower sluiceway gate and other structures as needed

Pending completion of the drawdown actions, a final report is to be developed to document the observed operational, environmental and regulatory impacts. In addition to documenting environmental impacts of the action, this report will identify the preferred repair options and note any additional mitigation or remediation, such as seismic remediation, that may be required for the dam. If it is assumed that DOE will repair the dam, construction could begin in 1992. If it is assumed that DOE will refill the impoundment, refill operations could begin in 1993 to restore the normal water level to 200 feet msl. Consideration would be given to begin refilling operations as soon as possible, perhaps before dam repairs are completed, to minimize impacts on the Par Pond ecosystem.

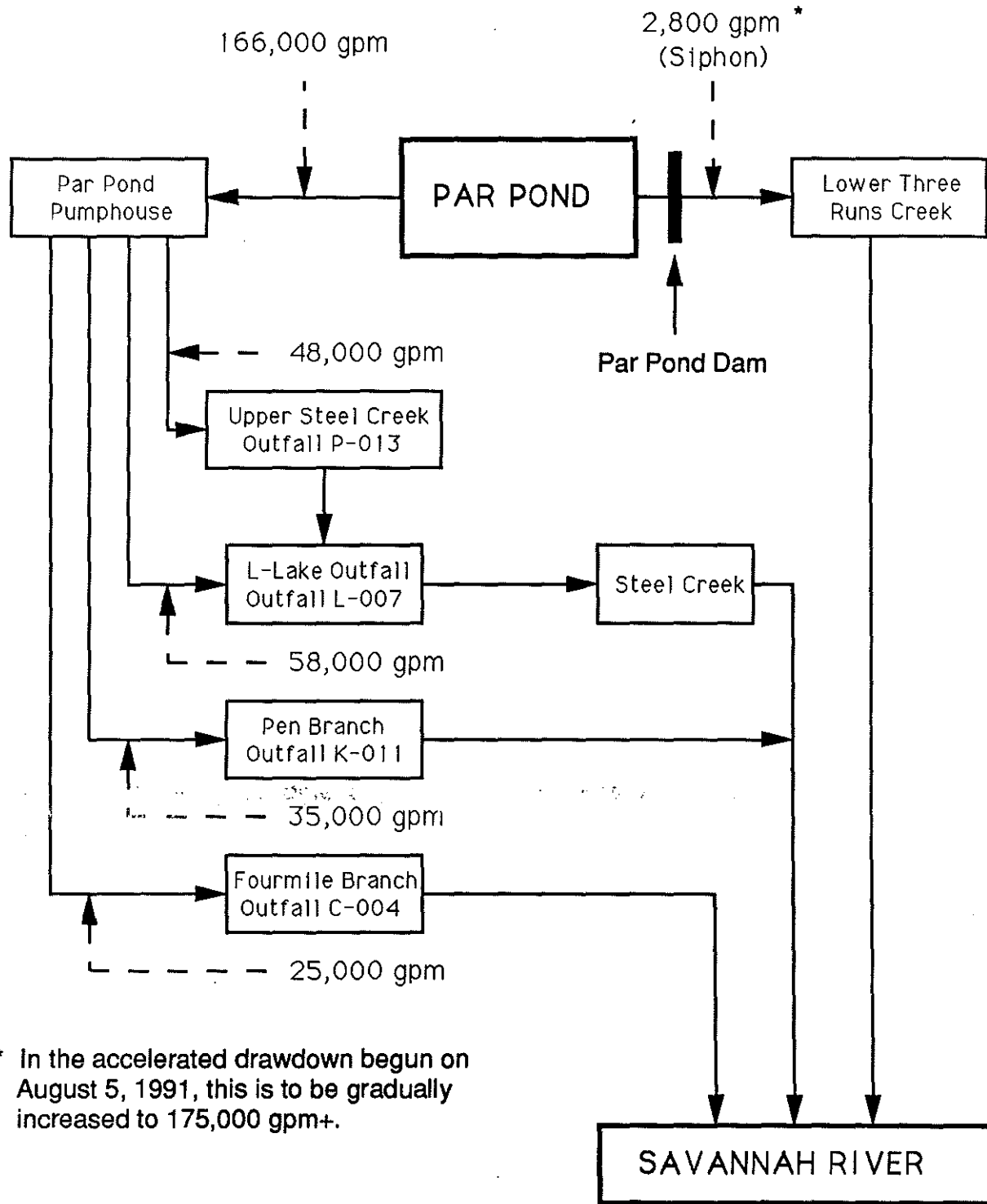


Figure 3-1. Diagram of the directed discharges of the drawdown pumping operation of Par Pond, SRS, South Carolina. Depicted pumping data (from 24 July 1991) are typical for the daily drawdown operations.

3.3 Alternative to the Implemented Action

The alternative to the implemented action discussed above is to take no action. This would not meet DOE objectives and would result in a failure to meet both the purpose and the need of the implemented action.

4.0 AFFECTED ENVIRONMENT

4.1 Geography

The SRS occupies an area of approximately 198,737 acres in Aiken, Barnwell and Allendale counties in southwestern South Carolina (see Figure 4-1). The site borders the Savannah River for about 17 miles near Augusta, Georgia, and Aiken and Barnwell, South Carolina. These cities are the largest population centers closest to SRS, but they are not located downstream of Par Pond or SRS. A small community, Martin, SC, is 12 miles downstream of Par Pond on Lower Three Runs Creek. Approximately 100 miles further downstream from SRS, the Savannah River supplies water to municipal systems serving people living in Beaufort and Jasper counties, SC, and living near Savannah, GA. Recreational use of impoundments on the Savannah River, including swimming, fishing, and boating water contact recreation, is more extensive upstream than it is near SRS and downstream. The Final Environmental Impact Statement for Continued Operation of K-, L-, and P-Reactors (ROEIS) (DOE, 1990) and the most recent socioeconomic survey of the six-county SRS area of influence (NUS, 1990) contain additional information on SRS facilities and the areas surrounding SRS.

