Tennessee Valley Authority, 1101 Market Street, LP 5A, Chattanooga, Tennessee 37402-2801

August 22, 2008

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

In the Matter of) Docket Numbers 52-014 and 52-015
Tennessee Valley Authority)

BELLEFONTE COMBINED LICENSE APPLICATION – ENVIRONMENTAL REPORT CHANGES RELATED TO UPDATED CRITERIA AND BASIS FOR COMPARATIVE RATINGS AMONG ALTERNATIVE SITES

Reference: Letter from Andrea L. Sterdis (TVA) to NRC Document Control Desk, "Bellefonte Combined License Application - Response to Environmental Report Request For Additional Information - Criteria and Basis for Comparative Ratings Among Alternative Sites," dated July 30, 2008 [ML082140229]

This letter identifies changes to the alternative site evaluation provided in Chapter 9, Section 9.3, of the Applicant's Environmental Report (ER) associated with the Bellefonte Nuclear Plant Units 3 and 4 (BLN) Combined License Application (COLA).

By the referenced letter dated July 30, 2008, the Tennessee Valley Authority (TVA) provided responses to NRC requests for additional information related to the alternative sites evaluation in Section 9.3 of the BLN ER. Attached to that letter was a TVA report titled, "Criteria and Basis for Comparative Ratings Among Alternative Brownfield and Greenfield Sites," (referred to as the TVA Criteria and Basis report) which provided the requested detail regarding the criteria for comparing alternative candidate sites to the BLN site. The July 30, 2008, letter also included a commitment to identify any COLA changes that were the result of the additional information contained in the TVA report. The enclosure to this letter satisfies that commitment by providing the COLA changes that are necessary to bring the BLN ER into conformance with the revised information in the TVA Criteria and Basis report.

In addition to the providing the needed COLA changes, TVA has also attached a revision to the TVA Criteria and Basis report. This revision resolves an inconsistency regarding the rating for barge access cost at the Murphy Hill site, and removes a reference to a transmission line study, which is not completed. These changes result in no substantive affect to the overall conclusions of the information provided in the referenced letter or the BLN ER.

D085
NRC

If you should have any questions, please contact Thomas Spink at 1101 Market Street, LP5A, Chattanooga, Tennessee 37402-2801, by telephone at (423) 751-7062, or via email at tespink@tva.gov.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 22nd day of Aug, 2008.

Andrea L. Sterdis
Manager, New Nuclear Licensing and Industry Affairs
Nuclear Generation Development & Construction

Enclosure:

Environmental Report Changes Related to Updated Criteria and Basis for Comparative Ratings Among Alternative Sites

Attachment:

Tennessee Valley Authority, Alternative Sites Report #2, "Criteria and Basis for Comparative Ratings Among Alternative Brownfield and Greenfield Sites," Revision 1, August 2008

cc (Enclosure and Attachment):
M. A. Hood, NRC/HQ

cc (w/o Enclosure and Attachment):
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M.W. Gettler, FP&L
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ENCLOSURE

ENVIRONMENTAL REPORT CHANGES RELATED TO UPDATED CRITERIA AND BASIS FOR COMPARATIVE RATINGS AMONG ALTERNATIVE SITES

ENVIRONMENTAL REPORT CHANGES RELATED TO UPDATED CRITERIA AND BASIS FOR COMPARATIVE RATINGS AMONG ALTERNATIVE SITES

This enclosure identifies changes to the alternative sites evaluation provided in Chapter 9, Section 9.3, of the Applicant's Environmental Report (ER) associated with the Bellefonte Nuclear Plant Units 3 and 4 (BLN) Combined License Application (COLA). These changes are necessary to reflect updated candidate site ratings information in the TVA report titled, "Criteria and Basis for Comparative Ratings Among Alternative Brownfield and Greenfield Sites," which was attached to the BLN request for additional information (RAI) responses in the referenced TVA letter dated July 30, 2008.

Reference:

Letter from Andrea L. Sterdis (TVA) to NRC Document Control Desk, "Bellefonte Combined License Application - Response to Environmental Report Request For Additional Information - Criteria and Basis for Comparative Ratings Among Alternative Sites," dated July 30, 2008 [ML082140229]

BLN COL APPLICATION TEXT CHANGES:

1. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.1, under the Geologic Evaluation heading, as follows:

   Although nuclear plants are designed to withstand a certain earthquake hazard, the prediction of earthquake timing and severity is subject to many uncertainties. Consequently, the objective of this criterion is to avoid proximity to seismological hazards. Sites with the least seismic risk are rated the highest.

   The Modified Mercalli (MM) Scale is one measure of the intensity of an earthquake. The scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature, and fabricated structures on a scale of 1 through 12, with 1 denoting the weakest earthquake and 12 denoting one that causes the greatest destruction. The lower degrees of the MM scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. This value is translated into a peak ground acceleration (PGA) value to measure the maximum force experienced. The PGA is measured in terms of percent of "g," the acceleration due to gravity. As an exclusionary criterion, the maximum level of ground motion specified by EPRI is PGA 0.30 g (30 percent g) at a probability of exceedance (PE) of 2 percent in 50 years, translating to once in 2500 years.

   For purposes of candidate site comparison based on vibratory ground motion, the PGA with a 2 percent probability of exceedance in 50 years (USGS 2008 seismic hazard maps) and the bedrock conditions were evaluated for the BLN, HVN, PBN, YCN, and MH sites. Sources of information for the bedrock evaluation were the original FE[I]Ss for the brownfield nuclear sites and Geologic Survey of Alabama data (1984) for the MH site. Each of these sites has a PGA of less than 0.30 g, with the PGAs ranging from 0.11 g to 0.20 g. Each of these sites is situated on rock (mostly limestone); however, PBN is on somewhat softer rock.

   A comparison of the two factors equally influencing rankings for these criteria (i.e., ground motion and bedrock foundation) are shown in Table 9.3-X1. Each of the five sites is acceptable and, with the exception of PBN, ranked equally with regard to bedrock foundation. However, the differences between the peak ground acceleration were enough

to warrant differentiation between the five sites, which is reflected in the overall ratings for the sites.

The HVN site lies within the Nashville Dome tectonic province. The design criteria for a plant at that site would be governed by a reoccurrence of a major earthquake in the Reelfoot Tectonic Structure west of the Nashville Dome. Analysis of a major earthquake in the Reelfoot Structure shows that the maximum intensity felt at the HVN site would be MM VII. The maximum acceleration for intensities of this level was estimated to be 0.14 g for safe shutdown earthquakes. More recent information using USGS Seismic Hazard maps (USGS data set accessed 2008) indicated the value to be 0.11 g.

The BLN, PBN, and MH sites lie within the Southern Appalachian Tectonic Province. For the eastern area sites in this province, the maximum earthquake was the 1897 Giles County, Virginia, earthquake, which had a reported intensity of MM VIII. The maximum acceleration for intensities of this level was estimated at 0.18 g for safe shutdown earthquakes. More recent detailed information for BLN, PBN, and MH from the USGS Seismic Hazard maps indicates the values to be 0.16, 0.17, and 0.14 g, respectively.

The YCN site lies within an area that is affected by earthquakes along the Reelfoot Tectonic structure at distances of 90 –to 140 mi. from the site. Intensities varying with location from a MM VIII to a MM IX should be employed for the safe shutdown earthquake for this area. The maximum acceleration for intensities of this level was estimated at 0.18 g for safe shutdown earthquakes. Review of the more recent USGS Seismic Hazard map data indicates a value of 0.20 g for the YCN site.

Table 9.3-1 is used as a consolidated table of comparisons for the TVA ASE. It includes the ratings for the geologic evaluation. As the difference between the peak ground acceleration is negligible between the five sites, all are rated equally with respect to foundation conditions.

2. Change COLA Part 3, ER Chapter 9, Section 9.3, by adding NEW Table 9.3-X1 near the end of the section, as follows:

Table 9.3-X1
Comparative Ranking of Alternative Candidate Sites
on the Basis of Ground Motion and Bedrock Foundation

Site	USGS (2007 draft) PGA 2% in 50 yrs	Ground Motion Rank	Bedrock Foundation Rank	Overall Rank
BLN	0.16	3	5	4
HVN	0.11	5	5	5
PBN	0.17	3	4	3
YCN	0.20	3	5	4
MH	0.14	4	5	4

3. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.1, under the Cooling System Suitability heading, as follows:

Cooling system requirements are important siting considerations for new power generating facilities. ~~The AP1000 plant chosen for the site needs no external ultimate heat sink postaccident other than air.~~ The objective of this subsection is to rate the candidate sites with respect to their ability to satisfy specific cooling system requirements. The AP1000 plant chosen for the site needs no external ultimate heat sink postaccident other than the surrounding atmosphere.

The evaluation of adequacy of water supply is based upon comparisons between the design basis water consumption rate for the facility and 1) the site-specific average flow (when regulated or on reservoirs) for each site; and 2) low flow conditions of the water body. A common assumption noted in the EPRI Siting Guide (Reference 1) is that states typically do not permit more than 10 percent of the "dependable flow" to be withdrawn for consumptive use. For reservoirs and lakes, the comparison considers the type of reservoir (capacity, and ability to maintain reservoir levels) as well as historic average and low flow rates. The BLN, YCN, and MH sites are located on large, high-volume reservoirs in which flow-through is regulated by both upstream and downstream dams. HVN and PBN are located on riverine stretches of rivers in which flow is also highly regulated by upstream and downstream dams.

In light of existing water quality standards, which limit increases in downstream temperature maximums and increases above ambient upstream temperature, the supply of available cooling water has become less important in plant siting because these standards tend to force the use of some form of auxiliary cooling. Heat exhausted by the same design plant (i.e., AP1000) at different site locations would be generally of uniform temperature, and makeup water for the auxiliary cooling systems would remain essentially unchanged between sites. Sites with larger amounts of available cooling water are, however, rated higher due to reduced risk of low-flow considerations.

~~The Tennessee River at the BLN site and the MH greenfield site has an average flow of approximately 38,850 cfs. The Cumberland River at the HVN site has an average flow of 17,000 cfs. The Holston River at the PBN site has an average flow of approximately 13,600 cfs. Flows into the Yellow Creek embayment come primarily from Pickwick Lake where the average discharge at Pickwick Landing Dam is 56,000 cfs.~~

The factors equally affecting the individual site ratings for this criterion are 1) average flow (pertinent because all sites are on either reservoirs or regulated reaches of rivers), and 2) whether or not the low-flow characteristics could potentially constitute an infrequent operational limitation. Low and average flow characteristics and overall ratings for the cooling water suitability analysis are presented in Table 9.3-X2 and discussed below, along with the sources of information and calculation assumptions used to estimate the flow rates.

The BLN site is located on Guntersville Reservoir of the Tennessee River System. Flow at the site is regulated upstream by TVA's Nickajack Dam (dam closure on December 14, 1967) and downstream by TVA's Guntersville Dam (dam closure on January 16, 1939). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using TVA's water records of total flow (turbine and spill) from Nickajack Dam from 1968 through 2007. Based on the information obtained through these sources of information, the Tennessee River flows past the BLN site at an average rate of approximately 37,000 cfs, with 7Q10 and 3Q20 low-flow values of 5780 cfs and 2050 cfs, respectively. (It is noted that the flow data used in this evaluation is for comparison between alternative sites only, and

differs from the BLN site evaluation flow data due to period of time during which the data was acquired and the data analysis methodology used to compute the flow data.)

The HVN site is located on Old Hickory Reservoir of the Cumberland River System. Flow at the site is regulated upstream by Cordell Hull Dam and Center Hill Dam and downstream by Old Hickory Dam (all U.S. Army Corps of Engineers' dams). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using TVA's water records of total flow (turbine and spill) from Cordell Hull Dam and Center Hill Dam from 1971 through 2007. Based on the information obtained through these sources, the Cumberland River reach (Old Hickory Reservoir) flows past the HVN site at an average rate of approximately 18,000 cfs, with 7Q10 and 3Q20 low-flow values of 1870 cfs and 980 cfs, respectively.

The PBN site is located on the Holston River of the Tennessee River System. Flow at the site is regulated upstream by TVA's Fort Patrick Henry Dam (dam closure on October 27, 1953). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using the USGS water records of flow measured at the "Holston River at Surgoinsville, TN" stream gauge from 1954 through 1998 (the gauge was removed from service in 1998). Based on the information obtained through these sources, the Holston River flows past the PBN site at an average rate of approximately 3900 cfs, with 7Q10 and 3Q20 low-flow values of 925 cfs and 768 cfs, respectively.

The YCN site is located on Pickwick Reservoir of the Tennessee River System. Flow at the site is regulated upstream by TVA's Wilson Dam (dam closure on April 14, 1924) and downstream by TVA's Pickwick Dam (dam closure on February 8, 1938). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using TVA's water records of total flow (turbine and spill) from Wilson Dam from 1938 through 2007. Based on the information obtained through these sources, the Tennessee River (Pickwick Reservoir) flows past the YCN site at an average rate of approximately 53,000 cfs, with 7Q10 and 3Q20 low-flow values of 7700 cfs and 3740 cfs, respectively.

The MH site is located on Guntersville Reservoir of the Tennessee River System. Flow at the site is regulated upstream by TVA's Nickajack Dam (dam closure on December 14, 1967) and downstream by TVA's Guntersville Dam (dam closure on January 16, 1939). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using TVA's water records of total flow (turbine and spill) from Nickajack Dam from 1968 through 2007. Based on the information obtained through these sources, the Tennessee River (Guntersville Reservoir) flows past the MH site at an average rate of approximately 37,000 cfs, with 7Q10 and 3Q20 low-flow values of 5830 cfs and 2070 cfs, respectively.

Because the average regulated flow rate past each site is adequate to provide required cooling system supply, the sites are rated equally on the Average Flow Rating factor. Three of the sites are situated on large reservoirs and two are located on regulated reaches of rivers (i.e., flow is also controlled by releases from upstream and downstream reservoirs). This situation generally reduces the utility and value of comparing low-flow statistics between sites, because of a greater capacity to flexibly manage flow under extreme conditions to meet multi-purpose objectives for the reservoir system. Comparison of estimated consumptive flow withdrawal for two operating AP1000 units to the most extreme low-flow characteristics indicates that the needed consumptive withdrawals are 10 percent or less for each site. Although acceptable at 10 percent of the 3Q20 flow for the Holston River, PBN would have the most operational challenges under extreme low-flow conditions, and therefore receives a lower scoring for the Low Flow Rating factor (Table 9.3-X2). This

situation is, however, ameliorated by flexibility that multi-purpose reservoirs, integrated river management, and regulated flows provide to respond to low-flow conditions.

Table 9.3-1 includes the ratings for the cooling system suitability analysis. As the flow rate past each site is more than adequate to provide required cooling system supply, ~~all~~ the BLN, HVN, YCN, and MH sites receive the highest rating; PBN is rated lower because of the operational challenges under extreme low-flow conditions~~are rated equally~~.

4. Change COLA Part 3, ER Chapter 9, Section 9.3, by adding **new** Table 9.3-X2 near the end of the section, as follows:

Table 9.3-X2

Average and Low Flow Characteristics and Ratings of the Alternative Sites

	Low Flow		Average Flow		
Site	7Q10 / 3Q20 (ft^3/s)	Rating	(ft^3/s)	Rating	Overall Rating
BLN	5780 / 2050	5	37,130	5	5
HVN	1870 / 980	4	17,710	5	5
PBN	925 / 768	3	3890	5	4
YCN	7700 / 3740	5	53,080	5	5
MH	5830 / 2070	5	37,440	5	5

5. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.1, under the Plant Safety Evaluation – Flooding Potential heading, as follows:

This section reviews the flooding potential of the sites. Sites that were issued construction permits met the desired exclusionary and avoidance siting criteria. These criteria exclude potential sites within major wetlands and areas ~~less than 1 ft. above~~ lower than the elevation of probable maximum flood (PMF). The PMF is the flood that can be expected from the most severe meteorologic and hydrologic conditions that are reasonably possible for an area. PMF values are typically used in the design of major dams and nuclear power plants.

The BLN site grade, at 628.6 ft. msl, is approximately ~~7~~ 6 ft. above the PMF ~~and maximum wave of 622~~ 622.5 ft. The PBN site grade, at 1180 ft. msl, is ~~3~~ 0.4 ft. above the PMF ~~and maximum wave of 1177~~ 1179.6 ft. The HVN site grade, at 538 ft. msl, is ~~17~~ 17.1 ft. above the PMF and maximum wave of ~~521~~ 520.9 ft. The YCN site grade, at 530 ft. msl, is ~~85~~ 84 ft. above the PMF and maximum wave of ~~445~~ 446 ft. The MH greenfield site is approximately 2 ft. above the PMF; no maximum wave height data are available for the greenfield site.

Table 9.3-1 includes the ratings for the flooding potential analysis. As all sites are above the PMF, and satisfied the desired exclusionary and avoidance siting criteria, they were rated equally with respect to flooding potential.

6. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.1, fifth through seventh paragraphs under the Accident Effects Evaluation heading and insert a new paragraph after the seventh paragraph, as follows:

The PBN site is 65 mi. from Knoxville, Tennessee, and the population within a 50-mi. radius is estimated to be ~~1.1 million~~ 900,000 people. The nearest town is Surgoinsville, Tennessee, which has a population of approximately ~~1500~~ 1800.

The YCN site is 30 – 40 mi. from the Florence – Muscle Shoals – Sheffield – Tuscumbia urban complex located east-southeast of this site, with a combined population of approximately ~~65,912~~ 67,000. The estimated population within a 50-mi. radius is estimated to be ~~250,000~~ 440,000.

The MH site is ~~remotely from the region's population growth areas, with no urban centers in the immediate vicinity.~~ about 30 mi. from Huntsville, Alabama, and the population within a 50-mi. radius is estimated to be about 945,000. The nearest town is Grant, Alabama, which has a population of about 700.

Table 9.3-1 includes the ratings for the population evaluation. On the basis of lower population numbers, YCN is rated slightly higher than the other sites. Based upon similarity of population characteristics, these remaining sites are rated equally with respect to population and accident effects.

7. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.1, eighth paragraph under the Accident Effects Evaluation heading, as follows:

~~Table 9.3-1 includes the ratings for the population evaluation.~~ In an evaluation of emergency planning considerations, ~~all~~ the four brownfield sites have relatively similar population densities with similar expected population growth rates, and close access to major U.S. highways. ~~No one site appears to be substantially different from the others. Therefore, all brownfield sites are rated equally in this comparison.~~ There is a prison under construction on a portion of the HVN site, which could complicate emergency planning. Although the ramifications of a nearby prison population are not fully certain at this time, the HVN site is therefore ranked lower than the other brownfield sites for emergency planning considerations. The greenfield site at Murphy Hill is rated ~~higher due to its remote location and distance to population centers with respect to population, but~~ lower for emergency planning due to ~~distance~~ the less updated system of access roads and more limited access from major U.S. highways.

8. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.1, tenth and eleventh paragraphs under the Accident Effects Evaluation heading, as follows:

Assessment of the meteorological conditions at the PBN, HVN, and YCN sites did not indicate any limiting conditions. The meteorology of the PBN, BLN, and MH sites provide a limited range of atmospheric conditions for transport and dispersion of plant emissions due to their valley locations and prevailing wind directions.

Table 9.3-1 includes the ratings for the evaluation of atmospheric dispersion. Development at some of the brownfield sites affects final EAB analysis due to recent industrial growth at

these sites. The HVN~~, PBN,~~ and YCN sites are rated slightly higher than BLN, PBN, and MH with respect to meteorological conditions.

9. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.2, under the Thermal Release Effects heading, as follows:

The objective of this subsection is to address the relative suitability of the candidate sites with respect to potential thermal release effects on receiving water bodies. The AP1000 plant design needs no external ultimate heat sink. During normal operation, the AP1000, like other types of nuclear power plants, can use this external cooling water. Heat removed by the condenser cooling water system generates the majority of this thermal release. An important consideration in evaluating the suitability of the sites was the proposed design of the condenser cooling water system at each site. Heat rejected by the same plant at different locations would remain virtually unchanged, and makeup water for the auxiliary cooling systems would be essentially the same at each site. The use of closed-cycle cooling is a best available technology for minimizing the amount of water withdrawal required.

~~The effect of this quantity of water on the receiving water body would be primarily a function of flow. The AP1000 plant design needs no external ultimate heat sink. During normal operation, the AP1000, like other types of nuclear power plants, can use this external cooling water.~~

The effect of returning unconsumed water (primarily that not evaporated from the cooling towers) to the receiving water body would be primarily a function of 1) the percentage of total flow that heated return water constituted in comparison to average and low flow in the receiving water body, and 2) whether or not the receiving water body is a reservoir, regulated river, or free-flowing river. An additional factor would be the thermal limits imposed by the pertinent NPDES permit. The purpose of such thermal limits at any site is to be protective of aquatic and water resource values; consequently, the flow comparison becomes the primary factor to consider. Because it was determined that no exclusionary or avoidance criteria were exceeded by these thermal discharges, sites with larger amounts of available cooling water are rated higher.

Table 9.3-1 includes the ratings for the thermal discharge analysis. The BLN and alternative sites exhibit acceptable flow characteristics for siting nuclear generation; however, they may be parsed upon their relative ability to assimilate heat and, although a regulatory-defined area, likelihood to affect aquatic resources in the receiving water body. As noted in the above discussion on cooling system suitability, the YCN site has a larger flow rate of dilution cooling water available. Thus, the YCN site is rated more suitable than the other sites with respect to cooling water availability. Similarly, based upon the flow comparisons as discussed under cooling system suitability, PBN is ranked lowest with regard to the potential for creating the most substantive issues for avoiding thermal effects to the receiving water body.

10. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.2, under the Entrainment and Impingement Effects heading, as follows:

When cooling water is pumped from water bodies, two environmental effects of concern can occur. The first effect, ~~E~~entrainment, refers to the removal of small, drifting organisms within

the cooling water. Small fish, fish eggs, plankton, and other aquatic/marine organisms experience high mortality rates as they pass through cooling water pumps and heat exchangers. The second effect, ~~I~~impingement, refers to larger organisms that are screened out of the cooling water at the intake structure. Impinged organisms can include large fish, crustaceans, turtles, and other aquatic/marine organisms that are unable to avoid the high intake velocities near the intake structure, and are thereby trapped on the intake screens.

No exclusionary or avoidance criteria apply to entrainment and impingement effects from the operation of condenser cooling water systems, similar to the above discussion on thermal discharges. The objective of this subsection is to address the relative suitability of the candidate sites with respect to potential entrainment and impingement effects.

Concerns about entrainment and impingement losses are resource dependent and vary on a site-to-site basis. Typically, power plants with once-through cooling water systems have higher entrainment and impingement effects than power plants with closed-cycle cooling water systems, such as proposed for the siting of AP1000 units at the alternative sites. Low-flow conditions can also increase the potential for entrainment and impingement to occur.

~~Low-flow conditions can increase entrainment and impingement; however, low-flow conditions, such as might occur during drought, have not been identified as a concern in any of the previous studies conducted.~~

Table 9.3-1 includes the ratings for the entrainment and impingement effects analysis. Three factors were utilized to influence these overall ratings: 1) the presence of endangered species that could be entrained or impinged, 2) relative densities of young fish reported in the references for Table 9.3-X3, and 3) potential for occurrence of low-flow situations exacerbating the potential for increased entrainment/impingement. The candidate sites were evaluated with respect to their relative potential for entrainment and impingement effects from closed-cycle cooling water systems. In general, closed-cycle cooling, which utilizes much less water than open-cycle cooling systems, substantively reduces the potential for entrainment and impingement impacts. Based upon the criteria identified above, and ~~B~~because similar systems would be provided for similar makeup water requirements, the BLN, HVN, and MH~~, and PBN~~ sites are overall rated equally on this criterion. Although the impact would also be related to the numbers of juvenile fish actually entrained once a site-specific plant were designed and operational, and the relative percentage removed from the reservoir, ~~T~~the YCN site rated slightly lower due to the presence of an extensive number of juvenile fish. PBN is rated lower due to the potential for entraining or impinging the federally listed spotfin chub and the greater potential for low flows to contribute to greater impingement or entrainment at a higher frequency of occurrence.

11. Change COLA Part 3, ER Chapter 9, Section 9.3, by adding **new** Table 9.3-X3 near the end of the section, as follows:

Table 9.3-X3
Densities of Young of Year Fish and Standing Stocks of Fish
in Each Reservoir Where Alternative Sites are Located

Site	Young of Year (YOY) Fish – Years Samples	Annual Average Total Numbers YOY Fish per 1000 m^3 Water Volume	Standing Stock Years Sampled	Standing Stock Densities of Fish (by weight) kg/ha
BLN	1975 - 1983	54,783 (1)	1971 - 1984 and 1985 - 1993	297 and 371, respectively (2)
PBN	1975 - 1976	2103 (1)	1975	5 - 29 (3)
YCN	1975, 1976, 1979, 1980	185,690 (1)	1974, 1975	67.2 (5)
HVN	1974, 1975	6776 (6)	1974, 1975	684 - 118.5 (6)
MH	1982	135,571 (1)	1981 - 1982	333.8 (4)

Sources:

1. TVA, 1983, Summary of TVA Larval Fish Investigations, Tennessee Valley Authority, Data Services Branch, Knoxville, Tennessee.
2. TVA, 1997, Final Environmental Impact Statement for the Bellefonte Conversion Project, Tennessee Valley Authority, Vol. 1.
3. USNRC, 1976, Draft Environmental Statement, Phipps Bend Nuclear Plant, Units 1 and 2, Tennessee Valley Authority, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. E3.
4. TVA, 1983, First Preoperational Assessment of Water Quality and Biological Resources of Guntersville Reservoir in the Vicinity of the Proposed Murphy Hill Coal Gasification Project, Tennessee Valley Authority, Office of Natural Resources, 287pp.
5. TVA, Final Environmental Statement, Yellow Creek Nuclear Plants 1 and 2, Vol. 1, Tennessee Valley Authority, Office of Natural Resources.
6. Winger, P.V., 1976, Comprehensive Summary of the Water Quality, Limnology and Fisheries of the Cumberland River Near the Proposed Hartsville Nuclear Power Plant, 1975, Tennessee Cooperation Fisheries Research Unit, Tennessee Technical University, Cookeville, Tennessee, 214pp.

12. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.3, under the Construction-Related Effects heading, as follows:

During construction of a nuclear power plant, the local population increases from the workers and families who relocate to the area, and the local community grows to support these people. A site is rated on its estimated ability to handle the number of construction workers who would move into the plant site vicinity with their families and the capacity of the

communities surrounding the plant site to absorb this temporary (in-migrant) population. Higher ratings are given to the sites better able to accommodate the increases in population.

The number of in-migrant workers is dependent on labor availability within commuting distance of the plant site. If an adequate supply of workers were available within reasonable commuting distance, few (if any) workers would choose to relocate to the site. The issue in siting, therefore, is the potential socioeconomic effects associated with any temporary influx of construction workers who live too far away to commute daily from their residence.

The capacity of communities to absorb an increase in population depends on the availability of sufficient resources such as adequate housing and community services (e.g., schools, hospitals, police, transportation systems, and fire protection) to support the influx without straining existing services. The factors that should be considered in rating sites from the perspective of construction effects includes labor requirements, location of labor pool, number of immigrants, and the economic structure of affected communities. Regardless of the site chosen, construction employment would be the same, with an estimated peak of approximately 3900 workers on-site. Assuming that 50 percent of the workers move to the area from elsewhere, there would be an increase of 1950 workers plus whatever family moved with them. Assuming a family size of four, the population increase would be 7800, about a 10 percent increase, for example, in Jackson County (BLN site).

Both Chattanooga, Tennessee, and Huntsville, Alabama, are within 50 mi. of the BLN site and would likely furnish many of the workers needed; some in-migrants might also locate in those areas. The city of Nashville, Tennessee, and the counties around it on the northeast to southeast sides are within 50 mi. of the HVN site. Around the PBN site, the Kingsport-Bristol-Johnson City area is within 50 mi., as is the smaller Morristown area. The YCN site is within 50 mi. of the Florence/Mussel Shoals/Sheffield/Tuscumbia - Quad Cities (Alabama) area as well as a number of smaller communities in Alabama, Mississippi, and Tennessee. The MH site is within 50 mi. of the Huntsville and Gadsden areas in Alabama. Each of the alternative sites has a reasonably-sized population center (i.e., greater than 25,000) within 50 mi. and, with the exception of Yellow Creek, has an estimated total population within 50 mi. of between 880,000 and 1.4 million.

Previous studies (information reported in the site-specific TVA EISs) and the current discussion herein that is based on the population numbers and cities noted within 50 mi. of each site, indicate ~~recent updates predicted~~ that the ~~four brownfield~~ BLN, HVN, and PBN sites are capable of adequately handling an increase in population due to construction worker influx, and the corresponding demand on housing and related services. Due to the relative size of the current population in the area, the impact at the YCN site could be more substantial than at the other sites. The YCN site could have more difficulty accommodating the increase without special assistance. Although ~~T~~the MH greenfield site is located in a more rural area where housing, infrastructure, transportation routes, and public services are less well-developed, its proximity to the Huntsville area and to other smaller urban centers would increase its ability to accommodate a major construction project. As a result, with the exception of YCN, which is rated lower, the other alternative sites are rated the same with respect to ~~Based on this, MH is rated lower, while the brownfield sites are rated equally for purposes of~~ construction-related socioeconomic effects, as presented ~~and are included~~ in Table 9.3-1.

13. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.3, under the Land Use heading, as follows:

Land to be used for new units would already be owned or acquired by TVA and would already be zoned for uses compatible with development of a new unit; existing units are integrated into the surrounding land use patterns. The PBN, BLN, YCN, and HVN sites have all been partially developed for industrial uses. The amount of industrial development varies from site to site. As an instrument of the federal government, TVA properties are not subject to local zoning regulation. For three of the sites (PBN, YCN, and MH) there are currently no local zoning or land use policies with which siting of nuclear generation would conflict. However, for the HVN site, local property within close proximity to the remaining TVA property is zoned for agricultural and light industry use.

Land use would change significantly with use of the MH greenfield site, as no development has occurred there to date.

With respect to BLN, the land had been previously dedicated as the site for Bellefonte Units 1 and 2. The NRC terminated the construction permits for those units in September 2006 at TVA's request. TVA currently owns all of the land at this site, and no further land acquisitions are required. The site is allocated by TVA for industrial use; further information is provided in Section 2.2.

While the construction permits for the HVN and PBN sites have been terminated, completion of a nuclear power plant at these sites would conform to the previously proposed urban and industrial development land use for the site and its vicinity, as designated by local governmental plans, policies, and controls. While portions of both sites have been transferred for other uses, TVA retains control of 1377 ac. at HVN (Figure 9.3-11), while only 102 ac. of the 1284-ac. site is retained at PBN (Figure 9.3-12). In a complex contractual arrangement with the local authorities for the Hawkins County PBN site, TVA does retain control over the original acreage until the entire acreage is purchased. At this time (May 2008) it is uncertain what effect a newly-identified prison under construction on the transferred portion of the HVN site would have on the suitability of that site.

The former YCN site has been transferred to the National Aeronautics and Space Administration (NASA) and subsequently to the State of Mississippi and is currently the site of a commercial complex now managed by Tishomingo County.; TVA retains control of only 13 ac. of the 1149-ac. site, as shown in Figure 9.3-13. However, there is a coherent portion of the former site still undeveloped and contiguous with the approximately 2300 acres of predominantly undeveloped industrial park and small private inholdings.

The MH site is still controlled by TVA and is currently designated for natural resource management. Figure 9.3-14 illustrates ownership for this site.

Ratings for this criterion are influenced by three factors: current state of disturbance of the site, potential degree of disturbance to current uses by siting a nuclear generation facility, and status of ownership. No land-use or ownership issues are evident for BLN. MH is rated substantively lower due to its greenfield status and the potential for disturbance of its current TVA natural resource management land use designation. Both HVN and YCN are rated slightly lower due to the need for re-acquisition of lands and potential for disturbance of current uses. As noted above, the effect of a prison being constructed at the HVN site is uncertain at this time.

PBN is also rated ~~lowest~~ lower because of the need to re-acquire property and greater potential for ~~needing to~~ affecting use of adjacent industrial sites. None of the sites affects public amenities such as national parks, preserves, or ecologically sensitive areas.

14. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.4, first and second paragraphs under the Water Supply heading, as follows:

The purpose of this criterion is to evaluate relative differences in the design and construction factors affecting costs for developing water supply facilities. Sites with local conditions that would require additional engineering costs to develop water supply capability (e.g., reservoirs to address water supply limitations) or reliability issues (e.g., low-flow constraints) or require substantively greater distances of piping or pumping to the site and acquisition of right-of-way to obtain adequate water supply are rated lower than sites with no such requirements.

All of the sites have access to cooling water sources that would provide adequate supply volume and reliability, such that no significant differential costs should be required for purchasing water rights or constructing on-site reservoirs. No groundwater usage would be required for any of the sites under consideration, as the reservoirs provide an adequate water supply. ~~Accordingly, all sites are rated equally on this criterion.~~ All sites except PBN are rated equally and highest on this criterion for cost of water supply. PBN could experience a greater potential for operational limitations due to low flows (also see discussion under Cooling System Suitability) that could potentially reduce its availability for generation. PBN is accordingly rated slightly lower. Table 9.3-1 includes the ratings for the water supply cost.

15. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.4, under the Transportation - Railroad heading, as follows:

The purpose of the second transportation criterion is to rate sites according to the factors affecting relative costs associated with providing rail access. Sites are rated in accordance with ~~the length of additional or new rail spur construction required to provide rail access~~ whether or not they have adequate existing rail access or would require additional or new rail spur construction to provide rail access. BLN, YCN, and PBN already have rail access but HVN~~, YCN,~~ and MH do not. These latter sites rated lower than the other ~~two~~ three sites on this criterion.

16. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.4, first and second paragraphs under the Transportation - Barge heading, as follows:

The purpose of the third transportation criterion is to rate sites according to the relative costs associated with providing barge access. ~~Sites are rated from highest to lowest in accordance with the estimated costs of constructing new barge access. The water body at each of the sites is sufficient to accommodate barge traffic. With the exception of BLN, barge facilities would have to be constructed at the other sites to receive major reactor components. A barge unloading facility and an access road from the barge facility to the site have been constructed at BLN. No additional costs for constructing a barge facility would be required. Based on these factors, BLN is given a higher rating on this criterion.~~ Barge

transport can be a comparatively advantageous (on a cost basis) method of transporting components such as reactor vessels, steam generators, or large modular units. The primary site factors affecting the relative costs among sites are whether or not 1) an adequate barge facility exists on-site; 2) an on-site facility exists that can be upgraded sufficiently; 3) a facility exists nearby to the site, but would require offloading components and then transporting by truck a short distance to the site; 4) a barge facility exists at a greater distance from the site (i.e., would require off-loading and long-distance transport of large components); or 5) it would be feasible to construct an on-site or nearby barge facility. Sites are rated from highest to lowest in accordance with these factors affecting costs for providing new barge access or providing alternative means of transport for major components. With the exception of PBN, the water body at each of the sites is sufficient to accommodate barge traffic. BLN and YCN currently have barge unloading facilities adequate to support construction of a nuclear facility. HVN and MH both have barge access that would need some upgrading, probably including some dredging. Direct barge access is not possible at PBN (see below), requiring off-loading and ground transport for a considerable distance.

A barge unloading facility and an access road from the barge facility to the site have been constructed at BLN. The YCN site has an existing adequate barge unloading facility directly across Yellow Creek from the site, but off-loading and ground transport would still be necessary to bring the large components on site. Although barge transport all the way to PBN is not possible (there is no barge lock at the downstream Cherokee Dam), off-loading at Knoxville, TN to other ground-based transport would be a possibility. When originally constructing the dam, TVA did acknowledge the possibility that someday the agency might need to provide for barge navigation into Cherokee Reservoir. However, during original construction at the PBN site, some large components were off-loaded in Knoxville, trucked to above Cherokee Dam (no lock), reloaded on a barge, moved up the reservoir, off-loaded a second time and land transported to the site. This approach required major effort (i.e., temporary closure and rolling roadblock of a U.S. highway for a few days). No factors contributing to substantive additional costs for utilizing the barge facilities at BLN or YCN were identified. Based on the primary site factors identified above, BLN and YCN were given highest ratings on this criterion, with HVN and MH receiving high ratings, and PBN receiving a low rating for the reasons identified. Table 9.3-1 includes the ratings for the highway, rail, and barge costs.

