WATTS BAR NUCLEAR PLANT
SUPPLEMENTAL
CONDENSER COOLING WATER PROJECT

Environmental Assessment
August 1998

August 26, 1998

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)—ENVIRONMENTAL ASESSMENT (EA) WATTS BAR NUCLEAR PLANT (WBN) SUPPLEMENTAL CONDENSER COOLING WATER (SCCW) SYSTEM

An EA (attached) was prepared concerning a proposal by TVA Nuclear to supplement the cooling capacity for WBN. The purpose of this system is to increase power generation at the plant which is constrained by cooling tower performance. The proposed SCCW system would use cooling water drawn from Watts Bar Lake at the Watts Bar Fossil Plant condenser cooling water intake structure. Approximately 135,000 gallons per minute of water would be routed through existing piping to the vicinity of the fossil plant at which point a new supply line would carry the water by gravity to the WBN unit 2 cooling tower basin for the purpose of further cooling water exiting the unit 1 cooling tower which supplies the unit 1 main steam condenser. A like flow of heated water would be discharged through an overflow weir from the unit 1 cooling tower basin by gravity through new piping to the existing fossil plant discharge channel and into the Tennessee River. Construction required for the system would occur entirely on TVA lands.

The EA evaluated 2 alternatives: (1) no action and (2) the proposed construction and operation of the SCCW. Other alternatives not addressed in detail due to technical or economic infeasibility were use of a diffuser at the fossil plant discharge, combined use unit 1 and 2 cooling towers, and further modification of the unit 1 cooling tower to improve performance. In addition to being economically infeasible, the use of a diffuser would cause extensive disturbance to the river bottom from excavation necessary to provide a bed for the diffuser.

The EA addressed potential environmental impacts of constructing the SCCW including impacts to air quality, wetlands and floodplains, endangered and threatened species, wildlife, and cultural and archeological resources. Best management practices required under WBN's Storm Water Pollution Prevention Plan and under a Tennessee General NPDES Permit for Storm Water Discharges Associated with Construction Activity would minimize erosion during construction. Discharge of hydrostatic test water will also be permitted under the General NPDES permit limiting impacts to water quality. Fugitive emission of particulate during construction would be minimized through use of reasonable precautions as required under Tennessee's air pollution regulations. The Aquatic Resource Alteration Permits required from the State of Tennessee for pipeline crossings of wet weather conveyances would mitigate impacts to aquatic resources. Upon review of TVA's assessment of historic properties, Tennessee's State Historic Preservation Officer (SHPO) in the Tennessee Historical Commission, and the Advisory Council on Historic Preservation confirmed that historic properties will not be adversely affected by this project.

Operational impacts addressed in the EA included impacts to water quality, endangered and threatened species, and aquatic ecology. A potential impact to native mussels, including endangered or threatened species, was identified in the immediate vicinity of the heated water discharge to the Tennessee River. To avoid these impacts, native mussels within an area 150 feet square would be relocated prior to system operation. The U.S. Fish and Wildlife Service confirmed that the project would not adversely affect these native mussel species. Computer modeling and past fossil plant thermal discharge field studies indicated that the State of Tennessee thermal water quality criteria would be met at the end of a 1000 foot mixing zone when using a 24 hour averaging period. A zone of passage for fish below the buoyant heated discharge plume in the unaffected lower portion of the water column would further minimize thermal impacts. A modification to WBN's State of Tennessee NPDES permit would be required for operation of the system. This permit would be expected to contain several conditions to monitor compliance with thermal water quality criteria and to confirm that aquatic biological impacts would be negligible.

TVA concluded, based on computer modeling of the thermal discharge, that use of a diffuser for the SCCW discharge offers no environmental advantages. River temperature measurements made during operation of the Watts Bar Fossil Plant thermal discharge (which is now decommissioned) support the SCCW model results. It is TVA staff opinion that the potential disruptive impact on the benthic community caused by construction of a diffuser would far exceed the impact resulting from use of the existing fossil plant discharge and that the full water column mixing created by a diffuser would expose the river bottom to warmer water than the discharge structure proposed by TVA. Also, the cost to construct and operate a diffuser would make the project economically infeasible. This economic analysis is presented in the EA at section 2.3.3.

TVA circulated the EA to the Tennessee Department of Environment and Conservation (TDEC), the Tennessee Historical Commission, the U.S. Fish and Wildlife Service (USFWS), and the U.S. Army Corps of Engineers, Nashville District. The correspondence to and from these agencies are contained in section 9.0 of the EA. In a letter dated April 27, 1998 from TWRA to TDEC's Division of Water Pollution Control, two issues were raised, that in its view remained unresolved. The two issues were related to the construction of a diffuser and monitoring of impacts to water quality and aquatic life. Subsequent to receipt of this letter, TVA made the following additional project commitments for monitoring which are listed in the EA at section 3.11:

- Conduct seasonal monitoring of the instream river temperatures within the mixing zone of the discharge during the first year of SCCW operation and compare the results with model projections, and
- Conduct a fisheries monitoring program in the vicinity of the WBN SCCW facilities during the first year of SCCW operation to study a limited number of crucial fish species to verify selected impact projections outlined in this EA.

Following further discussions with TDEC and TWRA, TVA received a letter from TDEC dated August 20 that granted conditional site approval for the project as proposed by TVA without a diffuser. In lieu of a diffuser, TDEC has required TVA to modify the existing discharge structure, if feasible, to maximize surface flow. This letter is contained in section 9.0 of the EA. TDEC's site approval is based on the following conditions:

1. TVA will develop a mussel relocation plan in cooperation with TWRA.
2. TVA will modify the existing discharge structure to direct flow off the river bottom and/or to dissipate the flow energy.
3. TVA will perform instream temperature monitoring at two locations: on the river bottom near the discharge at the perimeter of the mussel relocation zone, and in a vertical array in the water column at the end of the mixing zone. Additionally, if feasible, TVA will monitor river flow direction near but upstream of the discharge.
4. TVA will provide mussel habitat enhancement as defined in a proposal to be provided by TVA and reviewed by TWRA.
5. TVA will monitor the discharge as established as part of the NPDES permit and will include continuous flow and temperature, and chemical and biological sampling.

Based on the EA, the commitments contained in the EA and the requirements in environmental permits required for the project, we conclude that TVA's proposed construction and operation of the WBN SCCW would not be a major federal action significantly affecting the quality of the environment. Accordingly, an environmental impact statement is not required.

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Attachment
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WBN Supplemental Condenser Cooling Water Project

Environmental Assessment

Executive Summary

Project statement

This project would construct and operate a Supplemental Condenser Cooling Water (SCCW) system for the Watts Bar Nuclear Plant. The system would connect existing water intake and discharge piping originally operated as a part of the Watts Bar Fossil Plant to the cooling towers at the Nuclear Plant. This system would increase power production by the Watts Bar Nuclear Plant by reducing main turbine condenser temperature.

The gravity flow SCCW system would operate continuously except during times of chemical water treatment for the Nuclear Plant. Operation of the existing cooling tower was optimized previously at 105% of design capacity, however, warm weather power losses continue due to undersizing of cooling tower capacity to support maximum main turbine generator power and condenser cooling capacity. Without installation of the SCCW system, no increase in generation would be realized.

Commitments

1. Use of construction Best Management Practices
2. One-time relocation of native mussels
3. Addition of flow diverting provisions to discharge structure
4. Support experiment or test plan for enhancement of mussel habitat
5. Discharge monitoring
6. River monitoring

Conclusions

This assessment was prepared by an interdisciplinary environmental review team of the Tennessee Valley Authority. The team reviewed in depth the construction and operation of this proposed system relative to environmental requirements and guidelines. Specifically, the thermal discharge analysis demonstrates system operation within mixing zone required limits of 30.5 °C (86.9 °F) maximum discharge temperature, 3 °C (5.4 °F) maximum delta temperature, and ±2 °C (±3.6 °F) rate of rise. With the appropriate implementation of the above commitments, no significant adverse environmental impacts have been identified by the team.

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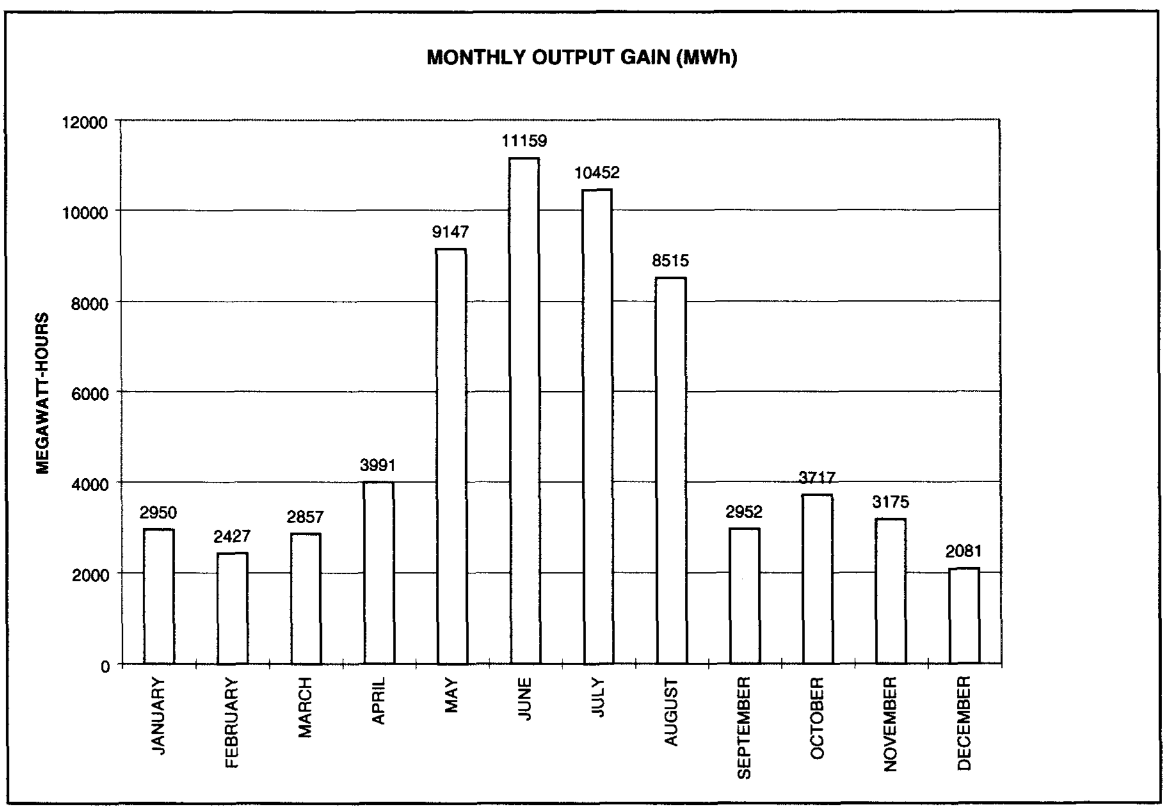
1.0 PURPOSE OF AND NEED FOR ACTION

1.1 Improved Plant Performance

The Condenser Circulating Water (CCW) system for Watts Bar Nuclear Plant (WBN) uses natural draft cooling towers to reject waste heat from the steam cycle. The capability of the towers to cool the CCW is significantly affected by site meteorological conditions. As the ambient temperatures become higher, the tower cooled water temperature also increases. This warmer water from the towers results in a decrease in the net megawatt output of WBN due to an increase in the condenser backpressure above the optimum design. If the temperature of the water to the main condenser could be reduced, the efficiency and output of WBN could be improved. Therefore, it was decided to investigate the feasibility of supplementing tower performance by routing cooler water from upstream of the Watts Bar Dam (WBH) to WBN. This water would mix with and lower the temperature of the water from the towers.

The use of water from WBH to supplement the present CCW would result in approximately 63,400 megawatt hours (MWh) increased output from WBN annually. This corresponds to a net revenue gain of approximately $1,600,000 in fiscal year 1999. This increased capacity would occur predominately in the warm weather months of May through August when the cooling tower cooled water is warmest. Figure 1-1 shows the increase in MWh for each month of an average year. This increase would result from a combination of factors, primarily reduced condenser backpressure with a resultant increase in turbine-generator output. Other less significant contributors would be avoided impacts and costs from reduced operation of some equipment (i.e. turning off of extra pumps) and extension of effective life of other items (e.g. condensate polisher resin beds).

Figure 1-1 Seasonal variation of energy gain under typical weather conditions



1.2 Description of Supplemental CCW System

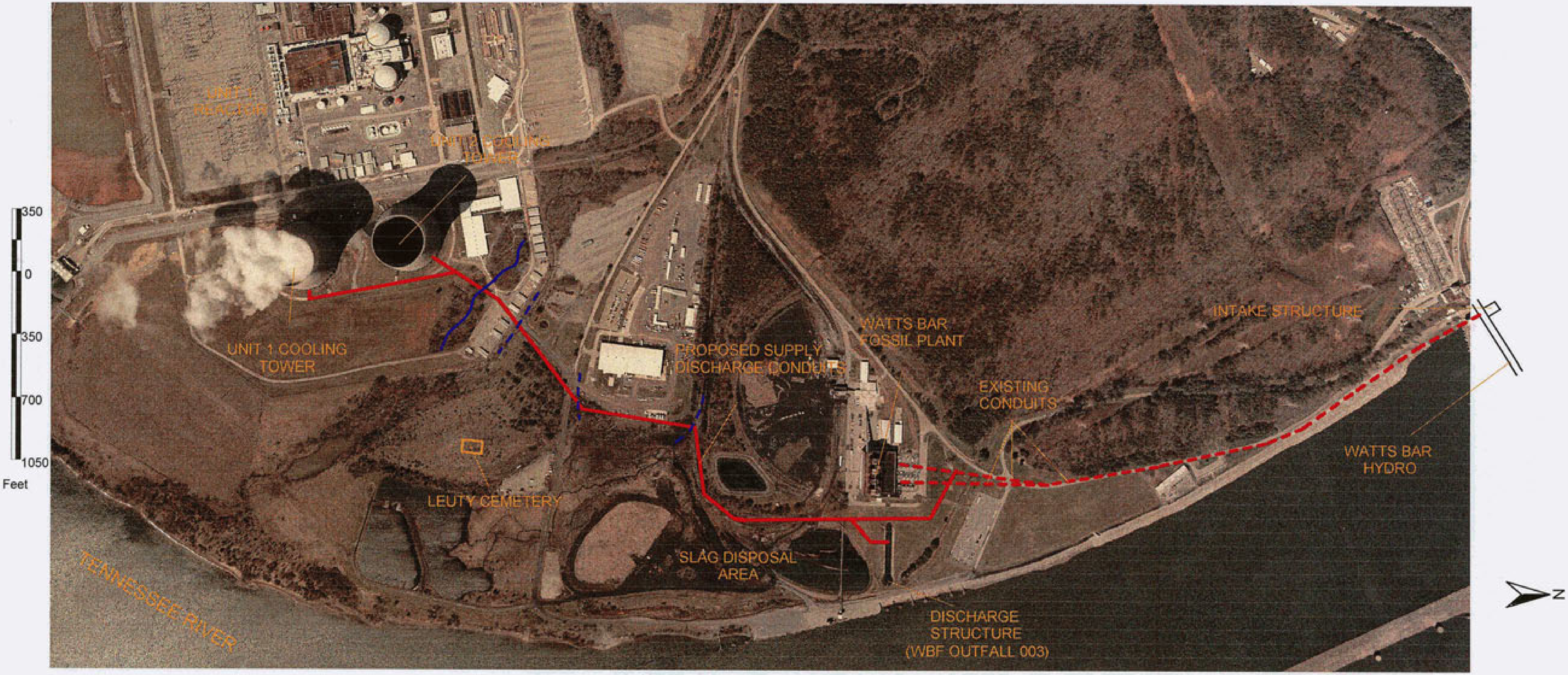
The proposed project would provide between 115,000 and 135,000 gallons per minute (gpm) from Watts Bar Reservoir to WBN, depending on the pool elevation, to supplement the cooling capacity of the existing cooling tower. The supplemental flow would normally be continuous during WBN operation. Existing structures supply circulating water for the WBF from the Watts Bar Reservoir. The proposed project would use some of the existing WBF components to take advantage of the gravity flow and eliminate the need for new pumps. This project would use the existing intake structure at WBH, and most of the existing large-diameter pipe from the WBH to WBF to supply supplemental cooling water to the WBN CCW system. New pipe between WBF and WBN cooling towers would be installed. The discharge structure at WBF would also be integrated into the project. See Figure 1-2 for the general location of the project components.

1.3 Public Involvement

TVA determined that the appropriate public involvement for the draft EA was to request comment from involved State of Tennessee and Federal agencies. Neither the environmental or socioeconomic effects of the project are expected to be of public concern. The project construction occurs only on TVA property, and no significant off-site environmental impacts are projected.

Applications for new or modified environmental permits may result in public notices and public meetings at a later time.

Watts Bar Site



WATTS BAR SUPPLEMENTAL
CCW PROJECT

FIGURE 1-2

1.4 Federal and State Permits and Licenses Required

All required Federal, State, and local regulatory non-radiological environmental permits and approvals were obtained for construction and operation of both WBN and WBF. These include various State permits or licenses for air, water, demolition landfill, underground storage tanks, and hazardous waste generation. Environmental regulatory agencies conduct periodic inspections to verify that these facilities are in compliance with their permits and applicable requirements. In addition, TVA conducts periodic internal audits to provide further assurance of compliance with applicable environmental regulations and TVA environmental policy. Table 1-1 lists the status of existing environmental permits for both WBN and WBF.

Table 1-1 Watts Bar Facilities Existing Permits

Source Description	Permit Number	Renewal Date	Expiration Date
WBN Paint Shop -- Air	048011P	07/01/2006	09/01/2006
WBN Sandblast Shop -- Air	048010P	07/01/2006	09/01/2006
WBN Cooling Tower 1 -- Air	019953P	None	None
WBN Cooling Tower 2 -- Air	019954P	None	None
WBN Lube Oil Vapor Extractor 1 -- Air	042726P	07/01/99	09/01/99
WBN Lube Oil Vapor Extractor 2 -- Air	042725P	07/01/99	09/01/99
WBN Auxiliary Boilers -- Air	043216F	07/01/2000	09/01/2000
WBN Hazardous Waste Generator (Fees)	TN2640030035	02/01/98	03/01/98
WBN Landfill (Fees)	721030025	09/30/98	10/17/98
WBN DG Underground Storage Tanks (Fees)	0-610035	01/31/98	03/31/98
WBN General NPDES Storm Water	TNR001343	12/26/2001	12/31/2001
WBN General Construction Storm Water	TNR102716	Per Project	None
WBN NPDES	TN0020168	03/29/98	09/29/98
WBF NPDES	TN00005461	3/31/97	8/1/2000

WBN's existing National Pollution Discharge Elimination System (NPDES) permit authorizes the discharge of process wastewater resulting from the generation of electric power by nuclear fission and associated operations, including steam generator blowdown, cooling tower blowdown, sanitary wastewater, intake screen and strainer backwash, metal cleaning wastewater, miscellaneous flows, and storm water runoff from specific outfalls. WBN will request an expedited special NPDES permit modification from the State of Tennessee in order to begin construction on the SCCW project with subsequent discharge of cooling water through WBF's Outfall 003. As shown in the above table, WBN's permit expiration date of 9/29/98 is approaching, and the WBN permit renewal will include references to the modified special permit which will add Outfall 003 at WBF. In turn, the WBF NPDES permit will be revised to eliminate Outfall 003.

In addition to changes in the NPDES permits, it would be necessary for TVA to obtain other state environmental permits for the construction phase of this project. Prior to constructing the new supplemental cooling water discharge and supply pipelines, an erosion control plan would be developed as a part of obtaining and implementing a Tennessee General NPDES Permit for Storm Water Discharges Associated with Construction Activity. An Aquatic Resource Alteration Permit (ARAP) for Utility Line Crossings would be required for pipeline crossings of wet weather conveyances and streams. A Notice of Intent to be covered under the General NPDES Permit for Discharges of Hydrostatic Test Water for testing of the WBF intake and existing pipeline as well as the newly constructed pipelines would also need to be submitted as appropriate.

The proposed project would not involve any jurisdictional wetlands. However, stream crossings may require Corps of Engineers Section 404 permits and ARAP permits. In addition, concurrence would be needed from USFWS and SHPO.

If work needs to be performed on the discharge structure itself, then Corps of Engineers and ARAP permits may be needed for work performed on stream banks or on the discharge structure in water.

No nuclear licensing issues were identified by the team as an impact by the SCCW project. A nuclear safety analysis will be completed as part of the project engineering design change to verify this preliminary conclusion.

The WBN Final Safety Analysis Report (FSAR) section 10.4.5 does commit to meeting all applicable water thermal criteria by dissipating the waste heat directly to the atmosphere by means of a natural draft cooling tower. With the implementation of this project, a portion of the waste heat (up to 20%) would be dissipated in the river. However, as demonstrated by the analysis of this assessment, applicable thermal criteria would still be met. In addition, this project would include provisions to maintain compliance with chemical criteria by control discharges to the same level as those presently in the blowdown leaving the cooling towers. This plan will be revised as appropriate when the SCCW project is implemented.

1.5 Other Environmental Reviews or Documentation

The construction and operational impacts of WBN were assessed by both TVA and NRC in separate EISs (TVA, 1972 and NRC, 1978). Prior to plant startup and receipt of an operating license, and following an extended construction period, TVA prepared a review of its EIS to identify any new issues (TVA, 1995). No substantial new issues were identified by this review. Subsequently, NRC decided to prepare a supplement to their 1978 EIS. The Notice of Availability of the Final Supplemental Statement was published on May 1, 1995 (Federal Register, 1995a). TVA decided to adopt the NRC Final Supplemental EIS, and published its Notice of Adoption on July 10, 1995 and Record of Decision on August 23, 1995 (Federal Register, 1995b and 1995c).

These EISs analyze the operation of the WBN CCW system including the cooling towers. The cooling tower chemical treatment, blowdown concentrations, and thermal effects of the blowdown stream discharge were analyzed.

In 1996, recovery of boiler slag at the Watts Bar Fossil Plant for commercial sale was proposed. The environmental effects of this project were presented in an environmental assessment (TVA, 1996). The proposed route of the pipeline for the WBN SCCW project would pass near and through portions of the WBF site impacted by boiler slag recovery operations identified in that environmental assessment.

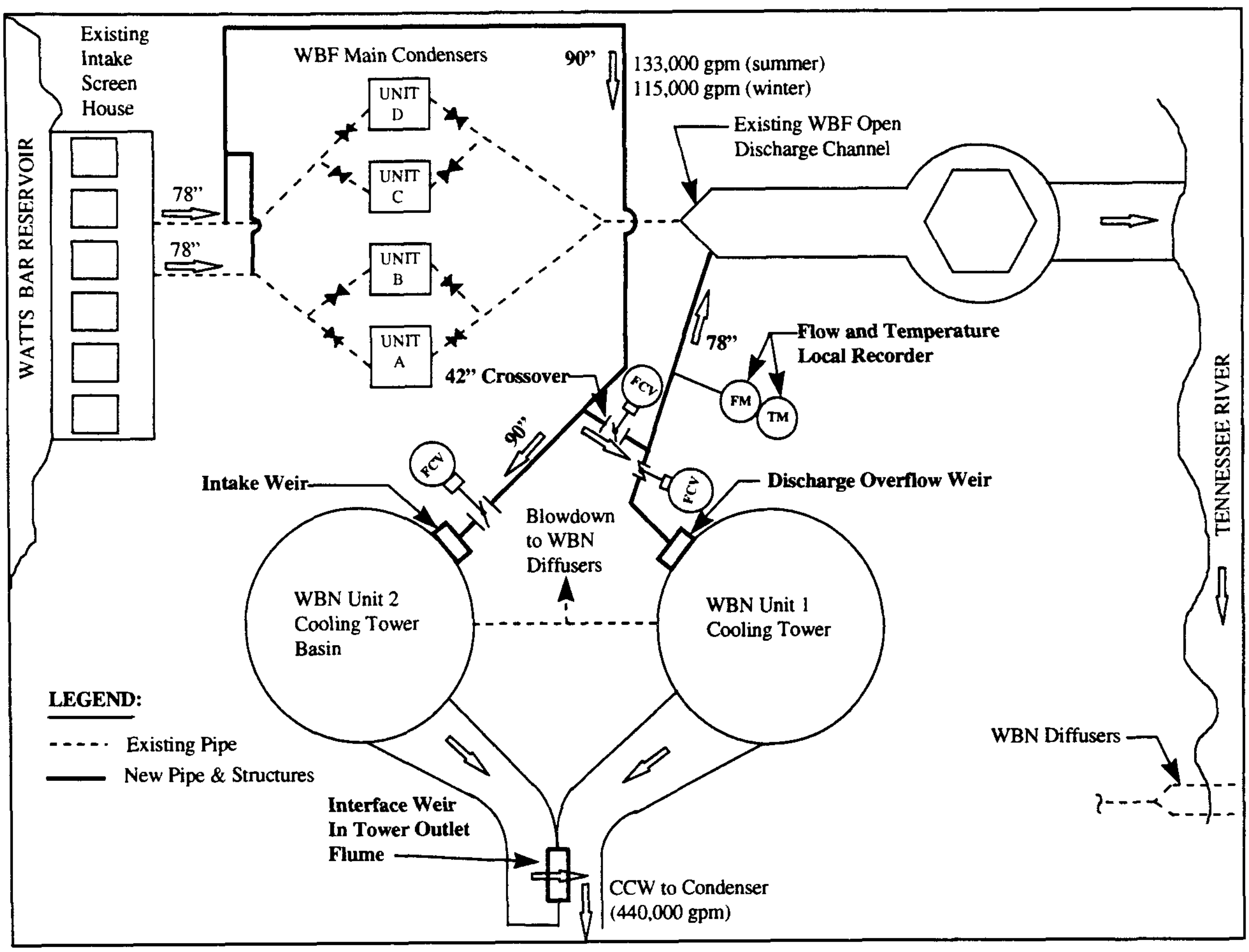
2.0 ALTERNATIVES

WBN has the capacity to generate more electrical power than is presently produced, particularly in the warmer weather months. This inherent capability can be realized if the average cold water temperature of the CCW system can be decreased, which in turn, will reduce turbine backpressure and improve turbine steam energy conversion into electrical output without increasing input energy. Various alternatives were evaluated for achieving the increased output as well as the No Action option.