4.1.1 Par Pond

Par Pond is a 2,640-acre impoundment created in 1958-59 as a cooling pond for P and R Reactors located on the SRS (see Figure 4-2). The impoundment in eastern SRS was formed by the construction of a dam across Lower Three Runs Creek some 20 miles upstream of the Savannah River. Water levels in the impoundment have been maintained at the 200 feet msl level, primarily through the pumping of Savannah River water to reactor operations and discharging to Par Pond. Additional makeup water has been pumped to Par Pond from the Savannah River as necessary to maintain normal water level. This amount has increased during periods when reactor operations have been shut down.

In addition to the main 2,640-acre impoundment, the Par Pond System contains several precooling ponds and an interconnecting system of effluent canals (see Figure 4-3). During reactor operations, this extensive system collectively results in the dissipation of up to 70 percent of the heat in the effluent cooling water from the reactor heat exchangers before it reaches Par Pond. The thermal effluent from reactor operations causes the surface temperatures in Par Pond to be approximately 5°C higher in the immediate discharge area of Par Pond than in the more distant areas (i.e., North and West Arms; Figure 4-3). The annual thermal stratification pattern in Par Pond is typical of a warm monomictic lake,

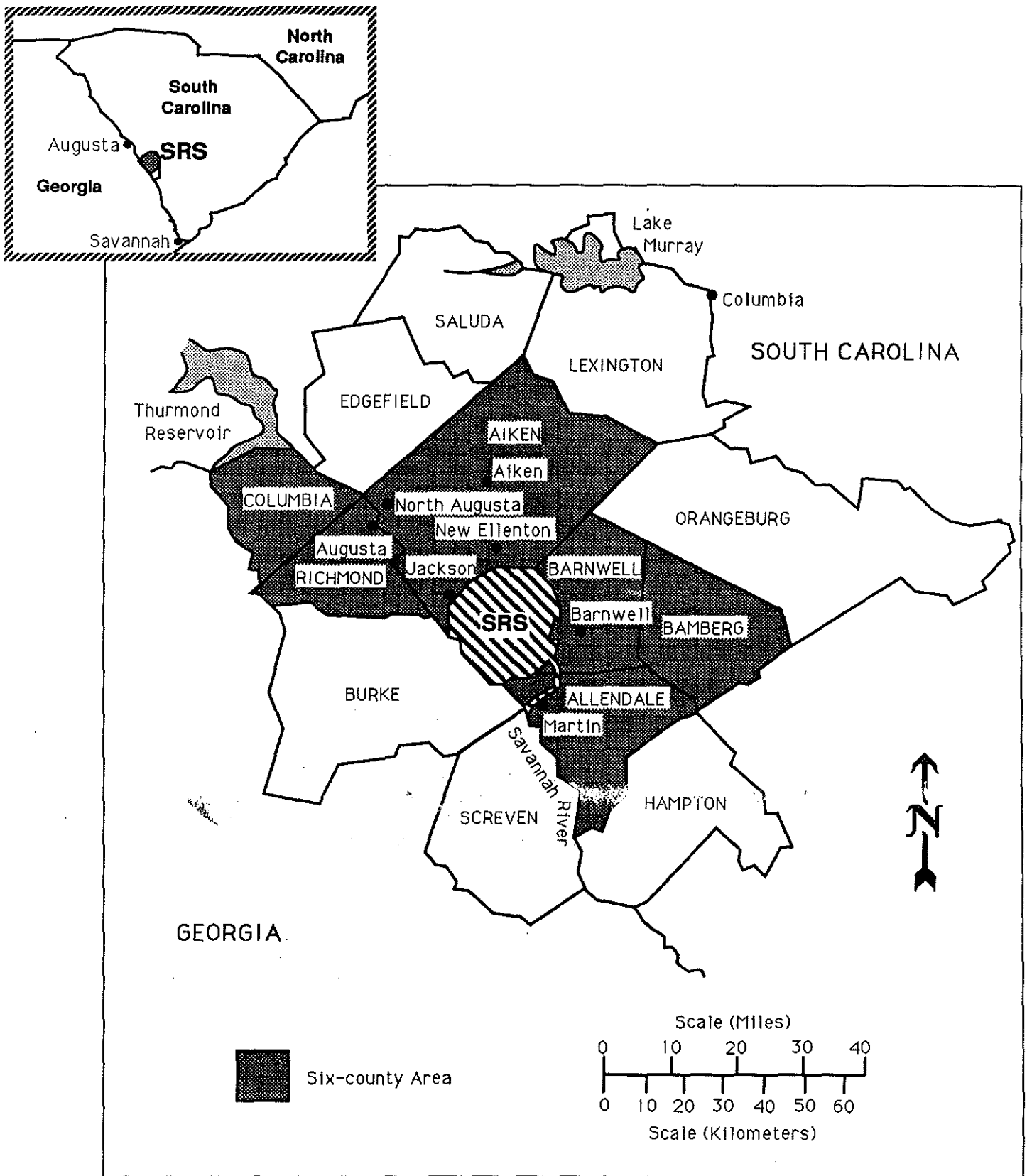


Figure 4-1. SRS location in relation to surrounding population centers and counties.