17. Change COLA Part 3, ER Chapter 9, Subsection 9.3.3.4, first and second paragraphs under the Flood Protection Cost heading, as follows:

The purpose of this criterion is to rate sites with respect to differential costs associated with construction of flood protection structures necessary to address probable maximum floods at the sites under consideration. Sites with the largest differences between site grade elevation and likely flood elevations are rated highest (least likely to incur costs associated with flood protection); sites with plant grade at or near flood level are rated lowest (most likely to incur costs associated with flood protection).

Per the elevation differences noted in the discussion of flooding potential in Plant Safety Evaluation above, YCN is rated highest for this criterion, BLN~~,~~ and HVN rate high, and PBN and MH rate significantly lower. Table 9.3-1 includes the ratings for the flood protection cost.

18. Change COLA Part 3, ER Chapter 9, Table 9.3-1, TVA ASE Summary of Results, to UPDATE the changes provided in the referenced TVA letter dated July 30, 2008, as shown on the following page. [Note: The only change beyond those in the referenced letter is that the Barge Access Cost rating for MH is changed from "2" to "4" to reflect the corresponding changes to page 45 of the Criteria and Basis paper provided as Attachment A to this enclosure.]

Reference:

Letter from Andrea L. Sterdis (TVA) to NRC Document Control Desk, "Bellefonte Combined License Application - Response to Environmental Report Request For Additional Information - Criteria and Basis for Comparative Ratings Among Alternative Sites," dated July 30, 2008 [ML082140229]

TABLE 9.3-1
TVA ASE SUMMARY OF RESULTS

	BLN	HVN	PBN	YCN	MH
Safety & Health Criteria –					
Geologic Evaluation	~~5~~ 4	5	~~5~~ 3	~~5~~ 4	~~5~~ 4
Cooling System Suitability	5	5	~~5~~ 4	5	5
Plant Safety Evaluation –					
Flooding Potential Evaluation	5	5	5	5	5
Accident Effects Evaluation –					
Population	4	4	4	4 5	~~5~~ 4
Emergency Planning	5	~~5~~ 2	5	5	4
Atmospheric Dispersion	4	5	~~5~~ 4	5	4
Operational Effects Evaluation	5	5	5	5	5
Transportation Safety Evaluation –					
Cooling Tower Drift	4	5	5	5	4
Environmental Criteria –					
Proximity to Natural Areas	4	3	5	2	5
Construction-Related Effects on Aquatic Ecology	5	5	5	5	5
Construction-Related Effects on Terrestrial Ecology	5	5	5	5	5
Construction-Related Effects on Wetlands	5	5	5	5	5
Operations-Related Effects on Aquatic Ecology					
Thermal Discharge	4	4	~~2~~ 3	5	4
Entrainment And Impingement Effects	5	5	~~5~~ 4	4	5
Operations-Related Effects on Terrestrial Ecology					
Cooling Tower Drift	4	5	5	5	4
Socioeconomic Criteria –					
Construction-Related Effects	5	5	5	~~5~~ 4	4 5
Highway Access During Construction	5	5	5	5	4
Operations-Related Effects	5	5	5	5	5
Environmental Justice Evaluation	5	5	5	5	5
Land Use	5	4	3	4	~~2~~ 3
Cultural Resources	5	4	4	4	5
Engineering and Cost Related Criteria –					
Water Supply Cost	5	5	~~5~~ 4	5	5
Transportation –					
Highway Access Cost*	5	5	5	5	3
Rail Access Cost*	5	3	5	~~3~~ 5	2
Barge Access Cost*	5	~~3~~ 4	~~3~~ 1	~~3~~ 5	~~2~~ 4
Transmission Access Cost*	5	~~2~~ 3	~~3~~ 5	2	~~2~~ 3
Site Preparation –					
Land Use And Ownership Assessment	5	3	3	2	2
Topographic Modifications	5	5	5	4	3
Flood Protection Cost*	~~3~~ 4	4	~~2~~ 3	5	~~2~~ 3
Cooling Water Cost*	5	5	5	5	5

		~~134~~	~~134~~	~~132~~	~~121~~
Total	142	133	130	135	125

1 = Least Suitable; 5 = Most Suitable
* = These criteria were based upon an examination of the relative potential for financial impacts from major factors contributing to "cost" associated with that criterion, rather than cost estimates.

ATTACHMENTS:

The following document is provided as an attachment to this enclosure:

Tennessee Valley Authority, *Criteria and Basis for Comparative Ratings Among Alternative Brownfield and Greenfield Sites*, Revision 1, August 2008.

ATTACHMENT
TENNESSEE VALLEY AUTHORITY
"CRITERIA AND BASIS FOR COMPARATIVE RATINGS AMONG
ALTERNATIVE BROWNFIELD AND GREENFIELD SITES"
AUGUST 2008

Tennessee Valley Authority

Alternative Sites Report #2

Criteria and Basis for Comparative Ratings Among Alternative Brownfield and Greenfield Sites

Rev. 1
August 2008

Revision Summary

Revision	Discussion of Changes
0	Original issue.
1	Minor changes, as follows: 1. Change pages 1, 5, and 46 to remove the reference to a July 2008 transmission line study. 2. Change page 2 (Table 1) and page 45 (Table 22) to accurately reflect the barge access rating ("4") for the Murphy Hill site, as stated in the text on top of page 45. 3. Change page 11 to clarify the basis for applying the same rating to all 5 sites for the flooding potential criterion. Added phrase that all of the alternative sites met the exclusionary and avoidance siting criteria. 4. Editorial change to page 11 to change "Raking" to "Rating" in the title of Table 6.

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Overview

This discussion provides detail regarding the criteria for comparing alternative candidate sites to the Tennessee Valley Authority (TVA) Bellefonte Nuclear Plant, Units 3 and 4 (BLN) site. The objectives of this comparison were: 1) to verify that a reasonable suite of viable candidate sites was considered, and 2) to determine if there were any obviously superior sites among the candidate sites for siting and operation of two AP1000 nuclear reactors. The Electric Power Research Institute (EPRI) Siting Guide (Reference 1 of Section 9.3.1 of the Environmental Report) was used as a general guideline. The criteria are generally grouped into four areas, i.e., those related to Safety and Health, Environmental, Socio-economic, and Engineering and Cost-Related Factors. Table 1 shows the individual ratings for selection criteria and total rating value of the sites in this comparison. Values shown in the table and discussed in the text are unweighted. The selection criteria and comparison reflect the need for balancing engineering, environmental and economic factors in selecting a site that meets the current need.

Information and comparisons were originally developed to support submission of the Applicant's Environmental Report (ER) for the BLN Combined License Application (COLA). This present document is in response to subsequent comments and questions from staff of the Nuclear Regulatory Commission (NRC) and their contractor, Pacific Northwest National Laboratory (PNNL), requesting greater detail about the criteria and basis for ratings. It includes the addition of information for a comparison of low-flow characteristics of the alternative sites, the result of which affect other criteria as discussed in the document. This document also contains updated ratings with newer information (e.g., December 2007 evaluation of transmission requirements for candidate sites) regarding the alternative sites, which will be reflected in a future revision to the ER. The update resulted in no substantive effect to the overall conclusions.

The candidate sites, which resulted from TVA's earlier site screening process, included the Bellefonte (BLN), Hartsville (HVN), Phipps Bend (PBN), and Yellow Creek (YCN) sites, all brownfield sites formerly permitted by the NRC or its predecessor, the Atomic Energy Commission (AEC) for construction of nuclear generation facilities, and the Murphy Hill (MH) greenfield site. Information from the original TVA Final Environmental [Impact] Statements (subsequently referred to as FESs) referenced for the individual sites was utilized wherever possible. The reference material upon which the site descriptions are based was reviewed by TVA staff and contractors to confirm it remains valid and adequately represents current conditions for the comparative screening level process, and has been updated as necessary to reflect more current information or data required to accurately depict current conditions for the alternative sites and environs. Citations for the original TVA FESs or the EPRI Siting Guide are provided at the end of this document rather than in the list of references for each individual criterion. Where other or updated sources of information were utilized, they are cited at the end of each discussion for an individual criterion. Table 2 indicates which information from the original ES's was reviewed and deemed adequate (R) and which was updated (U). Supporting information for the basis of criteria ratings also appears in Appendix A.

Based on this evaluation and comparison of sites, none of the alternative sites was to be avoided and there were no obviously superior site(s) to the BLN site. The range of suitability scores shows only a moderate spread, since these candidate sites were: 1) those identified as superior through TVA's earlier robust site screening and selection process, 2) reviewed in detail under the NEPA process; 3) previously selected for siting of generation, 4) received nuclear construction permits (except MH); and 5) the brownfield sites experienced similar subsequent ground disturbance. The BLN site is TVA's preferred alternative for siting of the two AP1000 reactors.

Table 1. TVA Alternative Site Evaluation – Criteria and Summary of Comparison

	BLN	HVN	PBN	YCN	MH
Safety & Health Criteria –					
Geologic Evaluation	4	5	3	4	4
Cooling System Suitability	5	5	4	5	5
Plant Safety Evaluation –					
Flooding Potential Evaluation	5	5	5	5	5
Accident Effects Evaluation –					
Population	4	4	4	5	4
Emergency Planning	5	2	5	5	4
Atmospheric Dispersion	4	5	4	5	4
Operational Effects Evaluation	5	5	5	5	5
Transportation Safety Evaluation –					
Cooling Tower Drift	4	5	5	5	4
Environmental Criteria –					
Proximity to Natural Areas	4	3	5	2	5
Construction-Related Effects on Aquatic Ecology	5	5	5	5	5
Construction-Related Effects on Terrestrial Ecology	5	5	5	5	5
Construction-Related Effects on Wetlands	5	5	5	5	5
Operations-Related Effects on Aquatic Ecology					
Thermal Discharge	4	4	3	5	4
Entrainment And Impingement Effects	5	5	4	4	5
Operations-Related Effects on Terrestrial Ecology					
Cooling Tower Drift	4	5	5	5	4
Socioeconomic Criteria –					
Construction-Related Effects	5	5	5	4	5
Highway Access During Construction	5	5	5	5	4
Operations-Related Effects	5	5	5	5	5
Environmental Justice Evaluation	5	5	5	5	5
Land Use	5	4	3	4	3
Cultural Resources	5	4	4	4	5
Engineering and Cost Related Criteria –					
Water Supply Cost	5	5	4	5	5
Transportation –					
Highway Access Cost*	5	5	5	5	3
Rail Access Cost*	5	3	5	5	2
Barge Access Cost*	5	4	1	5	4
Transmission Access Cost*	5	3	5	2	3
Site Preparation –					
Land Use And Ownership Assessment	5	3	3	2	2
Topographic Modifications	5	5	5	4	3
Flood Protection Cost*	4	4	3	5	3
Cooling Water Cost*	5	5	5	5	5
Total	142	133	130	135	125

1 = Least Suitable; 5 = Most Suitable

* = These criteria were based upon an examination of the relative potential for financial impacts from major factors contributing to "cost" associated with that criterion, rather than cost estimates.

Table 2. Status of Review and Update of Information Used in Comparisons (Sheet 1 of 4)		
Criteria	**Reviewed (R) Updated (U)[a]**	**Reviews and Updates[a]**
Safety & Health Criteria - Geologic Evaluation	U	Review of Modified Mercalli Scale measures for BLN and alternative sites. Update using US Geologic Survey (USGS) hazard mapping.
Cooling System Suitability	U	TVA Water Records using US Environmental Protection Agency (USEPA) DFLOW program. Average water flows reviewed. Updated and re-evaluated with additional information on low flows for each site.
Plant Safety Evaluation - Flooding Potential Evaluation	R	Sites were reviewed to confirm that they are above probable maximum flood (PMF) level and maximum wave height (maximum wave height date were not available for the greenfield site). Citations provided in Table 7 for 100-year flood, 500-year flood and PMF .
Accident Effects Evaluation - Population	U	Updated population data to reflect latest available. Source: U.S. Census Bureau.
Emergency Planning	U	Updated U.S. Census population data, conditions of local roads, and special populations (e.g., siting of new prison at HVN) were considered in comparing emergency planning considerations. *Dynamap Display v9.1,* Claritas Corp., Ithaca, NY.
Atmospheric Dispersion	R	Meteorological conditions described for existing FESs at the sites were reviewed to determine suitability and comparative ratings among the sites for nuclear plant siting.
Operational Effects Evaluation	R	Limiting conditions of original FESs examined. Population along release pathways was considered regarding potential for differences between sites. Source: U.S. Census Bureau.
Transportation Safety Evaluation - Cooling Tower Drift	R	Meteorological conditions of site FESs were reviewed with regard to potential for severity and duration of ice and fog events.

Table 2. Status of Review and Update of Information Used in Comparisons (Sheet 2 of 4)		
Criteria	**Reviewed (R) Updated (U)[a]**	**Reviews and Updates[a]**
Environmental Criteria - Proximity to Natural Areas	U	Proximity to natural sites was evaluated using most current information from TVA Regional Natural Heritage Program.
Construction-Related Effects on Aquatic Ecology	U	Updated information based upon State and federal threatened and endangered (T&E) species lists; most recent information available from TVA Regional Natural Heritage Program data base on T&E species and sensitive habitats; TVA Index of Biotic Integrity; TVA ecological health indicator scores from Vital Signs Program.
Construction-Related Effects on Terrestrial Ecology	U	Same as first two items listed for Aquatic Ecology. Aerial photogrammetry and National Wetland Inventory data; soil survey data; USDA hydric soils lists.
Operations-Related Effects on Aquatic Ecology - Thermal Discharge	U	Flow Characterizations Under "Cooling System Suitability," as related to potential for creating greater operational management issues for thermal releases in order to assure environmental protection.
Entrainment and Impingement Effects	R	Consideration of relative potential for entrainment and impingement effects, based on type and quantity of organisms in the water. Review of existing data. Citations provided for Table 19.
Operations-Related Effects on Terrestrial Ecology - Cooing Tower Drift	R	Assessment of the meteorological and topographic conditions at each site in the original FESs.
Socioeconomic Criteria - Construction-Related Effects	U	Update of U.S. Census population data and review of existing FES information relative to availability of workers within commuting distance; discussion of resources to support the population increase.
Highway Access During Construction	U	Review and update of relative adequacy of transportation access. Sources: Maps and local site visits. *Dynamap Display v9.1,* Claritas Corp., Ithaca, NY.
Operations-Related Effects	R	Not indicative of inherent site conditions.
Environmental Justice	U	U.S. Census Bureau. Updated tables using current U.S. Census information and provided

Evaluation		graphics of USEPA Enviromapper.

Table 2. Status of Review and Update of Information Used in Comparisons (Sheet 3 of 4)

Criteria	Reviewed (R) Updated (U)[a]	Reviews and Updates[a]
Land Use	U	Ownership assessment by TVA Realty, discussions with local industrial and planning representatives on availability of land; current use, zoning, and degree of disturbance updated to current conditions.
Cultural Resources	U	Prior TVA studies cited in text of this report; review of current National Register of Historic Places; consultations on original FESs for sites with state Historic Preservation Officers. Available information updated to current for each site.
Engineering- and Cost-Related Criteria - Water Supply Cost Factors[b]	R	Re-comparison of water supply capability and evaluation of reliability issues (i.e., how much development of water resource supply would be needed).
Transportation- Highway Access Cost Factors[b]	U	Review of degree of highway improvement to provide adequate car and truck access to site for major construction project. Confirmed highway conditions by site visits. Also see above: Highway Access During Construction. *Dynamap Display v9.1,* Claritas Corp., Ithaca, NY.
Rail Access Cost Factors[b]	U	Need for rail spur construction or upgrade required to provide rail access based upon original FESs and discussion with local representatives on current conditions and site visits.
Barge Access Cost Factors[b]	U	Need for construction or upgrade to provide barge access based upon original FESs, site visits, and discussions with local representatives and site visits.
Transmission Access Cost Factors[b]	U	Estimated miles as indicator for relative cost of additional transmission line or right of way, including environmental assessments. Updated by December 2007 TVA transmission planning study.
Site Preparation - Land Use and Ownership Assessment	U	Identification of existing TVA assets. Due diligence review conducted by TVA Realty. Website review and conversations with local officials regarding local use, review of

		proximate land uses.

Table 2. Status of Review and Update of Information Used in Comparisons (Sheet 4 of 4)

Criteria	Reviewed (R) Updated (U)[a]	Reviews and Updates[a]
Topographic Modifications	R	Original FESs and site examination of need for incurring substantive additional grading costs.
Flood Protection Cost Factors[b]	R	Per citations of Table 7 of this report - Differences between site grade elevation and likely flood elevations.
Cooling Water Cost Factors[b]	R	Ability to provide water (differences in need for on-site infrastructure).

a) Update indicates inclusion and use of new information or data from that in the original FESs, as at least partial basis of conclusions.
b) These criteria were based upon an examination of the relative potential for financial impacts from the major identified factors contributing to "cost" associated with that criterion, rather than cost estimates.

Comparison of Safety Criteria for Brownfield and Greenfield Sites

This discussion encompasses the basis for criteria and ratings related to safety, i.e., geologic evaluation; cooling system suitability; flooding potential; accident effects including those to populations, emergency planning and atmospheric dispersion; and operational effects.

Geologic Evaluation

Comparison of Ground Motion and Bedrock Foundation

Although nuclear plants are designed to withstand a certain earthquake hazard, the prediction of earthquake timing and severity is subject to many uncertainties. Consequently, the objective of this criterion is to assess plant risk related to proximity to seismological hazards. Sites with the least seismic risk are rated the highest. Information from the original TVA Environmental Statements (ES's) for each site is presented, as well as recently (2007-8) updated data from the U.S. Geologic Survey (USGS).

The Modified Mercalli (MM) Scale is one measure of the intensity of an earthquake. The scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature, and fabricated structures using a scale of 1 through 12, with 1 denoting the weakest earthquake and 12 denoting the earthquake that causes the greatest destruction. The lower degrees of the MM scale generally pertain to the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. This value is translated into a peak ground acceleration (PGA) value to measure the maximum force experienced. The PGA is measured in terms of percent of "g," the acceleration due to gravity. As an exclusionary criterion, the maximum level of ground motion suggested by EPRI (2002) is a PGA of 0.30 g (30 percent g) at a probability of exceedance (PE) of 2 percent in 50 years, translating to once in 2500 years.