2.1 The Proposed Action

The proposed action involves providing water from Watts Bar Reservoir to the CCW system at WBN to supplement the performance of the existing cooling tower. The arrangement of the project is schematically shown on Figure 2-1.

Figure 2-1. Conceptual flow diagram of SCCW system.



2.1.1 WBF Intake and existing pipeline

Water from the reservoir flows through an intake screen house that is adjacent to the west upstream side of WBH. The water enters the screen house through six intake sluice gates with bottoms at elevation 710, and traveling water screens. The gates tend to act as water skimmers since normal summer headwater is at elevation 740.5. The water flows approximately 3,200 feet to the fossil plant through two 78 inch diameter concrete pipes. One pipe serves units A & B, and the other serves units C & D. The piping then enters 5-feet 9-inch square concrete box culverts which serve the condensers. Portions of these components would be used in the project after some minor refurbishment.

2.1.2 New supply pipeline

A new 90-inch diameter reinforced concrete pipe would be tied into two existing 78-inch pipes at approximately 200 feet north of the WBF switchyard. This pipe would be routed around the east side of the WBF to the back side of the of the WBN Unit 2 cooling tower basin. The pipe would run along the side of the existing ash ponds and the coal yard on the fossil plant site. After leaving the WBF property, the pipe would be routed across the northeast portion of the WBN site to a new inlet structure at the Unit 2 tower. The pipe would be primarily above ground to minimize excavation and placement of backfill. A motor operated valve would be located in the pipeline prior to entering the cooling tower basin. The valve would be required to stop the flow to the tower basin whenever cooling tower blowdown is suspended during periodic chemical treatment of the CCW.

The supplemental CCW would be conveyed through the Unit 2 tower basin to the Unit 1 tower discharge flume. Here it would mix with the warmer water from the Unit 1 tower prior to being pumped to the inlet of the Unit 1 main condenser.

2.1.3 New discharge pipeline

To maintain the level and volume of the CCW system and to take advantage of the cooling effect, warm water must be discharged at the same flow rate as the supplemental supply. To accomplish this, an overflow weir structure would be provided on the side of the Unit 1 cooling tower basin. A 78-inch diameter reinforced concrete pipe would convey the discharge flow by gravity from the tower to the existing WBF discharge canal. This pipe would be routed along the side of the new supply pipe from the WBN tower to the vicinity of the WBF discharge. A motor operated valve would be located in the pipeline near the supply line valve. The valve would be required to stop the flow from the tower basin whenever cooling tower blowdown is suspended during periodic chemical treatment of the CCW.

In addition, a partial 42-inch crosstie pipeline with a control valve would be provided to divert up to 40% of the supplemental flow from the supply pipeline to the new WBN discharge line. This would be used in cooler months to reduce the amount of heat and lower the temperature of water discharged through the WBF discharge structure. This crosstie would also provide capability of a gradual change in discharge temperature during periods of system startup and shutdown.

2.1.4 WBF discharge structure

Water from WBF is discharged to the Tennessee River approximately 1.1 miles upstream of the nuclear plant intake through a discharge structure that consists of an open discharge canal, an overflow weir drop structure, and a below water discharge tunnel. This discharge tunnel is a rectangular culvert seven feet wide by 10 feet high at the discharge point. The elevation of the top of the culvert outlet is 675 feet, which coincides with the normal minimum pool elevation of Chickamauga Reservoir. At winter reservoir elevations, the culvert acts as an open channel discharge. At higher reservoir elevations, the top of the culvert opening is submerged to a maximum depth of 8 feet.

This existing structure would be used as the discharge for the warm water from the WBN Unit 1 tower basin. To reduce the potential of the heated discharge flow from impacting the river bottom in the vicinity of the discharge structure, a flow directing ramp or incline may be added to the discharge structure to direct the flow toward the surface as it enters the river. This would consist of prefabricating a diverter and placing it on the existing discharge structure apron or slab. This diverter would be installed if evaluations indicate a reduction of bottom impact will be achieved.

2.2 No Action

For the purpose of this assessment, the No Action alternative is continuation of the present operation of the WBN CCW system and not implementing the proposed project. Under the No Action option, the potential capacity of WBN would remain under utilized and no increased revenue would be generated. The extra capacity potentially available to the TVA power system would have to be provided from another source, possibly future new construction.

Any new project would have to address the specific environmental impacts unique to such a facility and its location. Depending on the type of generating facility equipment there might be no need for heated water discharge. However, there might be significant issues with air quality or water withdrawal impacts. Considering that the proposed project would comply with thermal water quality criteria and have no significant environmental impact, it is possible that the net effect of future new construction could be of greater environmental impact.

2.3 Other Actions and Project Variations not Considered in Detail

Other actions to lower the average CCW cold water temperature were considered. These included such options as:

- modification of the cooling tower,
- using both the Unit 1 and 2 cooling towers for Unit 1 operation,
- and adding a diffuser at the WBF discharge structure.

These options are discussed in sections 2.3.1 - 2.3.3.

2.3.1 Modification of the existing tower

Recent tests indicate the existing cooling tower is performing at about 105% of the design capacity. Since operation of the tower is already optimized and due to physical configuration of a natural draft tower, additional changes to enhance performance are not economically viable.

2.3.2 Using both towers for Unit 1 operation

A feasibility study prepared in August,1996, showed that cross-tie of the Unit 1 and Unit 2 cooling towers for Unit 1 operation provided no increase in plant output. The use of both cooling towers did not provide sufficient increase in plant output for recovery of capital and/or operating costs.

Using the towers in parallel would result in less water flow through the tower than the design conditions. Due to the physical and thermodynamic mechanisms associated with the performance of natural draft towers, a corresponding decrease in air flow results. This loss of air flow would offset the lower heat load on the tower with a resultant decrease in performance. The net effect would be no change of the combined tower cold water temperature. Using the towers in series would require not only capital expenditures for modifications but also operation of the Unit 2 CCW pumps with an increase in plant electrical load. Series operation would result in a lower final cold water temperature with an expected increase in plant output of 8 to 10 MW. However , this would be offset by the 9 megawatts required by the four CCW pumps.

32.3.3 Variances to Proposed Action

Adding a diffuser at the WBF discharge

The addition of a diffuser at the WBF discharge structure significantly increases the required capital investment to the point that the rate of return on investment would not be acceptable. The economic analysis for projects at TVA Nuclear facilities is based on an evaluation of the cost versus increased revenue and avoided operational and maintenance costs to determine the payback period and internal rate of return. To successfully compete for capital resources within TVA, a project typically must show a positive net present value (NPV), a 35% internal rate of return (IRR) using a 15% discount rate, and a payback in 3 years or less. The construction of a new diffuser was estimated to increase the capital cost of the proposed project by approximately 30% ($2 million) with no increase in the revenue. This increase would primarily result from the excavation and anchorage in the river channel necessary for a diffuser large enough to handle the 330 cfs discharge (Note this is 3 to 4 times the capacity of the existing WBN diffuser system). The incremental annual maintenance cost is estimated at $10,000. These increases in cost would extend the payback period more than 2 years to 9 years and reduce the IRR 4% to 26%. Based on this, TVA would not financially consider the proposed action with the added capital cost of a diffuser and no further action was pursued. This decision was further substantiated by thermal plume modeling which demonstrated the project as proposed complies with all thermal water quality criteria limits.

Installation of a diffuser to replace the existing WBF discharge would allow more rapid dissipation of the thermal effluent. However, due to the unique location of the Watts Bar Fossil (WBF) discharge, within one mile downstream of Watts Bar Dam, disruption of the benthic habitat in the vicinity of the discharge during installation of the diffuser would cause much greater impact to the resident mussel community than the limited impact area resulting from discharges at the current facility. These impacts include extensive disturbance to bottom life during construction. This would result from the excavation of the river bottom to provide a bed for the diffuser and associated anchorage. The excavated area would be far more extensive than the bottom area which the CORMIX model computed as being impacted by the thermal plume of the proposed project. In addition to the direct impact to the bottom life residing in the area of excavation, there would also be a potential impact downstream due the silt created from dredging and blasting. As described in Sections 3.2 and 3.3, potential adverse impacts to resident biota resulting from thermal discharges at the existing WBF outlet are very localized. Fish will have ready avenues to avoid the high temperatures in the immediate vicinity of the discharge and freshwater mussels will be moved from the impact zone.

Elimination of Crosstie Line

Another option was eliminating the crosstie capability from the scope of the proposed project (See section 2.1.3 for description). This was eliminated from consideration due to problems in compliance with thermal discharge temperature limits during winter operation.

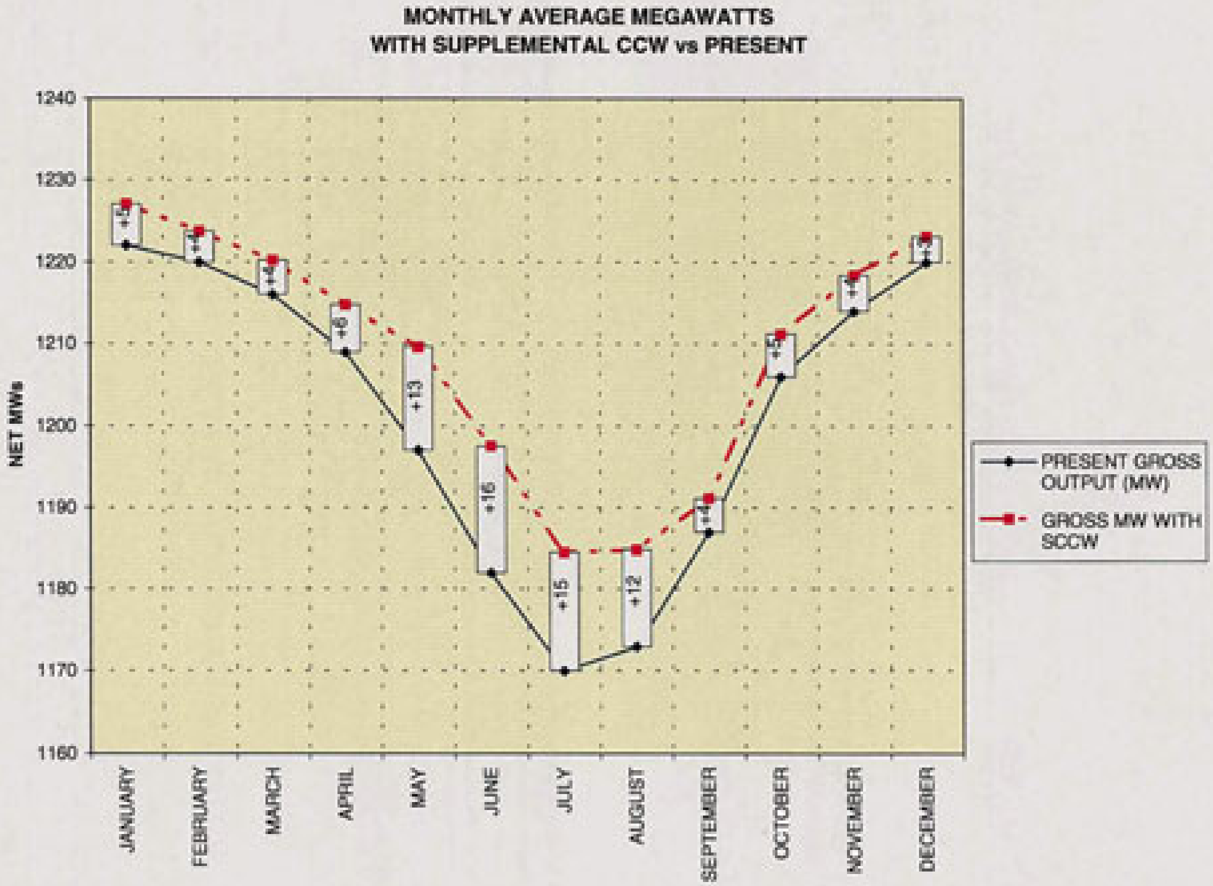
2.4 Comparison of Alternatives

Two alternatives are considered in this EA:

- **Proposed Action** — the SCCW system would be installed and operated to supply supplemental cooling water from Watts Bar Reservoir via the existing Watts Bar Fossil (WBF) intake and piping, and then through a new supply pipe installed from WBF to the WBN Unit 2 cooling tower basin. A new discharge pipe would be installed from the Unit 1 cooling tower basin to the existing WBF CCW discharge structure. (See Section 2.1 for a detailed description of design and operation.)

- **No action** — no SCCW system would be installed and no increase in generation capacity would be realized. Figure 2-2 shows the equivalent capacity that will continue to be lost from the No Action option on a monthly basis.

Figure 2-2 Monthly variation of power production capacity with/without proposed action.



2.4.1 Comparison of Construction Impacts

Only the proposed action would have environmental impacts from construction. These impacts, as evaluated in Section 3, would be both temporary and minor. These impacts include noise, fugitive dust, vehicle air emissions, soil erosion, vegetation alteration and loss, and wildlife disturbance. No unusual controls or measures would be required to mitigate these impacts. Routine measures such as best management practices (BMPs) for construction would provide adequate environmental controls for this project.

2.4.2 Comparison of Operational Impacts

The operational impacts of both alternatives include water intake entrainment and impingement of aquatic life, thermal discharges effects, and chemical discharge effects. Of course, for the No Action alternative, the impacts are simply a continuation of existing impacts. For the Proposed Action, the impacts are new.

Thermal Discharge—The proposed action would increase the annual thermal discharge (energy rejection) to the river, compared to the existing cooling tower blowdown, by a factor of 10. In July, the energy rejected to the river would be 13.7 times greater. However, the discharge flow rate and temperature, and the resulting river mixed water temperature, temperature change, and rate of temperature change in the river are the important factors in evaluating aquatic environmental impacts. Table 2-1 gives a summary of comparable river temperature data based on modeling results for the two alternatives. Both alternatives were evaluated at the end of their respective 1000 foot mixing zones. As shown in the Table, the two alternatives would have similar temperature effects. The primary differences are the maximum 24 hr temperature rise and rate of temperature rise which would be considerably higher for the proposed action.

Table 2-1. Comparison of Modeled Temperatures at the Discharge and at the End of 1000 Foot Mixing Zone for No Action and the Proposed Action (modeled from 1976 to 1993).

Parameter	Units	Alternative: Present WBN Diffuser		Alternative: Proposed Action (SCCW)	
Conditions at Each Discharge Point					
Maximum 1 hr Discharge Temperature	°F	96	July	95.9	July
Average 1 hr Discharge Temperature	°F	85.7	July	85.7	July
Maximum 24 hr Discharge Temperature	°F	91.1	July	91	July
Average 24 hr Discharge Temperature	°F	85.7	July	85.7	July
Conditions at the End of 1000 Foot Mixing Zone					
Maximum 24 hr Temperature	°F	82.5	July	83.5	July
Average 24 hr Temperature	°F	76.5	August	77.7	August
Maximum 24 hr Temperature Rise	°F	0.5	April	5.3	May
Average 24 hr Temperature Rise	°F	0.1	April	2.7	May
Maximum Rate of Temperature Change	°F/hr	1.5	February	3.5	May

As discussed in Section 3 (3.3.3.3 and 3.3.3.4), there are potential impacts of the proposed action to fish, bottom life, and mussels in the immediate vicinity of the proposed thermal discharge. Limited mortality of several fish species is projected near the proposed discharge due to elevated water temperature. However, no significant adverse effects are projected on these fish communities. Sauger and white bass congregate in the WBH tailwater, near the point of the proposed thermal discharge, prior to spawning. No significant impacts on spawning are projected to result from the proposed thermal discharge. Potential adverse impacts were projected to occur to mussels, including one endangered species, in the vicinity of the proposed thermal discharge. However, TVA proposes to relocate native mussels from a 2,100 m^2 area near the discharge which would minimize these potential impacts. As a result, the proposed action would cause only minor new impacts to fish and mussels. The existing WBN thermal discharge would continue to operate essentially unchanged (No Action), and would continue to have minimal, if any, impact on aquatic life.

Measured river temperatures comparable to the modeled results would have been helpful as a further comparison of the effect of the existing system. The WBN NPDES permit requires that field surveys be performed to verify the mixing zone dimensions and model results within one year of commercial operation. TVA performed one survey in April, 1997 and one in July, 1997. However, the weather in 1997 did not provide the extremes of conditions needed for comparison with the model results for the proposed system.

Entrainment and Impingement — The WBF intake structure at Watts Bar Dam (WBH) would resume operation, but at a reduced flow (about 50 percent of the former WBF flow). Entrainment and impingement were quantified for the WBF intake during 316(b) studies in 1974 - 1975. It is projected that entrainment impacts would be half the impacts predicted in the 316(b) studies for past operation of the WBF (see 3.3.3.1). Impingement impacts would be no greater than those indicated in the previous study (see 3.3.3.2). The existing WBN water intakes would continue to operate unchanged, thus not altering these entrainment and impingement impacts. As a result, the entrainment and impingement impacts of the proposed project are not expected to be significant.

Chemical Discharges—The present operation of the cooling tower concentrates river water chemical constituents (primarily dissolved solids) by a factor of approximately 2 in the blowdown. The proposed supplemental cooling water flow would dilute the discharge of the proposed system to a maximum concentration factor of 1.4, with an average projected to be about 1.2. The present discharge has no known adverse effects from the chemical discharge and the proposed SCCW discharge would provide an additional margin of safety due to the reduced concentration. Implementation of the proposed project would not increase or change the use of chemicals presently approved in the WBN NPDES permit.

3.0 ENVIRONMENTAL IMPACTS

Resources that could potentially be affected by the proposed action were identified by TVA technical staff. Appropriate regulatory issues included:

- air quality,
- water quality,
- threatened and endangered species,
- disposal of solid and hazardous waste,
- wetlands and floodplains,
- and cultural and archaeological resources.

The potential for effects to socioeconomic resources, traffic, land use conversion, and noise, are discussed in sections 3.7 and 3.10. Because of the obvious potential for thermal impacts to water quality due to the very nature of the proposed action, that issue was accordingly examined in detail (see Sections 3.2 and 3.3).

In this chapter, the existing situation with respect to the potentially affected resources is described, followed by a discussion of the potential for impacts from both construction and operation of the proposed SCCW project.

3.1 Air Resources

3.1.1 Existing Conditions for WBN - NAAQS Attainment

Rhea County, Tennessee and surrounding areas are currently classified as attainment (or unclassified) for all National Ambient Air Quality Standards (NAAQS), and as such, air quality conditions are considered to be good in this region. The NAAQS for ozone (O_3) and particulate matter (PM) have recently been revised. The O_3 NAAQS were lowered and new NAAQS were set for fine particulate matter ($PM_{2.5}$)—PM with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers. Attainment designations have not yet been revised to reflect the new NAAQS.

3.1.2 Construction Impacts - Fugitive Dust and Vehicle Emissions

PM emissions, chiefly fugitive dust, would be generated during the construction of the water supply and discharge pipelines for this project. Emissions during such construction are associated with land clearing and ground excavation activities. These PM emissions would be temporary and could be expected to vary from day to day, depending on the level of activity, the specific operations, and the weather conditions. The pipelines would be installed primarily above ground to minimize excavation and placement of backfill. TVA would adhere to State air regulations (TDAPC Chapter 1200-3-8) requiring reasonable precautions (for example, applying water sprays on dirt roads) as needed to reduce fugitive dust emissions. Considering the limited nature of this project, TVA expects that fugitive dust emissions would be minor and would not result in any significant impacts to the environment.

Some minor and transitory air quality impacts would result if open burning of natural waste materials (untreated wood, trees, tree trimmings, and brush) were conducted. State regulations (TDAPC Chapter 1200-3-4) place restrictions on the timing and location (with regards to nearby residences, hospitals, roads, etc.) for any open burning. TVA would adhere to these regulations to insure that any open burning does not significantly impact the environment.

Pollution from fossil-fuel combustion in construction equipment and increased traffic during construction would also cause some minor and temporary impact on of air quality in the vicinity of the project. Combustion emissions consist of PM, sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxides (NO_x), and hydrocarbons (HC). NO_x and HC emissions participate in photochemical reactions in the atmosphere to form O_3. As noted previously, the pipelines would be installed primarily near ground level to minimize excavation and placement of backfill. This approach would reduce the combustion-related emissions due to operation of construction equipment. Consequently, TVA expects that these relatively minor combustion-related emissions would not result in any significant impacts to the environment.

3.1.3 Operational Impacts

There are no operational impacts on air resources.

3.2 Water Quality

3.2.1 Existing Conditions

Groundwater

Geologic conditions at the inactive Watts Bar Fossil Plant site are generally considered to be the same as those at the WBN site. Information on Groundwater in the 1972 WBN EIS (TVA 1972) and the 1995 Supplemental Environmental Review (TVA 1995) were used to prepare the following description.

The Watts Bar Fossil Plant site is underlain by unconsolidated terrace and alluvial deposits consisting of gravel, sand, and clay. These surficial deposits average approximately 12.2 meters (40 feet) in thickness and are generally poorly water-bearing. The hydraulic conductivity of the terrace deposits is estimated to be 14.6 meters per day (48 feet/day) and porosity is estimated at 0.15. The average depth to groundwater in the surficial deposits is approximately 5.2 meters (17 feet) indicating an average saturated thickness of 7.0 meters (23 feet).

The Conasauga Formation, which is of Middle Cambrian age, forms the bedrock foundation at the site. This bedrock formation is composed of several hundred feet of interbedded limestones and shales. The general strike of the Conasauga is N30W, and the overall dip is to the southeast. The formation is poorly water-bearing with groundwater occurring in small fractures and bedding planes.

Groundwater system recharge at the site occurs from infiltration of local precipitation, which averages around 127 cm per year (50 inches per year) and from lateral underflow from the area north of the plant site. Approximately 20 to 25 cm (8 to 10 inches) of this precipitation enters groundwater storage. In this region, groundwater levels normally reach peak elevation in February and March and are at minimum levels in late summer and early fall. The depth to the water table is generally less than 6.1 meters (20 feet) throughout the site. All groundwater originating at the site ultimately discharges to the Tennessee River in upper Chickamauga Reservoir.

Surface Water

Water quality in the Tennessee River near the Watts Bar Fossil Plant is well documented by data collected during preparation of the WBN Environmental Impact Statements (NRC 1995, TVA 1972, TVA 1995). The quality of the water is generally good. It is slightly hard with hardness values generally less than 100 mg/L.

Surface water on the plant site is limited to local runoff and to waste treatment and holding ponds which have permitted discharges to the Tennessee River. Water may also continue to enter the ash pond from Watts Bar Reservoir. This water currently is conveyed to the Fossil Plant by two existing 78 inch concrete pipes to be used in proposed project. The discharge from this pond is permitted under NPDES.

WBN Chemical Impacts

Presently, WBN chemically treats the raw cooling and essential raw cooling water systems to control corrosion and biological fouling. The discharge of these systems provides makeup water to the CCW system. The CCW does not receive any direct injection of any of the chemical treatments. Only the residual remaining after passing through the raw water cooling systems is discharged into the CCW and is not counted on for any protective benefit in the CCW. These treatments are presently monitored with the combined cooling tower blowdown prior to discharging through the diffusers.

The NPDES permit regulates all liquid discharges of chemicals at the WBN Plant. To accomplish this task, the following chemicals are used in the manner described:

A copolymer dispersant is injected on a year-round continuous basis to keep settleable solids in suspension and thereby reduce accumulations of silt and rust. The release of the copolymer is anticipated to be no more than 0.2 milligram per liter (0.2 ppm) as active product.

Tetrapotassium pyrophosphate is injected on a year-round continuous basis to sequester iron from existing corrosion products in raw-water piping and ancillary components. The release of pyrophosphate at the diffuser discharge is not expected to exceed 0.2 milligrams per liter (0.2 ppm) as total phosphorus.

Zinc sulfate is injected on a year-round continuous basis to reduce corrosion rates of carbon-steel piping and components. The release of zinc sulfate is anticipated to be maintained at 0.2 milligram per liter (0.2 ppm) zinc.

Tolytriazole, a corrosion inhibitor, is injected periodically into the raw-water systems to reduce corrosion rates. Most of the heat exchangers cooled by the raw water systems are constructed with copper or copper-alloy tubes. The primary point of chemical injection is at the intake pumping station (about once every 2 weeks) when the river temperature is above 60° F.

Dodecylguanidine hydrochloride (DGH) and didecyldimethyl ammonium chloride (Quat), non-oxidizing biocides, are injected periodically to eradicate clams and mussels and prevent MIC.

1-bromo-3-chloro-5,5-dimethylhylhydantoin (BCDMH), an oxidizing biocide used to reduce MIC and control Asiatic clams and Zebra mussels, is injected at the intake pumping station approximately four hours each day throughout the year. Samples of river water are collected periodically during clam-spawning season to monitor the concentration of Asiatic clam larvae entering the plant. Twice a year, BCDMH is injected continuously for at least three weeks after the peak clam-dissemination periods (unless a non-oxidizing biocide is used).

The pyrophosphate, zinc sulfate, and copolymer is injected into the raw-water systems using flow controllers located in the intake pumping station. The BCDMH is also injected at the intake pumping station. The primary point of chemical injection for tolytriazole and DGH is the intake pumping station; however, other locations may be used as permitted.

Further details of the chemical usage are provided in the present NPDES discharge permit and will not change due to the proposed SCCW project.