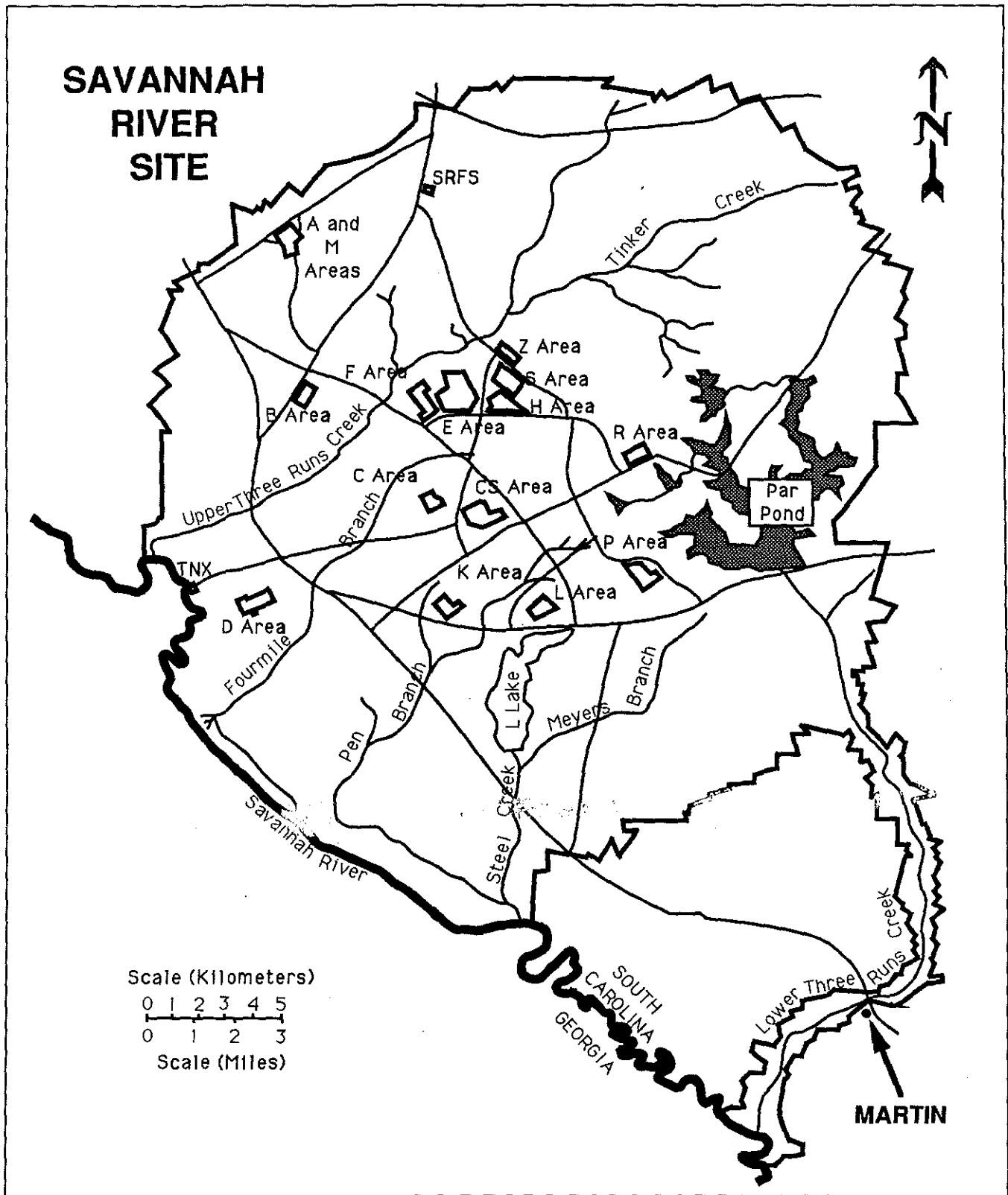


Figure 4-2. Map of the Savannah River Site showing the general location of the Par Pond Reservoir System.