For purposes of candidate site comparison based on vibratory ground motion, the peak ground acceleration (PGA) with a 2 percent probability of exceedance in 50 years (USGS 2008 seismic hazard

maps) and the bedrock conditions were evaluated for BLN, HVN, PBN, YCN, and the MH site. Sources of information for the bedrock evaluation were the original FE[I]Ss for the brownfield nuclear sites and Geologic Survey of Alabama data (1984) for the MH site. Each of these sites have a PGA of less than 0.30 g, with the PGAs ranging from 0.11g to 0.20g. Each of these sites is situated on rock (mostly limestone); however, PBN is on somewhat softer rock.

A comparison of the two factors equally influencing rankings for these criteria i.e., (ground motion and bedrock foundation) are shown in Table 3. Table 1 shows the overall total ratings for the geologic evaluation. Each of the five sites is acceptable and with the exception of PBN, ranked equally with regard to bedrock foundation. However, the differences between the peak ground acceleration were enough to warrant differentiation between the five sites, which is reflected in the overall ratings for the sites.

The HVN site lies within the Nashville Dome tectonic province. The design criteria for a plant at that site would be governed by a reoccurrence of a major earthquake in the Reelfoot Tectonic Structure west of the Nashville Dome. Analysis of a major earthquake in the Reelfoot Structure shows that the maximum intensity felt at the HVN site would be MM VII. The maximum acceleration for intensities of this level was identified in the original TVA FES for HVN to be 0.14 g for safe shutdown earthquakes. More recent information using USGS Seismic Hazard maps (USGS data set accessed 2008) indicated the value to be 0.11.

Table 3. Comparative Ranking of Alternative Candidate Sites on the Basis of Ground Motion and Bedrock Foundation

Site	Latitude	Longitude	USGS (2007 draft) PGA 2% in 50 yrs	Ground Motion Rank	Bedrock Foundation Rank	Overall Rank
BLN	34.7	85.9	0.16	3	5	4
HVN	36.35	86.08	0.11	5	5	5
PBN	36.47	82.81	0.17	3	4	3
YCN	34.96	88.21	0.20	3	5	4
MH	34.48	86.16	0.14	4	5	4

The BLN, PBN, and MH sites lie within the Southern Appalachian Tectonic Province. For the eastern area sites in this province, the maximum earthquake was the 1897 Giles County, Virginia, earthquake, which had a reported intensity of MM VIII. The maximum acceleration for intensities of this level was estimated in the original TVA Environmental Statements for these sites at 0.18 g for safe shutdown earthquakes. More recent detailed information for BLN, PBN and MH from the USGS hazard maps indicates the values to be 0.16, 0.17, and 0.14, respectively.

The YCN site lies within an area that is affected by earthquakes along the Reelfoot Tectonic structure at distances of 90 to 140 mi. from the site. Intensities varying with location from a MM VIII to a MM IX should be employed for the safe shutdown earthquake for this area. The maximum acceleration for intensities of this level was estimated in the original TVA ES at 0.18 g for safe shutdown earthquakes. Review of the more recent USGS hazard map data indicates a value of 0.20 for the YCN site.

References for Geologic Evaluation

1. TVA Final Environmental Impact Statements for individual alternative sites (See citations at end of document).
2. Murphy Hill - Geologic Survey of Alabama, 1984 Alabama Geologic Map, Website http://portal.gsa.state.al.us/arcexplorer/link.html?&link=20070725151431771_0, Accessed May 5, 2008.
3. U.S. Geological Survey, National Seismic Hazard Maps – 2008, Website http://gldims.cr.usgs.gov/nshmp2008/viewer.htm, Accessed May 5, 2008.

Cooling System Suitability

Cooling system requirements are important siting considerations for new power generating facilities. The objective of this subsection is to rate the candidate sites with respect to their ability to satisfy specific cooling system requirements. The surrounding atmosphere serves as the post-accident ultimate heat sink for the AP1000 plant. The evaluation of adequacy of water supply is based upon comparisons between the design basis water consumption rate for the facility and 1) the site-specific average flow (when regulated or on reservoirs) for each site; and 2) low flow conditions of the water body. A common assumption noted in EPRI (2002) is that states typically do not permit more than 10 percent of the "dependable flow" to be withdrawn for consumptive use. For reservoirs and lakes, the comparison considers the type of reservoir (capacity, and ability to maintain reservoir levels) as well as historic average and low flow rates. BLN, MH and YCN are all located on large, high volume reservoirs in which flow-through is regulated by both upstream and downstream dams. HVN and PBN are located on riverine stretches of rivers in which flow is also highly regulated by upstream and downstream dams.

In light of existing water quality standards, which limit increases in downstream temperatures and increases above ambient upstream temperature, the supply of available cooling water has become less important in plant siting because these standards tend to force the use of some form of auxiliary cooling. Heat exhausted by the same design plant (i.e., AP1000) at different site locations would be generally of uniform temperature, and makeup water for the auxiliary cooling systems would remain essentially unchanged between sites. Sites with larger amounts of available cooling water are, however, rated higher due to reduced risk of low flow considerations.

Based upon the sources of information and calculation assumptions noted below, the Tennessee River at the BLN site and the MH greenfield site have an average flow of approximately 37,000 cfs. The Cumberland River at the HVN site has an average flow of approximately 18,000 cfs. The Holston River at the PBN site has an average flow of approximately 3900 cfs. Flows into the Yellow Creek embayment come primarily from Pickwick Lake where the average discharge at Pickwick Landing Dam is 53,000 cfs. Low and average flow characteristics are presented in Table 4. Sources of information are presented in Table 6. Three of the sites are situated on large reservoirs and two are located on regulated reaches of rivers (i.e., flow is also controlled by releases from upstream and downstream reservoirs). This situation generally reduces the utility and value of comparing low flow statistics between sites, because of a greater capacity to flexibly manage flow under extreme conditions to meet multi-purpose objectives for the reservoir system.

Table 4. Average and Low Flow Characteristics of the Alternative Sites			
Site (cooling water supply)	**Low Flow 7Q10 (ft^3/s)**	**Low Flow - 3Q20 (ft^3/s)**	**Average Flow (ft^3/s)**
BLN (Guntersville Reservoir)	5780	2050	37,130
HVN (Regulated Cumberland River reach – Old Hickory Reservoir)	1870	980	17,710
PBN (Regulated Holston River reach - Cherokee Reservoir)	925	768	3890
YCN (Pickwick Reservoir)	7700	3740	53,080
MH (Guntersville Reservoir)	5830	2070	37,440

Table 1 includes the overall ratings for the cooling system suitability analysis. The factors equally affecting the individual site ratings for this criterion are: 1) average flow (pertinent since all sites are on either reservoirs or regulated reaches of rivers), and 2) whether or not the low flow characteristics could potentially constitute an infrequent operational limitation. Because the average regulated flow rate past each site is adequate to provide required cooling system supply, all sites are rated equally on the Average Flow Rating factor (Table 5). Comparison of estimated consumptive flow withdrawal for two operating AP1000 units to the most extreme low flow characteristics indicates that the needed consumptive withdrawals are 10 % or less for each site. Although acceptable at 10% of the 3Q20 flow for the Holston River, PBN would have the most operational challenges under extreme low flow conditions, and therefore receives a lower scoring for the Low Flow Rating factor (Table 5). This situation is, however, ameliorated by flexibility that multi-purpose reservoirs, integrated river management and regulated flows provide to respond to low flow conditions.

Table 5. Rating of Alternative Sites on Comparison of Average and Low-Flow Characteristics			
Site	**Average Flow Rating**	**Low Flow Rating**	**Overall Rating**
BLN	5	5	5
HVN	5	4	5
PBN	5	3	4
YCN	5	5	5
MH	5	5	5

Sources for Low-Flow Statistical Analysis for Alternative Sites

Sources of Information for Calculation of Low Flow Statistics for Ranking Comparisons of Alternative Sites are discussed below and presented in Table 6.

Bellefonte - The BLN site is located on Guntersville Reservoir of the Tennessee River System. Flow at the site is regulated upstream by TVA's Nickajack Dam (dam closure on December 14, 1967) and downstream by TVA's Guntersville Dam (dam closure on January 16, 1939). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using TVA's water records of total flow (turbine and spill) from Nickajack Dam from 1968 through 2007.

Hartsville - The HVN site is located on Old Hickory Reservoir of the Cumberland River System. Flow at the site is regulated upstream by Cordell Hull Dam and Center Hill Dam and downstream by Old Hickory Dam (all U.S. Army Corps of Engineers' dams). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using TVA's water records of total flow (turbine and spill) from Cordell Hull Dam and Center Hill Dam from 1971 through 2007.

Phipps Bend - The PBN site is located on the Holston River of the Tennessee River System. Flow at the site is regulated upstream by TVA's Fort Patrick Henry Dam (dam closure on October 27, 1953). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using the USGS water records of flow measured at the "Holston River at Surgoinsville, TN" streamgage from 1954 through 1998 (the gage was removed from service in 1998).

Yellow Creek - The YCN site is located on Pickwick Reservoir of the Tennessee River System. Flow at the site is regulated upstream by TVA's Wilson Dam (dam closure on April 14, 1924) and downstream by TVA's Pickwick Dam (dam closure on February 8, 1938). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using TVA's water records of total flow (turbine and spill) from Wilson Dam from 1938 through 2007.

Murphy Hill - The MH site is located on Guntersville Reservoir of the Tennessee River System. Flow at the site is regulated upstream by TVA's Nickajack Dam (dam closure on December 14, 1967) and downstream by TVA's Guntersville Dam (dam closure on January 16, 1939). Flow statistics were computed by the Environmental Protection Agency's DFLOW program using TVA's water records of total flow (turbine and spill) from Nickajack Dam from 1968 through 2007.

Table 6. Sources of Information for Calculation of Low Flow Statistics for Rating Comparisons of Alternative Sites	
Site	**Source**
BLN	TVA Water Records of Nickajack Dam from 1968 to 2007.
HVN	TVA Water Records of Cordell Hull Dam and Center Hill Dam from 1971 to 2007.
PBN	USGS Water Records of flow at "Holston River at Surgoinsville," TN streamgage from 1954 to 1998.
YCN	TVA Water Records of Wilson Dam from 1938 to 2007.
MH	TVA Water Records of Nickajack Dam from 1968 to 2007.

Plant Safety Evaluation - Flooding Potential

This section reviews the flooding potential of the sites. Sites that were issued construction permits met the desired exclusionary and avoidance siting criteria. These criteria exclude potential sites within major wetlands and areas lower than the elevation of probable maximum flood (PMF). The PMF is the flood that can be expected from the most severe meteorologic and hydrologic conditions that are reasonably possible for an area. PMF values are typically used in the design of major dams and nuclear power plants.

The BLN site grade, at 628.6 ft. msl, is approximately 6 ft. above the PMF of 622.5 ft. The PBN site grade, at 1180 ft. msl, is 0.4 ft. above the PMF of 1179.6 ft. The HVN site grade, at 538 ft. msl, is 17.1 ft. above the PMF and maximum wave of 520.9 ft. The YCN site grade, at 530 ft. msl, is 84 ft. above the PMF of 446 ft. The MH greenfield site is approximately 2 ft. above the PMF; no maximum wave height data are available for this greenfield site. Table 1 includes the ratings for the flooding potential analysis. Because the five alternative sites are above the PMF, and satisfied the desired exclusionary and avoidance siting criteria,they were rated equally with respect to flooding potential. These data and their sources are shown in Table 7.

Table 7. Flood Elevations (100-Year Flood, 500-Year Flood and Probable Maximum Flood) for Alternative Candidate Sites

Phipps Bend

Holston River Mile	100-Year Elevation (feet)*	500-Year Elevation (feet)*	PMF Elevation (feet)*
119.53	1111.5	1115.8	
120.57	1113.6	1117.5	
121.40	1115.7	1119.3	
122.01	1117.6	1121.0	1179.6(1)
122.50	1119.6	1122.9	
122.83	1120.3	1123.6	
123.33	1121.7	1124.9	

Yellow Creek

Yellow Creek Mile	100-Year Elevation (feet)*	500-Year Elevation (feet)*	PMF Elevation (feet)*
5.00	419.5	419.6	446(2)
6.00	419.5	419.6	446(2)

Hartsville

Cumberland River Mile	100-Year Elevation (feet)*	500-Year Elevation (feet)*	PMF Elevation (feet)*
284.00	469.0	478.0	520.9(3)

Murphy Hill

Tennessee River Mile	100-Year Elevation (feet)*	500-Year Elevation (feet)*	PMF Elevation(A) (feet)*
370.00	597.5	598.1	617.7

Notes:

* Elevations are National Geodetic Vertical Datum (NGVD) 1929.

(A) Reflects the completed dam safety modifications to Fort Loudoun-Tellico, Nickajack, and Watts Bar Dams. Assumes Chickamauga Dam has not been modified. Actual elevation would be somewhat lower.

(1) Probable Maximum Flood, excluding possible wave runup.
From TVA Preliminary Safety Analysis Report (PSAR), Phipps Bend Nuclear Plant.

(2) Probable Maximum Flood, excluding possible wave runup.
From TVA PSAR, Yellow Creek Nuclear Plant.

(3) Probable Maximum Flood and maximum wave runup.
From TVA Environmental Reports, Hartsville Nuclear Plants, Vol. 3.

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Accident Effects Evaluation

To evaluate sites with respect to the effects of design-related accidents, three site characteristics relevant to these effects are considered: population, emergency planning considerations, and atmospheric dispersion. Each is evaluated and assigned a set of ratings.

Population

For population, it is assumed that sites that were issued construction permits meet requirements of 10 CFR 100.21 regarding population, specific exclusion areas, having a low population zone outside the exclusion area, and sufficient distance to high population centers. This criterion gives preference to low local site population densities (i.e., mean densities less than 500 people per square mi.). The ranking was based on consideration of distances to nearby population centers (i.e., at least 4 miles to pop. center of 25,000 or greater; 10 miles to pop. center of 100,000 or more; 20 miles to pop. center of 500,000 or more; and 30 miles to pop. center of 1 million or more) and population totals (2000 Census data) within 20 and 50-mi. site radii. Figures 1 through 5 depict the locations of BLN and the four alternative sites, the 20 and 50-mile site radii for each site, and the population estimates within these radii. For this criterion, sites further from population centers and having a lower local population are rated higher.

The BLN site (Figure 1) is about 39 mi. from Huntsville, Alabama, and the population within a 50-mi. radius is estimated to be about 1 million people. The nearest town is Hollywood, Alabama, which has a population of approximately 900.

The HVN site (Figure 2) is about 43 mi. from Nashville, Tennessee, and the population within a 50-mi. radius is estimated to be about 1.5 million people. The nearest town is Hartsville, Tennessee, which has a population of approximately 2500.

The PBN site (Figure 3) is about 15 miles to the west-southwest of Kingsport, TN, the closest population center, about 65 mi. from Knoxville, Tennessee, and the population within a 50-mi. radius is estimated to be about 900,000 people. The nearest town is Surgoinsville, Tennessee, which has a population of approximately 1800.

The YCN site (Figure 4) is about 30 – 40 mi. from the Florence – Muscle Shoals – Sheffield – Tuscumbia urban complex located east-southeast of this site, with a combined population of approximately 67,000. The estimated population within a 50-mi. radius is estimated to be about 440,000.

The MH site (Figure 5) is located about 30 miles from Huntsville, AL, and the population within a 50-miles radius is estimated to be about 945,000. The site is fairly remotely located from the region's population growth areas, with no urban centers in the immediate vicinity. The nearest town is Grant, AL which has a population of about 700.

Table 1 includes the ratings for the population evaluation. On the basis of lower population numbers, Yellow Creek is rated slightly higher than the other sites. Based upon similarity of population characteristics, these remaining sites are rated equally with respect to population and accident effects.

Emergency Planning

For the evaluation of emergency planning considerations, the four brownfield sites have relatively similar population densities (with YCN being the least densely populated), with similar expected population growth rates, and close access to major U.S. highways (Table 8). There is a prison under construction on a portion

of the HVN site, which could complicate emergency planning. Although the ramifications of a nearby prison population are not fully certain at this time, the HVN site is therefore ranked lower than the other brownfield sites for emergency planning purposes. Access roads for each of the alternative sites had been previously upgraded as part of the development of the site as a nuclear generation site and those for HVN, PBN and YCN have subsequently supported industrial park types of activity. The three other brownfield sites (BLN, PBN and YCN) appear not to be substantively different from each other with regard to emergency planning considerations; therefore, these three brownfield sites are rated equally in this comparison (Table 1). The greenfield site at Murphy Hill is rated lower for emergency planning due to a less updated system of access roads and more limited access from major U.S. highways.

Table 8. Distances to Nearest Major Highway

Miles	BLN	HVN	PBN	YCN	MH
Driving Miles to Nearest U.S. Highway	2.47 mi. to U.S. 72. Adequate road infrastructure.	1.41 mi. to TN State Route 25. Adequate road infrastructure.	2.41 mi. to U.S. 11W. Adequate road infrastructure.	5.01 mi. to MS State Route 25. Adequate road infrastructure.	3.54 mi. to AL State Route 227. Substantive upgrade needed.

Atmospheric Dispersion

For atmospheric dispersion, meteorological conditions at a site are monitored and evaluated as part of determining suitability for siting of nuclear plants. The observation of temperature and wind conditions over time provides input into statistical models. The models can be used to help predict probable atmospheric dispersion of releases. Topographic conditions also influence extreme weather and temperature variations. Sites with better meteorological conditions are rated higher (i.e., limiting conditions affecting the transport and dispersion of plant emission would have a lower rating).

Assessment of the meteorological conditions at the PBN, HVN, and YCN sites in the original TVA Environmental Statements did not indicate any limiting conditions. The meteorology of the PBN, BLN and the nearby MH sites do, however, provide a more limited range of atmospheric conditions for transport and dispersion of plant emissions due to their valley locations and prevailing wind directions.

Table 1 includes the ratings for the evaluation of atmospheric dispersion. Development at some of the brownfield sites affects final EAB analysis due to recent industrial growth at these sites. The HVN and YCN sites are rated slightly higher than BLN, PBN and MH with respect to meteorological conditions.