Some of these treatments introduce chemicals into the CCW which are undesirable to be discharged to the river. These treatments include:

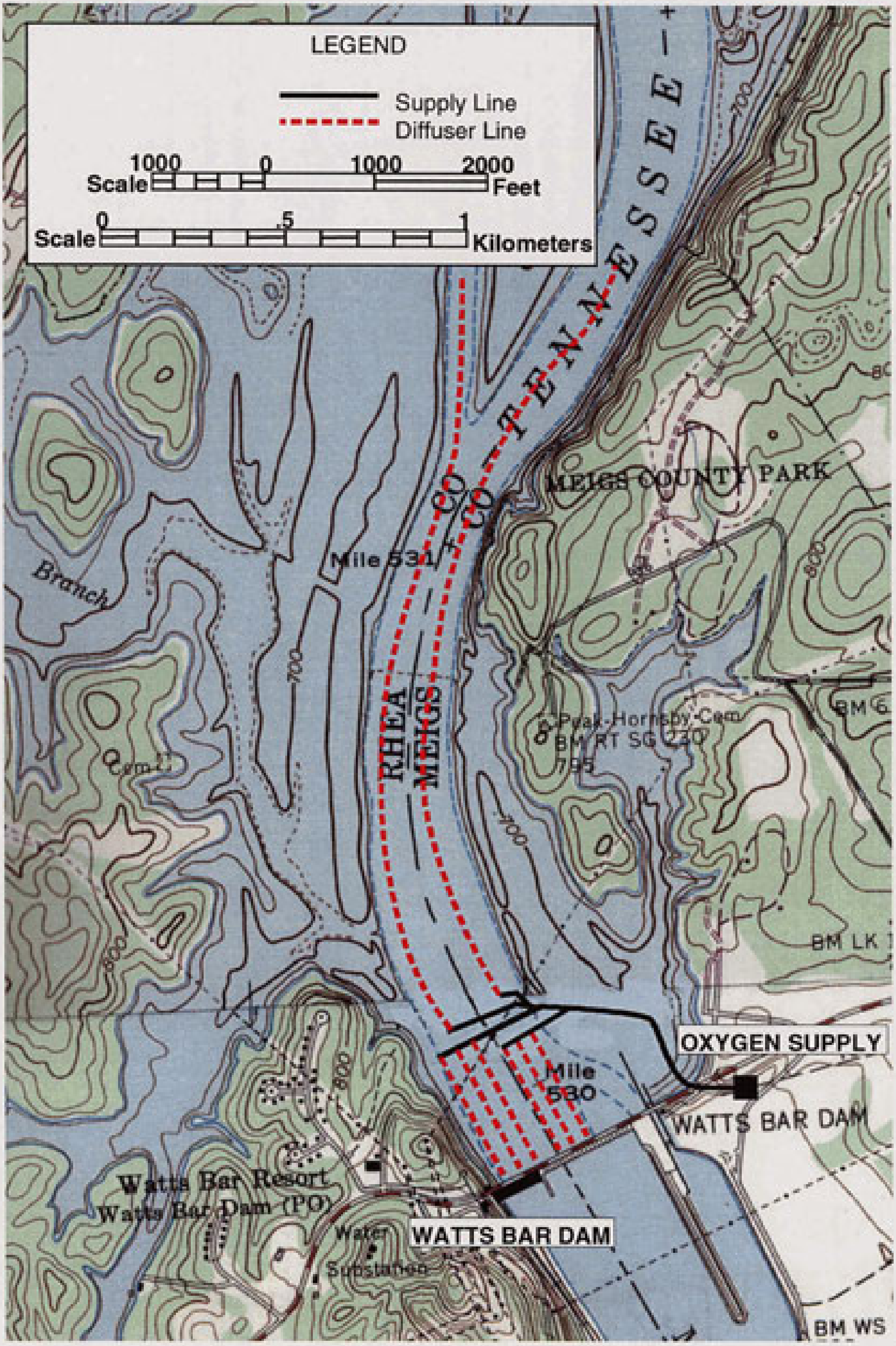
- Tolytriazole, a corrosion treatment
- Nonoxidizing molluscicide treatment

Blowdown from the cooling towers is suspended during these treatments until the residual of the adverse chemicals decreases to environmentally acceptable levels for discharge to the river as committed to and regulated under National Pollutant Discharge Elimination System (NPDES) Permit TN0020168 for WBN. The concentrations in the present WBN discharge to the river are within permit limits. The present NPDES discharge permit for WBN has a maximum daily limitation of 0.10 mg/l for total residual chlorine in the diffuser discharge, Outfall 101.

<u>Oxygenation of Watts Bar Hydro Releases</u>

The Watts Bar Fossil Plant site is located within reach of the Tennessee River which, periodically, has been impacted by low dissolved oxygen in the releases from Watts Bar Dam. In 1996, TVA installed a line diffuser system in Watts Bar Reservoir to meet a target dissolved oxygen concentration (DO) of 4.0 mg/L in the hydro plant release (turbine discharge). The system consists of four line diffusers with a total length of 24,000 feet arranged in the forebay along the old riverbed (See figure 3.2.1). Releases from Chickamauga Dam rarely contain low dissolved oxygen levels and there are no current plans to install an aeration system to address the occasional periods when releases from that dam drop to below 4 mg/L.

Figure 3.2.1. Line Diffuser Layout at Watts Bar Dam (Mobley, 1997)



The system has the capacity to dispense 900 standard cubic feet per minute (scfm) or 50 tons/day of oxygen from a 15,000-gallon bulk liquid oxygen storage facility located near the east end of Watts Bar Dam. The oxygen diffuser system is operated on an "as needed" basis based on DO concentrations measured in the turbine discharge. Analysis of data collected from 1961 through 1993 indicates that DO concentrations in the WBH release can drop below 4.0 mg/L between the months of May and August, with the greatest likelihood occurring in June and July. Therefore, DO concentrations are monitored on a continuous basis between the months of May and August. Due to the shallower depth of the right side (facing downstream) of Watts Bar forebay, releases from WBH Units 1 and 2 typically have DO concentrations about 0.5 mg/L higher than releases from the other units. Preferential use of Units 1 and 2 provides some measure of relief during the low release DO season (June to August) and reduces liquid oxygen usage.

3.2.2 Construction Impacts

Construction activities would result in exposed soils that could cause temporary increases in erosion and sediment runoff if not properly managed. Any stockpiled soil piles on the site would need to be avoided or moved. In addition, appropriate design and construction best management practices (BMPs) would be needed to minimize erosion and sediment runoff. Proper use of BMPs as appropriate would minimize the magnitude and duration of the impacts due to construction activity.

3.2.3 Operational Impacts

<u>Wastewater Impacts</u>

Potential water quality impacts associated with the withdrawal and subsequent discharge of water from Watts Bar Reservoir include chemicals or wastes added to the water and reduced hypolimnetic dissolved oxygen concentrations in Watts Bar and Chickamauga Reservoirs.

Modifications and revisions would need to be made for both WBN and WBF NPDES permits. Potential aquatic impacts associated with WBN current chemical treatments are addressed in Section 3.3, Aquatic Ecology. During periods of chemical treatment of the CCW system, normal SCCW discharge would be suspended as necessary, until the residual treatment chemicals are within discharge permit limits.

TVA presently uses an O_2 diffuser system to meet a target DO level of 4.0 mg/l in the WBH turbine discharge as stipulated in the Reservoir Release Improvement (RRI) program. Installation of the SCCW project is not anticipated to adversely impact the DO level in the River.

The O_2 diffuser system has been designed with sufficient capacity to adequately oxygenate the flow through the 5 hydro units. The SCCW flow (~ 330 cfs) is a small fraction of the hydro discharge (**< 1.0%** of 5 hydro units). The added flow out of the Reservoir for the SCCW would not be sufficient to significantly impact the oxygen content of the water discharged through the hydro units. In fact the constant SCCW flow could even enhance the DO level due to the continuous movement of water through the reservoir and reducing the residence time in the forebay upstream of the dam.

The top of the turbine intake is at elevation 711.2 and the bottom is at elevation 663.75. The intake for the SCCW has a bottom elevation of 710.0, one foot below the turbine intake, and the top at about elevation 730. The differences in elevation is another reason the SCCW is not anticipated to adversely affect the DO provisions of the oxygenation system. The oxygenation system is designed so that the injected O_2 is absorbed in the lower 30 feet of the reservoir or below elevation 700 which is below the SCCW intake. Therefore the SCCW flow will not short circuit the oxygenated water from the turbine intakes. Stratification and the flow pattern in the forebay upstream of the dam further reduces the impact of the water withdrawn for the SCCW on the results obtained from the oxygenation system.

The impact of the SCCW discharge on the DO in the river is anticipated to be insignificant. The stratification and flow pattern upstream of WBH naturally results in a higher DO level on the west side of the reservoir where the SCCW intake is located. While the SCCW is withdrawn from a cooler subsurface layer of the forebay, the supply is from side of the reservoir and in the reservoir strata where the higher DO level naturally occurs. The discharge will have passed through the cooling tower prior to release to the river and should be saturated with oxygen as it falls through the tower. These conditions in combination with the SCCW withdrawal being small relative compared to minimum daily flows in the river result in insignificant impact. The potential impact of the additional waste heat on DO concentrations in Chickamauga Reservoir is also expected to be insignificant due to the SCCW withdrawal being small relative to minimum daily flows in the river.

The discharge flow of the proposed project would be approximately half of that discharged during operation of WBF. Since the discharge would go through the existing concrete tunnel, the velocity of the flow into the river for the proposed project would be half of that during WBF operation. Due to the reduced velocity, there would be no erosion expected to the banks of the Tennessee River.

Thermal effects

A significant consideration of the proposed project would be the thermal impact of the heated effluent on the Tennessee River. The project was analyzed to determine compliance with water quality criteria for thermal discharge. Model results indicate that instream thermal criteria (1. maximum instream temperature of 86.9°F, 2. maximum rise of 5.4°F, and 3. maximum rate of change ± 3.6°F/ hr) can be met under normal operation of the supplemental CCW system, provided the bypass line is operated during months of December, February through April, and on an as-needed basis during November and January.

The thermal effects of WBN operation with the proposed SCCW system were modeled as described in Enclosure 1. Computer simulations of WBN operation were performed using recorded meteorology and dam releases for the period from January 1, 1976 through October 15, 1993. The ambient river temperature (WBH discharge temperature) was computed as a daily average. WBN intake temperature (ERCW and RCW systems) was computed on an hourly basis, as was the rate of change of downstream river temperature. The WBN discharge temperature (diffuser discharge and discharge through WBF structure) and downstream temperature were computed as 24-hour running averages. The maximum and monthly average computed values of ambient river temperature, WBN intake temperature, WBN discharge temperature, downstream river temperature, and instream temperature rise and rate of change of downstream temperature for the simulation period are shown in Table 3.2-1 for the existing WBN discharge and in Table 3.2-2 for the SCCW system. These results indicate the combined effects of the discharge from the WBF structure and the existing WBN diffusers. The instream temperature rise shown is the difference between the river temperature at the downstream end of the diffuser mixing zone and the temperature of the WBH discharge.

Sudden variations in the operation of the this project have the potential to impact the time rate of change of temperature in the river (ΔT/hr). Abrupt start or stop of the discharge flow, sudden changes in heat rejected to the CCW, and rapid initiation or stop of releases through the WBH were evaluated for any unfavorable effects. Fluctuations in heat load during normal startup, normal shutdown or load changes during operation, would not cause problems with the rate of rise due the gradual nature of the changes.

Normal startup or shutdown of the WBN unit would result in a gradual change in heat load as the reactor comes up in power or is shutdown. During startup, the discharge would initially be about the same temperature as the river and increase as the unit came up in power. This would occur over several hours to stay within feedwater chemistry and turbine startup limitations. During normal shutdown, the heat rejected to the CCW gradually reduces as the unit decreases in power over several hours. This results in a corresponding decrease in the heat load of the discharge flow. Sensitivity analyses on varying power levels at WBN from low loads to full power, indicate only a small variation in the final instream mixed temperature. Since TVA base loads nuclear units, WBN should rarely see significant load changes. In addition, normal startup and shutdown of the SCCW would occur when there is river flow equivalent to one WBH unit operating. All of this demonstrates that ΔT/hr limits would continue to be met during normal startup and shutdown of WBN.

Since the WBH units are used as peaking load capacity, their remote dispatching will result in frequent variations in the river flow past the WBF discharge. The analyses run to model the thermal impact of the project (Enclosure 1) included the actual flow variations through WBH which occurred during the period of January 1, 1976 through October 15, 1993. No problems with rate of rise were identified in these analyses with WBN at steady operation. Based on these results, it is concluded that ΔT/hr limits will be met during fluctuations in flow releases through WBH. When the project is brought online, these modeling results would be verified at various times during the first year of operation. The scope and specific components of this monitoring would be determined by TVA in coordination with the Tennessee Department of Environment and Conservation.

Due to limits placed on the rate of temperature change for the main steam system and the main turbine and for feedwater chemistry control, abrupt startup and corresponding heat rejection to the CCW does not occur at WBN. The only mechanism to abruptly increase the heat load discharged to the river would be by initiation of the SCCW with the unit at power or closure of the bypass. The analysis indicates this is only a problem when the WBN unit is operating at power and with a simultaneous river flow of less than one WBH unit. This would be averted through procedural control to only allow SCCW flow changes when there is at least one WBH unit in operation and to require opening of the bypass as part of the SCCW startup or shutdown. Therefore, noncompliance with the ΔT/hr limits would not occur due to a sudden increase in heat load. Unexpected shutdown due to a load shed, turbine trip or reactor trip are the events which would result in potential abrupt loss of heat load to the CCW. During these events, the reactor power level decreases almost immediately to about 6% of full power with residual heat continuing to decrease to approximately 1% within an hour. However, the impact of this dramatic decrease in heat input to the CCW is not immediately reflected in a drop in the temperature of the discharge to the river. The immense mass of heated water in the CCW (approximately 7.5 million gallons) acts as a thermal capacitor extending the duration required to drop the discharge temperature after the unit trip. Since cooler SCCW continues to flow into the CCW after unit trip, the discharge temperature would gradually decrease and eventually approach that of the SCCW supply. The most significant decrease occurs during the first hour after the unit trip when the heat input is so dramatically decreased. If this abrupt loss of the unit were to occur simultaneously with the maximum downstream river temperature rise in Table 3.2-2, a maximum drop of the discharge temperature of 15.5 °F would result during May. Should this extremely infrequent event occur, then, for a single hour, the rate of rise in the river could approximately - 4.5 °F in May and - 4.1 °F in June slightly exceeding the ±3.6 °F/ hr limit.

Operation of the supplemental CCW system would result in increased intake temperatures for the WBN RCW and ERCW systems. Based on historical data and normal WBH operations, there is little likelihood that the intake temperatures would reach or exceed the intake temperature safety limit of 85 °F (29.4°C). However, if the intake temperature should approach this limit, the intake temperature can be reduced by increasing discharge from WBH, operation of the bypass system, or by shutting down the supplemental CCW system. Should the WBH discharge temperature approach the WBN intake limit, initiation of WBN shut-down protocols would be required.

Based on the model results in Enclosure 1 and the above evaluations, operation of the proposed SCCW system would meet the instream thermal discharge criteria limits. While TVA is confident that the SCCW project would comply with thermal discharge criteria limits and no significant environmental impact would occur, a program would be implemented to monitor the instream temperature at various times during the first year of operation. Measurements will be taken to ascertain the instream mixed temperature approximately 1000 feet downstream of the WBF discharge structure and at the river bottom near the perimeter of the mussel relocation zone. This program will verify the resultant conclusions of the Environmental Assessment including thermal discharge temperature criteria are met with a 1000 ft mixing zone and 24 hr averaging time and adequacy of the mussel relocation zone to ensure the minimization of impact to bottom life. The program would also be designed to confirm the adequacy of using CORMIX3 to model the thermal plume for the SCCW discharge to the Tennessee River. The scope and specific components of this monitoring work would be determined by TVA in coordination with the Tennessee Department of Environment and Conservation.

In addition, based on previous evaluations of the simultaneous operation of WBN and Sequoyah Nuclear Plant (SQN), operation of the WBN SCCW system should have no significant effect on river temperatures in the vicinity of SQN.

Table 3.2-1 Computed Temperatures Based On 1976-1993 Meteorology and Dam Releases
24 hour averaging, 1230 MWe generation, without supplemental cooling water

		Intake	River Temperature				Discharge Temperature				Total
		Temperature	ambient	downstream	rise	rate	WBN diffuser		SCCW		heat
		24-Hr Avg	24-Hr Avg	24-Hr Avg	24-Hr Avg	Hourly	1-Hr Avg	24-Hr Avg	1-Hr Avg	24-Hr Avg	
		(F)	(F)	(F)	(F)	(F/hr)	(F)	(F)	(F)	(F)	(BTU/hr)
January	Max	51.7	51.7	51.7	0.4	1.2	79.2	78	0	0	2.18E+08
	Avg	42	42	42.1	0.1	N/A	62.8	62.8	0	0	1.01E+08
February	Max	51	51	51.1	0.4	1.5	82.2	79.3	0	0	2.72E+08
	Avg	41.9	41.9	41.9	0.1	N/A	65.1	65.1	0	0	1.13E+08
March	Max	56.1	56.1	56.1	0.4	1.4	85.7	81.9	0	0	1.83E+08
	Avg	47.7	47.7	47.7	0.1	N/A	69.4	69.3	0	0	1.06E+08
April	Max	65.1	65.1	65.2	0.5	1.4	86.8	83.2	0	0	1.64E+08
	Avg	56.7	56.7	56.7	0.1	N/A	73.8	73.7	0	0	8.32E+07
May	Max	71.9	71.9	71.9	0.4	1.4	90.1	87.2	0	0	1.30E+08
	Avg	64.5	64.5	64.5	0.1	N/A	78.8	78.7	0	0	7.13E+07
June	Max	78.8	78.8	78.8	0.2	1.1	92.7	89.4	0	0	1.30E+08
	Avg	70.7	70.7	70.7	0	N/A	83.4	83.3	0	0	6.55E+07
July	Max	82.5	82.5	82.5	0.2	1.1	96	91.1	0	0	1.19E+08
	Avg	74.9	74.9	74.9	0	N/A	85.7	85.7	0	0	5.71E+07
August	Max	81.7	81.7	81.9	0.1	0.7	94.4	89.5	0	0	8.26E+07
	Avg	76.5	76.5	76.5	0	N/A	85	85	0	0	4.43E+07
September	Max	81.1	81.1	81.1	0.2	0.6	91.7	88.1	0	0	8.78E+07
	Avg	75	75	75.1	0	N/A	81.4	81.5	0	0	3.40E+07
October	Max	76.7	76.7	76.7	0.1	0.5	89	86.2	0	0	9.45E+07
	Avg	68	68	68.2	0	N/A	74.2	74.3	0	0	3.04E+07
November	Max	67.9	67.9	68.1	0.2	1	84.6	82.7	0	0	1.37E+08
	Avg	58.8	58.8	59	0	N/A	69.5	69.7	0	0	5.18E+07
December	Max	59.2	59.2	59.5	0.3	1.1	84.1	80.9	0	0	1.80E+08
	Avg	48.7	48.7	48.9	0	N/A	64.9	64.9	0	0	7.83E+07

Table 3.2-2 Computed Temperatures Based On 1976-1993 Meteorology and Dam Releases
24 hour averaging, 1230 MWe generation, <u>with</u> supplemental cooling water
3 CCW pumps, Jan -Feb; Bypass flow Nov - Apr

		Intake Temperature 24-Hr Avg (F)	River Temperature ambient 24-Hr Avg (F)	downstream 24-Hr Avg (F)	rise 24-Hr Avg (F)	rate Hourly (F/hr)	Discharge Temperature WBN diffuser 1-Hr Avg (F)	WBN diffuser 24-Hr Avg (F)	SCCW 1-Hr Avg (F)	SCCW 24-Hr Avg (F)	Total heat (BTU/hr)
January	Max	52.8	51.7	52.7	3.8	1.4	77.2	77.1	64.6	64.9	1.31E+09
	Avg	43.5	42	43.7	1.6	N/A	60.7	60.8	52.5	52.5	6.83E+08
February	Max	52.8	51	52.7	3.8	1.7	80.3	77.4	65	63.6	1.39E+09
	Avg	43.7	41.9	43.7	2	N/A	63.1	63.1	53.7	53.7	7.71E+08
March	Max	59.1	56.1	58.5	4	1.5	85.7	81.8	72.4	70.2	1.37E+09
	Avg	49.6	47.7	49.6	2	N/A	69.4	69.3	59.8	59.7	7.92E+08
April	Max	66.4	65.1	66.3	3.2	1.4	86.8	83.1	75.8	74	1.25E+09
	Avg	58.2	56.7	58.3	1.7	N/A	73.8	73.7	66.3	66.2	7.11E+08
May	Max	75.2	71.9	74.4	5.3	3.5	90.1	87.2	90	87.2	1.84E+09
	Avg	67.1	64.5	67.1	2.7	N/A	78.8	78.7	78.7	78.6	1.02E+09
June	Max	80.2	78.8	80	4.2	1.6	92.6	89.4	92.6	89.4	1.69E+09
	Avg	72.8	70.7	72.8	2.1	N/A	83.4	83.3	83.4	83.3	9.17E+08
July	Max	83.7	82.5	83.5	3.4	1.6	95.9	91	95.9	91	1.55E+09
	Avg	76.5	74.9	76.5	1.6	N/A	85.7	85.7	85.7	85.7	7.81E+08
August	Max	82.9	81.7	82.8	2.4	1.3	94.3	89.4	94.2	89.4	1.15E+09
	Avg	77.7	76.5	77.7	1.2	N/A	85	85	85	85	6.10E+08
September	Max	82.3	81.1	82	2.4	1	91.7	88.1	91.6	88.1	1.03E+09
	Avg	76.1	75	76.2	1.1	N/A	81.4	81.5	81.4	81.5	4.63E+08
October	Max	78.3	76.7	78	3.1	1.1	89	86.2	89	86.2	1.31E+09
	Avg	69.3	68	69.4	1.3	N/A	74.2	74.3	74.2	74.3	4.25E+08
November	Max	69.4	67.9	69.7	3.1	1.2	84.6	82.7	76.8	78.9	1.08E+09
	Avg	59.9	58.8	60.2	1.2	N/A	69.5	69.6	64.8	65	4.26E+08
December	Max	60.6	59.2	60.7	3.7	1.5	84.1	80.9	71.4	69.3	1.23E+09
	Avg	50.1	48.7	50.3	1.5	N/A	64.9	64.9	57.7	57.8	5.90E+08

Definition of column headings for tables 3.2.1 and 3.2.2:

Intake Temperature - Intake temperature for the RCW and ERCW systems (°F), determined by adding the instream temperature rise due to the SCCW discharge to the ambient river temperature.

River Temperature
- ambient - Ambient river temperature (WBH discharge temperature) (°F)
- downstream - River temperature at downstream end of WBN diffuser mixing zone (°F)
- rise - Instream DT at downstream end of WBN diffuser mixing zone (F°)
- rate - Rate of change of river temperature at downstream end of WBN diffuser mixing zone (F°/hr)

Discharge Temperature
- WBN Diffuser - Temperature of discharge through WBN diffuser (°F)
- SCCW - Temperature of discharge through SCCW surface discharge (°F)

Total Heat - Combined heat discharge to river from WBN diffuser and SCCW discharge (BTU/hr)

Chemical Impacts

The chemical characteristics of the discharge are dependent upon the concentration level of dissolved solids in the CCW system. This is a function of the evaporative losses from the towers and the combined rate of makeup plus SCCW flows of river water. With maximum evaporative losses of 15,000 gpm and a minimum total flow into the towers of 85,000 gpm, the maximum concentration of dissolved solids would be approximately 1.4 times that in the river. A normal range of 1.1 to 1.2 concentrations would result from operation of this system.

Implementation of the SCCW will not increase or change the use of chemicals. Corrosion control chemicals are not used specifically for the CCW system which the SCCW supplies. These chemicals are only used in the once-through auxiliary cooling systems, ERCW and RCW. Also biocide chemicals for mollusk control are presently only used in the ERCW and RCW systems. Since the CCW system does not receive direct injection of these chemicals, there would be no change to the present use of such chemicals. While the total poundage of the chemicals released to the river would remain unchanged, the implementation of the proposed project would result in a decrease in the average ppm of continuously injected chemicals in the diffuser discharge. This is due to the decrease in concentration levels in the CCW resulting from the input of the SCCW flow mass.

As discussed in Section 3.2.1, cooling tower blowdown is temporarily suspended during certain periodic chemical treatments. The discharge of the SCCW system would also be suspended during these same times to prevent the introduction of these chemicals to the river.

An algeacide treatment may be specifically used in the CCW in the future and is approved in the present NPDES permit for WBN. This chemical would be injected as short duration dose shock treatment. SCCW supply would be suspended during the CCW treatment so that the amount of chemical is dependent of the fixed volume of the CCW system which is unchanged. Therefore, the proposed project would not require any increase use of this chemicals.

Also as discussed in Section 3.2.1, there is discharge of residuals from continuous corrosion control chemical treatments. The higher makeup rate due to the SCCW would result in further dilution and lower concentrations of the residual in the discharge to the river through the present WBN discharge point and the proposed WBF discharge.

As pointed out in Section 3.2.1. the present NPDES discharge permit for WBN has a maximum daily limitation of 0.10 mg/l for total residual chlorine in the diffuser discharge, Outfall 101. While not a permit limitation, the rationale used in approving the permit limit was based on a water quality requirement that the maximum in-stream concentration not exceed 0.019 mg/l as an instantaneous maximum and 0.011 mg/l as a weekly average. Operation of the proposed SCCW will ensure continued compliance with the in-stream concentration limits.