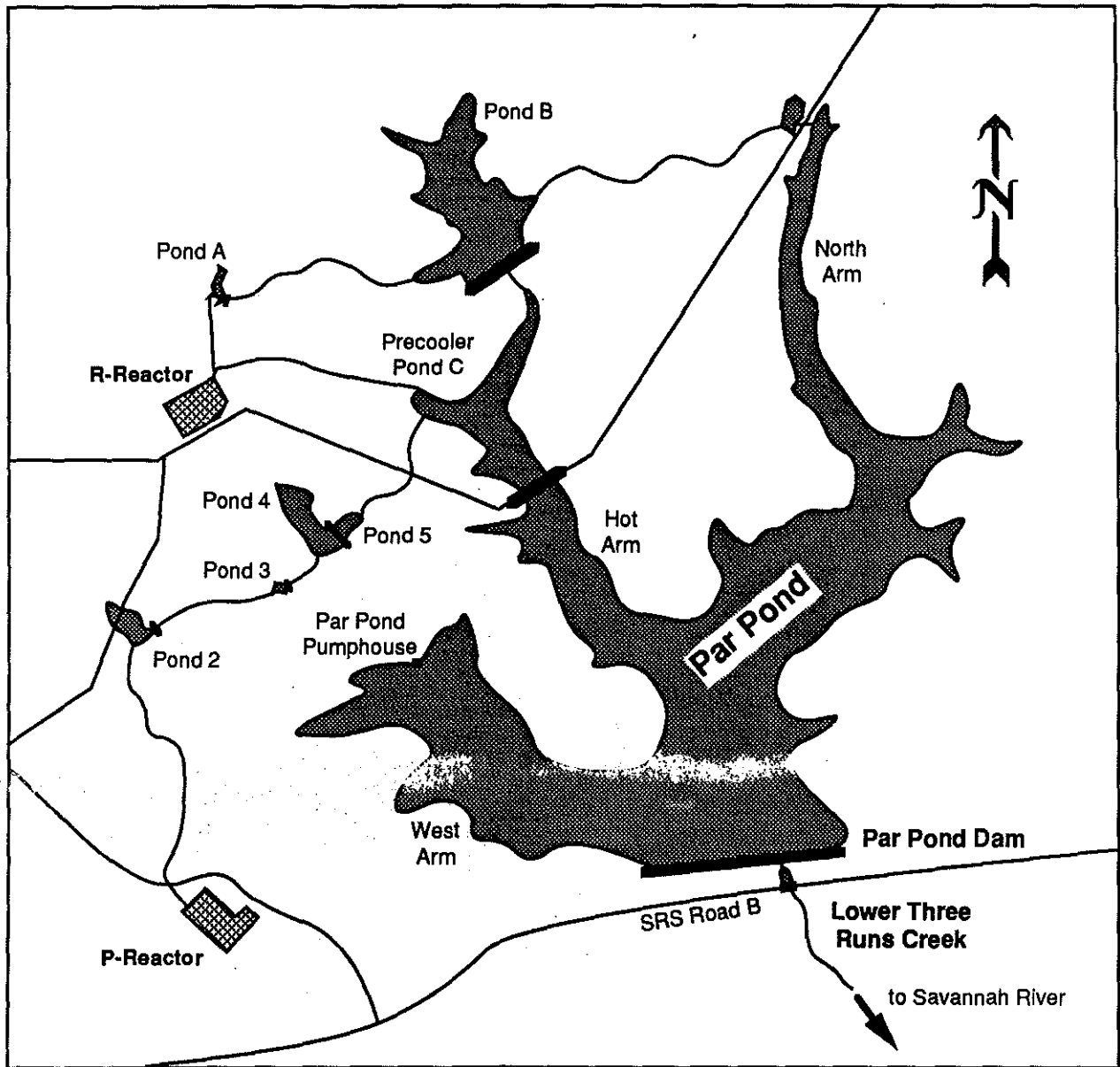


Figure 4-3. Diagram of the Par Pond Reservoir System including the precoolers and effluent canals from both R- and P-Reactors. The underground piping system from the Par Pond Pumphouse to P-, L-, K- and C-Reactors is not shown in this diagram.

stratifying from April through September, experiencing turnover in October, and mixing from October through March (Gladden et al., 1985). Sustaining the water level at approximately 200 feet msl from 1959 to 1991 has allowed for the development of a unique freshwater ecosystem supporting a stable ecological community (WSRC, 1991).

Before the creation of Par Pond, R-Reactor discharged its thermal effluents directly into the Lower Three Runs Creek. R-Reactor began operations in 1953 and ceased operation in June 1964. Upon completion in 1958, Par Pond began receiving secondary cooling water from R- and P-Reactors as follows:

- R-Reactor only--August 1958 to October 1961
- R- & P-Reactors--November 1961 to June 1964
- P-Reactor only--July 1964 to September 1988

The P-Reactor began operations in November 1961 and ceased operations in September 1988 (DOE, 1990). Since 1991, P-Reactor has been placed in a cold standby condition indefinitely. Options for continued operational uses of the reservoir are currently being assessed.

4.1.2 Par Pond Dam

The Par Pond Dam is an earthen dam approximately 65 feet high and 4500 feet long. The embankment was constructed with a 3:1 slope with a gently sloping earthen blanket on the downstream of the face. The earthen blanket was constructed shortly after the initial filling of the impoundment when seepage was observed on the dam's original downstream slope. Five relief wells were installed at the toe after initial filling to provide additional controls for the seepage within the dam. The elevation of the dam's crest is at 210 feet msl. The normal water level of the impoundment is 200 feet msl, with the design operating pool at 200 feet msl. At normal water level, the volume of the impoundment is approximately 57,000 acre feet (WSRC, 1991).

4.2 Ecology

Since the U.S. Government acquired the SRS in 1951, the ecological complexity and diversity on SRS has increased through an extensive forest management program. Prior to the federal acquisition, the area had been occupied by small residential communities, farms and forested lands. The SRS forest management program has subsequently increased forested areas and planted pine plantations to cover more than 90% of the area contained within the site. Wildlife management includes protection and enhancement of threatened and endangered species, such as the wood stork and red cockaded woodpecker, and population control of white-tailed deer and wild swine through supervised hunts. The SRS was designated as the nation's first National Environmental Research Park in 1972 and is one of the most extensively studied environments in the country. The ROEIS contains additional information on ecological characteristics of the SRS, Par Pond, and Lower Three Runs Creek (DOE, 1990).

4.2.1 Par Pond

Par Pond is a unique reservoir ecosystem within this region because of the relatively constant water levels (+/- 1 foot) that have been maintained within the impoundment. The historic stability of water levels has resulted in the development of extensive shoreline plant communities. This feature strongly influences the overall ecology of the ecosystem. Also, the addition of Savannah River makeup water to Par Pond has resulted in nutrient enrichment because the natural drainage to the pond is considerably lower in nutrients than the river water in the vicinity of the site. From the standpoint of water chemistry and biological communities, Par Pond generally fits the classification of an oligotrophic to mesotrophic lake (WSRC, 1991).