Operational Effects Evaluation

The impacts of severe accidents at each site would be similar. Since the site does not affect the design of the plant, the frequency and source term of severe accidents would be similar at each site. Furthermore, the differences in population are not sufficiently significant to affect the overall risk, which would be SMALL at each site.

Although the release pathways would be somewhat different at each site, the radiological impacts of normal operation at each site would be similar. The doses would be required to be maintained within regulatory limits, which will ensure that the impacts are SMALL.

All sites considered would be bounded by the analysis for operational effects of transportation and the uranium fuel cycle, and all are therefore assigned the same rating. No further comparison is made of these considerations at this time.

Transportation Safety Evaluation - Cooling Tower Drift

Operating plant cooling systems have the potential to create fog and ice hazards for local transportation routes. Sites with high frequencies of naturally occurring fog and ice events could be more adversely affected by cooling tower operations; sites with lower frequencies are rated higher.

Meteorological conditions at a site are monitored and evaluated as part of determining suitability for siting of nuclear plants. The observation of temperature and wind conditions over time provides input into statistical models. The models can be used to help estimate the effects of cooling tower drift. Topographic conditions also influence extreme weather and temperature variations. Sites with better meteorological conditions are rated higher.

Assessment in the original ESs for the sites of the meteorological conditions at the PBN, HVN, and YCN sites did not indicate any limiting conditions. As reflected in discussion in the original BLN ES, the meteorology of the BLN (and by reasonable assumption the nearby MH) site(s) provide a more limited range of atmospheric dispersion conditions for cooling tower drift. This situation may contribute to an increased severity and duration of ice and fog events. Table 1 includes the ratings for the transportation safety evaluation. The HVN, PBN, and YCN sites are rated slightly better (less likely) with respect to the potential for creating fog or ice conditions based upon site-specific meteorological conditions reported in the cited ESs.

Comparison of Environmental Criteria for Brownfield and Greenfield Sites

This discussion encompasses the basis for criteria and ratings related to Proximity to Natural Areas; Construction-Related Effects on Aquatic Ecology and Terrestrial Resources; and Operations-Related Effects on Aquatic Ecology and Terrestrial Resources.

Proximity to Natural Areas

In addition to the BLN site, four alternative sites were reviewed (1) to identify natural areas in the proximity of each site, and (2) to prioritize the sites according to their environmental superiority in that regard. In the case of natural areas, the environmentally superior ranking would be based on the number, proximity, and sensitivity of natural areas in proximity (within 3 miles) to the alternative sites. Source of the information on natural areas was TVA's Regional Natural Heritage database.

The PBN and MH sites have no natural areas within 3 mi. of the sites and are, therefore, rated highest. The BLN site has three TVA-designated Small Wild Areas within approximately 3 mi. of the site: Bell Island, Coon Gulf, and Section Bluff are TVA Small Wild Areas. The BLN site has historically been used for hunting, but this activity is no longer permitted. The HVN site has been used for hunting in cooperation with the Tennessee Wildlife Resource Agency (TWRA), but the site has been deleted as a hunting area in the new 2007 – 2008 TWRA Hunting Guide. This site is also immediately adjacent to the Cumberland River No. 2 State Mussel Sanctuary and is approximately 2 mi. from Old Hickory Wildlife Management Area. The YCN site is adjacent to the Tennessee-Tombigbee Waterway. Within 1 mi. of the YCN site are Sandstone Outcrops Protection Planning Site, Pickwick Lake Bluffs, Cooper Falls TVA Habitat Protection Area, Mississippi Wildlife and Recreation Land, and JP Coleman State Park. Other natural areas within a 3-mi. radius include Divide Section Wildlife Management Area and Lauderdale County State Wildlife Management Area. This site is rated lowest due to proximity to several natural areas. Based on proximity to natural areas and the number and sensitivity of such nearby areas which are non-TVA designated and managed, YCN is rated lowest, HVN ranks intermediate, BLN slightly better, and the PBN and MH sites are rated highest.

Construction-Related Effects on Aquatic Ecology

Many factors can be involved in the disruption of important aquatic species and their habitats. The objective of this subsection is to evaluate the candidate sites with respect to potential construction-related effects on important freshwater species and their habitats.

Regulatory Guide 4.7 (RG 4.7), *General Site Suitability Criteria for Nuclear Power Stations,* defines important plant and animal species if one or more of the following conditions apply:

- Species is commercially or recreationally valuable.
- Species is officially listed as endangered or threatened.
- Species presence ensures the well-being of another species indicated by either of the two bulleted items above.
- Species is a critical component of the structure and function of a valuable ecosystem.
- Species is a biological indicator of radionuclides in the environment.

Of particular concern are potential effects to habitat areas used by important species. These areas include those used in the following ways: breeding and nursery; nesting and spawning; wintering; and feeding.

The following types of siting criteria were used to evaluate the candidate sites:

- Exclusionary – Designated critical habitat of endangered species.
- Avoidance – Areas where threatened and endangered species are known to occur on-site.
- Suitability – Areas where limited potential effects are expected.

During this evaluation, no information was identified that indicated any of the sites met the exclusionary and avoidance criteria cited above. For purposes of comparing and rating the candidate sites, the ratings were based upon the following two suitability factors that influenced the overall site ratings: potential to affect federally listed threatened or endangered aquatic species or their habitats, and potential to affect other important key aquatic species, habitats or ecosystem functions. As noted earlier, individual factors were unweighted. The factors influencing overall individual site ratings are shown in Table 9. A rating of "5" is assigned to sites where no or low potential effects is expected (no effect or may affect - not likely to adversely affect T&E, or no or low for other key species or ecosystem functions). A rating of "3" is assigned to sites where the potential for effects to federally listed species is likely to affect but uncertain at this point due to limited information, or potential moderate effects could be anticipated to other important non-federally listed species or habitats. A rating of "1" is assigned where the proposed siting may affect or is likely to adversely affect, federally listed species, consequently, formal consultation is likely to be required due to potential impacts, or potentially severe impacts are expected to other important non-federally listed species or habitats. Intermediate ratings would be assigned upon the basis of best professional judgment.

Table 9. Ratings for Aquatic Ecological Factors Affecting Overall Rating for Potential Construction Effects

Site	Potential to Affect Federally-Listed Threatened or Endangered Aquatic Species or Their Habitats*, **	Potential to Affect Other Important Key Aquatic Species, Habitats or Ecosystem Functions	Overall Rating for Potential Construction Effects
BLN	5	5	5
HVN	5	5	5
PBN	5*	5	5
YCM	5	5	5
MH	5	5	5

* See text for definition of criteria ratings.

** Potential operational impacts on listed species, particularly the spotfin chub, are considered under the entrainment/impingement discussion of operational impacts.

The following summary of information, as well as that presented in Appendix A and in the referenced documents, was the basis of site ratings shown in Table 9. The following discussion is structured to provide the information and basis for ratings (Table 9) in the two areas: 1) potential to adversely affect threatened or endangered species or their habitat; and 2) potential to affect other important key species, habitats or ecosystem functions.

Potential to Affect Federally Listed Threatened or Endangered Aquatic Species or Their Habitat

As mentioned above, none of the sites had or potentially affected designated critical habitat of threatened or endangered aquatic species. Additionally, a search of the TVA Regional Natural Heritage data base indicated no known occurrences of threatened or endangered aquatic species on any of the sites. During this evaluation, no information was identified that indicated any of the sites met the exclusionary and avoidance criteria cited above. Although a number of listed species are historically reported from mainstream reaches of the Tennessee or Cumberland Rivers or major tributaries near the sites, construction of impoundments and their regulated releases (highly modified in thermal, flow distribution, water quality, and nutrient, characteristics), with the exception of the spotfin chub in the Holston River (PBN site), have eliminated local populations in large portions of rivers previously occupied by these species including areas adjacent to the candidate sites. Additionally, except for the spotfin chub, no individuals of federally listed species were collected in the general community sampling described for the various sites under the section titled, "Potential to Affect Other Important Key Species, Habitats or Ecosystem Functions."

Bellefonte - The occurrence records for threatened and endangered aquatic species in the vicinity of the BLN site are discussed in Sections 2.4, 4.3 and 5.3 of the ER.

Hartsville - In the TVA Regional Heritage data base, several federally listed mussel species were identified as records historically collected from the Cumberland River near this site (Table 10). A survey by divers in January 2001 in the Cumberland River in the vicinity of the HVN site, however, revealed that the once-thriving population of endangered mussels was no longer present (TVA, 2002).

Table 10. Federally Listed Aquatic Species Reported From Smith and/or Trousdale Counties, Tennessee

Common Name	Scientific Name	Federal Status	State Status
Mussels			
Dromedary pearlymussel	*Dromus dromas*	Endangered	Endangered
Cumberland combshell	*Epioblasma brevidens*	Endangered	Endangered
Orangefoot pimpleback	*Plethobasus cooperianus*	Endangered	Endangered
Ring pink	*Obovaria retusa*	Endangered	Endangered
White wartyback pearlymussel	*Plethobasus cicatricosus*	Endangered	Endangered
Yellow-blossom pearlymussel	*Epioblasma florentina florentina*	Endangered	Endangered
Purple catspaw	*Epioblasma obliquata obliquata*	Endangered	Endangered
Pink mucket	*Lampsilis abrupta*	Endangered	Endangered
Rough pigtoe	*Pleurobema plenum*	Endangered	Endangered
Appalachian monkeyface	*Quadrula sparsa*	Endangered	Endangered

Phipps Bend - Several state- and federally-listed aquatic species are known from Hawkins County, Tennessee (Table 11). The spotfin chub (federally listed as Threatened) is routinely collected at the HRM 118 IBI site and is likely present in the Holston River adjacent to the PBN site. None of the eight federally listed mussel species reported from Hawkins County has been collected from the main stem of the Holston River in the vicinity of the Phipps Bend site. No state- or federally listed aquatic species are known to occur on the Phipps Bend site itself. The Cumberland bean mussel and purple bean mussel are reported from Beech Creek, a tributary to the Holston River that enters the river at approximately river mile 109, but are not known to occur in the main stem Holston River.

Table 11. Federally Listed Aquatic Species Reported from Hawkins County, Tennessee

Common Name	Scientific Name	Federal Status	State Status
Mussels			
Birdwing pearly mussel	*Lemiox rimosus*	Endangered	Endangered
Fine-rayed pigtoe pearly mussel	*Fusconaia cuneolus*	Endangered	Endangered
Cumberland bean pearly mussel	*Villosa trabalis*	Endangered	Endangered
Turgid blossom pearly mussel	*Epioblasma turgidula*	Endangered	Endangered
Shiny pigtoe	*Fusconaia edgariana*	Endangered	Endangered
Cumberland monkeyface pearly mussel	*Quadrula intermedia*	Endangered	Endangered
Green blossom pearly mussel	*Epioblasma torulosa gubernaculum*	Endangered	Endangered
Purple bean	*Villosa perpurpurea*	Endangered	Endangered
Fish			
Spotfin chub	*Cyprinella monacha*	Threatened	Threatened

Murphy Hill - Several state- and federally listed aquatic species are known from Marshall County, Alabama (Table 12). However, due to the impoundment of the Tennessee River during the creation of Guntersville Reservoir, none of these species is currently known to occupy areas on or adjacent to the Murphy Hill site.

Table 12. Federally Listed Aquatic Species Reported from Marshall County, Alabama

Common Name	Scientific Name	Federal Status	State Status
Mussels			
Pink mucket pearlymussel	*Lampsilis abrupt*	Endangered	Protected
Shiny pigtoe pearlymussel	*Fusconaia cor*	Endangered	Protected
Fine-rayed pigtoe mussel	*Fusconaia cuneolus*	Endangered	Protected
Orange-footed pimpleback mussel	*Plethobasus cooperianus*	Endangered	Protected
Rough pigtoe mussel	*Pleurobema plenum*	Endangered	Protected
Slabside pearlymussel	*Lexingtonia dolabelloides*	Candidate	Protected
Amphibians			
Black Warrior waterdog	*Necturus alabamensis*	Candidate	Protected
Fish			
Snail darter	*Percina tanasi*	Threatened	Protected
Turtles			
Flattened musk turtle	*Sternotherus depressus*	Candidate	Protected

Yellow Creek - Two federally listed aquatic species are known from Tishomingo County, Mississippi (Table 13. However, due to the impoundment of the mainstream Tennessee River and Yellow Creek during the creation of Pickwick Reservoir and habitat alterations in streams on the Yellow Creek site, none of these species is currently known to occupy areas on or adjacent to the Yellow Creek site.

Table 13. Federally Listed Aquatic Species Reported from Tishomingo County, Mississippi

Common Name	Scientific Name	Federal Status	State Status
Mussels			
Cumberlandian combshell	*Epioblasma brevidens*	Endangered	Endangered
Slabside Pearlymussel	*Lexingtonia dolabelloides*	Candidate	Protected

Potential to Affect Other Important Key Aquatic Species, Habitats or Ecosystem Functions

Habitats and topography at the BLN, HVN, PBN, and YCN sites have already been heavily disturbed during the original construction activities at these brownfield sites, and through their subsequent use to date as sites for industrial development or maintenance (BLN, HVN, PBN and YCN). The MH site and portions of the TriState Industrial Park surrounding the former TVA YCN site (should a portion of it be needed) are the only major portions in a less disturbed state, although some recovery of habitat or addition of habitat type (e.g., wetlands) may have occurred over time in minor areas of the other sites. Ratings were also assigned under the assumption that for each site: 1) applicable regulatory standards and permit requirements and conditions would be met for any site chosen; and 2) that best management and construction practices similar to those described in subsequent environmental documents (i.e., the TVA ER submitted with the BLN COLA and subsequent NRC EIS under development) for the BLN site and associated ancillary infrastructure would also apply at the alternative sites if one were chosen. This screening level of information is not intended to be exhaustive, but is intended to communicate what is known about the sites and whether or not the project design features and characteristics of habitat or communities known to occur at or near a site would indicate potential for impacts to important resources or habitats of special concern.

Using available information, the candidate sites were evaluated to discern 1) whether or not other important species and habitats were present, and 2) whether or not they were likely to be affected by locating nuclear generation at each site. Information on important species was obtained and communities characterized from the previous environmental studies conducted for the original ESs for the sites. Where noted in the text, other available information sources were utilized to update. For discussion of federally listed species see the previous section of this document. The suitability of a site was evaluated according to the number of resource areas in which limited potential effects are expected, as directly correlated to the number of important or unique aquatic resources that may occur at the site. Table 1 includes the ratings for the evaluation of construction-related effects on aquatic ecology. Based on the information for terrestrial resources discussed below, in the attached Appendix, and in the material of the ER describing the BLN site, the BLN and alternative sites are rated equally high (i.e., exhibiting little likelihood of substantive effects key living resources or habitats).

Bellefonte - Aquatic resources for the proposed BLN site and potential impacts are described in Sections 2.4, 4.3, and 5.3 of the BLN ER. The following discussion is in regards to the remaining alternative sites.

Hartsville - Aquatic habitats that could be potentially impacted by the proposed development on the HVN site are the Cumberland River (Old Hickory Reservoir), and several streams and constructed ponds present on the site. Aquatic communities in adjacent areas of Old Hickory Reservoir may be impacted by activities undertaken in riparian zones that change the topography of the shoreline, reduce the usefulness of shoreline areas for spawning and feeding, or alter shoreline vegetation, particularly the loss of a wooded shoreline. The bank along the Cumberland River is almost entirely wooded, with sparse understory vegetation in areas immediately adjacent to the river. Most areas on top of the riverbank, and adjacent to formerly cleared areas are very dense, woody, old field habitats, except for small areas where access points and structures were constructed in association with the canceled nuclear plant.

TVA biologists most recently collected monthly experimental gill net and electrofishing samples near the site from September 1992 through January 1993. Thirty-five species, none of which is protected species, were collected. Gizzard and threadfin shad comprised the largest group of fish in the sample; game fish that are more abundant were bluegill, largemouth bass, and sauger. With the exception of a population of "dirty darters," which are considered in need of management by the Tennessee Wildlife

Resources Agency, the aquatic fish fauna known from the site, nearby tributaries or from the Cumberland River in this reach are indicative of common assemblages found in the region. As noted for Proximity to Natural Areas above, this site is also immediately adjacent to the Cumberland River No. 2 State Mussel Sanctuary. Several mussel species that are federally listed as endangered have historically been collected from the Cumberland River near this site. As discussed earlier, a recent survey indicates the local population is no longer there in the immediate vicinity of the site. There are no other unique or special aquatic habitats known to occur on or in the vicinity of HVN.

Phipps Bend - TVA employs an Index of Biotic Integrity to assess environmental quality of free-flowing streams and some tailwater areas in the Tennessee River system, by applying ecologically based metrics to resident aquatic communities. As part of its long-term Vital Signs Monitoring Program TVA has a "fixed station" site at Holston River mile (HRM) 118, just downstream of the PBN site. This site was sampled yearly from 1990 to 1997 (with the exception of 1995), and has been sampled every other year beginning in 2001. This locality has consistently rated in the fair/good or good categories during recent sampling (2001 – 2007). This river supports a warmwater fishery common to the area. The fish assemblage includes such sport fish as largemouth, smallmouth, and spotted bass. There are no known unique or special habitats on or in the vicinity of PBN.

Yellow Creek - TVA monitored Pickwick Reservoir near the YCN site annually from 1991 through 1994 to establish baseline data on the reservoir's ecological health under a range of weather and flow conditions. Pickwick is now evaluated every other year as part of TVA's Vital Signs Monitoring Program. The overall ecological condition in Pickwick Reservoir rated good in 2004, with the highest score to date. The inflow rating, which is based on fish and benthos, also was the highest to date in 2004 and contributed to the overall higher score for the reservoir. Pickwick has scored about the same every year — either high fair or good — depending primarily on chlorophyll concentrations, which are affected by reservoir flows, and conditions in the Bear Creek embayment, which generally rate lower than at other monitoring locations on the reservoir. Common sport fish in the area are sauger, crappie, black bass and several species of sunfish. The local fauna is typical of reservoirs of the Tennessee River in north Alabama and no unique or special aquatic habitats are known on or in the vicinity of YCN.