Actual measurements of the residual chlorine concentrations in the WBN discharge since the plant went into operation indicate the highest daily maximum has been 0.088 mg/l and the highest daily average has been 0.037 mg/l. The majority of the time the residuals were at or below the measurable level of 0.025 mg/l. This is an indication of the low residual in the CCW system and reflects the chlorine demand of the CCW system and the scrubbing effect of the water passing through the cooling tower. With the proposed project the chlorinated makeup streams, ERCW and RCW, will be total mixed with the SCCW as it passes through the CCW system. The affect of the mixing of the SCCW, ERCW and RCW will be to decrease the residual chlorine in the CCW to below measurable levels. This will result due to the significant chlorine demand of the large volume of raw river water for the SCCW. Accordingly, the SCCW discharge as well as the present blowdown will contain lower residual concentrations.

Using a mass balance evaluation with a discharge flow of 270 cfs (135,000 gpm) and a conservative concentration of 0.025 mg/l in the proposed SCCW discharge, a minimum stream flow of 85 cfs would be required to meet the 0.019 mg/l instantaneous maximum in-stream concentration. A minimum stream flow of 343 cfs would be required to meet the 0.011 mg/l weekly average. A conservative estimate of leakage alone through WBH is about 250 cfs which is almost three times the minimum to meet the instantaneous maximum in-stream concentration limit. Operation of a single WBH unit at minimum capacity (approximately 4000 cfs) for 2 hours in any day would be more than adequate to meet the minimum stream flow of 343 cfs for the instream weekly average. It is concluded that there will be no adverse impact on the river from chlorine due to the operation of the SCCW.

3.3 Aquatic Ecology

3.3.1 Existing Conditions

<u>Fish Community, Sport/Commercial Fishery</u>

Aquatic communities in the inflow, transition, and forebay zones of all Tennessee River reservoirs, and several major embayments, are sampled routinely as part of the TVA Vital Signs Monitoring Program to assist in monitoring reservoir environmental quality. One part of this program uses electrofishing and experimental gill netting results to calculate Reservoir Fish Assemblage Index (RFAI) scores as an expression of fish community quality. RFAI results are available from the forebay area of Watts Bar Reservoir (TRM 531) in the vicinity of the WBF intake; upper Chickamauga Reservoir (TRM 529) in the vicinity of the WBN and WBF plant discharges; and below these plant discharges at the Chickamauga Reservoir transition zone (TRM 490).

RFAI sampling results (Table 3.3.1) indicate similar communities at all three locations. A total of 38 fish species was collected from the Watts Bar forebay and the Chickamauga transition site, with 42 species recorded during sampling in the vicinity of the WBN and WBF discharges (Chickamauga inflow). No consistent change in fish community status at these locations appears to have occurred since the program was initiated in 1990 (Scott, 1992 and Dycus, 1995). Annual variations within each site are minimal. Average RFAI scores from each site compare favorably with average scores from similar areas in other mainstream Tennessee River reservoirs (Table 3.3.2).

Reservoir-wide creel surveys have been conducted periodically on Chickamauga and Watts Bar reservoirs by Tennessee Wildlife Resources Agency (TWRA). Black basses (*Micropterus* sp.) have been the most sought after sport fish in both reservoirs in recent years, accounting for 34 to 41 percent of the overall fishing effort during 1993 through 1995 (O'Bara, 1994; 1995; 1996). Crappie (*Pomoxis* sp.) drew 14 to 22 percent of the fishing effort during these years, striped bass 4 to 14 percent, sauger made up 3 to 6 percent, and catfish 1 to 11 percent. Sport Fishing Index (SFI) scores for largemouth bass and sauger indicate Watts Bar and Chickamauga rated in the top ten out of 35 reservoirs in the Tennessee and Cumberland River basins regarding quality of the fisheries for each of these species (TVA unpublished data). The channel catfish fishery in these two reservoirs ranked in the top 15.

Recreational fishing data in the Watts Bar tailwater (TRM 523.2 to TRM 529.9) also were collected during both preoperational and operational monitoring for WBN using access point angler creel surveys (Baxter et al. 1997). Preoperational creel results were limited to catch rate estimates, average weight of each species, and percent composition of the catch. During WBN operational monitoring (April 1996 through March 1997), harvest, catch, and effort data were collected to characterize the fishery in the vicinity of the WBN and WBF discharges.

Baxter et al. (1997) concluded that the operation of WBN had no impact on the Watts Bar tailwater fishery during the initial year of operation. Operational creel results indicated a majority of fishing in the area below Watts Bar Dam (71%) was done from the bank, with 49 % of this pressure being exerted along the bank adjacent to the WBF and WBN plants. Anglers expended an estimated 277,284 hours of effort during the initial year of operation with an average daily effort of 597 hours on weekdays and 1209 hours on weekend days indicating this is a heavily used tailwater for fishing. Monthly angling effort varied somewhat throughout the year with highest effort during March, May, June, and July (Figure 3.3.1).

Catfish were the main species sought by anglers in the Watts Bar Dam tailwater area during operational monitoring (Table 3.3.3). Sauger, white bass, black basses, and striped bass also were important to the fishery. Catfish angling effort was highest during summer months, with sauger dominating the fall and winter fishery (Baxter et al. 1997). Angling effort for white bass and crappie was highest during winter and spring months, and striped bass fishing occurred mainly during fall and winter months.

Creel results including all anglers reveal that bluegill, white bass, catfish, yellow bass, sauger, crappie, and black bass were caught in the Watts Bar tailwater more frequently than any other species (Figure 3.3.2). A majority of the sauger, white bass, and striped bass are caught along the side of the tailwater adjacent to the WBF and WBN plants as these species of fish orient to the current coming through the generators located in this side of Watts Bar Dam. Catfish also congregate along the current during summer months. During non-generation periods, individuals of all these species tend to roam the tailwater area and are not as concentrated.

Commercial fishing in the vicinity of WBF and WBN is not possible due to current velocities in the area making netting virtually impossible. Commercial netting is not permitted in Watts Bar Reservoir. Therefore, potential impact of the WBN SCCW project on commercial fishing is not an issue.

Table 3.3.1. Species of Fish Collected during TVA Vital Signs Monitoring between 1991 and 1996 from Watts Bar Reservoir Forebay (TRM 531), Chickamauga Reservoir Inflow (TRM 529), and Chickamauga Reservoir Transition (TRM 490).

Scientific Name	Common Name	TRM 531	TRM 529	TRM 490
Ichthyomyzon casteneus *	Chestnut lamprey			X
Lepisosteus oculatus	Spotted gar	X		X
Lepisosteus osseus	Longnose gar	X	X	
Alosa chrysochloris	Skipjack herring	X	X	X
Dorosoma cepedianum	Gizzard shad	X	X	X
Dorosoma petenense	Threadfin shad	X	X	X
Hiodon tergisus	Mooneye	X	X	
Campostoma anomalum	Central stoneroller		X	X
Cyprinella spiloptera	Spotfin shiner	X	X	X
Cyprinella whipplei	Steelcolor shiner	X	X	
Cyprinus carpio	Common carp	X	X	X
Notemigonus crysoleucas	Golden shiner	X	X	X
Notropis atherinoides	Emerald shiner	X	X	X
Notropis chrysocephalus *	Striped shiner		X	
Pimephales notatus	Bluntnose minnow	X	X	X
Pimephales vigilax	Bullhead minnow	X		X
Carpiodes carpio	River carpsucker			X
Carpiodes cyprinus	Quillback		X	
Hypentelium nigricans	Northern hog sucker	X	X	
Ictiobus bubalus	Smallmouth buffalo	X	X	X
Minytrema melanops	Spotted sucker	X	X	X
Moxostoma duquesnei	Black redhorse		X	
Moxostoma erythrurum	Golden redhorse		X	
Ictalurus furcatus	Blue catfish	X	X	X
Ictalurus punctatus	Channel catfish	X	X	X
Pylodictis olivaris	Flathead catfish	X	X	X
Labidesthes sicculus	Brook silverside	X	X	X
Morone chrysops	White bass	X	X	X
Morone mississippiensis	Yellow bass	X	X	X
Morone saxatilis	Striped bass	X	X	X
Lepomis auritus	Redbreast sunfish	X	X	X
Lepomis cyanellus	Green sunfish	X	X	X
Lepomis gulosus	Warmouth	X	X	X
Lepomis macrochirus	Bluegill	X	X	X
Lepomis megalotis	Longear sunfish		X	X
Lepomis microlophus	Redear sunfish	X	X	X
Micropterus dolomieui	Smallmouth bass	X	X	X
Micropterus punctulatus	Spotted bass	X	X	X
Micropterus salmoides	Largemouth bass	X	X	X
Pomoxis annularis	White crappie	X	X	X
Pomoxis nigromaculatus	Black crappie	X	X	X
Perca flavescens	Yellow perch	X	X	X
Percina caprodes	Logperch	X	X	X
Stizostedion canadense	Sauger	X	X	X
Stizostedion vitreum	Walleye	X	X	X
Aplodinotus grunniens	Freshwater drum	X	X	X
	TOTAL	38	42	38

* Species either not full-time residents of reservoirs or usually not captured with these gear types.

Table 3.3.2. Reservoir Fish Assemblage Index Scores (higher scores indicate better quality) from the vicinity of WBF intake (TRM 531), in the vicinity of WBN/WBF discharges (TRM 529), and below the WBN/WBF outlets (TRM 490).

Year	TRM 531	TRM 529	TRM 490
1990	42	50	45
1991	42	48	45
1992	35	42	41
1993	39	56	51
1994	43	52	43
1995		44	50
1996	41	38	44
Average	40	47	46
Mainstream Reservoir Averages (1991-1995)	41 (forebay zones)	42 (inflow zones)	41 (transition zones)

Table 3.3.3 Estimated effort for major species sought after by fishermen in the Watts Bar tailwater fishery, April 1996 through March 1997.

Directed Species Group	Percent Effort	Estimated Effort (hours)	Estimated Trips
Any Species	32	88,731	19,587
Catfish	22	61,002	13,801
Sauger	13	36,045	7,853
White Bass	12	33,274	6,681
Striped Bass	6	16,637	4,413
Black Basses	6	16,637	2,955
Sunfish	5	13,864	2,818
Crappie	4	11,091	2,509

Bottom Life

The aquatic insects, snails, and other animals which live in and on the river bottom in the Watts Bar tailwater were sampled most recently in 1996 as part of the operational monitoring program for WBN (Baxter, et al. 1997). A total of 86 different taxa (identified to orders, families, genera, or species) was found at the five sampling sites in the tailwater (between TRM 521.0 and 528.5). The most abundant species at the two stations near the WBF discharge was the planarian *Dugesia tirgrina* (28 percent of the average site total), followed by the Asiatic clam, *Corbicula fluminea*, (24 percent), and the amphipod *Gammarus minus* (18 percent). These three species, accompanied by the next three most abundant taxa (a trichopeteran, *Cyrnellus fraternus;* Chironomidae; and Tubificidae) accounted for 91 percent of the total number of animals encountered at these sites.

Freshwater Mussels

The State of Tennessee has designated the first 10 miles of the Tennessee River downstream from Watts Bar Dam (TRM 529.9 - 520.0) a mollusk sanctuary. The taking of aquatic mollusks and the degradation and/or destruction of aquatic habitat is prohibited in this reach of the river.

As part of the monitoring program for the WBN Project and for other purposes, TVA aquatic biologists have conducted several examinations of freshwater mussels in the Tennessee River downstream from Watts Bar Dam. Three of these studies include sites within the two-mile reach just downstream from the dam. Starting in 1983, TVA staff have been routinely monitoring the status of mussel stocks in three "mussel beds" near WBN, including a mile-long bed along the left (descending) shore of the river opposite this project site (between River Miles 528.0 and 529.0). In 1990, TVA mussel divers searched several sites between WBN and the dam which would have been affected by construction of a (then) proposed new lock and a possible new bridge (between River Miles 527.9 - and 529.4). In 1997, as part of this project, TVA divers searched for mussels just offshore from the WBF discharge (at River Mile 529.2).

Pertinent results from these studies are presented in Tables 3.3.4 and 3.3.5. As indicated in Table 3.3.4, live representatives of 13 native mussel species were found just offshore from the WBF discharge. The most abundant species found near this discharge was the elephantear, *Elliptio crassidens* (57 percent of the total), while three other species (pink heelsplitter, *Potamilus alatus*; pimpleback, *Quadrula pustulosa*; and Ohio pigtoe, *Pleurobema cordatum*) each accounted for at least five percent of the total. Mussels were relatively scarce throughout this area (on average, one animal per three square meters) and appeared to be rather evenly distributed.

Results from other pertinent mussel surveys (Table 3.3.5), indicate that a total of 25 native species have been found in recent years within this two-mile river reach; however, several species have been encountered only in the well-studied mussel bed along the left shore. When the sample size is large enough (at least 50 mussels), the elephantear is nearly always the most abundant species (23 - 81 percent of the total). Other abundant species typically include the Ohio pigtoe, pimpleback, and purple wartyback, *Cyclonaias tuberculata*, usually in that order. The available abundance estimates (presented in Table 3.3.5) indicate that mussels are relatively scarce along the right shore both upstream and downstream from the WBF discharge (about one animal per two square meters) and appear to be less abundant along the left shore near the lock and dam (one per 10 square meters). The single set of abundance estimates made along the left shore downstream from the dam indicates that mussels are more abundant there (an average of 1.2 mussels per square meter); however, those results include considerable variation, perhaps because some of the sites are within the known bed and others are outside of it.

A recent summary of native mussel information from the Watts Bar Dam tailwater (TVA and NRC 1995) indicates that the surviving animals are remnants of the much more diverse mussel community which existed in this part of the river before the dams were built. Nearly all of the individual mussels are large and, apparently, quite old. Very few of the species show any evidence of recent recruitment.

Table 3.3.4. Freshwater mussels encountered during diver-conducted searches of transects located just off shore from the Watts Bar Fossil Plant discharge (Tennessee River Mile 529.2), May 27, 1997.

Species	Near Shore	~ 20 Meters off shore	~ 30 Meters off shore	Totals
Elliptio crassidens	27	16	19	62
Potamilus alatus	7	4	1	12
Quadrula pustulosa	4	4	2	10
Pleurobema cordatum		1	6	7
Anodonta grandis	2	1		3
Cyclonaias tuberculata		1	2	3
Quadrula metanevra			3	3
Ellipsaria lineolata		2		2
Leptodea fragilis	2			2
Lampsilis abrupta ◎			1	1
Lampsilis ovata		1		1
Ligumia recta			1	1
Obliquaria reflexa	1			1
Total Specimens	43	30	35	108
Species Included	6	8	6	13
Search Area (m^2)	100	100	110	310
Number/m^2	0.43	0.30	0.32	0.35

◎ - federal endangered species

Table 3.3.5. Results of other recent mussel surveys within two river miles downstream from Watts Bar Dam, Tennessee River Miles (TRM) 529.9 to 527.9.

Species	TRM 529.4 R* (1990)	TRM 529.4 L (1990)	TRM 527.9-528.6R (1990)	TRM 527.9-528.6L (1990)	TRM 528.2-529.0L (1996)	TRM 528.2-529.0L (1983-1994)
Elliptio crassidens	21	2	32	204	268	2921
Pleurobema cordatum	17		4	34	47	530
Quadrula pustulosa	1	4	52	4	20	241
Cyclonaias tuberculata	4		8	5	13	142
Potamilus alatus	1		6	1	4	50
Ellipsaria lineolata			3		9	43
Amblema plicata	2	4	3	1	3	39
Lampsilis abrupta ◎	2			1	1	26
Anodonta grandis		1	2		1	20
Ligumia recta			1		1	18
Quadrula metanevra	1				1	18
Actinonaias ligamentina						8
Lampsilis ovata						8
Leptodea fragilis			3	2	1	8
Megalonaias nervosa						7
Obliquaria reflexa	4	1	20			7
Tritogonia verrucosa		2	4		1	7
Elliptio dilatata			1	1		6
Pleurobema oviforme						6
Anodonta suborbiculata						1
Cyprogenia stegaria ◎						1
Fusconaia maculata						1
Lasmigona complanata						1
Pleurobema plenum ◎						1
Ptychobranchus fasciolaris						1
Lasmigona costata					1	
Total Specimens	53	14	139	253	371	4111
Species Included	9	6	13	9	14	25
Sample Area (m^2)	100	100	250	200	nd	nd
Number/m^2	0.53	0.14	0.56	1.26	--	--

* - L = along Left (descending) shore; R = along Right shore
◎ - federal endangered species
nd - not determined (survey conducted using time intervals, not area)

3.3.2 Construction Impacts

Aquatic species would not be affected by construction associated with this project as construction activities will not occur in the water or along the shoreline. Use of appropriate erosion control BMPs during construction would prevent sedimentation effects on fish, mussels, and other benthic organisms.

3.3.3 Operational Impacts

3.3.3.1 Fisheries - Entrainment

The proposed use of the WBF intake to supply water for WBN would involve half of the water volume used when WBF was in service. A 316(b) entrainment study (TVA 1976) conducted biweekly during the period March 24 through July 28, 1975, estimated hydraulic entrainment by WBF to range from 0 to 1.53 percent of reservoir flow. Estimated entrainment of total fish larvae ranged from 0.11 to 0.86 percent of the total population transported through Watts Bar Dam generators during the period sampled. Total larval fish entrainment during the entire sampling period was estimated to be 0.24 percent of the transported population. The low (0.24%) estimated entrainment of larval fish resulted in a conclusion of no significant adverse impact on the fisheries resource of Watts Bar Reservoir from the WBF intake. The proposed SCCW project would result in loss of fish eggs and larvae through entrainment at half (0.12% estimated entrainment) previous levels.

3.3.3.2 Fisheries - Impingement

As part of 316(b) monitoring at TVA fossil plants, fish impinged on the WBF intake traveling screens were collected during weekly 24-hour counts from August 1974 through July 1975. During the 29 samples, a total of 2,507 fish was impinged. Twenty-two species were represented, with threadfin shad comprising 59 percent of the total. Other dominant species in impingement samples were freshwater drum (13%) and bluegill (12%). Expanding numbers from 29 samples to a total of 273 days during the period sampled, an estimated 21,787 fish were impinged during August 1974 through July 1975 (Table 3.3.6). SCCW operation would require half of the intake volumes of WBF; however only half of the intake screens would be in use. Therefore, the intake velocity and resultant fish impingement of the SCCW would be similar to that occurring during the previous WBF operational monitoring.

Table 3.3.6 – Annual Fish Impingement Projection

	Aug. 1974	Sept. 1974	Oct. 1974	Nov. 1974	Dec. 1974	Jan. 1975	Feb. 1975	Mar. 1975	Apr. 1975	May 1975	June 1975	July 1975	Total
Days sampled	4	4	4	3	3	3	3	3	2	4	4	5	42
Days/month	31	30	31	30	31	31	28	31	30	31	30	31	365
Threadfin Shad	620	1,658	178	90	413	951	1,017	3,710	3,210	1,387	83	831	12,784
Gizzard Shad	8	23	8	0	124	21	19	52	45	54	135	50	539
Skipjack Herring	23	23	295	150	382	62	56	620	315	8	0	31	1,695
Mooneye	0	0	0	0	0	0	19	10	30	0	8	0	52
Emerald Shiner	0	0	0	0	0	0	0	0	15	62	0	6	87
Steelcolor Shiner	0	0	8	0	10	10	0	0	0	0	0	0	26
Bullhead Minnow	0	8	0	0	0	0	0	0	0	0	0	0	9
Smallmouth	0	0	0	0	0	0	0	10	0	0	0	0	9
Blue Cat	0	30	0	10	10	0	0	10	0	8	0	0	70
Channel Catfish	0	68	39	10	0	21	9	21	90	39	0	19	295
Flathead Catfish	8	15	0	0	0	0	0	0	0	0	0	0	26
White Bass	0	0	0	80	52	0	0	0	150	0	0	118	365
Yellow Bass	0	8	0	0	0	0	0	0	0	0	0	0	9
Striped bass	0	0	0	0	0	0	0	10	0	0	0	19	35
Redbreast SF	0	0	0	0	0	0	0	0	0	0	0	6	9
Bluegill	271	953	155	120	21	10	0	21	180	155	150	329	2,642
Smallmouth Bass	16	23	0	0	0	0	0	0	0	0	0	0	43
Spotted Bass	0	0	0	0	0	0	0	0	0	0	0	43	61
White Crappie	0	68	23	0	10	31	0	10	90	16	0	6	226
Black Crappie	0	0	0	0	0	0	0	0	0	0	0	6	9
Logperch	0	0	0	0	0	0	0	0	0	16	0	6	26
Freshwater Drum	380	188	101	30	62	62	308	351	615	178	308	279	2,772
	1,325	3,060	806	490	1,085	1,168	1,428	4,826	4,740	1,922	683	1,748	21,787

3.3.3.3 Fisheries - Thermal Impacts

The main thermal-related fishery impacts anticipated from the WBN operational change include: 1) concentration of fish and fishermen in the vicinity of the WBF discharge, 2) potential for fish kills in the immediate vicinity of the WBF discharge, and 3) potential for impacts on reproduction or growth of important sport and prey fish species.

Heated effluents can concentrate fishing effort and fish on a reservoir, especially during winter months (McNurney and Dreier, 1981), thus increasing the potential for adverse impacts. Concentrating fishermen together with large aggregations of a particular species of fish can result in overharvest and a subsequent decline of that fishery. However, recent information on sport fishing and sport fish communities in the vicinity of WBN (Baxter et. al. 1997) and Sequoyah Nuclear Plant (SQN) (Wrenn et al. 1989 and Kay and Buchanan 1995) revealed limited concentration of fishermen or fish in plant discharge areas. No adverse impacts were documented on fishermen effort or success, or sport fish communities as a result of heated water effluents from these plants.

Plant operational changes can result in rapid shifts in environmental conditions such as water temperatures, which can adversely impact fish populations. Under "worst case" conditions described during April for WBN SCCW system operation (see Section 3.2.3 and Enclosure 1), water temperatures at the end of the mixing zone (305 meters or 1000 feet downstream of the WBF discharge) will increase a maximum of only 2.3°C (4.1°F) above ambient water temperatures. Except in extreme instances (rapid changes in water temperature greater than 10°C or 18°F), thermal impacts to resident fish species are minimized if timely relief from the condition is available. Only at temperatures near the upper lethal limit for a particular species will a limited exposure to higher temperatures at the end of the mixing zone of the WBN SCCW potentially have adverse impacts. Even under these circumstances, Neill and Magnuson (1974) reported that yellow perch (*Perca flavescens*), a cool-water relative to sauger, make short-term feeding forays (2 to 3 hours) into water heated up to 3°C above their upper lethal temperature with no adverse effects.

The greatest potential for adverse impact due to operational changes under the WBN SCCW project involves water temperatures in the immediate vicinity of the WBF discharge. Section 3.2.3 details how the immediate area of the SCCW discharge will be influenced during startup and shutdown of the SCCW system. No adverse impacts to fish are anticipated during normal operation, at startup, or at shutdown due to the gradual nature of the discharge temperature changes under these conditions. When an unexpected WBN shutdown occurs (i.e. load shed, turbine trip, or reactor trip) there potentially could be an abrupt loss of heat load to the CCW, resulting in a maximum drop of the temperature at the point of discharge of 9.1°C (15.5°F) after one hour, with a maximum instream rate of change of -2.5°C/hr (-4.5°F/hr). Since these worst-case conditions occur during May and June, when ambient water temperatures are around 20-25°C, this level of water temperature decrease will not cause mortality of even the most cold water sensitive fish species, threadfin shad. If the abrupt temperature decline were to occur during times when the ambient temperatures were near the lower lethal limit of threadfin shad (10°C, Griffith 1978), threadfin in the immediate vicinity of the discharge could experience mortality. Water temperature decreases due to unexpected WBN shutdown during winter months could result in declines of up to 3.3°C (6°F) at the point of discharge after one hour. Under these conditions, limited mortality of threadfin shad could occur. This is due to the warm discharge providing a refuge from the colder ambient water thereby preventing the seasonal mortality that normally occurs for this cold sensitive species. No other fish species is anticipated to experience mortality under operation of WBN with the SCCW.

The hydrology of the discharge (see Enclosure 1) is such that lethal temperatures involve the entire water column for only a few meters horizontally. Water temperatures will dissipate rapidly until the ΔT at a distance of 30.5 meters (100 feet) from the outlet is reduced to 5.6°C (10°F), which is sub-lethal to even the most thermally intolerant species, except near their lethal temperature limits. The current ΔT limit of <3°C (5.4°F) at the end of the mixing zone will be attained within 46 meters (150 feet) of the discharge. This should allow fish residing in the vicinity of the discharge to avoid the maximum ΔT and prevent, or minimize fish mortality at unexpected WBN shutdown.

The potential for impacts on reproduction or growth vary with individual species, and a review of these possible impacts requires the use of representative species. Fish species to be addressed individually include sauger, threadfin shad, catfish, white bass, and striped bass. Sauger is an important cool-water sport fish species with a relatively low maximum thermal tolerance (Koenst and Smith, 1976). Threadfin shad is a major forage species in the reservoir that experiences severe stress below 10°C and near total mortality below 4°C (Griffith, 1978; Lewis and Heidinger, 1979; Irwin and Bettoli, 1995). White bass is an important warm-water sport fish in the Watts Bar tailwater area. Striped bass is an introduced "trophy" species, that, like sauger, is sensitive to high temperatures. Catfish, which constitute a majority of the fishery in the tailwater area during summer months, are relatively tolerant species.

Sauger

Sauger populations in Tennessee River reservoirs historically have experienced considerable fluctuations in density (Hackney and Holbrook, 1978). An extreme sauger population decline in Chickamauga Reservoir during the mid to late-1980s was documented by Hevel (1988), Hickman et al. (1989), Hickman et al. (1990), and Hevel and Hickman (1991). Yeager (1990), St. John (1990), Brown (1990), and Pegg et al. (1996) also noted the decline of sauger in other Tennessee River reservoirs and searched for causes. Water velocities and water temperatures during the April spawning period are generally cited as important factors in sauger spawning success and ultimately year-class strength (Yeager, 1990; Yeager and Shaio, 1992; Hickman and Buchanan, 1996). Brooks (1993) also reported that optimal water temperatures (7-10°C) during spawning and incubation coupled with high water levels promoted fry and fingerling survival in the Illinois River.