Par Pond supports a variety of vertebrates including a large population of American alligators, game and non-game species of fish, substantial numbers of waterfowl, wading birds, and the bald eagle, an endangered species. One of the main reasons for an observed increased use of this ecosystem by these species is the fact that this impoundment is remote and not open to the public (Gladden et al., 1985). Water quality in Par Pond has been profoundly impacted by human activities, including heated effluent and radionuclides from reactor operations, nutrients from sewage treatment plants along the Savannah River, and agricultural runoff from the Savannah River makeup water it has used for decades.

Pollutants have entered Par Pond as a result of (1) SRS process-related leaks and purges (e.g., cesium and tritium) and (2) Savannah River makeup water (e.g., mercury). While none of these pollutants are believed to have significantly altered the ecology of Par Pond (Gladden et al., 1985), the heated effluent from reactor operations discharged into the impoundment has impacted this ecosystem.

An estimated 222 Ci of ^{137}Cs (cesium) was released to Par Pond and the Lower Three Runs Creek drainage from R-Reactor between 1954 and 1964. The source of the cesium was leaking fuel or target slugs in the spent fuel storage basins. When R-Reactor was shut down in 1964, all cesium releases from that source were stopped. Based on recent sampling efforts, it is estimated that there are approximately 0.22 Ci of cesium in the waters of Par Pond. The average annual concentrations of cesium (3.5 pCi/L) in Par Pond (Hayes, 1991) are well below the annual average of 100 pCi/L in the Safe Drinking Water Act (40 CFR 141).

Most of the cesium released by R-Reactor is presently contained in the sediments of both Par Pond and Lower Three Runs Creek. Sediment concentrations of cesium in these areas range from 1 pCi/gm up to several hundred pCi/gm. The distribution and/or location of these concentrations is variable. For example, recent studies have shown that Par Pond cesium sediment concentrations increase with depth from the water's edge.

Since 1984, the tritium concentration in Par Pond has been decreasing due to the smaller amounts of tritium releases from P-Reactor, hydrologic loss processes, and inflow from local surface water that is low in tritium. Recent sampling efforts have shown that the current tritium inventory in Par Pond waters is approximately 195 Ci. Tritium is lost from Par Pond by flow to Lower Three Runs Creek (both over the spillway and by seepage) and to the atmosphere by evaporation and exchange processes. Measurements have shown that tritium concentrations are uniform from top to bottom at the deepest part of the impoundment near the dam. The average annual concentrations of tritium (3.0 pCi/ml) in the impoundment are slightly higher than in the Savannah River at the U. S. Highway 301 bridge (approximately 2.0 pCi/ml). These concentrations are well below the Safe Drinking Water Act (40 CFR 141) guideline of 20 pCi/ml annual average (Hayes, 1991).

4.2.2 Lower Three Runs Creek

The Lower Three Runs Creek watershed is the second largest of the six SRS streams with 180 square miles. From Par Pond Dam, the stream flows entirely onsite about 20 miles in a southerly direction to the Savannah River. Several tributaries rising on SRS flow into this stream in its lower reaches, substantially increasing its flows.

Prior to the construction of Par Pond, Lower Three Runs Creek received the full flow discharge (up to 175,000 gpm) of effluent from R-Reactor. Following the development of the impoundment, this drainage experienced a period of extremely high flow between 1963-64. As late as the mid 1970s, effects of these high discharges were evident in the upper reaches of the stream below the dam (Gladden, 1979). During recent years, the average flow in Lower Three Runs Creek at SRS Road B immediately below the dam has been approximately 15,000 gpm, with high flows of approximately 40,000 gpm (WCFM, 1991). However, the average stream flow at Patterson Mill (approximately five miles downstream from the dam) has been approximately 36,000 gpm (1974-1989), with observed short-term high flows of approximately 330,000 gpm (1980).

4.3 Radiation Environment

In the SRS area, natural radiation sources contribute 82%, or about 300 millirem per year, to the annual radiation dose of 361 millirem to the environment. SRS operations contribute 0.1%, or less than 0.1 millirem, to the annual dose. The remaining radiation sources are medical exposures (15%, or 52 millirem per year) and consumer products (about 3%, or 9 millirem per year). The ROEIS contains more information on specific contributing radiation sources, such as cesium and tritium (DOE, 1990).

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 Consequences from Implemented Action

5.1.1 Par Pond Ecosystem

The level of the damage to the Par Pond ecosystem is a primary concern associated with the current drawdown operations. The current drawdown of Par Pond to approximately 181 feet msl would substantially reduce the volume of its surface waters, because the Par Pond pumphouse is pumping exclusively from its surface waters. As a result, most of the remaining volume of water in the impoundment would be bottom water, which is devoid of oxygen. This exclusive withdrawal of surface waters is also predicted to reduce the volume of good quality surface water to the point where there is insufficient oxygenated water to maintain the existing community of aquatic organisms like fish. Additionally, as the depth of the surface water layer decreases, the probability increases that a significant mixing of anoxic bottom water with a small volume of surface water could occur. A substantial and rapid mixing of this nature will significantly reduce the water quality in the surface layer, which could result in fish kills. The probability that such events would occur increases as the rate and extent of drawdown is increased (WSRC, 1991), unless a seasonal overturn adequately aerates bottom water. The depth of any supplemental pumping is currently undetermined.

Exposure of the sediments during the drawdown would result in the leaching of nutrients and organics into the remaining water. The probable consequences of such leaching would be increased biological oxygen demand (BOD) to decompose the organic material (with resultant reduced oxygen levels in the surface water layer) and increased inorganic nutrient (e.g. N, P) concentrations that would stimulate algal productivity and subsequently produce eutrophic conditions in the impoundment. Extremely high primary productivity frequently leads to large daily changes in dissolved oxygen concentrations and pH. Under extreme conditions, such eutrophication could also result in fish kills. The reduction in pond volume generally would reduce the capacity to receive nutrients without adverse consequences (WSRC, 1991).