Murphy Hill - TVA monitored Guntersville Reservoir annually from 1991 through 1994 to establish baseline data on the reservoir's ecological health under a range of weather and flow conditions. Guntersville is now evaluated every other year as part of TVA's Vital Signs Monitoring Program. The ecological health condition of Guntersville Reservoir has rated good consistently since TVA's monitoring program began, and 2004 was no exception. As in past years, ecological health indicator scores for the reservoir were among the highest observed for all TVA reservoirs. The local fauna is typical of reservoirs of the Tennessee River in north Alabama. There are no unique or special aquatic habitats known on or in the vicinity of YCN.

Construction-Related Effects on Terrestrial Ecology

During this evaluation, no information was identified that indicated any of the sites met general exclusionary and avoidance criteria for terrestrial impacts, as they were identified earlier in the discussion for aquatic ecology. For purposes of comparing and rating the candidate sites, the ratings were based upon the following two suitability factors, which influenced the overall site ratings: potential to affect federally listed threatened or endangered species or their habitats, and potential to affect other important key terrestrial species, habitats or ecosystem functions. As noted earlier, individual factors were unweighted. The factors influencing overall individual site ratings are shown in Table 14. A rating of "5" is assigned to sites where no or low potential effects are expected (no effect or may affect - not likely to adversely effect for T&E, or no or low for other key species or ecosystem functions). A rating of "3" is assigned to sites where the potential for effects to federally listed species is likely may affect but uncertain at this point due to limited information, or potential moderate effects

could be anticipated to other important non-federally listed species or habitats. A rating of "1" is assigned where the proposed siting may affect-likely to adversely affect, federally listed species and formal consultation is likely to be required due to potential for impacts, or potentially severe impacts are expected to other important non-federally listed species or habitats. Intermediate ratings would be assigned upon the basis of best professional judgment.

Table 14. Ratings for Terrestrial Ecological Factors Affecting Overall Rating for Potential Construction Effects

Site	Potential to Affect Federally Listed Threatened or Endangered Terrestrial Species or Their Habitats*	Potential to Affect Other Important Key Terrestrial Species, Habitats or Ecosystem Functions*	Overall Rating for Potential Construction Effects
BLN	5	5	5
HVN	5	5	5
PBN	5	5	5
YCN	5	5	5
MN	5	5	5

* See text for definition of criteria ratings.

The following summary of information, as well as that presented in Appendix A and in the referenced documents was the basis of site ratings shown in Table 14. The following discussion is structured to provide the information and basis for ratings (Table 14) in the two areas: 1) potential to adversely affect threatened or endangered species or their habitat; and 2) potential to affect other important key species, habitats or ecosystem functions.

Potential to Affect Federally Listed Threatened or Endangered Terrestrial Species or Their Habitat

As mentioned above, none of the sites had or potentially affected designated critical habitat of federally listed terrestrial species. Additionally, a search of the TVA Regional Natural Heritage data base indicated no known occurrences of threatened or endangered terrestrial species on any of the sites. During this evaluation, no information was identified that indicated any of the sites met the exclusionary and avoidance criteria comparable to those identified in the aquatic ecology section above. Although none has been observed on the individual sites, the listed bat species forage distances along the Tennessee or Cumberland Rivers.

Bellefonte - The occurrence records for threatened and endangered terrestrial species in the vicinity of the BLN site are discussed in Sections 2.4, 4.3 and 5.3 of the ER.

The U.S. Fish and Wildlife Service (USFWS) list of threatened, endangered and candidate species for Smith and Trousdale counties, Tennessee, includes two terrestrial species, including one mammal species and one plant species (Table 15). Of the federally listed species potentially present, only the gray bat has been observed near the Hartsville site. No federally listed threatened or endangered species are known to occur on the Hartsville site.

Table 15. Federally Listed Terrestrial Species Reported From Smith and/or Trousdale Counties, Tennessee			
Common Name	**Scientific Name**	**Federal Status**	**State Status**
Mammals			
Gray bat	*Myotis grisescens*	Endangered	Endangered
Plants			
Short's bladderpod	*Lesquerella globosa*	Candidate	

Phipps Bend – The USFWS list of threatened, endangered and candidate terrestrial species for Hawkins County, Tennessee includes two mammals. Of these species potentially present in the area (Table 16), only the gray bat has been observed near the Phipps Bend site. No federally listed threatened or endangered plant species are known to occur on the Phipps Bend site.

Table 16. Federally Listed Terrestrial Species Reported from Hawkins County, Tennessee			
Common Name	**Scientific Name**	**Federal Status**	**State Status**
Mammals			
Gray bat	*Myotis grisescens*	Endangered	Endangered
Indiana bat	*Myotis sodalis*	Endangered	Endangered

Murphy Hill - The USFWS list of threatened, endangered and candidate terrestrial species for Marshall County, Alabama, includes one bird, two mammals and two plants. Of the federally listed species potentially present in the area (Table 17), only the gray bat has been observed near the MH site. No federally listed threatened or endangered species are known to occur on the MH site.

Table 17. Federally Listed Terrestrial Species Reported from Marshall County, Alabama			
Common Name	**Scientific Name**	**Federal Status**	**State Status**
Birds			
Red-cockaded woodpecker	*Picoides borealis*	Endangered	
Mammals			
Gray bat	*Myotis grisescens*	Endangered	Endangered
Indiana bat	*Myotis sodalis*	Endangered	Endangered
Plants			
Price's potato bean	*Apios priceana*	Threatened	
Green pitcher plant	*Sarracenia oreophila*	Endangered	

Yellow Creek - The USFWS list of threatened, endangered and candidate terrestrial species for Tishomingo County, Mississippi, includes two mammals. Of the federally listed species potentially

present in the area (Table 18), only the gray bat has been observed near the YCN site. No federally listed threatened or endangered species are known to occur on the YCN site.

Table 18. Federally Listed Terrestrial Species Reported from Tishomingo County, Mississippi

Common Name	Scientific Name	Federal Status	State Status
Mammals			
Gray bat	*Myotis grisescens*	Endangered	Endangered
Indiana bat	*Myotis sodalis*	Endangered	Endangered

Potential to Affect Other Important Key Terrestrial Species, Habitats or Ecosystem Functions

Many factors can be involved in disruption of important terrestrial species and their habitats. The objective of this subsection is to characterize the candidate sites as to whether or not there are types of important species, resources or habitats present and susceptible to potential impacts (see the previous discussion of RG 4.7 for the definition of important plant and animal species). For a discussion of federally listed species see the previous section of this document.

The alternative sites were evaluated with respect to information available on important species/ habitats, groundcover, and National Wetland Inventory (NWI) mapped wetlands (following section). Data and information utilized (Appendix A) was predominantly obtained from: 1) recent searches for each candidate site for listed species or occurrences of important species or resources (e.g., rookeries) in the TVA Regional Natural Heritage data base; 2) the previous TVA environmental studies originally conducted for the ESs for the sites; and 3) where noted in the text more recent environmental reviews or surveys. During this evaluation, no information was found to indicate that any of the sites met the exclusionary and avoidance criteria; the evaluation was thereby focused on the relative suitability of each site. The available information (primarily that of the earlier TVA ESs prepared for the sites) indicates that for the terrestrial habitats, available terrestrial wildlife habitats on the brownfield sites are not of high quality because of formerly intense agricultural uses, as well as clearing and site alteration for power plant construction. Remaining habitats support common assemblages of terrestrial plant and animal species for the areas. Little, if any, additional impact would appear to occur to important or unique terrestrial resources due to the use of alternative brownfield sites. As discussed in Appendix A, some degree of impact to state-listed plants may occur at the MH or YCN sites if such species were subsequently found in potential habitat that would be within a project footprint. Further construction for sites that were issued construction permits by NRC (or AEC) would not substantially disrupt the available wildlife habitats in the area. Table 1 includes the ratings for the evaluation of construction-related effects on terrestrial ecology. Based on the information reviewed, BLN and the alternative sites rated equally high for this criterion.

Bellefonte - Terrestrial resources for the proposed BLN site and potential impacts are described and characterized at length in Sections 2.4, 4.3, and 5.3 of the ER.

Hartsville – The Hartsville site was previously used intensively for agricultural purposes for many years. At the time TVA acquired the site, it consisted primarily of pasture, cropland and understocked woodland (TVA FES). The human activities had continuously disrupted plant and animal habitats and communities. The site had no unusual terrestrial habitats, primarily because of the intense agricultural activity. Those areas of the former TVA site not currently under pavement, buildings or maintenance associated with the existing industrial park consist primarily of old fields undergoing early successional plant growth with some minor area of riparian woodlands along the river.

Distinct groups of terrestrial wildlife are found in association with the vegetation types occurring on the HVN site. Common amphibians and reptiles often found in old field habitats include American toad, upland chorus frog, and black racer. Birds found in this type of habitat include song sparrow, eastern towhee, eastern wild turkey, and black vulture. Resident mammals include eastern cottontail rabbit, white-tailed deer, and coyote. Amphibians and reptiles commonly found in riparian habitats include bullfrog, green frog, red-spotted newt, and northern water snake. Birds found in this type of habitat include Carolina wren, eastern phoebe, barred owl, and American woodcock. Mammals include beaver, muskrat, raccoon, and white-tailed deer. Seeps and damp rock outcrops with small pools of water are found on the site. These areas provide suitable habitat for frogs and salamanders and are likely used as a water source by a variety of wildlife species.

Amphibians and reptiles at HVN found in upland woodlands include spring peeper, gray tree frog, eastern box turtle, and gray rat snake. Birds commonly found in this type of habitat include red-tailed hawk, American crow, eastern tufted titmouse, and Carolina chickadee. Mammals common to the area include eastern gray squirrel, white-footed mouse, woodland vole, and eastern chipmunk. The TVA Regional Natural Heritage Program database indicated that three state-listed animal species—Bewick's wren, Allegheny woodrat, and southeastern shrew—occur in Smith and Trousdale Counties and could potentially occur on-site.

Several species of game animals occur on the HVN project area. The heavily modified habitats, which are abundant on the site, provide suitable habitat for white-tailed deer and eastern wild turkey. These species are quite common in the project area. Other game species such as beaver, eastern gray squirrel, eastern cottontail rabbit, American woodcock, and northern bobwhite quail are also found on the site. Ponds and wetlands on the area provide resting and foraging habitat for waterfowl including wood duck, Canada goose, mallard, and hooded merganser.

Phipps Bend - For the PBN site, the wildlife distributions are similar to those found at HVN. As described in the original TVA FES, the Phipps Bend site was previously used for agricultural purposes, primarily pasture and cropland, for many years prior to the construction of the partially-built PBN nuclear plant. This cultivation and other human activity continually disrupted the plant and animal communities and left most of the area in a relatively disturbed state. At the time TVA acquired the property, about 80 percent of the approximately 1250 acres was cleared (mostly for hay production) and the remainder was in woods. Habitats were subsequently further seriously disturbed by the TVA construction activities for PBN in the 1970s. Currently large portions of the site that are not under pavement or buildings or undergoing active maintenance around buildings of the occupied industrial park, are in early plant successional stages. The remaining small wooded areas consist of predominantly mixed hardwoods with small stands of cedar-hardwood, pine-hardwood and Virginia pine. River level fluctuations result in a riparian vegetation zone near the Holston River occupied by wetland floral species. Important species in this type are wingstem, jewelweed, poison hemlock, boneset, joe-pye weed and marsh purslane.

There are no known uncommon terrestrial plant communities in the vicinity of Phipps Bend. There are several state-listed plant species known to occur within 10 miles of the project site, but a review of maps and knowledge of rare plants in the region indicates habitat for these species do not occur within or adjacent to the site; therefore, no significant impacts to these botanical resources are expected if this site were selected.

Wildlife habitat is primarily limited to the portions of the site not currently utilized for industrial park. The remaining mix of successional habitats, small stands of wooded areas and riparian zone give support populations of bobwhite quail, gray squirrel, raccoon, cottontail rabbit, red and gray fox, mourning dove, white-tail deer, wood duck and other waterfowl along the Holston River. No important wading bird

colonies are reported within 3 mi. of the Phipps Bend site. Two state-listed terrestrial species (barn owl and Virginia rail) have been seen on the Phipps Bend site.

Yellow Creek – At the time of acquisition by TVA (TVA FES), the YCN site was predominantly forested, with habitats characterized as flood plain forest, ravine forest, upland draw canopy forest, beech and terrace canopy forest, upland slopes, ridges and mixed. Much of the former YCN site was subsequently disturbed by construction activities for the original, partially-completed power plant, and terrestrial habitats in areas not currently part of the existing industrial park, consist primarily of returning early- to mid-successional vegetation. Relatively undisturbed forest areas are dominated by oak and hickory species mixed with some pines. The surrounding landscape consists of similar forested habitat. Along with the historic record of the Federal Candidate species, *Platanthera integrilabia* (monkey-face orchid), there are 16 state-listed species recorded from the Yellow Creek Reservation. Even though much of the Yellow Creek Site has been highly disturbed, a review of maps and knowledge of rare plants in the region indicates that remnant habitat for these species could occur within or adjacent to the site; therefore substantive impacts to local populations of these state-listed species could occur if this site were chosen.

The deciduous forested areas provide habitat for bird species such as wild turkey, Carolina chickadee, downy woodpecker, American crow, red-eyed vireo, and tufted titmouse. Other animals likely occurring in this habitat include white-tailed deer, eastern gray squirrel, whitefooted mouse, slimy salamander, eastern box turtle, and copperhead.

Birds common in early successional habitats include Carolina wren, eastern bluebird, white-eyed vireo, northern cardinal, and indigo bunting. Common mammals include striped skunk, eastern cottontail rabbit, white-tailed deer, Virginia opossum, and various rodents. Reptiles often found in early successional habitats include racers, black rat snake, and eastern garter snake. No important wading bird colonies are reported within 3 mi. of the site.

Murphy Hill - Habitats for terrestrial animals at the MH site are similar to conditions at the Bellefonte site. These two sites are located in the same physiographic region, and both sites border Guntersville Reservoir. The vegetative cover of the MH site is a diverse mosaic of forests and fields resulting from the wide range of soil and topographic conditions and by past and present land uses. At time of acquisition in the 1970's, approximately one-fourth of the site was non-forested with the remainder being woodlands. Nonforested areas consisted and consist of open or reverting fields undergoing early- to mid-successional stages. Woodland area consists of mixed hardwoods and pine. A review of maps and information regarding rare plants in the region indicates habitat for waterweed, along the banks of Guntersville Reservoir, is present in the project area. In addition the wooded undisturbed areas of Murphy Hill provides suitable habitat for false helleborne and southern red trillium; therefore, substantive impacts to local populations of these state-listed species could occur if these species were found to be present in site-specific studies.

The original TVA FES for the site indicates habitat diversity created on this site was such that a total of more than 200 species of terrestrial vertebrates were observed or collected during TVA investigations of the site. Large numbers of migrant wintering waterfowl populations are present on Guntersville Lake during the winter and fall migration periods. There are no records of important wading colonies within 3 mi. of the project site.

Construction-Related Effects on Wetlands

Wetlands are recognized as a vital part of the ecosystem. Activities in wetlands are regulated under Section 404 and Section 401 of the Clean Water Act, and Executive Order 11990 (Strand 1997). Section 404 implementation requires activities in jurisdictional wetlands be authorized through a Nationwide

General Permit or Individual Permit issued by the U.S. Army Corps of Engineers (USACE). Section 401 requires water quality certification by the States for projects permitted by the federal government). In Tennessee, activities that may alter aquatic resources, (e.g., wetlands) are also regulated by the Tennessee Department of Environment and Conservation through the Aquatic Resource Alteration Permit program, under the authority of the Tennessee Water Quality Control Act of 1977. Alabama and Mississippi do not have specific regulations regarding wetlands and aquatic resources. However, the Alabama Department of Environmental Management and the Mississippi Department of Environmental Conservation administer Section 401 water quality certifications in their respective states. Executive Order 11990 requires federal agencies to minimize wetland destruction, loss, or degradation, and preserve and enhance natural and beneficial wetland values, while carrying out agency responsibilities.

The objective of this subsection is to evaluate the sites with respect to potential impacts from construction-related dewatering or filling activities on area wetlands.

Information about wetlands at each site was obtained using aerial photogrammetry at each site, NWI data, soil survey data, and hydric soil lists for Alabama, Mississippi, and Tennessee (Miller and Murohree 1983, Moore et al. 1979, Soil Survey Staff 2007). Dates of NWI aerial photos were: Murphy Hill – 1983; Phipps Bend – 1980; Hartsville – 1980; Yellow Creek – 1980; and Bellefonte – 1981. The wetland information was obtained by the USFWS using high altitude aerial photography. The wetland types were classified in accordance with *Classification of Wetlands and Deepwater Habitats of the United States (FWS/OBS - 79/31 December 1979).*

Bellefonte - For BLN, 40 ac. of scrub-shrub and forested wetlands exist within the proposed site boundary. A wetland delineation conducted by TVA in 2006 identified six additional forested wetlands covering a total of approximately 11 ac. in the vicinity of the proposed construction area. These six wetlands were not shown on NWI maps.

Hartsville - There are approximately 36 ac. of emergent and forested wetlands at the HVN site. Most of these are associated with Corley Branch, Dixon Creek, and the shoreline of Old Hickory Reservoir (Cumberland River). Most of these wetlands are concentrated around the eastern, western, and southern boundaries of the survey area.

Phipps Bend - At the PBN site, there are approximately 11 ac. of emergent and forested wetlands. These wetlands are associated with a large 57-ac. open water complex in the floodplain of the Holston River along the eastern boundary of the survey area.

Yellow Creek - There are approximately 11 ac. of emergent and forested wetlands at the YCN site. Wetlands are concentrated in the southwestern corner of the site and are generally associated with the Yellow Creek embayment and Tackett Branch.

Murphy Hill - There are approximately 3 ac. of emergent, scrub-shrub, and forested wetlands at the MH site. These wetlands are located in the north-central part of the site near the Guntersville Reservoir shoreline.

Table 1 includes ratings for the wetlands assessment. Stringent environmental laws regulate dewatering or filling of most wetlands. For purposes of this comparison, most potential construction areas are located sufficiently far away from these relatively minor areas of wetlands (when compared to the available site acreages) that it would be possible to avoid most existing wetlands. Therefore, potential adverse impacts from dewatering or filling are expected to be avoided or minimized such that any potential impacts would be insignificant, and all sites are rated equally.