The potential for the proposed WBN SCCW project to impact sauger spawning success is limited to disruption of the normal migration of adults to the spawning area. Watts Bar Dam blocks sauger during the annual spawning migration resulting in a congregation of sauger in the Watts Bar tailwater area during winter months. Typically, as individuals approach spawning readiness (late March-early April), they move downstream to the most suitable spawning site available. Sauger in Chickamauga Reservoir spawn approximately eight miles downstream of Watts Bar Dam. The major concern for sauger with WBN SCCW operational changes is if spawners were delayed or diverted from moving to the spawning area. Hevel and Hickman (1991) and Kay and Buchanan (1995) reported no concentration or diversion of sauger to the warm water near the SQN diffusers during the fall-winter period when sauger migrate past that plant. The increased water temperature at the WBN SCCW discharge is also not anticipated to alter adult sauger migration patterns.

Another potential concern is the concentration of adults during WBN operation in the immediate vicinity of the WBF discharge during the winter period when they are staging at Watts Bar Dam. This could result in an increase in fishermen catch of migrating sauger which might lead to overharvest of spawners. This is considered unlikely as this condition has not occurred in similar situations at SQN or WBN on Chickamauga Reservoir (Kay and Buchanan 1995 and Baxter et. al. 1997) or at Bull Run Steam Plant on Melton Hill Reservoir (Schneider et. al. 1977). Sauger do not concentrate in the Watts Bar tailwater area during summer months when discharge temperatures are high enough to adversely impact growth. Therefore, the WBN SCCW project is not anticipated to have negative impacts on sauger growth.

White Bass

As with sauger, white bass apparently declined in abundance and fishermen catches during the mid-1980s. By 1992, the white bass population had improved (Buchanan 1994) as year-class strength, numbers harvested, and harvest rate in Chickamauga Reservoir had increased to levels higher than those reported for 1986. Competition with an expanding population of yellow bass was suggested as the major factor limiting the white bass population in Chickamauga Reservoir. White bass, like sauger, concentrate during the late winter and spring below Watts Bar Dam and would be exposed to potential impacts of the WBN SCCW project. White bass have three primary spawning sites in Chickamauga Reservoir. The closest of these to the WBN area is eight miles downstream at Hunter Shoals. As with sauger, no alteration of white bass spawning migration patterns is anticipated as a result of the WBN SCCW project. Some concentration of white bass staging below Watts Bar Dam may occur in the immediate vicinity of the WBF discharge during WBN operational periods. If this occurs, fishermen catch could increase, slightly enhancing the potential for overharvest of spawners. However, as with sauger, there is no indication of this happening under similar circumstances (Kay and Buchanan 1995 and Buchanan 1994).

The maximum growth potential for white bass occurs from 27-28.5°C (Magnuson et al. 1990). During the time frame when white bass inhabit the tailwater area, the maximum water temperature in the vicinity of the WBF discharge will be 28°C. Therefore, no adverse impacts on white bass growth are anticipated.

Threadfin Shad

Numbers of juvenile threadfin shad in Chickamauga Reservoir cove rotenone samples have fluctuated considerably between 1970 and 1995 (Jenkins, 1996). Peak mean density of 22,913 young-of-the-year (YOY) threadfin per hectare was found in 1985, with the lowest mean density, 53 fish per hectare, occurring in 1978. Threadfin shad are very sensitive to cold water temperatures (severe stress below 10°C and near total mortality below 4°C) and severity of low winter water temperatures often is the determining factor in survival and reproductive success the following year (Griffith, 1978; Lewis and Heidinger, 1979). During very cold years, adult densities often are reduced to a point where significant recruitment does not occur the following year. Low density estimates of YOY threadfin in Chickamauga Reservoir were preceded by especially cold winters (Jenkins, 1996).

Lewis and Heidinger (1979) reported that threadfin shad were attracted to the heated effluent of a power plant during winter. A potential exists for the creation of a winter thermal refuge for threadfin shad in the vicinity of the WBF discharge. This artificial refuge could increase the number of spawners the following spring enhancing the potential for a large threadfin shad year class. However, if long non-operational periods occur during winter at WBN, water temperatures would decline, potentially resulting in large mortality of attracted threadfin shad. It must be kept in mind that these fish would have died due to ambient conditions unless they were in the vicinity of a natural refuge such as a spring outlet. Threadfin shad are tolerant of water temperatures in excess of 32°C, limiting the impact of maximum water temperatures. However, rapid increases in water temperature (>10°C) in the immediate vicinity of the discharge could cause limited threadfin shad mortality.

Catfish

Catfish support a majority of the angling effort during summer months in the inflow area of Chickamauga Reservoir. During an extended drought in the mid-1980s, catfish in Chickamauga Reservoir were reported to decline in abundance. Peck and Buchanan (1995) initiated an investigation in 1988 to determine the quality of the catfish population in the reservoir. They found the number of catfish harvested by sport fishermen in Chickamauga Reservoir remained relatively stable from 1988 through 1993, and gill netting catch rates from inflow, transition, and forebay zones of the reservoir during 1989 through 1993 suggested a generally increasing population. The inflow area in the vicinity of WBN and WBF consistently had higher gill netting catch rates than other areas of the reservoir. Length distributions of catfish (blue, channel, and flathead) collected by Tennessee Tech University (TTU) personnel during August 1997 (Chris O'Bara, personal communication) indicate healthy populations of each species with numerous year classes represented in each population.

Catfish spawn in cavities formed by crevices in rock, cave-like depressions in the bank, hollow logs, or debris such as discarded automobile tires. Adequate spawning habitat does not exist in the immediate vicinity of the WBF discharge, and therefore the WBN SCCW changes are not anticipated to influence catfish spawning success. Catfish are very tolerant to high temperatures with upper thermal tolerance limits from 32 to 37.8°C (Eaton et al. 1995, Allen and Strawn 1968) and preferred or maximum growth temperatures of 30 to 33.5°C (Andrews and Stickney 1972, Eaton et al. 1995). The "worst case" maximum water temperature at the end of the WBF mixing zone is projected to be 30°C, and the maximum discharge temperature in the immediate vicinity of the WBF outlet pipe is projected at 34.7°C. No adverse impacts on catfish survival or growth are anticipated.

Striped Bass

Striped bass were initially stocked into Chickamauga Reservoir by TWRA in 1974 (Anders Myhr, personal communication). This, and subsequent striped bass introductions, resulted in the establishment of a "trophy" fishery in the Watts Bar tailwater in the vicinity of the WBF and WBN plants. Stripers accounted for 2,955 fishing trips and 16,637 estimated hours (6% of total fishing effort) in the tailwater in 1996-1997 (Baxter et al. 1997).

Striped bass are an introduced species and spawning requirements are seldom met in Tennessee River impoundments and populations are generally maintained by supplemental stocking. Striped bass eggs are semi-buoyant and current velocities must be sufficient to keep the fertilized eggs in the water column until hatching. These conditions are met below Watts Bar Dam only during extremely wet springs when water has to be released through the spillway gates during the striped bass spawn (generally in April). Therefore, WBN SCCW system operation will not impact striped bass spawning.

Striped bass growth potential is best from 20 to 24°C (Coutant 1975). It is anticipated that striped bass will congregate in the warmer discharge water during winter months, and avoid the discharge during summer when the water temperatures are above the preferred temperature range. Currently, striped bass do not congregate in the vicinity of the WBF discharge (Anders Myhr, personal communication). Therefore, it is not anticipated that striped bass will be exposed to rapid temperature increases occurring during plant start-up. However, if some striped bass are in the immediate area of the discharge during initiation of WBN generation using the SCCW system, some limited mortality could occur. As with sauger and white bass, if striped bass congregate in the winter in the immediate vicinity of the WBF discharge during WBN operation, increases in fishermen harvest are probable.

TVA would conduct a fisheries monitoring program in the vicinity of WBN SCCW facilities during the first year of SCCW operation to verify selected impact projections outlined in this EA regarding sauger and striped bass. Additional aspects to be addressed in the monitoring program include minimal demonstration of impacts resulting from impingement and entrainment, along with fish community monitoring aspects.

Bottom Life

Bottom-dwelling species, including freshwater mussels, in the immediate vicinity of the WBF discharge could be adversely affected by the elevated temperature of the water being released here from WBN. As indicated in Section 2.1, the temperature of the discharge water (prior to mixing) would be as high as 96°F, approximately 10 degrees warmer than the warmest observed temperature in this part of the river. Information presented in Enclosure 1 (especially Figure 4), however, indicates this heated water would rise to the surface very quickly. Animals present in the relatively small amount of bottom habitat that would be exposed to water temperatures above ambient levels (an area just offshore from the point of discharge measuring approximately 150 x 150 ft., approximately 22,500 sq. ft. (2,100 m^2)) would either not be able to survive there or would experience different growing conditions than elsewhere in the Watts Bar tailwater. Many insects and other resident species that would be adversely affected by warmer water temperatures could swim or drift out of the impact area. Resident freshwater mussels, however, would not be able to avoid the heated water on their own and could be adversely affected. If this alternative is adopted, TVA would minimize the potential impacts on native mussel species by relocating as many resident mussels as possible out of the 2,100 m^2 (22,500 sq. ft.) area where the thermal impacts would affect the river bottom. Divers would collect these animals and place them in suitable mussel habitat elsewhere in the Watts Bar mollusk sanctuary. The operational temperature monitoring described in section 3.2.3 would demonstrate that the selected area for relocation as predicted by the CORMIX model was adequate to ensure the minimization of impact to bottom life or suggest that additional actions might be necessary to protect mussel resources near the discharge. All of these activities would be conducted in coordination with the Tennessee Wildlife Resources Agency.

3.3.4 Chemical Impacts

NPDES permits control the discharge of chemicals from WBN and WBF (See Section 1.4). In support of past chemical treatments of condenser cooling water, TVA conducted toxicity assessments of the molluscicide, Clamtrol, alone and in combination with other chemical additives at WBN. TVA concluded that significant effects on aquatic life would not occur due to the amounts of chemicals used, the frequency of use, and the rapid dilution in the Tennessee River (TVA 1995a; U.S. NRC 1995). Monthly whole effluent toxicity (WET) tests were conducted on WBN discharges over a year-long period when chemicals were being used by the plant. Test results did not identify toxicity in undiluted Outfall 101 effluent (diffuser discharge) based on the responses of daphnids (*Ceriodaphnia dubia*) and fathead minnows (*Pimephales promelas*). Both species are standard NPDES toxicity biomonitoring organisms. Additional targeted studies indicated that daphnids are much more sensitive to active ingredients of Clamtrol than a fish or two species of juvenile freshwater mussels (TVA and NRC 1994). Based on 96-hour survival data, daphnids were nine times more sensitive than fathead minnows. When silt was present in the mussel tests (a natural condition in the river), daphnids were fifteen times more sensitive to the molluscicide than the most sensitive mussel tested. TVA also concluded that NPDES WET testing would identify any potentials for aquatic life impairments, should they occur.

On August 20, 1996, TVA requested concurrence from the Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control, to make minor modifications to the biocide and corrosion control chemical treatment programs at WBN. This request included the substitution of the non-oxidizing biocide (molluscicide) H-130M (didecyldimethylammonium chloride or DDMAC) for a similar biocide, Clamtrol (dodecylguanidine hydrochloride and n-alkyl dimethyl benzyl ammonium chloride or DGH and quat) which has been used at WBN. On September 6, 1996, TDEC approved the requested modification at a discharge concentration <0.05 mg/L DDMAC, as long as the discharge was to the Tennessee River.

The substitution of the molluscicide H-130M for Clamtrol should not pose a problem, based on extensive testing of H-130M alone and with other chemical additives used at TVA's Sequoyah Nuclear Plant (TVA 1995b and 1995c). Greatest toxicity of H-130M was measured in a 9-day juvenile mussel aqueous exposure test without silt. However, toxicity demonstrated in the "silt-free" test (LC_{50} = 47.1 μg/L) was completely eliminated (zero mortality at 300 μg/L) by the addition of silt into the test chambers (detoxification factor >6.4). Next greatest toxicity of H-130M was measured in a 7-day larval fish test (IC_{25} = 104.2 μg/L). This concentration is approximately two times the projected (permitted) 50 μg/L discharge concentration before mixing. The molluscicide was not toxic to daphnids (*Ceriodaphnia dubia*) in aqueous tests or to sediment dwelling organisms (scuds, midges, juvenile mussels) in whole-sediment tests at the permitted discharge concentration of 50 μg/L. In approving the chemical treatment modifications at WBN, the State of Tennessee concluded that discharges of the molluscicide into the Tennessee River at <50 μg/L should pose no problem for instream water quality (TDEC 1996).

Based on these results, TVA concludes that the chemical treatment program for supplemental cooling water at WBN would not constitute an adverse environmental impact. The NPDES permit for WBN requires periodic WET testing using daphnids and fathead minnows as test organisms. Future testing and compliance of the WBN and WBF condenser cooling water discharges with NPDES WET and chemical limits would ensure protection of aquatic life in the Tennessee River from chemical additions.

3.4 Terrestrial Ecology

3.4.1 Existing Conditions

Watts Bar Nuclear Plant and the Watts Bar Fossil Plant are located immediately downstream of the Watts Bar Dam on the Tennessee River at Tennessee River Mile (TRM) 530. The proposed project would be located between the Watts Bar Fossil Plant at TRM 529 and the cooling towers of the Watts Bar Nuclear Plant. Land uses in the local area around the plant sites include agriculture, forestry, and residential uses. The TVA Watts Bar Dam reservation is primarily lawn and upland forest of mixed oaks, hickories, tulip tree and pines.

Much of the property within the Watts Bar Nuclear and Watts Bar Fossil plant sites has been used for power generation sites or for other uses associated with the construction of these generating facilities. Prominent recent land uses have included building sites, parking areas (paved and graveled), lawn maintenance, construction lay-down areas, spoil areas, and storage areas. Several buildings and parking areas have been removed and allowed to revert to fallow conditions.

Because of extensive site disturbance, much of the area along the proposed route is currently open or covered with shrubby vegetation. Approximately 45 percent of the proposed route crosses lawn areas. About 30 percent is in moist, deciduous forests, chiefly hackberry, red maple, green ash, black willow and other early successional species. Another 10 percent is shrub/scrub areas of lespedeza, sumac, blackberry, privet, ironweed, Virginia pine and various grasses. Approximately 5 percent has wetland vegetation of cattails, cardinal flower, marsh mallow and soft rush. The remainder of the route consists of roads, roadsides, cleared areas and other idle land.

The proposed project site has been disturbed extensively by previous construction activities and operations of the Watts Bar Nuclear and Watts Bar Fossil Plants. At its northern end, the proposed pipeline route would cross a fenced area (primarily lawn) adjacent to the Watts Bar Fossil Plant. As it proceeds south, the route runs along the edge or crosses portions of the existing slag disposal area for the Watts Bar Fossil Plant. After leaving the slag disposal area, the route crosses an open area adjacent to roadways. The route then crosses a narrow wooded area along a natural drainage northeast of the cooling towers. The route in the vicinity of the cooling towers would be over open land that is currently covered with sparse grassy vegetation.

Along with natural drainage, the slag disposal areas receive water from the Fossil plant and from slag washing operations. The slag disposal area in general exhibits some wetland functions. A small wetland area supporting hydrophytic vegetation is present in the natural drainage immediately northeast of the cooling towers. Additional discussion of wetlands is provided in section 3.7. Vegetation in the slag disposal area consists of some typical wetland species such as cattail and wool grass along with more upland species such as Virginia pine and sumac.

Common terrestrial mammal species in the project vicinity include white-tailed deer, raccoons, opossums, gray squirrels, and groundhogs, and a variety of shrews and mice commonly found in early successional habitats. Local birds include American robin, European starling, mockingbird, Canada goose, morning dove, killdeer, and a variety of songbirds and neotropical migrants. Amphibians and reptiles include those species often found in wetland habitats, such as spring peepers, northern cricket frogs, gray treefrogs, and midland water snake.

The Yellow Creek Wildlife Management Area (WMA) is located approximately 1 mile west of Watts Bar Nuclear Plant. It is designated primarily for the benefit of migrant and wintering waterfowl. An area designated by the Tennessee Wildlife Resources Agency as the Yellow Creek Key Endangered Species Habitat (KESH) is adjacent to the WMA and is managed for osprey. Chickamauga Shoreline TVA Habitat Protection Area is located on the east bank beginning at TRM 528. It provides habitat for bald eagles and osprey, and provides riparian buffer for the adjacent State Mussel Sanctuary. Chickamauga Reservoir State Mussel Sanctuary is located in the section of the Tennessee River between TRM 520 and TRM 529.9. TVA Natural Heritage records indicate a heronry (a roosting or breeding area for herons) located approximately one mile northeast of the Watts Bar Fossil Plant. In 1990 approximately 20 pairs of great blue herons nested at this site. However, the number of nests at the site had fallen to 4 in 1993. Another heronry was located approximately one half mile southwest of the Nuclear Plant, near the Yellow Creek KESH. However, this heronry has been inactive since 1988.

3.4.2 Construction Impacts

During construction, a corridor 50 feet wide (approximate average) and 4,000 feet long (approximately 4.5 acres) would be disturbed. This disturbance would be from clearing, earth moving (excavation and fill) and from movement of associated construction equipment. Plans call for minimum maintenance of a 30-foot wide right-of-way along the pipeline route primarily to prevent growth of trees. Right-of-way maintenance would be similar to that performed on transmission line rights-of-way. That is, periodic mowing or spraying of herbicides would be used to prevent growth of trees or other woody vegetation along the pipeline.

During construction, existing vegetation along the pipeline right-of-way would be altered (removed, then allowed to return as grass or low brush). Total area affected by the right-of-way would be about 4.5 acres. The net effect on vegetation would be that vegetation within the pipeline right-of-way would be altered from its current condition (brush, shrubs and some trees) to an early successional (fallow-like) condition maintained by periodic mowing or herbicide treatments.

Mobile resident wildlife species would be temporarily displaced directly by the onsite disturbance and indirectly by noise and the presence of workers and equipment during construction. Some non-mobile species or species of low mobility could be lost within the work zone. Construction of the proposed pipeline would result in the conversion of some forested habitats to early successional habitats. Any adverse direct impacts to terrestrial wildlife would occur on a localized basis. Because no rare, threatened, or endangered species occur on site, indirect and cumulative impacts to terrestrial wildlife are expected to be minor and regionally insignificant.

3.4.3 Operational Impacts

Noise and other operational nuisances to wildlife species are expected to be minimal. Operational noise is not expected to contribute to current ambient noise levels. Noise should have no impact on nearby heronries due to the distance of the heronries from the site.

The proposed pipeline would be embedded in the soil roughly to the centerline with the remaining covered by a mounded overburden approximately 12 inches deep on top of pipe. One road crossing of the above-ground section of the pipeline would be required (see Figure 1.2). This road crossing would be at a point where the pipeline is routed below grade. Drainage culverts would be placed under the pipeline in areas where drain water could accumulate.

The ground level segment of the proposed pipeline could create a minor barrier similar to a fence to some non-avian fauna. Some more mobile species such as deer, raccoons, groundhogs and opossums would be able to cross the pipeline at road crossings, along the buried portions, or simply climb over the mounded overburden placed on the ground level pipe. Smaller mammals, reptiles and amphibians would be able to cross under the pipeline via the drainage culverts.

Direct or indirect effects to the nearby Yellow Creek WMA and KESH, the TVA habitat protection area, or heronries are expected to be negligible.

3.5 Endangered and Threatened Species

3.5.1 Existing Conditions

As part of recent environmental review activities for the Watts Bar Nuclear Plant, TVA and the Nuclear Regulatory commission (NRC) compiled information on the endangered and threatened species which are known to exist in the general vicinity of Watts Bar Dam (TVA and NRC 1995). Seven federally listed species were identified; two species are terrestrial (bald eagle, *Haliaeetus leucocephalus*; and gray bat, *Myotis grisescens*) and the other five are aquatic (snail darter, *Percina tanasi*; fanshell, *Cyprogenia stegaria*; dromedary pearly mussel, *Dromus dromas*; pink mucket, *Lampsilis abrupta*; and rough pigtoe, *Pleurobema plenum*). The bald eagle and snail darter are now listed as federal threatened species but the gray bat and all four mussel species are listed as endangered. Two state listed wildlife species were also identified. The osprey (*Pandion haliateus*) and grasshopper sparrow (*Ammodramus savannarum*) are listed as threatened and in need of management in Tennessee, respectively. No state or Federal protected plant species are known from the Watts Bar Reservation. Available information indicates that regional populations of the bald eagle and snail darter are increasing, while the regional population of the gray bat appears to be relatively stable. In the Tennessee River downstream from Watts Bar Dam, all four mussel species are represented only by relatively few, old individuals. As indicated in Section 3.3 (Aquatic Life), these and most other native mussel species apparently have not reproduced successfully in this part of the river for many years (TVA and NRC 1995).

Bald eagles and gray bats have been observed in the general vicinity of Watts Bar and Chickamauga Reservoirs but are not closely associated with the Watts Bar Dam tailwater. In recent years, the wintering bald eagle population in the Watts Bar-Chickamauga Reservoir area has increased to about 30 birds and a pair of these eagles built, then abandoned a nest in this area in 1994 (Tennessee Wildlife Resources Agency unpublished data). Gray bats probably forage for flying insects over upper Chickamauga Reservoir and are known to roost in caves between 6 and 30 km (4 to 20 miles) from Watts Bar Dam (USFWS 1982). Snail darters are known to occur in Sewee Creek (which enters the river approximately eight km [five miles] downstream from Watts Bar Dam) and in the river near that creek mouth. Other snail darter populations occur in direct tributaries of the Tennessee River between Huntsville, Alabama, and Knoxville, Tennessee (USFWS 1984).

Results of recent mussel surveys near this project site (Section 3.3 and Tables 3.3.4 and 3.3.5) indicate that three of the four endangered mussel species (all but the dromedary pearly mussel) have been found in the two-mile reach just downstream from Watts Bar Dam. A single specimen of the fanshell was found at TRM 528.8 in the mussel bed along the left (descending) shoreline during 1983. Similarly, one specimen of the rough pigtoe was found at TRM 528.9 in the same left-shore mussel bed during the 1985 survey. No additional specimens of either species have been found in this reach during subsequent years and only two other specimens of each species have been found at other sites in the Watts Bar tailwater (all four at TRM 520.6). Reproducing populations of the fanshell persist in the Green and Licking Rivers in Kentucky, and in the Clinch River, Tennessee and Virginia (USFWS 1991). The rough pigtoe persists in the Green and Barren Rivers in Kentucky, the Cumberland River in central Tennessee, and in the Clinch River, Tennessee and Virginia (USFWS 1984). The rough pigtoe was placed on the list of federal endangered species in 1976 (USFWS 1984) but the fanshell was not added to that list until 1990 (USFWS 1991).

A few specimens of the pink mucket, *Lampsilis abrupta*, have been found during each extensive mussel survey conducted in the Watts Bar tailwater. In the two-mile reach just downstream from the dam, a single pink mucket was found just offshore from the WBF discharge during the 1997 survey (Tables 3.3.4), two were found along the right (descending) shore not far upstream from the WBF discharge in 1990 (Table 3.3.5), and several have been found during recent years in the mussel bed along the left (descending) shore (Table 3.3.5). In terms of relative abundance, the pink mucket consistently accounts for 0.3 to 0.7 percent of well-sampled mussel communities in this tailwater (TVA and NRC 1995). Besides the Watts Bar tailwater, the pink mucket is known to exist at scattered locations from the Kanawha River in West Virginia, west to the Osage and Meramec Rivers in Missouri, south to the Black River in Arkansas, and east to the Tennessee and Cumberland Rivers in Tennessee. The most upstream site in the Tennessee River watershed where this species has been found is the Clinch River in northeast Tennessee (USFWS 1985).

So far as is known, each of these endangered mussel species has similar feeding and reproductive requirements. Adult members of these species live imbedded in cobble or gravel river bottoms where water currents prevent excessive silt accumulations. Native mussels feed by filtering small food particles (detritus, algae, etc.) out of the water. Reproduction involves a stage when the larvae (glochidia) must become temporary parasites on certain fish species in order to complete their development. The required "fish hosts" are unknown for most of these species; however, the pink mucket is reported to parasitize sauger (*Stizostedion canadense*) and freshwater drum (*Aplodinotus grunniens*) (USFWS 1985). Members of these mussel species may live for 40 years or more.

Watts Bar reservoir has one of the largest breeding populations of osprey in the southeast. Yellow Creek, located one mile west of the project area, is designated as "Key Endangered Species Habitat" (KESH) by the Tennessee Wildlife Resources Agency and is managed for breeding populations of osprey. Osprey are likely to forage along the shoreline of Watts Bar adjacent to the project area.

TVA Regional Natural Heritage files indicate no records of grasshopper sparrows at the Watts Bar Nuclear site. However, early successional habitat favored by this species exists in the general vicinity. Therefore, it is likely that this species can be found near the project site.

3.5.2 Construction Effects

No endangered or threatened species would be affected by construction associated with this project. Bald eagles, gray bats and osprey would continue to occasionally forage over the site and would not be affected by this work. None of the construction activity would occur in the water or along the shoreline. Use of appropriate erosion control BMP during the construction activity would prevent sedimentation effects on endangered mussels in the river.

Because construction of the pipeline is restricted to the Nuclear and Fossil Plant sites, little impact to state listed terrestrial species of wildlife is expected.

3.5.3 Operational Effects

The bald eagle, gray bat, and snail darter would not be adversely affected by the operation of this water system. Eagles and gray bats would continue to occasionally forage over the site and would not be affected by the discharge. Snail darters in the river near the mouth of Sewee Creek would be unaffected by the minor increase in water temperature. State listed species of wildlife are not likely to be affected by operation of the pipeline.