Remobilization of cesium from Lower Three Runs Creek sediments during the drawdown of Par Pond is expected to contribute only minor amounts of cesium (20-30%) to the river and only for a short period of time (Hayes, 1991).

Aquatic Plants

The drawdown would result in the desiccation and death of at least above-ground portions of all of the aquatic plants along the shore zone of Par Pond. Although specific data are not known to be available, it is expected that these areas are characterized by high primary productivity and sediments that are rich in both organic matter and inorganic nutrients. Further, these areas of emergent and submergent vegetation function as habitat and food sources for numerous animal species. The recovery of these plants would depend on the presence of appropriate resistant seeds or stems/root structures, as well as the duration of

the drawdown. Those plant species that do not have exposure resistant resting forms would likely be slow to become reestablished in the shore zone and could be excluded for a number of years by plant species that are capable of rapid recovery or colonization (WSRC, 1991).

Plankton

The drawdown of Par Pond could result in the reduced diversity of periphyton and zooplankton through elimination of the shore zone plant habitat. Restoration of this habitat following refilling of the impoundment should result in rapid reestablishment of this community. The input of nutrients and organic matter from the shore zone into the open water may result in eutrophic conditions in the lake. Should this occur, the phytoplankton community will increase substantially in primary productivity rates and the community would be dominated by blue-green algae (WSRC, 1991).

Aquatic Invertebrates and Fish

Many aquatic insects and shellfish, such as clams and snails, occupy near shore (littoral) bottom habitats. Most of these species have limited powers of movement, and would likely be lost during the drawdown operations. The richest habitats will be those associated with the surface water layer. Benthic macroinvertebrates constitute a major food source for many fish and some waterfowl, wading birds, and reptiles and amphibians. Consequently, the loss of the benthic invertebrate community could have an adverse impact on the available prey base for many other organisms using this ecosystem (WSRC, 1991).

Many of the fish species in Par Pond depend upon the vegetation for shelter and foraging habitat. The shelter function is particularly important for larval and juvenile fish and for some species that achieve small size as adults. As Par Pond is lowered, these small fish will be forced out of the shore zone vegetation and become subject to predation from larger fish. As such, it is anticipated that in the short term, the average condition will increase for larger fish in the impoundment while most smaller fish will be lost to predation. On the longer term, larger fish may experience food limitation because of the lack of production in smaller fish during 1991 and the absence of substantial food resources in the shore zone benthic community. The size and age structure of most fish species would be influenced for several years because of the expected low survivorship of juvenile fish during 1991. The season of the drawdown does make a difference and could function as a natural mitigation measure (WSRC, 1991).

The rapid drawdown of Par Pond and the likely resultant degradation of water quality noted previously can also significantly affect fish inhabiting open water. The current fish community in Par Pond would be forced to occupy a limited environment that has less than 50 percent of the current surface area and an even more reduced volume of suitable (oxygenated) water. The rates of oxygen demand cannot be estimated, but it is clear that the oxygen demand per volume of Par Pond water would increase (WSRC, 1991).

The greatest risks to the remaining fish community would be associated with eutrophication, organic matter influx from decaying vegetation, and rapid mixing of the bottom waters with the shallow zone of the oxygenated surface water layer. Any of these conditions create the potential for a significant fish kill in the remaining fish population (WSRC, 1991).

Amphibians and Reptiles

Reptiles, such as American alligators, and amphibians use the shore zone vegetation areas for reproduction and foraging and the season and length of the drawdown would make a difference. Lowering the water level would expose nests to predation. Also, juveniles of many reptile and amphibian species use the shore zone vegetation for protection from larger predators, and as such, much of the reproductive effort for 1991 may be lost (WSRC, 1991).

Adults of some reptile species could emigrate to more favorable habitats following the drawdown of the impoundment. The resultant occupied habitats may include nearby wetlands as well as offsite areas. Some of the alligators may be large and hence may pose a safety threat. To the extent that these organisms have radionuclide body burdens, offsite immigration may represent potential impacts associated with offsite transport of contaminants (WSRC, 1991).

Birds

Par Pond is a major resource and refuge for both resident and migratory waterfowl species. Surveys over the last 10 years have revealed 3,000-5,000 birds using Par Pond at any one time, and thousands more use the impoundment as a stop-over point during migration. Densities of waterfowl begin increasing dramatically in September-October. The birds are attracted to Par Pond by its abundant food resources and isolation from hunting pressure and disturbance. The construction of L-Lake has provided an alternate resource for waterfowl, and SREL surveys have indicated that wintering waterfowl tend to move from Par Pond to L-Lake in late January/early February. This phenomenon is most clearly shown by species such as ring-necked ducks that feed heavily on clams. The reduction in Par Pond water levels will likely force these birds to alternate areas, such as L-Lake, Ponds A and B, or offsite areas. In the latter case, the birds would be subject to increased hunting pressure (WSRC, 1991).

Mammals

Resident white-tailed deer and wild swine may forage on vegetation growing in the contaminated sediments. In addition, the swine would likely root in the exposed lake bed for tubers and roots of the shore zone vegetation. The potential exists for both of these mammal species to uptake contaminants (primarily cesium) while foraging on the exposed Par Pond sediments. Both white-tailed deer and wild swine are harvested during the site's fall public hunts. Individual animals are analyzed for cesium and, if found to contain a body burden in excess of acceptable limits, are not returned to the hunter.