References for Wetlands Evaluation

1. Miller, K. H., and L. C. Murphree. 1983. Soil Survey of Tishomingo County, Mississippi. Soil Conservation Service, United States Department of Agriculture in cooperation with Mississippi Agricultural and Forestry Experiment Station.

2. Moore, C. L., B. T. Birdwell, W. C. Mangum, and C. McCowan. 1979. Soil Survey of Hawkins and Hancock Counties, Tennessee. Soil Conservation Service, United States Department of Agriculture in cooperation with Tennessee Agricultural Experiment Station.

3. Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for Jackson and Marshall Counties, Alabama and Smith and Trousdale Counties, Tennessee [Online WWW]. Available URL: "http://soildatamart.nrcs.usda.gov" [Accessed *August 9, 2007*].

4. Strand, M. N. 1997. Wetlands Deskbook, 2nd Edition. The Environmental Law Reporter, Environmental Law Institute, Washington, D.C.

Operations-Related Effects on Aquatic Ecology

The discussion and evaluation of the operations-related effects on aquatic ecology are primarily related to environmental effects from the operation of condenser cooling water systems. These typically include expected thermal release effects, as well as entrainment and impingement effects.

Thermal Release Effects

The objective of this subsection is to address the relative suitability of the candidate sites with respect to potential thermal release effects on receiving water bodies. The AP1000 plant design needs no external ultimate heat sink. During normal operation, the AP1000, like other types of nuclear power plants, uses external cooling water. Heat removed by the condenser cooling water system generates the majority of the thermal releases. An important consideration in evaluating the suitability of the sites was the proposed design of the condenser cooling water system at each site. Heat rejected by the same plant at different locations would remain virtually unchanged, and makeup water for the auxiliary cooling systems would be essentially the same at each site. The use of closed-cycle cooling is a best available technology for minimizing the amount of water withdrawal required.

The effect of returning unconsumed water (primarily that not evaporated from the cooling towers) to the receiving water body would be primarily a function of 1) the percentage of total flow that heated return water constituted in comparison to average and low flow in the receiving water body, and 2) whether or not the receiving water body is a reservoir, regulated river or free-flowing river. An additional factor would be the thermal limits imposed by the pertinent NPDES permit. Since the purpose of such thermal limits at any site is to be protective of aquatic and water resource values, the flow comparison becomes the primary factor to consider. Because it was determined that no exclusionary or avoidance criteria were exceeded by these thermal discharges, sites with larger amounts of available cooling water are rated higher.

Table 1 includes the ratings for the thermal discharge analysis. Bellefonte and the alternate sites exhibit acceptable flow characteristics for siting generation; however, they may be parsed upon their relative ability to assimilate heat and, although in a regulatory-defined area, likelihood to affect aquatic resources in the receiving water body. As noted in the above discussion on cooling system suitability, the YCN site has a larger flow rate of dilution cooling water available. Thus, the YCN site is

rated more suitable than the other sites with respect to cooling water availability. Similarly, based upon the flow comparisons as discussed under cooling system suitability, PBN is ranked lowest with regard to the potential for creating the most substantive issues for avoiding thermal effects to the receiving water body.

Entrainment and Impingement Effects

When cooling water is pumped from water bodies, two environmental effects of concern can occur. Entrainment refers to drifting organisms passing through the cooling water system. Small fish, fish eggs, plankton, and other aquatic/marine organisms experience high mortality rates as they pass through cooling water pumps and heat exchangers. Impingement refers to larger organisms that are screened out of the cooling water at the intake structure. Impinged organisms can include large fish, crustaceans, turtles, and other aquatic/marine organisms that are unable to avoid the high intake velocities near the intake structure, and are thereby trapped on the intake screens.

No exclusionary or avoidance criteria apply to entrainment and impingement effects from the operation of condenser cooling water systems, similar to the above discussion on thermal discharges. The objective of this subsection is to address the relative suitability of the candidate sites with respect to potential entrainment and impingement effects.

Concerns about entrainment and impingement losses are resource dependent and vary on a site-to-site basis. Typically, power plants with once-through cooling water systems have higher entrainment and impingement effects than power plants with closed-cycle cooling water systems, such as proposed for the siting of AP1000 units at the alternative sites. Low-flow conditions can also increase the potential for entrainment and impingement to occur.

Table 1 includes the overall ratings for the entrainment and impingement effects analysis. Three factors (Table 14) were utilized to influence these overall ratings: 1) the presence of endangered species that could be entrained or impinged; 2) relative densities of young fish reported in the references of Table 19; and 3) potential for occurrence of low flow situations exacerbating the potential for increased entrainment/impingement. The candidate sites were evaluated with respect to their relative potential for entrainment and impingement effects from closed-cycle cooling water systems. In general, closed cycle cooling, which utilizes much less water than open cycle cooling systems, substantively reduces the potential for entrainment and impingement impacts. Based upon the criteria identified above, and because similar systems would be provided for similar makeup water requirements, the BLN, HVN, MH sites are overall rated equally on this criterion. Although the impact would also be related to the numbers of juvenile fish actually entrained once a site-specific plant were designed and operational, and the relative percentage removed from the reservoir, the YCN site rated slightly lower due to the presence of an extensive number of juvenile fish (Table 20). PBN is rated lower due to the potential for entraining or impinging the federally listed spotfin chub and the greater potential for low flows to contribute to greater impingement or entrainment at a higher frequency of occurrence.

Table 19. Densities of Young of Year Fish and Standing Stocks of Fish in the Reservoir Where Alternative Sites Are Located.

Site	Young of Year (YOY) Fish – Years Samples	Annual Average Total Numbers YOY Fish Per 1000 m^3 Water Volume	Standing Stock Years Sampled	Standing Stock Densities of Fish (by weight) kg/ha
BLN	1975 - 1983	54,783 [1]	1971 - 1984 and 1985 - 1993	297 and 371, respectively [2]
PBN	1975 - 1976	2103 [1]	1975	5 - 29 [3]
YCN	1975, 1976, 1979, 1980	185,690 [1]	1974, 1975	67.2 [5]
HVN	1974, 1975	6776 [6]	1974, 1975	684 - 118.5 [6]
MH	1982	135,571 [1]	1981 - 1982	333.8 [4]

1. TVA, 1983. Summary of TVA Larval Fish Investigations. Tennessee Valley Authority, Data Services Branch, Knoxville, Tennessee
2. TVA, 1997. Final Environmental Impact Statement for the Bellefonte Conversion Project. Tennessee Valley Authority, Vol. 1
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4. TVA, 1983. First Preoperational Assessment of Water Quality and Biological Resources of Guntersville Reservoir in the Vicinity of the Proposed Murphy Hill Coal Gasification Project. Tennessee Valley Authority. Office of Natural Resources. 287pp.
5. TVA, Final Environmental Statement. Yellow Creek Nuclear Plants 1 and 2, Vol. 1. Tennessee Valley Authority, Office of Natural Resources.
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Table 20. Factors Contributing to Overall Rating of Sites on the Basis of Potential Entrainment/ Impingement (E/I)				
Sites	**Known Presence of Federally Listed Fish Species Susceptible to E/I**	**Densities of YOY Fish and Fish Standing Stocks Relative Potential for E/I**	**Potential for Low Flows to Contribute to Higher E/I**	**Overall Rating**
BLN	5	5	5	5
HVN	5	5	4	5
PBN	3	5	3	4
YCN	5	3	5	4
MH	5	4	5	5

Operations-Related Effects on Terrestrial Ecology - Cooling Tower Drift

This subsection evaluates the effects of cooling tower drift. In every cooling tower, there is a loss of water to the environment from the evaporative cooling process. This evaporated water leaves the tower in a pure vapor state and presents no threat to the environment. Small unevaporated water droplets are also exhausted through the cooling tower, causing a phenomenon known as drift. These unevaporated water droplets carry minerals, debris, microorganisms, and water treatment chemicals, potentially affecting the environment. High drift losses are typically caused by fouled, inefficient, or damaged drift eliminators, excessive exit velocities, or imbalances in water chemistry.

Minimizing drift losses in a cooling tower reduces the risk of affecting the environment. The principle concern with cooling tower drift effects is related to the downwind deposition of cooling water salts. Salt deposition can adversely affect sensitive plant and animal communities through changes in water and soil chemistry. Information about the important terrestrial and aquatic plant and animal communities, habitats, and wetlands near the candidate sites are as discussed above and in Appendix A.

As mentioned in the fog and ice safety subsection above, meteorological conditions at a site are monitored and evaluated as part of determining the suitability of nuclear plant siting. The observation of temperature and wind conditions over time provides input into statistical models. The models can be used to help predict the probable path and dispersion of cooling tower drift. Topographic conditions also influence extreme weather and temperature variations. Sites with better meteorological conditions are rated higher. Assessment of the meteorological conditions at the PBN, HVN, and YCN sites in the original ESs did not indicate any limiting conditions. The meteorology at the BLN and MH (due to close proximity, by assumption) sites tend to display a limited variation in atmospheric conditions that can negatively affect transport and dispersion of cooling tower drift. On the basis for potential effects from cooling tower drift being affected by local meteorological conditions, the HVN, PBN, and YCN sites are rated higher (as slightly less likely to have effects) than the BLN or MH sites.

Comparison of Socioeconomic Criteria for Brownfield and Greenfield Sites

Construction-Related Effects

During construction of a nuclear power plant, the local population increases from the workers and families who relocate to the area, and the local community grows to support these people. A site is rated on its estimated ability to handle the number of construction workers who would move into the plant site vicinity with their families and the capacity of the communities surrounding the plant site to absorb this temporary (in-migrant) population. Higher ratings are given to the sites better able to accommodate the increases in population.

The number of in-migrant workers is dependent on labor availability within commuting distance of the plant site. If an adequate supply of workers were available within reasonable commuting distance, few (if any) workers would choose to relocate to the site. The issue in siting, therefore, is the potential socioeconomic effects associated with any temporary influx of construction workers who live too far away to commute daily from their residence.

The capacity of communities to absorb an increase in population depends on the availability of sufficient resources such as adequate housing and community services (e.g., schools, hospitals, police, transportation systems, and fire protection) to support the influx without straining existing services. The factors that should be considered in rating sites from the perspective of construction effects includes labor requirements, location of labor pool, number of immigrants, and the economic structure of affected communities. Regardless of the site chosen, construction employment would be the same, with an estimated peak of approximately 3,900 workers on site (see Section 4.4.2.1 of the BLN ER, as changed by TVA's July 3, 2008 letter providing responses to the NRC Information Needs related Socioeconomics/EJ). Assuming that 50 percent of the workers move to the area from elsewhere, there would be an increase of 1,950 workers plus whatever family moved with them. Assuming a family size of four, the population increase would be 7,800, about a ten percent increase, for example, in Jackson County (BLN site).

Both Chattanooga and Huntsville are within 50 miles of the BLN site and would be likely to furnish many of the workers needed; some movers might also locate in those areas. Nashville and the counties around it on the northeast to southeast side are within 50 miles of the HVN site. Around the PBN site, the Kingsport-Bristol-Johnson City area is within 50 miles, as is the smaller Morristown area. The YCN site is within 50 miles of the Florence/Mussel Shoals/Sheffield/Tuscumbia - Quad Cities (AL) area as well as a number of smaller communities in Alabama, Mississippi, and Tennessee. The MH site is within 50 miles of the Huntsville and Gadsden areas in Alabama. Each of the alternative sites has a reasonably-sized population center within 50 miles (i.e., greater than 25,000) and, with the exception of Yellow Creek, has a total population within 50 miles of between about 880 thousand and 1.4 million.

Previous studies (information reported in the site-specific TVA ESs) and the current discussion herein based upon the population numbers and cities noted within 50 miles of each site, indicate that the four brownfield sites are capable of adequately handling an increase in population due to construction worker influx, and the corresponding demand on housing and related services. However, due to the relative size of the current population in the area, impacts at the YCN site could be more substantial than at the other sites. The YCN site could have more difficulty accommodating the increase without special assistance (*Yellow Creek Nuclear Plant Units 1 and 2, Environmental Report,* Volume 2, pp. 9.3-2 and 9.3-3). While the MH greenfield site is located in a more rural area, its proximity to the Huntsville area and to other smaller urban centers would increase its ability to accommodate a major construction project. As a

result, with the exception of YCN, which is ranked lower, the alternative sites are ranked the same with respect to purposes of construction-related socioeconomic effects.

TVA In-Lieu–of-Tax Payments During Construction -- Construction work in progress (CWIP) is included in the asset base and, therefore, is used in determining the allocation of in-lieu-of-tax payments to states and, in turn, in determining allocation to local governments, depending on the extent to which each state uses book value of TVA power property in its distribution formula. Therefore, the affected local area would benefit from an increase in payments as construction progresses. In Tennessee, an additional portion of the TVA in-lieu-of tax payments received by the state may be made available for assistance to areas impacted by TVA construction.

Highway Access

In reviewing access effects, nuclear plant construction requires dependable highway access for large vehicles. Sites with available access are rated higher. Because construction of nuclear plants was proposed or initiated at four of the sites, transportation access was previously constructed at each site. At least parts of the HVN, PBN and YCN sites are currently being utilized as industrial sites with sufficient access to function in that capacity. Access by highway is available for vehicles of expected sizes at these sites. Each of the sites is within about 5 miles of a state or federal highway. BLN is about 2.5 miles from US 27, HVN is 1.4 miles from TN 25, PBN is 2.4 miles from US 11W, Yellow Creek is 5.0 miles from MS 25, and MH 3.5 miles from AL 227. It is expected that a sufficient amount of access development would be performed to accommodate the number of construction and operations workers' vehicles.

The four brownfield sites are therefore rated equally with respect to site access. Per discussion in the Accident Effects Evaluation section above, access to the MH site is more limited and is rated lower accordingly. Table 1 includes the ratings for the highway access effects analysis.

Operations-Related Effects

The socioeconomic effects of operations relate primarily to the impacts and benefits afforded to local communities as a result of constructing the plant. These benefits are generally not indicative of inherent site conditions that affect the relative suitability of sites. Increase in local tax revenue generated by workers and their families and increased in-lieu-of-tax revenues, as discussed below, typically mitigate impacts and benefit local communities and infrastructure once a plant is operational. As a result, the alternative sites are rated equally on this criterion. Table 1 includes the ratings for the operations-related effects.

TVA In-Lieu-of-Tax Payments During Operations -- As directed by Section 13 of the TVA Act, TVA pays in-lieu-of-tax payments equal to 5 percent of its gross proceeds from the sale of power (excluding sales to federal agencies). Once a plant begins operating, these payments are made to state governments, except for small amounts paid directly to certain counties under the provisions of the TVA Act. The amount paid to each state and its counties is determined equally by two factors: the gross proceeds of TVA power sales within the state as a share of the total TVA gross proceeds, and the total book value of TVA power property within the state as a share of total TVA power property. This book value currently includes a book valuation of $3.1 billion for the existing facilities at BLN, which is in the process of being depreciated. Amounts paid directly to counties are deducted from the state total. The state of Alabama allocates 78 percent of its receipts from TVA to the 16 TVA-served counties in the state. In FY 2007, slightly more than $112 million was distributed to the state of Alabama, of which $87.4 million went to the 16 TVA-served counties. Of this amount, Jackson County received $10.4 million.

If the proposed BLN Units 3 and 4 had been completed and the current book valuation of BLN had been completely written off, the total payout to Jackson County would have been almost $13.6 million, a

difference of almost $3.2 million for FY 2007. The current book value is likely to be totally or largely written off by the time Units 3 and 4 would go on line. However, this estimate does not take into account a number of other likely future events. For example, completion of Watts Bar Nuclear Unit 2 would increase book value in Tennessee relative to the total, thereby somewhat decreasing the Alabama share of total TVA book value and therefore the Alabama share of TVA payments. Other future events could also affect the payment to Jackson County, including fluctuation or growth in revenue, plant retirements and additions, and future depreciation of assets.

Other Alabama counties served by TVA would also experience increases in payments due to completion of BLN Units 3 and 4. For example, Marshall and DeKalb Counties to the south would have estimated increases of almost $1.1 million and about $530 thousand, respectively. To the west, the larger counties of Madison (Huntsville) would have an estimated increase of over $3.2 million, and Morgan (Decatur) almost $2.6 million.

If the project were located at the MH site, the process of allocating the increase in the lieu-of-tax payments would be as described for the BLN site since both are located in Alabama. The actual amount of the impact to Marshall County has not been estimated. However, it should be similar in order of magnitude.

If the project were located at the YCN site, the allocation process would be governed by Mississippi law. The total allocation to Mississippi would increase due to the larger share of TVA assets in the state. At the present time, the state of Mississippi retains 10 percent of the amount it receives from TVA. Tishomingo County, where the YCN site is located, receives 12.5 percent of the total. (This special provision is currently under discussion in the state and may possibly be discontinued.) The remainder is allocated to 35 counties, 95 municipalities, and 69 school systems within the TVA service area. These allocations are based on each location's share of total TVA and TVA distributor sales within the state. While the state of Mississippi would receive an increased share of the total TVA payment, Tishomingo County's share of the state total would not increase; the total payment to the county would increase at the same rate as other local governments.

If the project were located at either the PBN site or the HVN site, the allocation process would be governed by Tennessee law. Under state law, cities and counties receive, first, the amount they were receiving in FY 1977. Of the amount the state receives over and above what it received in FY 1977, 48.5 percent is allocated to counties and incorporated cities in the state. This redistribution is based solely on population for cities, which receive 30 percent. Counties receive 70 percent, based on population (30 percent), total acres in the county (30 percent), and TVA-owned acres in the county (10 percent). The total payment to the state by TVA would increase as a result of the increase in book value of TVA property in the state relative to other states. The county would receive a somewhat larger payment due to the increased TVA payment to the state and to a small extent the increase in TVA-owned acres in the county.

Environmental Justice

The objective of the environmental justice (EJ) evaluation is to confirm that the effects of proposed actions do not result in disproportionate adverse effects to minority and low-income communities. In comparing sites, this principle is evaluated based on whether any disproportionate effects to these communities is significantly different when comparing one site to another.

It was first determined if the proposed action results in significant adverse effects. If not (i.e., no significant health and safety effects are identified), then there are no EJ concerns, regardless of the percentage of minority or low-income populations identified within the surrounding communities of a site.