Specimens of the pink mucket and, potentially, other endangered mussel species present in the immediate vicinity of the WBF discharge could be adversely affected by the elevated temperature of the discharge water. As indicated in Section 2.1, the temperature of the discharge (prior to mixing) would be approximately 96°F, approximately 10 degrees warmer than the warmest observed temperature in this part of the river. Information presented in Enclosure 1 (especially Figure 4), however, indicates this heated water would rise to the surface very quickly. Endangered mussels present in the relatively small amount of bottom habitat that would be exposed to water temperatures above ambient levels (an area just offshore from the discharge measuring approximately 150 x 150 ft., approximately 22,500 sq. ft. (2,100 m^2)) would either not be able to survive there or would experience different growing conditions than elsewhere in the Watts Bar tailwater. If this alternative is adopted, TVA would minimize the potential for impacts to endangered mussel species by relocating as many resident mussels as possible out of the 2,100 m^2 area where the thermal impacts would affect the river bottom. Divers would collect these animals and place them in suitable mussel habitat elsewhere in the Watts Bar mollusk sanctuary. This activity would be conducted in compliance with Section 7 of the Endangered Species Act through coordination with the U. S. Fish and Wildlife Service, and the Tennessee Wildlife Resources Agency. As indicated in a letter dated May 26, 1998, the U.S. Fish and Wildlife Service has concurred that completion of the mussel relocation effort prior to the use of this discharge point would result in no adverse effect on endangered or threatened species. The short-term operational monitoring of temperatures in the mixing zone (described in section 3.2.3) would verify the adequacy of the CORMIX model results used to predict and select the relocation area or suggest that additional measures might be necessary to ensure protection of endangered mussels near the discharge. Completion of the mussel relocation effort prior to the use of this discharge point would result in no adverse effect on endangered or threatened species.

3.6 Solid and Hazardous Wastes

No hazardous wastes will be generated by the construction processes planned for this project.

Little if any solid waste will be generated which should be in the form of inert materials such as construction rubble. Any solid wastes generated would be disposed of in accordance with TVA procedures, consistent with State of Tennessee rules governing solid waste disposal.

Soils would be returned to their original locations or reused along the pipeline following disturbance during excavation, pipe installation, and backfill (around or over the pipe) and are therefore not a solid waste.

3.7 Wetlands and Floodplains

3.7.1 Field Inspection and Notes

A review of National Wetland Inventory (NWI) maps show no wetlands exist in the proposed project site. A field survey performed on September 3, 1997 indicated an emergent wetland (Site 1) approximately 2 hectares in size has developed within the abandoned ash disposal site south of the old steam plant. A summary of the field notes is provided as Table 3.7.1. The hydrology of this wetland is influenced primarily by process wastewater emerging from the fossil plant. To a lesser degree, it receives drainage from a wooded area northwest of the steam plant and settling ponds south of the plant. Vegetation in this wetland area consists of sycamore, black willow, sweetgum, American hornbeam, box-elder, yellow poplar, green ash, willow oak, marsh-mallow, swamp smartweed, wool-grass, cattail, flatsedge, soft rush, and unidentified species of sedges. The soil survey for Rhea County (1948) maps Atkins soil series, a hydric soil, in this drainage. Because this area is part of a waste treatment system, it is not considered a water of the United States and is not a wetland falling under the jurisdiction of the Clean Water Act (i.e., it is not a jurisdictional wetland).

The proposed supply line would cross through or along the edge of a ravine (15 to 20 feet deep) adjacent to the cooling towers (Site 2). This ravine is one of the least disturbed areas along the route. The soil survey indicates the presence of hydric soils north of this crossing, but construction has effectively drained this area. Although hydric soils were observed within the ravine and sufficient hydrology does exists, the plant community is dominated by upland species, and this area is not considered a jurisdictional wetland. A site description based on field inspection is provided as Table 3.7.2.

3.7.2 Construction Impacts

The proposed pipeline route would follow the edge of the slag disposal area containing Site 1. During construction, a corridor approximately 50 feet wide (average) would be disturbed in a portion of the wetland area, and existing vegetation would be removed within the right of way. Drainage patterns could be altered somewhat. However, measures that allow continued free surface water drainage under the proposed pipeline would minimize the impact to non-jurisdictional wetlands. Thus, overall hydrology of the wetland area would not be affected significantly.

The proposed supply line would cross through or along the edge of a ravine (15 to 20 feet deep) adjacent to the cooling towers (Site 2. If the undisturbed portion of the ravine is crossed, the pipeline would be located above grade and would be supported by pilings or other support structure which would minimize the impact. Here, surface water flow patterns would not be affected. However, vegetation (primarily woody) would be removed along the right of way. These effects would be localized and insignificant.

3.7.3 Operational Impacts

According to preliminary design, 60 to 80% of the proposed pipeline would generally be embedded in the soil approximately to the centerline, with the remaining cross section of the pipeline extending above grade and covered with soil. Drainage culverts or other measures would be placed in areas where water accumulates to prevent ponding behind the pipeline and to prevent alteration of surface water flow patterns. It is likely that some of the impacted wetland areas would revert to wetland, as hydrology influences the development of wetland plant species. Because of periodic right-of-way maintenance, these areas would likely revert to herbaceous and/or shrub/scrub wetland areas.

Table 3.7.1 - Site Field Notes, Wetland Site 1

SOILS:

Depth	Matrix	Mottles	Texture
0 - 3"	10YR4/3		Silt Loam
3 - 7"	10YR5/2		Sandy Loam
7 - 10	10YR5/1	7.5YR4/4	Sandy Loam

VEGETATION:

Common	Latin	Stratum	Indicator*
Sycamore	*Platanus occidentalis*	Tree	FACW-
Black Willow	*Salix nigra*	Tree/Shrub	OBL
Sweetgum	*Liquidambar styraciflua*	Tree/Shrub	FAC+
Am. Hornbeam	*Carpinus caroliniana*	Tree	FAC
Box-Elder	*Acer negundo*	Tree	FACW
Yellow Poplar	*Liriodendron tulipifera*	Tree	FAC
Green Ash	*Fraxinus pennsylvanica*	Tree	FACW
Willow Oak	*Quercus phellos*	Tree	FACW-
Marsh-Mallow	*Althaea officinalis*	Shrub	NI
Swamp Smartweed	*Polygonum hydropiperoides*	Herb	OBL
Wool-Grass	*Scirpus cyperinus*	Herb	OBL
Cattail	*Typha latifolia*	Herb	OBL
Flatsedge	*Cyperus spp.*	Herb	FACW & OBL
Soft Rush	*Juncus effusus*	Herb	FACW+
Sedge	*Carex spp*	Herb	FACW or OBL

ADDITIONAL REMARKS:

Water stained leaves
Oxidized root coatings
Depth of standing water in places >12 inches
Atkins soil series is mapped and is hydric.

Table 3.7.2. Site Field Notes Wetland Site 2

SOILS:

Depth	Matrix	Mottles	Texture
0 - 10"			Cobbly river sediments
Some areas:			
0 - 4"	10YR4/1		Sandy loam
4 - 10"	10YR5/1		Sandy Loam

VEGETATION:

Common	Latin	Stratum	Indicator*
Red Maple	*Acer rubrum*	Tree	FAC
Black Willow	*Salix nigra*	Tree/Shrub	OBL
Sweetgum	*Liquidambar styraciflua*	Tree/Shrub	FAC+
Am. Hornbeam	*Carpinus caroliniana*	Tree	FAC
Yellow Poplar	*Liriodendron tulipifera*	Tree	FAC
Alder, Common	*Alnus serrulata*	Tree	NI
American Beech	*Fagus grandifolia*	Tree	FACU
Hackberry	*Celtis occidentalis*	Tree	FACU
Dogwood	*Cornus florida*	Tree	FACU
Amer. Holly	*Ilex opaca*	Shrub	FAC-
Privet	*Ligustrum sinense*	Shrub	FAC
Nettle	*Urtica spp.*	Herb	FAC

ADDITIONAL REMARKS:

Oxidized root coatings

Depth of standing water in places >10 inches

***PLANT INDICATOR STATUS CATEGORIES FOR TABLE 3.7.1 AND 3.7.2 FIELD NOTES**

Indicator Category	Indicator Symbol*	Definition
Obligate wetland plants	OBL	Plants that occur almost always (estimated probability >99%) in wetlands
Facultative wetland plants	FACW	Plants that occur usually (estimated probability >67-99%)in wetlands, but also occur (estimated probability 1%-33%) in non-wetlands
Facultative plants	FAC	Plants with a similar likelihood (estimated probability 33% - 67%) of occurring in both wetlands and non-wetlands
Facultative upland plants	FACU	Plants that occur in sometimes (estimated probability 1% - <33%) in wetlands, but occur more often (estimated probability >67% - 99%) in non-wetlands
Obligate upland plants	UPL	Plants that occur rarely (estimated probability <1%) in wetlands
Not Indicated	NI	

*Categories were originally developed and defined by the U.S. Fish and Wildlife Service National Wetlands Inventory and subsequently modified by the National Plant List Panel. The three facultative categories are subdivided by (+) and (-) modifiers. Soil nomenclature follows U.S. Department of Agriculture - Soil Conservation Service 1975 and Munsell Color 1975.

3.8 Cultural and Archaeological Resources

3.8.1 Existing Conditions

The Watts Bar Fossil Plant is eligible for listing in the National Register of Historic Places (NR); it was the first fossil plant built by TVA. Construction started in 1940, and generation began in 1942. The nearby Watts Bar Dam, Hydroelectric Plant and Lock date from the early 1940s and are also eligible for the NR.

Archaeological sites 40RH1 and 40RH5-7 are within the Watts Bar Fossil and Nuclear Plant Reservations. Archaeological resources present within the reservations were first identified by Clarence B. Moore in 1915 when he reported the locations of the Viniard Landing Group of aboriginal mounds (three clusters of mounds: cluster 1, mounds- A, B and C; cluster 2, mounds -D, E and F; and cluster 3, mounds-G and H) and the Luty Place Mound. The 1936 archaeological reconnaissance of Chickamauga Reservoir included part of the reservations. This survey identified RH1 and RH5 (possibly Moore's Keyforver Place, and Kimbrough Place) and located seven of Moore's eight Viniard Landing Mounds (designating them RH7 units 9 through 15). The Luty Place Mound was also relocated and designated RH6. To mitigate adverse construction impacts of the Watts Bar Nuclear Plant, in 1971 the University of Tennessee-Knoxville conducted investigations at the mound complex associated with 40RH6 and at 40RH7. In 1972 the University of Tennessee-Chattanooga conducted archaeological investigations at the habitation site portion of 40RH6.

3.8.2 Construction Impacts

The Watts Bar Fossil Plant would be visually impacted by the pipeline but the impact would not be adverse. The nearby Watts Bar Dam would not be impacted by the proposed project.

Given prior terrain alterations along the proposed pipeline route, there would not be any construction impacts to any archaeological site.

TVA has completed consultation with the Tennessee State Historic Preservation Officer, pursuant to Section 106 of the National Historic Preservation Act, 36 CFR Part 800, regarding the above findings on proposed project impacts on significant cultural resources.

3.8.3 Operational Impacts

There are no operational impacts to cultural and archaeological resources.

3.9 Socioeconomic Resources

The proposed project has an estimated capital cost of approximately $6.8 million. This estimate includes design and construction costs including all labor and materials. Approximately one-half of the estimated cost is labor with the other one-half being materials. The duration of the construction phase of the project would be about 10 months. Peak construction employment is estimated to be 50 workers.

3.9.1 Existing Conditions

For construction purposes, the area labor market serving WBN is defined to include Knox and Hamilton counties (Knoxville and Chattanooga) and the counties in the valley and along Interstate Highway 75 between the two. In 1994, total employment in this area was about 565,000, with total annual earnings of about $14.8 billion.

3.9.2 Environmental Justice

This project's construction impacts would be confined to the TVA reservations of the Watts Bar Fossil Plant and Watts Bar Nuclear Plant. The nearest residence is over 1 mile from the proposed project. No potential for impacts to minority or low income persons were identified.

3.9.3 Impacts

The area labor market can easily provide the necessary labor for the proposed project. Because of the short duration of the project and the proximity to both Chattanooga and Knoxville, most persons employed by the project can be expected to commute daily. As a result no impacts to the local housing market or community infrastructure are anticipated. Although beneficial, this project would be a very small addition to the area payroll.

Most materials for this project (primarily reinforced concrete pipe and valves) would not likely be procured locally. Materials such as lumber and crushed limestone could be procured locally and would have some small beneficial effect on the local economy.

Heated water discharged to the WBH tailwaters during project operation are not expected to significantly alter the sport fishery (see Section 3.3). Therefore, any subsistence fishing that may occur in the vicinity of the project should not be impacted.

3.10 Issues Not Requiring Detailed Analysis

The following issues did not require a detailed analysis nor mitigation to determine that potential impacts were insignificant:

3.10.1 Traffic

Although some truck traffic would occur to supply materials to the project, no impacts are anticipated since an excellent road network serves the site vicinity.

3.10.2 Land Use Conversion

The entire project would be located on portions of the two power plant sites which are allocated for industrial use. No important or uncommon terrestrial habitat would be disturbed or converted.

3.10.3 Noise

The construction phase of the project would temporarily create typical noise levels from heavy construction equipment. No residential or other sensitive human receptor is located within 1 mile of the project. No Federally listed threatened or endangered species inhabit the proposed site. Due to noise, some temporary relocation of common wildlife in the vicinity of the project could occur during construction. No operational noise above ambient levels is anticipated. General Health and Safety Practices will determine worker hearing protection required during the construction of this project.

3.11 Commitments

A summary of all specific commitments made by this EA are listed below:

1. Use of construction Best Management Practices (BMPs) to limit erosion and reasonable precautions to minimize fugitive dust

2. A one-time relocation of native mussels in the immediate vicinity of the new thermal discharge prior to initial operation of the SCCW system

3. Addition of provisions at the discharge structure apron (concrete slab) to direct the warmer discharge water to the surface and minimize impact on the river bottom

4. Support experiment or test plan for enhancement of mussel habitat to improve conditions conducive to species-specific juvenile mussel recruitment

5. Discharge monitoring to include:

    - Flow
    - Temperature
    - Chemical and biological sampling

6. River monitoring to include:

    - Seasonal vertical instream river temperature monitoring at end of mixing zone during the first year of SCCW operation with comparison of the results with model projections to verify top to bottom mixing of thermal plume
    - River bottom temperature monitoring to verify high temperature impact is limited to zone predicted by TVA thermal plume modeling
    - River bottom flow direction monitoring (if feasible) to verify no adverse heated flow upstream to adjacent mussel beds
    - Conduct a fisheries monitoring program in the vicinity of WBN SCCW facilities during the first year of SCCW operation to verify selected impact projections outlined in this EA

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5.0 LIST OF AGENCIES AND PERSONS CONTACTED

Tennessee Wildlife Resources Agency, Anders Myhr, District III Fisheries Biologist.

Discussed the potential for construction and thermal impacts as a result of the proposed WBN CCW project on all aspects of the tailwater sport fishery below Watts Bar Dam.

Tennessee Wildlife Resources Agency, David McKinney, contacted by Gary Hickman

US Department of Interior, Fish and Wildlife Service, various meetings and teleconferences

Tennessee Wildlife Resources Agency, meeting and various teleconferences

Tennessee Department of Environment and Conservation, Division of Water Pollution Control, various meetings and teleconferences

United States Environmental Protection Agency, various meetings and teleconferences with Regional office in Atlanta, GA

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7.0 GLOSSARY

ARAP - Aquatic Resource Alteration Permit

CCW - Condenser Cooling Water used in tube shell heat exchangers to condense turbine steam

cfs - cubic feet per second

daphnids - Aquatic invertebrate organisms (water fleas) that include the toxicity test species *ceriodaphria dubia*

DO - dissolved oxygen

EA - environmental assessment; a written environmental analysis which is prepared pursuant to the National Environmental Policy Act to determine whether a federal action would significantly affect the environment and thus require preparation of a more detailed environmental impact statement.

gpm - gallons per minute

Hydro - a term used to identify a type of generating station in which the primary generation equipment is driven by water power.

IC25 - The 25 percent inhibition concentration, or the concentration of a substance (or whole effluent sample) that causes a 25 percent reduction in the measured response during a sub-chronic toxicity test. For Whole Effluent Toxicity (WET) evaluations, the measured responses are survival and growth in a 7-day larval fathead minnow (*Pimephales promelas*) test and survival and reproduction in a 3-brood daphnid (*Ceriodaphnia dubia*) test.

jurisdictional wetlands - wetland areas that fall under the jurisdiction of the U.S. Army Corps of Engineers pursuant to the Clean Water Act.

KESH - Key Endangered Species Habitat

L - liter, a metric measure of volume

LC50 - The concentration of a substance (or whole effluent sample) that causes mortality to half the test organisms in an acute toxicity test. An acute exposure for aquatic life is normally 48 hours, but may be as long as 96 hours.

mg - milligram, one-thousandth of a gram

MWH - megawatt hours, a unit of measurement of electrical energy equal to one million watt hours.

NAAQS - National Ambient Air Quality Standards

NPDES - National Pollutant Discharge Elimination System

NRC - Nuclear Regulatory Commission

riparian - shoreline

SCCW - Supplemental Condenser Cooling Water

TRM - Tennessee River Mile

Turbine - a machine that generates mechanical power from flowing water (hydrostation turbine) or flowing steam (steam turbine).

USFWS - United States Fish and Wildlife Service

WBF - Watts Bar Fossil plant

WBH - Watts Bar Hydro plant

WBN - Watts Bar Nuclear plant

WET - Whole Effluent Toxicity

WMA - Wildlife Management Area

8.0 ENCLOSURES

1. WBN SCCW Thermal Plume Modeling (Separate Enclosure)
2. Effect of Watts Bar Nuclear Plant and Watts Bar Steam Plant Discharges on Chickamauga Lake Water Temperatures (Separate Enclosure)
3. Discharge Temperature Limit Evaluation for Watts Bar Nuclear Plant (Separate Enclosure)

9.0 ATTACHMENTS

Chronological listing of correspondence by author:

1. J. Bennett Graham, Senior Archaeologist, Land Management, to Dr. Joe Garrison, Environmental Review Coordinator, Tennessee Historical Commission dated November 17, 1997.

2. Herbert L. Harper , Executive Director and Deputy State Historic Preservation Officer, to J. Bennett Graham, Cultural Resources Program, Division Land and Economic Resources, "TVA Watts Bar/108 inch Water Pipeline, Unincorporated, Rhea County," dated November 25, 1997.

3. J. Bennett Graham, Senior Archaeologist, Land Management, to Martha Catlin, Eastern Office of Review, Advisory Council on Historic Preservation, dated December 17, 1997.

4. Lee A. Barclay, Field Supervisor, US Department of Interior, Fish and Wildlife Service, to Greg Askew, Environmental Management, TVA, "Watts Bar Nuclear Power Supplemental Condenser Cooling Water Project," dated December 22, 1997.

5. Herbert L. Harper, Executive Director and Deputy State Historic Preservation Officer, to Jon M. Loney, Environmental Management, TVA, "TVA, Watts Bar NP/Condenser Cooling, Unincorporated, Roane County," dated December 29, 1997.

6. Aubrey D. McKinney, Chief, Environmental Services Division, TWRA, to Jon M. Loney, Environmental Management, TVA, "Draft environmental Assessment for the Watts Bar Nuclear Plant Supplemental Condenser Cooling Water Project," dated January 14, 1998.

7. J. Bennett Graham, Senior Archaeologist, Land Management, to Jon M. Loney, Environmental Management, TVA, "Watts Bar Nuclear Plant - 108 inch Auxiliary Cooling Water Pipeline From Watts Bar Fossil Plant - Section 106 Compliance," dated March 12, 1998.

8. Jon M. Loney, Environmental Management, TVA, to Aubrey D. McKinney, Chief, Environmental Services Division, TWRA, "Environmental Assessment (EA) for the Watts Bar Nuclear Plant (WBN) Supplemental Condenser Cooling Water (SCCW) Project," dated March 26, 1998.

9. Aubrey D. McKinney, Chief, Environmental Services Division, TWRA, to Paul E. Davis, Director, Division of Water Pollution Control, Tennessee Department of Environment and Conservation, "Watts Bar Nuclear (WBN) Plant Supplemental Condenser Cooling Water (SCCW) Project," dated April 27, 1998.

10. Jon M. Loney, Environmental Management, TVA, to Lee A. Barclay, Field Supervisor, US Department of Interior, Fish and Wildlife Service, dated May 7, 1998.

11. Odis E. Hickman, Jr., Radwaste/Environmental Superintendent, Watts Bar Nuclear Plant, Tennessee Valley Authority, to Phillip L. Stewart, Manager, Chattanooga Field Office, Division of Water Pollution Control, Tennessee Department of Environment and Conservation, "Watts Bar Nuclear Plant (WBN) -Supplemental Condenser Cooling Water Project Draft Engineering Report", dated May 11, 1998.

12. Lee A. Barclay, Field Supervisor, US Department of Interior, Fish and Wildlife Service, to Jon M. Loney, Environmental Management, TVA, "FWS #98-236," dated May 26, 1998.

13. C. Randall McIntosh, Manager of Projects, Watts Bar Nuclear Plant, Tennessee Valley Authority, to Phillip L. Stewart, Manager, Chattanooga Field Office, Division of Water Pollution Control, Tennessee Department of Environment and Conservation, "Watts Bar Nuclear Plant (WBN) - Proposed Supplemental Condenser Cooling Water (SCCW) Project - Validation of the Cormix Model," dated June 4, 1998.

14. C. Randall McIntosh, Manager of Projects, Watts Bar Nuclear Plant, Tennessee Valley Authority, to Phillip L. Stewart, Manager, Chattanooga Field Office, Division of Water Pollution Control, Tennessee Department of Environment and Conservation, "Watts Bar Nuclear Plant (WBN) - Supplemental Condenser Cooling Water (SCCW) Project - Revised Draft Environmental Assessment," dated June 19, 1998.

15. Phillip L. Stewart, Manager, Chattanooga Field Office, Division of Water Pollution Control, Tennessee Department of Environment and Conservation, to Odis E. Hickman, Jr., Radwaste / Environmental Superintendent, Watts Bar Nuclear Plant, Tennessee Valley Authority, "Conditional Site Approval for New Outfall Construction, Proposed Supplemental Condenser Cooling Water Project, NPDES Permit No. TN0020168, Tennessee River and Yellow Creek, Rhea County," dated August 20, 1998.

November 17, 1997

Dr. Joe Garrison
Environmental Review Coordinator
Tennessee Historical Commission
Clover Bottom Mansion
2941 Lebanon Pike
Nashville, Tennessee 37243-0442

Dear Dr. Garrison:

TVA is proposing to construct a 108-inch water pipeline from the deactivated Watts Bar Fossil Plant to the Watts Bar Nuclear Plant (proposed route is on enclosed map). The purpose of this proposed project is to route water from the condenser cooling water (CCW) system of the former Watts Bar Fossil Plant to the CCW system of the Watts Bar Nuclear Plant. This system is expected to increase the nuclear plant's efficiency and generation by up to 50 MW. The pipeline will be constructed on a grade built up of slag from the old fossil plant for the entire route. As you can note on the enclosed map, the pipe would run along the toe of the contour in back of the former fossil plant. It is our opinion that the old Watts Bar Fossil Plant is eligible for the National Register of Historic Places. While the pipeline will have an impact on this eligible structure, given all the ancillary facilities constructed in this area over the years, we do not think that the impact will be adverse.

While the entire route of the proposed pipeline has been extensively altered in the past, it crosses the recorded location of archaeological site 40RH1 and may cross an outer edge of 40RH6. However, slag was deposited over this area of the route in the 1950's and 60's and the pipe will be placed either on the slag or in the top 24 inches. We do not think that construction of this waterline will have an effect on any archaeological site.

By this letter we are seeking staff determinations regarding our above findings. If questions arise, I can be reached at (423) 632-1583.

Sincerely,

J. Bennett Graham
Senior Archaeologist

JBG:BB
Enclosure
cc: Files, LM, FOR 1A-N

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

November 25, 1997

Mr. J. Bennett Graham
Cultural Resources Program
Div. Land & Economic Res.
Norris, Tennessee 37828

RE: TVA, WATTS BAR/108 INCH WATER PIPELINE, UNINCORPORATED, RHEA COUNTY

Dear Mr. Graham:

Pursuant to your request, this office has reviewed documentation concerning the above-referenced undertaking. This is a requirement of Section 106 of the National Historic Preservation Act for compliance by the participating federal agency or applicant for federal assistance. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (51 FR 31115, September 2, 1986).

Considering available information, we find that the project as currently proposed will not adversely affect any property that is eligible for listing in the National Register of Historic Places. Therefore, this office has no objection to the implementation of this project. You should now inform the Advisory Council on Historic Preservation of this no adverse effect determination. Please enclose a copy of this determination in your notification to the Council as delineated at 36 CFR Part 800. **Until you have received a final comment on this project from the Council, you have not completed the Section 106 review process.** Please direct questions and comments to Joe Garrison (615)532-1559. We appreciate your cooperation.

Sincerely,

Herbert L. Harper

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jyg

3

December 17, 1997

Ms. Martha Catlin
Eastern Office of Review
Advisory Council on Historic Preservation
Old Post Office Building, Suite 803
1100 Pennsylvania Avenue, NW
Washington, DC 20004

Dear Ms. Catlin:

The Tennessee Valley Authority (TVA) proposes to construct a supplementary cooling water pipeline at the Watts Bar Nuclear Power Plant in Rhea County, Tennessee. The proposed pipeline would be constructed over two archaeological sites and in the vicinity of the Watts Bar coal-fired power plant, a property eligible for inclusion in the National Register of Historic Places. The Tennessee State Historic Preservation Officer (SHPO) concurs with TVA that the proposed undertaking will not adversely affect any of these properties. Project documentation is enclosed for your review pursuant to Section 800.5(d) of the Advisory Council's regulations.