5.1.2 Lower Three Runs Creek

The environmental effects of the drawdown of Par Pond on the Lower Three Runs Creek drainage would be affected by both the rate of drawdown and the depth from which the water is withdrawn from the impoundment. If surface water is to be pumped from Par Pond as projected, the environmental effects would be largely restricted to those associated with flow effects. If bottom water is pumped from the impoundment, poor water quality in the bottom of Par Pond will necessitate mitigative action (e.g., mechanical aeration) before the water is released into Lower Three Runs Creek (WSRC, 1991).

Based on its history, Lower Three Runs Creek has already experienced high flows; however, these observed extremes were of much shorter duration than the projected drawdown discharges. Inundation of the floodplain, some increased scouring of sediments, and displacement of plants and macroinvertebrates in the upper reaches of the stream would occur; but these effects should be readily reversible when normal flows are restored as was demonstrated with the discharge from R-Reactor into Lower Three Runs Creek prior to construction of Par Pond (WSRC, 1991).

5.1.3 Offsite Areas

The drawdown of Par Pond will result in an increase in the offsite transport of contaminants (primarily cesium, tritium, and mercury) suspended in the reservoir's water column and discharged into the Savannah River.

Cesium

During drawdown of the surface waters from Par Pond, a total of approximately 0.14 Ci of cesium will be released through SRS surface streams. Assuming all of the cesium is transported to the river, then the cesium concentration in the river will depend on drawdown rate, the river flow rate, the cesium concentration in Par Pond surface water (3.1 ± 0.8 pCi/L), and the current cesium concentration in the river (0.012 pCi/L). For the highest predicted possible drawdown rate of 240,000 gpm and a low flow of 5,000 cfs in the river, the cesium concentration in the river is estimated to be 0.35 pCi/L (Hayes, 1991). This concentration, which would cause a dose rate of 0.0009 mrem per year, is well below EPA's standard for community drinking water systems under the Safe Drinking Water Act (40 CFR 141) of 4 mrem per year to an individual drinking two liters per day.

Remobilization of cesium in Lower Three Runs Creek sediments during the drawdown of Par Pond is expected to contribute only minor amounts of cesium to the river and only for a short period of time. In general, the drawdown operations on Par Pond would result in a slight increase in the cesium level in the Savannah River, but this would be below regulatory standards.

Tritium

The tritium in the waters of Par Pond is present at a uniform concentration of 3.0 pCi/ml. This is slightly higher than the tritium concentrations of approximately

2.0 pCi/ml in the Savannah River at Highway 301. Both of these are below EPA's maximum average annual concentration of tritium permitted in community drinking water systems under the Safe Drinking Water Act regulations (40 CFR 141) of 20 pCi/ml per year. The impact of the air release of tritium into the environment as a result of the drawdown is not projected to be significant (WSRC, 1991).

Mercury

The offsite impacts of mercury as a result of drawdown operations are currently being evaluated. Initial concerns about the offsite transport of mercury-contaminated fish leading to human food chain impacts have resulted in the installation of screens on the upstream end of siphons and pump lines being used in the drawdown of the impoundment.

Although no studies have been conducted to date to assess the impact of the airborne doses to offsite individuals, no health effects or significant or measurable doses of radiological constituents are expected.

In general, the drawdown operations on Par Pond will result in a slight increase in the cesium level in the Savannah River due to cesium transport, but this will be below regulatory standards. No significant impacts to offsite water quality are expected as a result of the drawdown.

5.1.4 Worker Safety

Upon completion of the current Par Pond drawdown to approximately 181 feet msl, approximately 1,300 acres of sediment will be exposed containing cesium and tritium. The possibility exists for cesium and tritium to mobilize and become airborne as the lake bed dries raising onsite worker radiation exposure concerns. However, for tritium the impact of airborne releases from these sediments into the environment as a result of the drawdown is not projected to be significant.

For cesium, the Annual Limit of Intake (ALI) for cesium listed in ICRP 30 is 6×10^6 Bq, which, if inhaled, would result in a Committed Effective Dose Equivalent (CEDE) of 5 rem. The reported maximum sediment concentrations of cesium in Par Pond (<100 pCi/gm) would be equivalent to 3.7 Bq/gm. To receive a CEDE of 5 rem, a radiation worker at Par Pond must inhale 6×10^6 Bq/3.7 Bq/gm or 1.6×10^7 grams (approximately 3,520 lbs) of airborne dust. This is very unlikely (WSRC, 1991).

Another assessment can be made from the industrial hygiene standpoint. The nuisance dust limit is 10 mg/cu m. Since an adult breathes 9,600 liters of air during each eight-hour period, the daily nuisance dust intake limit is 0.1 gm and the annual limit is 25 gm. This is roughly equivalent to 0.08 mrem/yr for a cesium concentration of 100 pCi/gm (WSRC, 1991).

In summary, the human health concerns associated with onsite worker airborne radiation exposure in the projected exposed areas of Par Pond are not expected to be significant.

5.2 Consequences from Possible Future Actions

Pending the completion of the geotechnical investigations and evaluation of alternative options for repair and refill, DOE is expected to repair and subsequently refill Par Pond. However, it is not clear at this time what specific repair, remedial, or refilling actions will be authorized. Alternative options for repair and refill are under consideration, including the following:

- Extend, repair and grout around the outlet conduit
- Construct a downstream seepage berm and energy dissipation system
- Provide filters and drains along the downstream portion of the dam and the conduit to improve internal drainage
- Repair lower sluiceway gate and other structures as needed

Repair activities for Par Pond dam would take place mostly within developed areas at the dam and immediately downstream. These activities would be mostly compatible with existing land uses in these areas and are not expected to significantly impact these uses. Lake levels would be held at approximately 181 feet msl during the construction period. Existing roads and facilities would be used as much as possible. Temporary construction impacts such as noise, dust, and fumes would be controlled to minimal levels. Standard sedimentation and erosion control measures would be implemented and any appropriate permits would be obtained.

Repair activities are not expected to adversely affect environmentally sensitive areas such as historical or archaeological sites, or endangered species habitats, because none are located in the dam vicinity. Activities conducted in the floodplain or wetlands adjacent to the dam and impoundment, such as earthwork or dewatering activities, would be conducted in accordance with accepted industry standards and applicable regulations. Any necessary permits would be obtained. All possible actions would be taken to minimize potential harm to the floodplain and wetlands. Earthwork would be done in such a way as to minimize impacts on humans and wildlife.

The size of the projected construction force and specific construction details are not known at this time. When specific actions are authorized, their environmental consequences will be determined and analyzed.

Refill operations could begin as soon as possible, even before dam repairs are completed, if possible. This would minimize impacts on the Par Pond ecosystem. Specific details of the impacts of refilling Par Pond on such things as successional species colonizing areas opened up by the drawdown will be evaluated.

5.3 Mitigation Plan and Specific Actions

To reduce the impacts of the drawdown operations of the Par Pond repair activities, DOE is evaluating the following mitigation efforts that are or will be taken as deemed necessary:

- Survey work areas to ensure that appropriate personnel and environmental protection measures are implemented.
- Implement any plans to refill the impoundment to the normal water level as soon as possible to help vegetation recover quickly as possible. Refill operations could possibly begin before dam repairs are completed to minimize impacts on the Par Pond ecosystem.
- Restock some fish species or organisms as soon as possible after the drawdown to help the system recover more quickly.
- Study the potential mobilization of airborne contaminants from the drying exposed lake bed to identify the need to limit exposure to humans and wildlife.

Other mitigations actions or efforts will be implemented as they are identified and evaluated as appropriate.

6.0 REGULATORY COMPLIANCE

NEPA

This document was prepared by DOE to comply with the National Environmental Policy Act (NEPA) of 1969, as amended, and at the request of the Council on Environmental Quality (CEQ), as made during July 9, 1991, discussions regarding alternative arrangements pursuant to Section 1506.11 of the CEQ regulations for implementing NEPA (40 CFR 1506).

Wetlands Regulations

DOE policy, as stated by Secretary of Energy James Watkins, is that DOE actions will support the President's national goal of no net loss of wetlands (Watkins, 1989). In addition, 10 CFR 1022.15 requires that DOE design or modify its actions to minimize potential harm to or within wetlands or floodplains. As stated in Section 5.1, drawdown activities will temporarily impact Par Pond and Lower Three Runs Creek wetland communities. Previous experience demonstrates that wetland communities will reestablish themselves over a period of time, depending on the length and severity of the drawdown. Studies are underway to evaluate impacts on these areas and mitigate these impacts as much as possible. DOE policy is to preserve and protect wetlands resources at SRS in accordance with the national goal of no net loss of wetlands.

Executive Order 11988 discusses floodplain management and Executive Order 11990 discusses the protection of wetlands.

Drinking Water Regulations

No impacts are expected on downstream water users (Hayes, 1991).

Clean Water Regulations

Existing NPDES permit requirements are not expected to be impacted by drawdown, repair, and refill activities at Par Pond.

The COE has made a determination that no permit under Section 404 of the Clean Water Act is required for current drawdown activities. The COE stated that a nationwide permit covers Par Pond repair and refill activities since the action is considered to be the repair, rehabilitation, or replacement of a previously authorized, currently serviceable structure. Further, no deviations are expected from the plans or uses of the original structure. The dam would not be expanded and no dredged or fill material would be placed into any COE jurisdictional area. A permit under Section 404 of the Clean Water Act was obtained from the COE in August 1991 for riprapping activities conducted in the floodplain of Lower Three Runs Creek immediately downstream of the dam.

Navigable Water Regulations

An emergency permit for State navigable waters construction was obtained from the S. C. Water Resources Commission in August 1991 after the commission determined that the proposed dam repair was necessary to protect the health and public safety.

Clean Air Regulations

The National Emission Standards for Hazardous Air Pollutants (NESHAP) for radionuclides other than radon from DOE facilities is contained in 40 CFR 61, Subpart H. A report addressing radioactive emissions must be submitted annually by DOE. A permit application must be submitted for any facility that emits radionuclides with an effective dose equivalent greater than 1 percent of the prescribed standard. The SRS is considered a facility for the purposes of this regulation. At this time, it is uncertain if airborne releases from the sediments will exceed the standards. However, no impacts are expected as a result of airborne releases from the exposed sediments (WSRC, 1991).

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Waste Regulations

Par Pond is on the SRS CERCLA Site Evaluation List in the draft Federal Facility Agreement (FFA) as requiring investigation under CERCLA. Due to the current drawdown of Par Pond of approximately 20 feet to 181 feet msl, sediment, previously under water, is being exposed. This sediment contains metals and radionuclides, with cesium expected to have the highest concentrations. There is a potential that the cesium could impact human health, so a limited risk assessment is expected to be prepared for submittal to the U. S. Environmental Protection Agency (EPA) Region IV and South Carolina Department of Health and Environmental Control (SCDHEC). The assessment

would address hypothetical risks (using EPA guidance) and site specific risks (using SRS assumptions) for workers, trespassers, residents at the SRS boundary, and a hypothetical resident at Par Pond.

Dam Safety Regulations

The extent of Federal Emergency Regulatory Commission's (FERC) requirements on the drawdown and repair of the Par Pond Dam are uncertain at the present time.

7.0 REFERENCES

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