If you have any questions regarding this request, please call me at (423) 632-1583.

Sincerely,

J. Bennett Graham
Senior Archaeologist
Land Management

DEO:BB
Enclosures
cc: Dr. Joe Garrison
Tennessee Historical Commission
Clover Bottom Mansion
2941 Lebanon Pike
Nashville, Tennessee 37243-0442

Files, LM, FOR 1A-N

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, Tennessee 38501

December 22, 1997

Mr. Greg Askew
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Re: Watts Bar Nuclear Power Supplemental Condenser Cooling Water Project

Dear Mr. Askew:

Thank you for your letter and enclosures of December 11, 1997, regarding the subject project. The Fish and Wildlife Service (Service) has reviewed the four documents which you submitted. The Service was also represented at a meeting held on December 18 to discuss this project.

The draft environmental assessment (December 5, 1997) appears to be comprehensive in nature. The meeting held on December 18 allowed a thorough discussion of the project, anticipated chemical and thermal impacts, and planned efforts to minimize adverse impacts to aquatic resources, including species federally listed as endangered.

It is our understanding that the proposed project will result in the addition of a new thermal discharge at the TVA Watts Bar Fossil plant. Based on thermal modeling done by TVA, the dispersion zones of the fossil plant discharge and the nuclear plant discharge will not overlap. Mussels would be relocated from an area approximately 150' x 150' in the immediate vicinity of the new discharge. At least one mussel species federally listed as endangered (*Lampsilis abrupta*) could be included in the relocation effort.

Some concern was expressed about the change from hourly temperature averaging to daily (24-hour) averaging. What maximum temperatures would result based on some intermediate averaging periods (i.e., 2 hr, 5 hr)? Please keep us informed of your evaluation of this, and other, issues as you proceed through the permitting process.

We appreciate the opportunity to review documents on the subject project and provide comments. We also appreciate the time and effort involved to have an open and informative meeting on this project. Should you have any questions, please contact Allen Robison of my staff at 931/528-6481.

Sincerely,

Robert T. Bay

for Lee A. Barclay. Ph.D.
Field Supervisor

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

December 29, 1997

Mr. Jon M. Loney
Environmental Management
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

RE: TVA, WATTS BAR NP/CONDENSER COOLING, UNINCORPORATED, ROANE COUNTY

Dear Mr. Loney:

Pursuant to your request, this office has reviewed documentation concerning the above-referenced undertaking received Friday, December 19, 1997. This is a requirement of Section 106 of the National Historic Preservation Act for compliance by the participating federal agency or applicant for federal assistance. Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (51 FR 31115, September 2, 1986).

Considering available information, we find that the project as currently proposed will not adversely affect any property that is eligible for listing in the National Register of Historic Places. Therefore, this office has no objection to the implementation of this project. You should now inform the Advisory Council on Historic Preservation of this no adverse effect determination. Please enclose a copy of this determination in your notification to the Council as delineated at 36 CFR Part 800. **Until you have received a final comment on this project from the Council, you have not completed the Section 106 review process.** Please direct questions and comments to Joe Garrison (615)532-1559. We appreciate your cooperation.

Sincerely,

Herbert L. Harper
Executive Director and
Deputy State Historic
Preservation Officer

HLH/jyg

TENNESSEE WILDLIFE RESOURCES AGENCY

ELLINGTON AGRICULTURAL CENTER
P. O. BOX 40747
NASHVILLE, TENNESSEE 37204

January 14, 1998

Mr. Jon M. Loney, Manager
Environmental Management
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902-1499

re: Draft Environmental Assessment for the Watts Bar Nuclear Plant Supplemental Condenser Cooling Water Project

Dear Mr. Loney:

The Tennessee Wildlife Resources Agency is in the process of reviewing the above Draft Environmental Assessment. We should complete this review in the near future and will provide comments and recommendations to you on or before February 9, 1998. Please contact me at 615/781-6643 if there are additional data which should be brought to our attention.

Sincerely,

Aubrey D. McKinney, Chief
Environmental Services Division

ADM/bjs

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TENNESSEE WILDLIFE RESOURCES AGENCY

ELLINGTON AGRICULTURAL CENTER
P. O. BOX 40747
NASHVILLE, TENNESSEE 37204

January 28, 1998

Mr. Jon M. Loney, Manager
Environmental Management
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902-1499

re: Draft Environmental Assessment for the Watts Bar Nuclear Plant (WBN) Supplemental Condenser Cooling Water (SCCW) Project

Dear Mr. Loney:

The Tennessee Wildlife Resources Agency has completed initial review of the above referenced document and supporting materials, and offers the following comments and recommendations.

1. Utilization of a diffuser at Watts Bar Fossil facility (WBF) to accommodate thermal releases associated to proposed SCCW project is dismissed as economically unacceptable DEA (2.3.3 p.12); the document, however, does not provide an economic analysis of this issue. Please provide those data routinely used in cost effectiveness determinations including diffuser cost and maintenance over the life of the project as compared to the increase in both capacity and revenue from WBN over the same period. Likewise, dismissal of a diffuser option appears to conflict with the statement at DEA (2 p. 12) that in the absence of the SCCW project new, presumably diffuser equipped, facility construction would be required.

2. Over the years, the Tennessee Valley Authority (TVA) has utilized provisions in the 316(a) process to consider significant increase in both the annual thermal discharge and deviation from state and federal thermal standards at both Watts Bar Nuclear and Sequoyah Nuclear. Given the maximum potential thermal release capacity of these projects, what are the upper bounds of such increases that TVA might seek in future proposals? This anslysis should include defining the circumstances of thermal releases considered by TVA to have potentially

adverse impact on water quality and fish and aquatic life. We suggest that neither U.S. Environmental Protection Agency (EPA) nor Tennessee Department of Environment and Conservation (TDEC) continue with the incremental alterations, modification, or variances until such time as the ultimate boundaries or future requests are more clearly defined.

3. As a result of the complexity and variability of flow and water quality conditions in tailwater situations, environmental impact projections are, at best, highly speculative; documentation of actual impact under operational conditions requires extensive, well designed monitoring, such as TVA's vital signs monitoring program, the reservoir release improvement monitoring, and discharge specific operational monitoring programs. We are concerned that TVA may divest itself of both the capability and the commitment for such state of the art monitoring and research programs in preparation for national deregulation of the power industry. Absolute confidence in TVA's commitment to continued excellence in field sciences of aquatic ecology and water quality is essential to consideration of projects with speculative impacts such as the SCCW proposal. As part of this process, TVA should prepare a comprehensive, integrated summary of monitoring and research commitments for both Watts Bar and Sequoyah nuclear operations, and Watts Bar and Chickamauga Reservoirs in consultation with Tennessee, the U.S. Environmental Protection Agency, and the U.S. Fish and Wildlife Service (USFWS) for incorporation by reference into the appropriate NPDES permits or through other formal agreements.

4. The DEA (3.2.3 p. 19) does not specify how implementation of the SCCW would alter or increase the use of chemicals for corrosion control or biofouling. Please provide an estimation of the increased use of such chemicals. Likewise, we suggest that NPDES modification for all chemical release outfalls include periodic WET evaluation using the 9-day juvenile mussel test with silt and whole sediment test with appropriate organisms in addition to present toxicity testing requirements.

5. The DEA (3.2.3 p. 20) does not address the potential impacts of providing additional release from Watts Bar Hydroelectric facility (WBH) to meet the thermal intake requirements at WBN. The potential impact, particularly of sustained late summer, early fall releases from Norris Reservoir should be fully discussed, including an evaluation of the anticipated frequency, duration, and circumstances requiring prolonged releases from Norris Reservoir.

6. The DEA analysis (3.33 p. 30) relies upon 316(b) entrainment and impingement studies which were conducted in 1975, more than two decades ago. Are there recent data indicating that entrainment and impingement impacts in 1998 would be reasonably similar to those observed in 1975? In the absence of such corroborating information, TVA should propose limited sampling as necessary to provide for comparative evaluation of the 1975 studies and current conditions.

7. We concur with the description of the mussel community in the Watts Bar tailwater sanctuary as a remnant of the diverse assemblage of mussels existing prior to the impoundment. The reasons for the inability of the remaining mussels to reproduce are not understood. We suggest that mitigation for the proposed SCCW project include a substantial research effort to identify the reasons this mussel community is unable to reproduce. Likewise, the ability of juvenile mussels, obtained through culture techniques, to survive and grow in the WBH tailwaters should be evaluated.

8. A continuing concern in the Tennessee River system is expansion of zebra mussels and their potential adverse impact on native species of fish and aquatic life. Please provide an evaluation of the potential response of zebra mussels to conditions resulting from the proposed SCCW project as proposed and with a new diffuser at WBF.

Until such time as these outstanding issues are resolved, we cannot recommend the WBN/SCCW project to either TDEC, the USFWS or EPA; we look forward to working with all parties to address these concerns.

If you have questions or need additional information, please contact me at 615/781-6643.

Sincerely,

Aubrey D. McKinney, Chief
Environmental Services Division

ADM/bjs

cc: Philip Stewart - TDEC/WPC, Chattanooga
Anders Myhr - TWRA, Region III
David Young - TWRA, Region III

March 12, 1998

Jon M. Loney, WT 8C-K

WATTS BAR NUCLEAR PLANT - 108 INCH AUXILLARY COOLING WATER PIPELINE FROM WATTS BAR FOSSIL PLANT - SECTION 106 COMPLIANCE

The attached letters evidence TVA's compliance with Section 106 of the National Historic Preservation Act for the above referenced project. Under the regulations of the Advisory Council on Historic Preservation at 36 CFR Part 800.5(d)(1) when TVA finds the effect of an undertaking on a historic property (Watts Bar Fossil Plant and two archaeological sites) is not adverse, TVA will obtain the SHPO's concurrence (November 19, 1997 and November 25, 1997 letters) and notify and submit to the Council summary documentation (December 17, 1997 letter). Under Part 800.5(d)(2) of the Council's regulations, if the Council does not object to the finding within 30 days of receipt of notice, TVA is not required to take any further steps in the Section 106 process. No objection to our finding has been received from the Council more than 75 days after the notice was sent.

If you have any questions about this compliance documentation, please give me a call at 632-1583.

J. Bennett Graham
Senior Archaeologist
Land Management
NRB 2C-N

DEO:BB
Attachments
cc: Files, LM, FOR 1A-N

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Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

March 26, 1998

Aubrey D. McKinney, Chief
Environmental Services Division
Tennessee Wildlife Resources Agency
Ellington Agricultural Center
P.O. Box 40747
Nashville, Tennessee 37402

ENVIRONMENTAL ASSESSMENT (EA) FOR THE WATTS BAR NUCLEAR PLANT (WBN) SUPPLEMENTAL CONDENSER COOLING WATER (SCCW) PROJECT

Dear Mr. McKinney:

We appreciate the detailed comments given in your letter dated January 28, 1998. TVA staff reviewed these comments and prepared responses which are enclosed. The format consists of a restatement of each of your comments followed by TVA's response.

In summary, TVA believes that the proposed WBN SCCW project will have only minor localized effects, and that our environmental assessment, including the proposed mitigation, supports this conclusion. Please call me at 423-632-3012 if you would like to discuss our comments.

Sincerely,

Jon Loney, Manager
Environmental Management

Enclosure

TVA Comments to TWRA Comments Given in Mr. Aubrey D. McKinney's Letter Dated January 28, 1998

TWRA Comment 1. Utilization of a diffuser at Watts Bar Fossil facility (WBF) to accommodate thermal releases associated to proposed SCCW project is dismissed as economically unacceptable DEA (2.3.3 p.12); the document, however, does not provide an economic analysis of this issue. Please provide those data routinely used in cost effectiveness determinations including diffuser cost and maintenance over the life of the project as compared to the increase in both capacity and revenue from WBN over the same period. Likewise, dismissal of a diffuser option appears to conflict with the statement at DEA (2 p.12) that in the absence of the SCCW project new, presumably diffuser equipped, facility construction would be required.

> **TVA Response:** The economic analysis for projects at TVA Nuclear facilities is based on an evaluation of the cost versus increased revenue and avoided operational and maintenance costs to determine the payback period and internal rate of return. To successfully compete for capital resources within TVA, a project typically must show a positive net present value (NPV), a 35% internal rate of return (IRR) using a 15% discount rate, and a payback in 3 years or less. The construction of a new diffuser was estimated to increase the capital cost of the proposed project by approximately 30% ($2 million) with <u>no</u> increase in the revenue. This increase would primarily result from the excavation and anchorage in the river channel necessary for a diffuser large enough to handle the 330 cfs discharge (Note this is 3 to 4 times the capacity of the existing WBN diffuser system). The incremental annual maintenance cost is estimated at $10,000. These increases in cost would extend the payback period more than 2 years to 9 years and reduce the IRR 4% to 26%. Based on this TVA would not financially consider the proposed action with the added capital cost of a diffuser and no further action was pursued. This decision was further substantiated by thermal plume modeling which demonstrated the project as proposed complies with all thermal water quality criteria limits.
>
> Installation of a diffuser to replace the existing WBF discharge would allow more rapid dissipation of the thermal effluent. However, due to the unique location of the Watts Bar Fossil (WBF) discharge, within one mile downstream of Watts Bar Dam, disruption of the benthic habitat in the vicinity of the discharge during installation of the diffuser would cause much greater impact to the resident mussel community than the limited impact area resulting from discharges at the current facility. While all impacts have not been extensively investigated and quantified, obvious affects include extensive disturbance to bottom life during construction. This would result from the excavation of the river bottom to provide a bed for the diffuser and associated anchorage. The excavated area would be far more extensive than the bottom area which the CORMIX model computed as being impacted by the thermal plume of the proposed project. In addition to the

direct impact to the bottom life residing in the area of excavation, there would also be a potential impact downstream due the silt created from dredging and blasting. As described in the EA, potential adverse impacts to resident biota resulting from thermal discharges at the existing WBF outlet are very localized. Fish will have ready avenues to avoid the high temperatures in the immediate vicinity of the discharge and freshwater mussels will be moved from the impact zone.

The statement in DEA paragraph 2.2, No Action, regarding need for another source to provide the capacity available from the proposed project was not intended to restrict future construction options. Elimination of the diffuser was specifically applicable to the economics of this proposed project and therefore not in conflict with future projects. Any new project would have to address the specific environmental impacts unique to such a facility and its location. Depending on the type of generating facility equipment there might be no need for heated water discharge and consideration of a diffuser. However, there might be significant issues with air quality or water withdrawal impacts. Considering that the proposed project is projected to comply with thermal water quality criteria and have no significant environmental impact, this was intended to point out the possibility that the net effect of future construction could be of greater environmental impact.

TWRA Comment 2. Over the years, the Tennessee Valley Authority (TVA) has utilized provisions in the 316(a) process to consider significant increase in both the annual thermal discharge and deviation from state and federal thermal standards at both Watts Bar Nuclear and Sequoyah Nuclear. Given the maximum potential thermal release capacity of these projects, what are the upper bounds of such increases that TVA might seek in future proposals? This analysis should include defining the circumstances of thermal releases considered by TVA to have potentially adverse impact on water quality and fish and aquatic life. We suggest that neither U.S. Environmental Protection Agency (EPA) nor Tennessee Department of Environment and Conservation (TDEC) continue with the incremental alterations, modification, or variances until such time as the ultimate boundaries or future requests are more clearly defined.

TVA Response: Beyond the current proposal, TVA has no plans to increase thermal discharges to Chickamauga Reservoir. Because both Sequoyah and Watts Bar Nuclear Plants use cooling towers, the majority of necessary thermal releases are now rejected to the atmosphere.

TVA believes that its permitted thermal releases have only localized effects. This belief is evidenced by the limited mixing zone lengths necessary to meet State of Tennessee thermal water quality criteria which protect water quality, and by monitoring results that have failed to identify adverse impacts. Thus, TVA does not believe that its thermal releases have reservoir-scale effects. As a result, TVA sees no regulatory need nor practical benefit of analyzing reservoir behavior in response to hypothetical thermal releases. For the present proposal, TVA's environmental assessment evaluated the cumulative behavior and impact of the existing WBN thermal release and the proposed release.

TWRA Comment 3. As a result of the complexity and variability of flow and water quality conditions in tailwater situations, environmental impact projections are, at best, highly speculative; documentation of actual impact under operational conditions requires extensive, well designed monitoring, such as TVA's vital signs monitoring program, the reservoir release improvement monitoring, and discharge specific operational monitoring programs. We are concerned that TVA may divest itself of both the capability and the commitment for such state of the art monitoring and research programs in preparation for national deregulation of the power industry. Absolute confidence in TVA's commitment to continued excellence in field sciences of aquatic ecology and water quality is essential to consideration of projects with speculative impacts such as the SCCW proposal. As part of this process, TVA should prepare a comprehensive, integrated summary of monitoring and research commitments for both Watts Bar and Sequoyah nuclear operations, and Watts Bar and Chickamauga Reservoirs in consultation with Tennessee, the U.S. Environmental Protection Agency, and the U.S. Fish and Wildlife Service (USFWS) for incorporation by reference into the appropriate NPDES permits or through other formal agreements.

TVA Response: Environmental impact projections resulting from operation of WBN using the SCCW system are speculative, yet, as indicated in the EA, they are based on results of the best available modeling tool (CORMIX). The EA documents a reasonable and accepted engineering approach to predicting the behavior and characteristics of the proposed thermal discharge. There is uncertainty to such methods, but because of conservative assumptions, TVA believes the estimates of temperature changes and the extent of the discharge plume were appropriately characterized. This characterization was taken in combination with extensive knowledge of resident biological communities in the Watts Bar Reservoir forebay and Watts Bar Dam tailwater ecosystems. This knowledge is supplemented with large historical databases from these two areas as a result of previous compliance monitoring, site assessments, and a detailed "vital signs" monitoring program. As Mr. McKinney suggested, a monitoring program could be devised to determine if projections were correct, however, it is TVA's contention that the potential for unforeseen impacts is limited, and the additional expense is not merited.

Comment 3, clarified through subsequent discussions with Mr. McKinney, goes on to request continuous, or at least intermittent commitments to monitor biological impacts of both Watts Bar and Sequoyah nuclear operations on Watts Bar and Chickamauga Reservoir aquatic communities. While this request may have some merit with regard to operational monitoring for the two nuclear plants, TVA considers this request outside the scope of the WBN SCCW project.

Monitoring activities currently in place on Watts Bar and Chickamauga Reservoirs include those done under the Vital Signs Monitoring program, funded by Federal appropriations, and compliance operational monitoring in the vicinity of Watts Bar Nuclear Plant. Vital Signs Monitoring activities include water quality and biological community (fish and benthic macroinvertebrate) aspects. Reservoirs are sampled biennially, except Chickamauga, where fish community sampling was done during "unscheduled" years through funding provided by Watts Bar and Sequoyah Nuclear Plants to provide information relative to existing compliance issues or variance requests. Operational Monitoring at Watts Bar Nuclear Plant was done during 1996 and 1997, the initial two years of operation, as part of Clean Water Act compliance, however, TVA will recommend discontinuing this effort as no adverse impacts have been identified. Only the Vital Signs monitoring funded by Federal appropriations is projected for either of these reservoirs, or in the vicinity of either Watts Bar or Sequoyah Nuclear plants in the future.

TWRA Comment 4. The DEA (3.2.3 p.19) does not specify how implementation of the SCCW would alter or increase the use of chemicals for corrosion control or biofouling. Please provide an estimation of the increased use of such chemicals. Likewise, we suggest that NPDES modification for all chemical release outfalls include periodic WET evaluation using the 9-day juvenile mussel test with silt and whole sediment test with appropriate organisms in addition to present toxicity testing requirements.

TVA Response: Implementation of the SCCW will not increase or change the use of chemicals. No corrosion control chemicals are used specifically for the CCW system which the SCCW supplies. These chemicals are only used in the once-through auxiliary cooling systems, ERCW and RCW. Only the residual remaining after passing through these systems would be discharged into the CCW and is not counted on for any protective benefit in the CCW. Also biocide chemicals for mollusk control are presently only used in the ERCW and RCW systems. Since the CCW system does not receive direct injection of these chemicals, there would be no change to the present use of such chemicals. While the total poundage of the chemicals released to the river would remain unchanged, the implementation of the proposed project would result in a decrease in the average ppm of continuously injected chemicals in the diffuser discharge. This due to the decrease in concentration levels in the CCW resulting from the input of the SCCW flow mass.

An algaecide treatment may be specifically used in the CCW. This chemical would be injected as short duration dose shock treatment. SCCW supply would be suspended during the CCW treatment so that the amount of chemical is dependent of the fixed volume of the CCW system which is unchanged. Therefore the proposed project would not require any increase use of this chemical.

As explained in the DEA, whenever the introduction of chemical controls results in residuals in the CCW in excess of permissible discharge levels, blowdown is withheld until acceptable residuals are attained. The discharge of the SCCW will be operated in this manner.

A description of the chemical usage in the raw water systems, ERCW and RCW, is as follows:

- A copolymer dispersant will be injected on a year-round basis to keep settleable solids in suspension and thereby reduce accumulations of silt and rust. The release of the copolymer is anticipated to be no more than 0.2 milligram per liter (0.2 ppm) as active product.

- Tetrapotassium pyrophate will be injected on a year-round continuous basis to sequester iron from existing corrosion products in raw-water piping and ancillary components. The release of pyrophosphate at the diffuser discharge is not expected to exceed 0.2 milligrams per liter (0.2 ppm) as total phosphorus.

- Zinc sulfate will be injected on a year-round continuous basis to reduce corrosion rates of carbon-steel piping and components. The release of zinc sulfate is anticipated to be maintained at 0.2 milligram per liter (0.2 ppm) zinc.

- Butyl benzotriazole (Copper-TrolTM), a corrosion inhibitor, will be injected periodically into the raw-water systems to reduce copper corrosion rates. Most of the heat exchangers cooled by the raw water systems are constructed with copper or copper-alloy tubes.

The total poundage of the chemicals and the maximum concentration levels of releases to the river would remain unchanged for the proposed project. Also the average ppm of continuously injected chemicals would decrease in the WBN diffuser discharge.

With respect to WET evaluation using the 9-day juvenile mussel test with silt and whole sediment test with appropriate organisms, TVA believes that this subject was adequately covered in the SCCW EA and in previous WBN documents.

TWRA Comment 5. The DEA (3.2.3 p.20) does not address the potential impacts of providing additional release from Watts Bar Hydroelectric facility (WBH) to meet the thermal intake requirements at WBN. The potential impact, particularly of sustained late summer, early fall releases from Norris Reservoir should be fully discussed, including an evaluation of the anticipated frequency, duration, and circumstances requiring prolonged releases from Norris Reservoir.

TVA Response: There are no anticipated or planned additional releases from either Watts Bar or Norris Reservoirs needed to meet the intake temperature requirements at WBN. The paragraph in the EA (3.23.3, page 20) which mentions possible increased WBH discharges was intended only to indicate that there are actions which could be taken to reduce the WBN intake temperature in the statistically unlikely event that the limit is approached.

The WBN intake temperature limit of 85° F was not reached or exceeded at any time during the 18 years of simulated operation of the SCCW system. The maximum predicted WBN intake temperature was 83.7° F. This was based on recorded dam releases, reservoir elevations, and meteorological data from January 1, 1976 through October 15, 1993. The meteorological data should be conservative (higher air temperatures) because the data were measured at the Chattanooga airport, which is an urban area. No credit was taken for thermal stratification in the river, so actual WBN intake temperatures should be lower than predicted.

TWRA Comment 6. The DEA analysis (3.33 p.30) relies upon 316(b) entrainment and impingement studies which were conducted in 1975, more than two decades ago. Are there recent data indicating that entrainment and impingement impacts in 1996 would be reasonably similar to those observed in 1975? In the absence of such corroborating information, TVA should propose limited sampling as necessary to provide for comparative evaluation of the 1975 studies and current conditions.

TVA Response: The requested sampling would allow determination if fish populations (both larval and adult) in the vicinity of the WBF intake are similar now to those present in 1975. While there have been some changes in factors influencing water quality of Watts Bar Reservoir since the 1975 impingement and entrainment studies, Vital Signs Monitoring results from 1990 to 1997 indicate a relatively stable fish community in the forebay environment. Although reductions in adverse influences, mainly in the upper reservoir areas, may have impacted resident fish between 1975 to 1990, the potential for major shifts in forebay fish community quality appears remote.

New aeration activities in the forebay may influence distribution patterns of some fish (e.g. striped bass) that require cool, oxygenated water. During times of the year when aeration is required to maintain dissolved oxygen levels in the tailwater (late summer and early fall), increased impingement by the WBF intake of striped bass drawn to the aerated area above the dam could occur if the aeration system failed. Individuals would be forced into warmer, oxygenated levels where they may became stressed due to their low tolerance to high water temperatures and become susceptible to impingement. However, operation of the SCCW would not be the causative agent. Aeration is not necessary during the spawning period in the Watts Bar forebay, and therefore entrainment should not be influenced over that experienced in the early 1970s (except for only half of the flow required during WBF operation will be needed for the WBN SCCW project).

TWRA Comment 7. We concur with the description of the mussel community in the Watts Bar tailwater sanctuary as a remnant of the diverse assemblage of mussels existing prior to the impoundment. The reasons for the inability of the remaining mussels to reproduce are not understood. We suggest that mitigation for the proposed SCCW project include a substantial research effort to identify the reasons this mussel community is unable to reproduce. Likewise, the ability of juvenile mussels, obtained through culture techniques, to survive and grow in the WBH tailwaters should be evaluated.

TVA Response: As indicated in the draft environmental assessment, this renewed use of the Watts Bar Fossil Plant discharge would have a detectable effect only on a very small part of the available gravel and cobble mussel habitat in the Tennessee River downstream from Watts Bar Dam. Completion of this project would expose an area of bottom habitat measuring less than 150 x 150 ft. to temperature conditions which would be higher than normal for this part of the Watts Bar Dam tailwater. TVA has proposed to relocate the few native mussels which exist in the thermal impact area to other suitable mussel habitat in the Watts Bar tailwater. That relocation appears to be adequate mitigation for the potential adverse effects this discharge could have on native mussels in the river.

TVA biologists are well aware of the status of native mussel stocks downstream from Watts Bar Dam and the other mainstream dams on the Tennessee River. On several occasions (e.g., in the 1990 Reservoir Operations Review EIS, and in the 1986 Watts Bar Pre-operational Monitoring Report), TVA has acknowledged that the dams are probably related to the lack of mussel recruitment in these tailwaters. While TVA staff agree that the specific causes of this lack of recruitment are unknown, the presence of some reproducing mussel stocks in specific locations downstream from a few Tennessee River dams seems to offer tantalizing clues which might be used to solve this mystery. Unfortunately, neither TVA nor any other federal, state, or non-governmental agency has given this project the emphasis some believe it deserves. In spite of this lack of any other attention to this recovery project, TVA does not see any logic in attempts to link the general issue of mussel recovery to a minor project which happens to have been proposed for the Watts Bar Dam tailwater.

TWRA Comment 8. A continuing concern in the Tennessee River system is expansion of zebra mussels and their potential adverse impact on native species of fish and aquatic life. Please provide an evaluation of the potential response of zebra mussels to conditions resulting from the proposed SCCW project as proposed and with a new diffuser at WBF.

TVA Response: TVA monitoring activities indicate that zebra mussels presently occur in both Watts Bar Reservoir and in the Watts Bar tailwater. During 1997, sampling in the river downstream from Watts Bar Dam has documented that zebra mussel larvae reached a peak of approximately 800 per cubic meter in the water, and zebra mussel adults were present at approximately 50 per square meter on many hard substrates. Research being conducted in the Great Lakes and elsewhere indicates that zebra mussels can tolerate water temperatures down to near freezing; however, temperatures above 90 degrees Fahrenheit inhibit reproduction and, above about 93 degrees, zebra mussel survival.

The proposed SCCW project (without or with a diffuser) would have only very localized impacts on zebra mussels in Watts Bar Reservoir or the tailwater. Zebra mussels would be unlikely to survive in the 90+ degree water within the discharge structures or on the small area of river substrate which would be bathed with this heated flow. Adult zebra mussels living on the river bottom within the remainder of the mixing zone would be virtually unaffected by the heated water because the warm water would quickly rise to the surface and be completely mixed with ambient temperature water before coming back into contact with the river bottom. Downstream from the mixing zone, zebra mussels would be virtually unaffected by the 0.1 or 0.2 degree increase in temperature caused by the SCCW discharge.

TENNESSEE WILDLIFE RESOURCES AGENCY

ELLINGTON AGRICULTURAL CENTER
P. O. BOX 40747
NASHVILLE, TENNESSEE 37204

April 27, 1998

Mr. Paul E. Davis, Director
Division of Water Pollution Control
Tennessee Department of Environment & Conservation
6th Floor, L&C Annex
401 Church Street
Nashville, TN 37243-1534

re: Watts Bar Nuclear (WBN) Plant
Supplemental Condenser Cooling Water (SCCW) Project

Dear Mr. Davis:

Please find attached a copy of the Tennessee Valley Authority's (TVA) March 26, 1998 response to Tennessee Wildlife Resources Agency (TWRA) correspondence of January 28, 1998 regarding TVA's SCCW project. Considering the dismissive nature of TVA's response to TWRA concerns and recommendations, we must recommend that a National Pollutant Discharge Elimination System (NPDES) permit not be issued to accommodate the SCCW project until such time these issues are effectively resolved.

The rationale adopted by TVA for this project incorporates significant unresolved contradictions:

1. **Diffuser Issues**: The volume of the proposed SCCW discharge is approximately five times larger than the existing WBN diffuser release. Permitting the SCCW release through the existing Watts Bar Fossil (WBF) culvert may impact the Division's ability to require utilization of appropriate diffuser technology elsewhere in the Tennessee River Valley in the future. We find nothing in the SCCW project to distinguish it from other requests for thermal releases of this magnitude which would, in all likelihood, require utilization of diffuser technology. We are likewise concerned about permitting a non-diffuser equipped thermal release based on modeling results which are strongly counter intuitive.

A portion of TVA's rationale for not equipping this release with a diffuser is the potential, temporary adverse impact on the benthic community, including freshwater mussels. TVA acknowledges that the demise of the Watts Bar tailwaters mussel community is directly related to the Watts Bar Hydroelectric (WBH) facility and further acknowledges that the SCCW project unites WBH/ WBF/WBN into single entity. Allowing TVA to use concern for adverse impact to the benthic community as rationale for a non-diffuser equipped thermal release while concurrently disclaiming responsibility for conservation of the same community is (see, TVA response 7), at best, inconsistent with the intent of the NPDES process.

One of the originally proposed benefits of the WBN project was elimination of adverse environmental impact from the WBF facility. It would appear that reestablishing a non-diffuser equipped thermal release from WBF partially negates that identified benefit and likewise is counter to the intent of the anti-backsliding provisions of the Clean Water Act.

2. **Monitoring Issues:** The purpose of the SCCW project is to increase power production at WBN with a subsequent increase in profit for TVA. TVA, however, is willing to commit to related aquatic resource impact monitoring only to the extent that national tax payor funds are made available through appropriated dollars from the U.S. Congress (see, TVA response 3). Monitoring the environmental impact of TVA hydro, fossil, and/or nuclear power projects should be a TVA power responsibility, incorporated in the appropriate permits or certifications, unrelated to non-power funding.

With regard to reliance on 316 (a) data now more than 20 years old, TVA's position is that evaluating the current validity of those data may result in information requiring further consideration of aquatic resource impacts related to the WBN facility in general and the SCCW project in particular. Impact assessment based on reliable information gathered by the discharger is an important component of the NPDES permit process and should not be discarded for the SCCW project.

Through the combined impacts of the Watts Bar Hydroelectric facility and the Watts Bar Nuclear facility, TVA essentially controls the quality of one of Tennessee's premier aquatic resources. The rationale TVA puts forward to support the SCCW project, if adopted, assures that project elements remain distinct, thus diminishing TVA's responsibility for the cumulative impacts of the WBH/WBF/WBN complex. TWRA wishes to re-emphasize our original comments 3 and 6 of January 28, 1998; we consider the issue of an appropriate monitoring commitment to be incorporated into an NPDES permit for WBN/SCCW to be wholly unresolved.

Our concerns with regard to discharge release impacts, utilization of diffuser technology, model verification, updating 316(a) data, and conservation of freshwater mussels are unresolved. Likewise, our concerns over potential adverse impacts on the behavior, survival and recruitment of sauger, catfish, striped bass, and freshwater mussels are unresolved

Your time and attention in this matter is greatly appreciated.

Sincerely,

Aubrey D. McKinney, Chief
Environmental Services Division

ADM/bjs
cc: EPA - Region IV, Atlanta, GA
Jon Loney - TVA

May 7, 1998

Dr. Lee A. Barclay, Supervisor
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, Tennessee 38501

Dear Dr. Barclay:

Enclosed is a copy of the near-final Tennessee Valley Authority Environmental Assessment (EA) concerning the proposed Supplemental Condenser Cooling Water Project at the Watts Bar Nuclear Plant, Tennessee River Mile 528. This version of the EA (final except for the insertion of the enclosures and attachments) contains relatively few changes from the draft provided to your office in December, 1997. As you may remember, that draft was used as the basis for a discussion with you, your staff, and Tennessee Department of Environment and Conservation staff on December 18, 1997.

The EA indicates that seven species federal endangered or threatened species are known to occur in the vicinity of Watts Bar Nuclear Plant. In the EA, we conclude that three of these species (the bald eagle, gray bat, and snail darter) would not be affected by the proposed action. With regard to the four endangered mussel species (pink mucket, fanshell, dromedary pearlymussel, and rough pigtoe), only the pink mucket has been found in recent years within the portion of the Tennessee River that would be affected by the project. As indicated in the EA, TVA proposes to relocate endangered and other mussels out of the 150 x 150 ft. thermal impact area offshore from the discharge point to other suitable habitats within the State of Tennessee Watts Bar mollusk sanctuary. Our conclusion in the EA is that completion of the mussel relocation effort prior to the use of the discharge would not result in an adverse effect on the pink mucket or any other endangered mussel species.

We believe the information about federal endangered and threatened species presented in the EA, and our determinations that this project either will not have any effect, or will not have any adverse effect on these species fulfills our obligations under the Endangered Species Act. Please review the endangered species material in the EA and, if appropriate, indicate your concurrence with our determinations in a response to this letter.

Thank you, again, for hosting the December 1997 meeting and for your continuing interest in this project. If you have any questions about this request, please contact TVA staff members Charles P. Nicholson (423/632-3582) or John J. Jenkinson (423/751-6903).

Sincerely,

Original Signed By
Greg Askew
for

Jon M. Loney, Manager
Environmental Management

CPN

CPN:BL
Enclosure
cc: Gregory L. Askew, WT 8C-K
C. Randall McIntosh, ADM 1V-WBN
John J. Jenkinson, CST 17B-C
Files, EM, WT 8C-K

Prepared by Charles P. Nicholson and John J. Jenkinson

WBN cooling - FWS ltr

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

May 11, 1998

Mr. Philip L. Stewart, Manager
Tennessee Department of Environment & Conservation
Division of Water Pollution Control
Chattanooga Field Office
Suite 550, 540 McCallie Avenue
Chattanooga, Tennessee 37402-2013

Dear Mr. Stewart:

WATTS BAR NUCLEAR PLANT (WBN) - SUPPLEMENTAL CONDENSER COOLING WATER PROJECT DRAFT ENGINEERING REPORT

Enclosed is a copy of the subject draft engineering report and draft design drawings for the Supplemental Condenser Cooling Water project. This environmental report includes the need for the proposed project, the operational impacts, the routing of the SCCW pipelines, the discharge flow calculations, and the materials list.

The enclosed information is being provided for your early review and comment. We are not requesting a permit modification at this time. We will submit our request and three copies of the engineering report and preliminary plans in subsequent correspondence, once all environmental reviews have been completed and a final decision has been made.

If you have any questions regarding this engineering report, please contact Robert W. Bond at (423) 697-4108 in Chattanooga or me at (423) 365-3325 at Watts Bar Nuclear Plant.

Sincerely,

Odis E. Hickman, Jr.

Odis E. Hickman, Jr.
Radwaste/Environmental Superintendent

Enclosure

→K Mal

United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, Tennessee 38501

May 26, 1998

RECEIVED
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Doc. No.____
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Environmental Management

Mr. Jon M. Loney
Manager, Environmental Management
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Attention: Mr. Charles P. Nicholson

Re: FWS #98-236

Dear Mr. Loney:

Thank you for your letter and enclosure of May 7, 1998, transmitting an environmental assessment for the proposed Supplemental Condenser Cooling Water Project at the Watts Bar Nuclear Plant in Rhea County, Tennessee. The Fish and Wildlife Service (Service) has reviewed the document and offers the following comments.

The Service concurs that the proposed action will not affect the endangered gray bat, or the threatened bald eagle and snail darter. We further concur that the project is not likely to adversely affect the endangered pink mucket pearly mussel, fanshell, dromedary pearly mussel, or the rough pigtoe. In view of this, we believe that the requirements of Section 7 of the Endangered Species Act are fulfilled. Obligations under Section 7 must be reconsidered, however, if: (1) new information reveals that the proposed action may affect listed species in a manner or to an extent not previously considered, (2) the proposed action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the action.

Thank you for the opportunity to comment on this action. If you have any questions, please contact Jim Widlak of my staff at 931/528-6481, ext. 202.

Sincerely,

Douglas B. Winford
for Lee A. Barclay, Ph.D.
Field Supervisor

MAY 29 '98

ACTION	NOTE	P. Site Operations	Plant Manager	Business & Work Perf	Const. Completion	Engg. & Materials	Human Resources	Site Support	Concerns Resolution	Media	Nuclear Assurance	Licensing

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

June 4, 1998

Mr. Philip L. Stewart, Manager
Chattanooga Field Office
Division of Water Pollution Control
Suite 550, 540 McCallie Avenue
Chattanooga, Tennessee 37402

Dear Mr. Stewart:

WATTS BAR NUCLEAR PLANT (WBN) - PROPOSED SUPPLEMENTAL CONDENSER COOLING WATER (SCCW) PROJECT - VALIDATION OF THE CORMIX MODEL

During telecons with the Tennessee Department of Environment & Conservation (TDEC), uncertainty regarding the accuracy with which CORMIX3 models the discharge of the SCCW to the Tennessee River was expressed. TVA has identified actual temperature measurements of river conditions from a 1974 field survey with heated discharge into the river from an operating Watts Bar Fossil Plant (WBF). As a result of the TEDC concerns, TVA decided to validate CORMIX3 by modeling WBF operation and discharge and comparing the predicted temperatures to the actual field measured survey results.

Temperature surveys were conducted in the vicinity of the WBF discharge on March 14 and 15, 1974, with the plant in operation. The results of the survey are presented in a TVA Division of Water Control Planning Report No. 9-1105, "Watts Bar Steam Plant Water Temperature Surveys." Two CORMIX model runs were made to simulate the thermal plume configuration with river and plant discharge conditions existing at the time of the field survey. Results of these runs were compared to the field measurements to determine consistency between them. The details of this comparison effort are presented in the paper, "Comparison of CORMIX Results with Field Measurements During Watts Bar Fossil Plant Operation." It is our opinion that the correlation seen between the CORMIX model and the field data validates the appropriateness of using CORMIX to model the SCCW discharge. Accordingly, TVA believes CORMIX is adequate to predict the thermal effects to the river from SCCW operation and conservatively assess the resultant environmental impact.

A copy of this paper and a reprint of the original survey are enclosed. We trust this will help to alleviate any concern you might have regarding the adequacy of CORMIX modeling of SCCW operation. Hopefully, this will give you further confidence in the validity of the results presented in the Environmental Assessment for the SCCW project.

If you have any questions please feel free to contact me at (423) 365-3843.

Sincerely,

C. Randall McIntosh

C. Randall McIntosh
Manager of Projects
Watts Bar Nuclear Plant

Enclosures
cc (Enclosures):
Mr. Bruce Evans
Division of Water Pollution Control
Tennessee Department of Environment & Conversation
6th Floor, L&C Annex
401 Church Street
Nashville, Tennessee 37243-1534

Aubrey D. McKinney, Chief
Environmental Services Division
Tennessee Wildlife Resources Agency
Ellington Agricultural Center
P.O. Box 40747
Nashville, Tennessee 37402

TVA

Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

June 19, 1998

Mr. Philip L. Stewart, Manager
Chattanooga Field Office
Division of Water Pollution Control
Suite 550, 540 McCallie Avenue
Chattanooga, Tennessee 37402

Dear Mr. Stewart:

WATTS BAR NUCLEAR PLANT (WBN) - SUPPLEMENTAL CONDENSER COOLING WATER (SCCW) PROJECT - REVISED DRAFT ENVIRONMENTAL ASSESSMENT

This letter transmits a revision of the draft Environmental Assessment (DEA). Since submittal of the initial DEA in December 1997, Tennessee Department of Environment & Conservation (TDEC) and Tennessee Wildlife Resources Agency (TWRA) personnel have raised issues in letters, meetings, and teleconferences with TVA. The DEA has been revised to provide clarification and additional information to address these issues.

The primary areas of update are as follows:

- Chemical Impacts - Sections 3.2.1 and 3.2.3 have been revised to provide more detail on the present chemical treatments for the raw water systems at WBN and why the SCCW will not affect existing treatments or result in an adverse impact from chemical discharge to the river.
- Dissolved Oxygen (DO) Impact - Sections 3.2.1 and 3.2.3 have been revised to provide information on the present oxygenation provisions at Watts Bar Hydro and why the SCCW will not adversely impact DO in the river.
- Erosion - Section 3.2.3 has been revised to explain why SCCW operation is not expected to cause any erosion to the banks of the river.
- Temperature Monitoring - Sections 3.2.3, 3.3.3.3, 3.5.3, and 3.11 have been revised to add a program to conduct seasonal monitoring of the instream river temperature during the first year of SCCW operation. The measured data will be compared to the predicted CORMIX model results.
- Fish Monitoring - Section 3.3.3 has been revised to add a program to study a limited number of crucial fish species during the first year of operation to verify there is no unexpected impact.

Enclosed is the revised DEA for TDEC's information and use. So that all important issues can be fully discussed, TVA would like to schedule an interagency meeting with TEDC and others. TVA proposes the meeting be held the week of June 29 at Watts Bar Nuclear Plant. Please notify me as soon as possible of your availability to attend the proposed meeting.

If you have any questions please feel free to contact me at (423) 365-3843.

Sincerely,

C. Randall McIntosh

C. Randall McIntosh
Manager of Projects
Watts Bar Nuclear Plant

Enclosures
cc (Enclosures):

Mr. Bruce Evans
Division of Water Pollution Control
Tennessee Department of Environment & Conversation
6th Floor, L&C Annex
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Aubrey D. McKinney, Chief
Environmental Services Division
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ENVIRONMENTAL ASSISTANCE CENTER
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August 20, 1998

Mr. O. Erskin Hickman, Jr., Superintendent - Radwaste/Environmental Control
Tennessee Valley Authority
Watts Bar Nuclear Plant
P. O. Box 2000, MOB2U
Spring City, TN 37381

Re: Conditional Site Approval for New Outfall Construction
Proposed Supplemental Condenser Cooling Water Project
NPDES Permit No. TN0020168
Tennessee River and Yellow Creek, Rhea County

Dear Mr. Hickman:

This letter is in response to the site approval request for the above referenced project. The project is described in TVA's draft Engineering Report and Construction Plans dated May 11, 1998 and supported by TVA's revised draft Environmental Assessment dated June 19, 1998. Supplemental information submitted by Mr. Randall McIntosh on July 31, 1998, described the proposed instream monitoring program. This correspondence also addresses information exchanged during the July 24, 1998 meeting in Nashville between representatives of the Division of Water Pollution Control and TVA.

Project Summary

TVA proposes to use the existing water inlet and bank side discharge structures at Watts Bar Fossil Plant to supply and discharge supplemental condenser cooling water (SCCW) to the nuclear plant cooling tower and main condenser. TVA understands that the Division would not consider allowing a side discharge for wastewater flows comparable to the planned project, at this or any other location, except that the proposed project would use an existing discharge structure which modeling has shown can be operated with minimal impact. The predicted result of the SCCW use is an increase in condenser performance, which will translate into approximately 64,000 megawatt hours additional annual energy output. By using the existing structures and inlet piping to the fossil plant, TVA has designed a gravity feed system for both the intake and the discharge of the SCCW. New piping and connections will be necessary from the river water intake at the fossil plant to the No. 2 cooling tower basin, and from the No. 1 cooling tower basin overflow to the fossil plant discharge structure. A bypass line from the inlet piping to the discharge piping may be used in the winter months to reduce the possibility of instream temperature rises greater than 5.4° F.

The existing fossil plant discharge structure is a channel with an overflow weir drop structure directing flow to a side bank discharge tunnel. The discharge will be either under (maximum of eight feet) or even with the water surface depending on river stage and season. TVA used the CORMIX 3 model, an EPA endorsed model used for side bank discharges, to predict the mixing zone for the heated discharge. This model predicted that the heated discharge will descend to the river bottom immediately adjacent to the outfall structure and will rebound to the surface within a 150' x 150' impact zone. When using 24 hour averaging, TVA's model predicts that sufficient mixing will occur within 1000 feet downstream from the outfall to meet thermal water quality criteria.

Division Concerns

Please note that thermal water quality criteria are established for one hour averages only. In addition, it should be pointed out that compliance with the thermal water quality criteria does not necessarily guarantee compliance with narrative water quality criteria (i.e., no harm to aquatic life).

The entire reach of the Tennessee River for ten miles downstream from the Watts Bar Dam has been designated as a mussel sanctuary by the Tennessee Wildlife Resources Agency (TWRA). The Division is concerned about the location of the fossil plant discharge structure in relation to endangered mussel beds supporting habitat for four endangered species of mussel in this river section. One such bed is located within the area of direct discharge impact. The Division believes that the side bank discharge as proposed would not be as protective of the remaining mussel beds as other types of discharge structures; e.g., multiport diffuser. If permitted, the additional risk would need to be offset in some fashion.

Conditional Site Approval

The Division reviewed the SCCW project in accordance with the Department's rules for control of construction and operation of wastewater treatment and discharge facilities. We also reviewed and discussed all of the TVA supplied information concerning this project, including the special circumstances involved in the use of the side bank discharge. As a result of our review, and in consideration of the feasibility to mitigate the loss of critical aquatic habitat and the increased risk to remaining habitat, we hereby grant site approval for this project contingent on TVA's acceptance and compliance with the following conditions:

1. Some of the threatened and endangered mussels of concern are located within the predicted impact area. The Division and TVA both have concerns about the survival of the relocated mussel population. To provide an appropriate margin of safety for this irreplaceable natural resource, the Division requests that a mussel relocation plan be developed which is acceptable to both David McKinney of TWRA and John Jenkinson of TVA prior to the commencement of project operation.

2. The Division believes that a properly designed and constructed diffuser outfall would add a safety factor to the protection of the endangered mussels and the maintenance of river water quality. However, since TVA must use the existing fossil plant discharge structure, physical controls must be added to maximize surface discharge and minimize bottom discharge impact. For example, a flow directing/energy dissipation structure may be designed and placed at the end of the discharge outfall tunnel to direct the majority of the discharge flow to the river surface, instead of allowing it to plunge directly toward the river bottom. Final engineering plans and drawings must show the proposed structure modifications.

3. The outfall structure design must insure that the predicted impact zone is not exceeded. Permanent, continuous river bottom temperature monitoring must be established on all sides of the impact zone. Since TVA proposed four temperature monitors in the July 31, 1998 document, the Division would prefer that the monitors be stationed for maximum delineation of the perimeter of the potential hot water plume. The worst ambient river conditions for thermal plume mixing will occur during the summer months (warm river temperature) and low or no river flow through Watts Bar Dam. Therefore, it is suggested that two temperature monitors be stationed equidistant along the impact zone perimeter parallel to river flow and perpendicular to discharge flow. The two remaining temperature monitors may be stationed as proposed; one upstream and one downstream of the discharge. Each temperature monitor should be located in the center of the impact zone perimeters perpendicular to river flow.

   The vertical temperature study presented in the revised draft environmental assessment and the July 31, 1998 TVA proposed monitoring program must also be implemented within the first year of SCCW discharge.

   To more adequately characterize discharge impact under varying river conditions and dam operation, the Division proposes that TVA determine river bottom flow direction. A permanent, continuous monitoring station must be established, if feasible. This monitoring station should be set up in the general proximity and upstream of the discharge structure and the predicted impact zone.

4. As part of this project, TVA shall provide measures to enhance the available habitat for the mussel population in this stretch of the river. The Division is of the opinion that habitat improvement may be partially accomplished through improving conditions conducive to species-specific juvenile mussel recruitment. We propose to include in the Watts Bar Nuclear Plant NPDES permit a requirement that TVA must submit a habitat enhancement proposal for review and approval by TWRA and the Division within six months of commencement of the SCCW project operation. This proposal should include structural and/or administrative controls which have shown either experimental or proven benefits to mussel habitat enhancement.

5. Monitoring criteria for this outfall will be established as part of the NPDES permit. These criteria will include at a minimum continuous flow and temperature measurement, as well as chemical and biological sampling. Provisions for collecting these measurements and samples must be implemented during construction of the project General river monitoring, such as fisheries monitoring, will also be included in the permit.

This conditional site approval should be used for planning purposes only. It does not grant approval to construct or discharge from the proposed outfall. TVA should not construe this conditional site approval to represent a certainty that an NPDES permit will be issued for this proposed discharge as contemplated by the TVA documents thus far reviewed by the Division. Opportunity for public participation must be made during the permit application process. However, if additional information regarding adverse water quality and habitat impacts does not emerge during the draft permit and public participation steps, it is likely that an NPDES permit can be issued for this discharge.

<u>**Further Steps for Final Project Approval**</u>

As stated during the July 24, 1998 meeting, the Division would like to include this project as part of the current Watts Bar Nuclear Plant permit renewal application. Therefore, the next step for TVA is to submit a permit modification request associated with the SCCW project to the Chattanooga Environmental Assistance Center for review and permit inclusion. The modification request should provide a general conceptual approach for the conditions outlined above. A final copy of the Environmental Assessment and two final copies of the Engineering Report and Plans should be included in this request package for review and appropriate fee assessment. The final Engineering Report and Plans should include the instrumentation for continuous monitoring parameters specified in the NPDES permit. After review and acceptance, the Engineering Report and Plans will be stamped approved by the Division. One copy of the Engineering Report and Plans will be returned to TVA to be maintained at the construction site.

Additionally, it should be noted that the Division has not yet received the previously requested revised and/or amended NPDES application forms, along with a comprehensive flow diagram. Copies of this information may also be sent to our Permit Section in Nashville to expedite matters.

The Division appreciates TVA's willingness to work towards an environmentally acceptable project. If you have any questions regarding the above site approval or project conditions, please call me or Cynthia Anderson at (423)634-5712.

Sincerely,

Philip L. Stewart

Philip L. Stewart, P.E.
Manager
Division of Water Pollution Control

pls\cma\permit\tva\wbn\sccwlet

cc: Randall McIntosh, Senior Project Manager, TVA - Watts Bar Nuclear Plant
cc: DWPC, Nashville, Director's Office, c/o Paul Davis, P.E.
cc: DWPC, Nashville, Permit Section, c/o Saya Qualls, P.E.
cc: TWRA, Nashville, c/o David McKinney