If significant adverse health or safety effects are expected, then EJ concerns may be relevant to site comparison. However, a significance finding based on EJ considerations would be true only if disproportionate adverse effects on minority or low-income populations are identified at one or more sites, thereby resulting in significant differences between sites.

The next step is to compare population data for minorities and low-income populations among sites. With the 2005 U.S. Census Bureau data factored in, the percentages of minorities and low-income populations is still relatively small among the candidate sites. Table 21 below (Table 9.3-2 of the ER) provides a summary of the pertinent updated EJ-related information for each candidate site.

Additionally, EPA's Enviromapper program for EJ indicates no significant concentrations of minority or low income populations at the blockgroup level for the alternative sites (Figures 6 through 13).

In conclusion, no significant differences in EJ effects are expected among the sites under consideration. No significant effects to any human populations are expected to occur at any of the sites under consideration; thus, there are no significant disproportionate effects only on minority or low-income populations. Therefore, no significant differences in EJ effects are expected between the candidate sites, and the alternative sites each receive the same highest rating.

Based on this analysis, there is no basis for differentiation of sites according to an EJ perspective, despite differences in the percentages of minority and low-income populations found within the surrounding communities of each site. The alternative sites are found to be equally and highly suitable. Table 1 includes the ratings for the EJ evaluation.

Table 21. Alternative Site Evaluation – Total, Minority and Poverty Populations (2005 Census)

Site	County (State)	Total pop. (2006)	White (Pct.) (2005)	Black (Pct.) (2005)	Asian (Pct.) (2005)	Hispanic (Pct.) (2005)	Other (Pct.) (2005)	Pct. below poverty (2004)
	Jackson (AL)	53,926	91.1	3.8	0.3	1.6	3.2	15.3
	Marion (TN)	27,942	94.1	4.1	0.0	0.8	1.1	15.0
	Dade (GA)	16,233	96.5	1.2	0.4	1.1	0.8	12.3
BLN	DeKalb (AL)	68,014	87.4	1.8	0.2	9.0	1.6	15.8
	Marshall (AL)	87,185	88.2	1.6	0.3	8.7	1.2	15.8
	Madison (AL)	304,307	69.8	23.5	2.0	2.2	2.5	11.7
	Franklin (TN)	41,319	91.0	5.5	0.6	2.0	0.9	13.5
	Trousdale (TN)	7811	86.0	10.5	0.3	2.6	0.6	14.5
	Macon (TN)	21,726	96.0	0.6	0.3	2.8	0.3	16.3
HVN	Smith (TN)	18,753	94.1	3.1	0.2	1.7	0.9	13.0
	Wilson (TN)	104,035	89.4	6.8	0.6	2.1	1.1	8.5
	Sumner (TN)	149,416	89.1	6.5	0.8	2.5	1.1	9.6
	Hawkins (TN)	56,850	96.6	1.7	0.3	0.9	0.5	15.7
	Scott (VA)	22,882	98.1	0.8	0.1	0.6	0.4	14.9
	Sullivan (TN)	153,239	95.7	2.1	0.5	0.8	0.9	14.0
PBN	Greene (TN)	65,945	95.3	2.1	0.3	1.6	0.7	15.3
	Hamblen (TN)	61,026	84.8	4.1	0.9	9.3	0.9	15.2
	Grainger (TN)	22,453	97.4	0.6	0.1	1.3	0.6	17.0
	Hancock (TN)	6713	98.6	0.5	0.1	0.4	0.4	28.5
	Tishomingo (MS)	19,112	93.4	3.6	0.1	2.6	0.3	15.2
	Prentiss (MS)	25,615	84.5	14.0	0.2	0.7	0.6	16.2
	Alcorn (MS)	35,589	86.1	11.4	0.2	1.8	0.5	17.3
YCN	Colbert (AL)	54,766	80.7	16.7	0.3	1.3	1.0	14.7
	Lauderdale (AL)	87,891	87.8	9.7	0.4	1.2	0.9	16.2
	McNairy (TN)	25,722	91.5	6.3	0.2	1.1	0.9	17.5
	Hardin (TN)	26,089	94.1	3.7	0.3	1.2	0.7	19.2
	Marshall (AL)	87,185	88.2	1.6	0.3	8.7	1.2	15.8
	DeKalb (AL)	68,014	87.4	1.8	0.2	9.0	1.6	15.8
	Jackson (AL)	53,926	91.1	3.8	0.3	1.6	3.2	15.3
MH	Madison (AL)	304,307	69.8	23.5	2.0	2.2	2.5	11.7
	Morgan (AL)	115,237	81.3	11.8	0.6	4.7	1.6	14.0
	Blount (AL)	56,436	90.9	1.5	0.2	6.4	1.0	12.4

Land Use

Land to be used for new units would already be owned or acquired by TVA and would already be zoned for uses compatible with development of a new unit; existing units are integrated into the surrounding land use patterns. The PBN, BLN, YCN, and HVN sites have all been partially developed for industrial uses. The amount of industrial development varies from site to site. Land use would change significantly with use of the MH greenfield site, as no development has occurred there to date. As an instrument of the federal government, TVA properties are not subject to local zoning regulation. For three of the sites (PBN, YCN and MH) there are currently no local zoning or land use policies with which siting of nuclear generation would conflict. However, for the HVN site, local property within close proximity to the remaining TVA property is zoned for agricultural and light industry use.

With respect to BLN, the land had been previously dedicated as the site for Bellefonte Units 1 and 2. Construction permits for those units were terminated in September 2006. TVA currently owns all of the land at this site, and no further land acquisitions are required. The site is allocated by TVA for industrial use; further information is provided in Section 2.2 of the COLA.

While the construction permits for the HVN and PBN sites have been terminated, completion of a nuclear power plant at these sites would conform to the previously proposed industrial development land use for the site and its vicinity, as designated by local governmental plans, policies, and controls. While portions of both sites have been transferred for other uses, TVA retains control of about 1377 ac. at HVN (see Individual Site Analysis, HVN), while only 102 ac. of the 1284-ac. site is retained at PBN (see Individual Site Analysis, PBN). In a complex contractual arrangement with the local authorities for the Hawkins County PBN site, TVA does retain control over the original acreage until the entire acreage is purchased. At this time (May 2008) it is uncertain what effect a newly-identified prison under construction on the transferred portion of the HVN site would have on the suitability of that site.

The former YCN site was initially transferred to the National Aeronautics and Space Administration (NASA) and subsequently to the State of Mississippi and is currently the site of a commercial complex now managed by Tishomingo County. TVA retains control of only about 13 ac. of the 1149-ac. site (see Individual Site Analysis, YCN). However, there is a coherent portion of the former site still undeveloped and contiguous with the approximately 2300 acres of predominantly undeveloped industrial park and small private in-holdings. The MH site is still controlled by TVA and is currently designated for natural resource management (see Individual Site Analysis, MH).

Ratings for this criterion are influenced by three factors: current state of disturbance of the site; potential degree of disturbance to current uses by siting a nuclear generation facility; and status of ownership. No land-use or ownership issues are evident for BLN. MH is rated substantively lower due to its greenfield status and potential for disturbance of its current land use designation by TVA for natural resource management. Both HVN and YCN are rated slightly lower due to the need for re-acquisition of lands and potential for disturbance of current uses. As noted above, the effect of a prison being constructed at the HVN site is uncertain at this time. PBN is also rated lower because of the need for reacquiring property and greater potential for needing to affect use of adjacent industrial sites. None of the sites affects such public amenities as national parks, preserves or ecologically sensitive areas.

Cultural Resources

The preservation of cultural heritage is important to our understanding of the development of human civilizations. This section provides a description of the cultural resources identified at the alternative sites. This criterion is rated upon the number of identified cultural resource sites as an indicator of the potential for encountering new unknown cultural sites during development of alternative sites. Sites with increased potential for impacts to these resources would be rated lower than those with no impacts. These numbers are identified in the individual site description above and in Section 2.5 of the ER for the BLN site. The BLN and MH sites were ranked slightly higher due to the small number of sites identified and the protective/avoidance measures already in place. The other sites rated slightly lower due to the extensive number of sites already identified, indicating the potential for new discoveries if systematic surveys are performed.

Bellefonte – BLN-specific information is presented in Section 2.5 of the ER.

Hartsville - Northern middle Tennessee, the region surrounding the HVN site has been an area of human occupation for the last 12,000 years. Prehistoric land use and settlement patterns vary, but short and long-term habitation sites are generally located on floodplains and alluvial terraces along rivers and tributaries. Specialized campsites tend to be located on older alluvial terraces and in uplands. European interactions with Native Americans associated with the fur trading industry in this area began in the seventeenth and eighteenth centuries, with the latter half of the eighteenth century marked by small skirmishes and ambushes between settlers and Native American groups. By the end of the eighteenth century, land in the Nashville Basin had been granted to veterans of the Revolutionary War. Agriculture dominated the economies of both Smith and Trousdale counties in the nineteenth and well into the twentieth century. Economic activities in Smith County now center on large industry and mining of the county's rich zinc deposits. Trousdale County remains linked to its agricultural roots, with the city of Hartsville becoming a thriving center for the loose-leaf tobacco market in the twentieth century.

Prior to and during construction of the Hartsville Nuclear Plant, archaeological surveys were conducted within the project location. These surveys identified 40 archaeological resources. Several sites that were to be adversely impacted within the project area were excavated. Because no systematic historic/architectural survey of the project area has ever been conducted, no historic/architectural sites were recorded in the project area. Ten historic properties are listed on the National Register of Historic Places (NRHP) in Smith County, and seven properties are listed in Trousdale County. None of the properties is within the area of potential effect (APE) for the previously proposed project or in the immediate vicinity of the site.

Phipps Bend - Phipps Bend is located in east Tennessee, an area of human occupation for the last 12,000 years, which spans five broad cultural periods: Paleo-Indian (11,000 – 8,000 BC), Archaic (8000 – 1600 BC), Woodland (1600 BC – AD 1000), Mississippian (AD 1000 – 1700), and Historic (AD 1700 – present). Prehistoric land use and settlement patterns vary during each period, but short and long-term habitation sites are generally located on floodplains and alluvial terraces along rivers and tributaries. Specialized campsites tend to be located on older alluvial terraces and in the uplands. In East Tennessee, during the seventeenth and eighteenth centuries, Europeans and Native Americans began interacting through the fur trading industry. Euro-American settlement increased in the early nineteenth century as the Cherokee were forced to give up their land. Hawkins County was originally established as a North Carolina county on January 6, 1787. At this time, the county consisted of what are now Hancock, Grainger, Jefferson, Knox, Roane, Meigs, and Hamilton counties. Development around the Hawkins Court House soon became known as the town of Rogersville. In 1858, the East Tennessee and Virginia Railroad used slave labor to lay the first tracks through an area called Bulls Gap, which is located near Rogersville. During the Civil War, the strategic location of the tracks made Bulls Gap the frequent scene

of fighting between Union and Confederate forces. After the war, the railroad dominated the economic life of Bulls Gap. From the 1840s through the 1870s, the marble industry was developed in Hawkins County, and the area became famous for its pink and red variegated marble. Marble from Hawkins County was used in the Washington Monument in Washington, D.C., as well as the balustrades and stairways of the Capitol. Today the principal sources of farm income are beef cattle and burley tobacco. In 1791, the town of Rogersville printed Tennessee's first newspaper, *The Knoxville Gazette.*

Prior to construction of the Phipps Bend Nuclear Plant, archaeological surveys were conducted within the project location. These surveys identified 23 archaeological resources. Seven sites that could be adversely impacted within the project area were evaluated. In consultation with the TN-SHPO, TVA recommended four of the seven sites as potentially eligible for NRHP listing and the remaining 19 sites as ineligible for the NRHP. Furthermore, TVA recommended a determination of no adverse effect to the four sites due to avoidance. The TN-SHPO concurred with all of these determinations. It is unknown how many potentially eligible or eligible sites still exist within the project area. No historic/architectural resources were identified prior to construction of the Phipps Bend Nuclear Plant; however, no systematic historic/architectural survey has ever been conducted of the project area. Ten historic properties are listed on the NRHP in Hawkins County, none of which is within the APE for the previously proposed project or in the immediate vicinity of the site.

Yellow Creek - Northern Mississippi, the location of the YCN site, has been the location of human occupation for more than 12,000 years. The prehistory and history of the area is generally divided into six broad periods: Paleo-Indian (10,000 – 8,000 BC); Archaic (8,000 – 1000 BC); Gulf Formational Period (1100 – 300 BC); Woodland (300 BC – AD 900); Mississippian (AD 1000 – 1700), and Historic (AD 1700 – present). Prehistoric land use and settlement varies during each period, but generally, short- and long-term habitation sites are located on floodplains and alluvial terraces along rivers and tributaries. Specialized campsites tend to be located on older alluvial terraces and in the uplands. The Historic Period is represented by settlement in the region by Europeans, Euro-Americans, and African-Americans and the subsequent removal of Native American tribes. Tishomingo County was formed in 1832 by the state of Mississippi following secession of the land by the Chickasaw. Agriculture was important to the county throughout the nineteenth century and into the early twentieth century. More recently, industry has increased throughout the county.

Prior to and during construction activities on the Yellow Creek Nuclear Plant site, archaeological surveys were conducted within the project location. These surveys resulted in the identification of 227 archaeological resources, of which 76 were determined eligible as a district in the NRHP. Thirty-four of the 76 sites within the project area were investigated for intact subsurface archaeological deposits, and 19 of these were investigated further based on the presence of intact deposits. TVA, in consultation with the Mississippi SHPO, determined that the construction of Yellow Creek Nuclear Plant would have no adverse effect on the archaeological district due to the mitigation measures. No historic/architectural resources have been identified within the project area; however, no systematic historic/architectural survey was conducted for the project area. Seventeen historic properties are listed on the NRHP in Tishomingo County; however, none of the properties was within the project APE for the previously proposed Yellow Creek project or in the immediate vicinity of the site.

Murphy Hill - Human occupation of Northern Alabama in the vicinity of Murphy Hill occurred from the Paleo-Indian to the Historic period. In northern Alabama, prehistoric archaeological chronology is generally broken into five broad time periods: Paleo-Indian, Archaic, Gulf Formational, Woodland, and Mississippian. Prehistoric land use and settlement patterns vary during each period, but short- and long-term habitation sites are generally located on floodplains and alluvial terraces along rivers and tributaries. Specialized campsites tend to be located on older alluvial terraces and in the uplands. European interactions with Native Americans in this area began in the seventeenth and eighteenth centuries

associated with the fur trading industry. Various excursions and temporary settlements by the British, French, and Spanish occurred prior to this period.

Marshall County was created in 1836. Warrenton, in Brown's Valley near Guntersville, was an early trading post. It was incorporated in 1841 and served briefly as the county seat in the 1840s. Marshall County residents tended to have small farms, with corn and livestock forming the backbone of the relatively self-sufficient agricultural regime. Cotton was grown in suitable areas. Following the Civil War, Alabama was readmitted to the Union in 1868. The effects of the war were not as keenly felt in Marshall County, where the economy was not as dependent on slave labor. Tenancy increased in Marshall County in the early twentieth century as cotton production continued to increase. Cotton production had declined significantly during the 1920s and 1930s as a result of the combined effects of the boll weevil, the lack of cheap labor, and competition from other markets, and a more diversified agricultural economy began to take its place with soybeans, truck farming, and livestock products replacing the corn and cotton regime. By the late twentieth century, poultry raising and processing, feeding mills, and hatcheries were the largest segment of Marshall County's economy.

Prior to the proposed construction of the Murphy Hill Coal Gasification Plant, an archaeological survey was conducted within the project location. This survey resulted in the identification of four archaeological sites. Only one site, a prehistoric burial mound, was recommended eligible for the National Register of Historic Places (NRHP). Subsequent looting of this site necessitated mitigation measures through archaeological excavation. In consultation with the Tennessee State Historic Preservation Officer (TN-SHPO), TVA recommended a determination of no adverse effect based on the results of the 1973 survey and subsequent mitigation measures. The TNSHPO concurred with these determinations. No systematic historic/architectural survey was conducted for the project area, although known historic/architectural resources existed in the vicinity of the proposed Murphy Hill plant in the 1970s. Thirteen historic properties are listed on the NRHP in Marshall County, none of which is within the APE of the previously proposed project or in the immediate vicinity of the site.

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Comparison of Engineering and Cost-Related Criteria for Brownfield and Greenfield Sites

This discussion encompasses the basis for criteria and ratings related to factors substantively affecting: Water Supply; Transportation Access including Highways, Rail, Barge and Transmission; Site Preparation including Land Use and Ownership Assessment, Topographic Modifications, Flood Protection, and Cooling Water Costs.

Water Supply

The purpose of this criterion is to evaluate relative differences in the design and construction factors affecting costs for developing water supply facilities. Sites with local conditions that would require additional engineering costs to develop water supply capability (e.g., reservoirs to address water supply limitations), reliability issues (e.g., low-flow constraints) or require substantively greater distances of piping or pumping to the site and acquisition of right-of-way to obtain adequate water supply are rated lower than sites with no such requirements.

All of the sites have access to cooling water sources that would provide adequate supply volume and reliability, such that no significant differential costs should be required for purchasing water rights or constructing on-site reservoirs. No groundwater usage would be required for any of the sites under consideration, as the reservoirs provide an adequate water supply. All sites except PBN are rated equally and highest on this criterion (Table 1) for cost of water supply. PBN could experience a greater potential for operational limitations due to low flows (also see discussion under cooling system suitability) that could potentially reduce its availability for generation. PBN is accordingly rated slightly lower.

Transportation - Highway

Sites are compared with respect to factors that would affect costs for providing access by highway, rail, and barge. The purpose of the first transportation criterion is to rate sites based on the length of additional or new highway construction (See Table 8) and status of need for road upgrades required to provide car and truck access. Highway access for HVN, BLN, YCN, and PBN were previously upgraded in anticipation of construction and access roads for each of these sites (except BLN) currently supports commercial and worker traffic into, and out of, an industrial park. While some additional highway upgrades may be necessary to support construction and operation of new nuclear power plants, no significant differential highway access development costs are expected. The four brownfield sites rated equally for this criterion. Although the distance mileage of local road to a state highway is not the greatest among sites, a lower rating is assigned to the Murphy Hill site due to the lack of upgraded local roads in the vicinity of the site.

Transportation – Railroad

The purpose of the second transportation criterion is to rate sites according to the factors affecting the relative costs associated with providing rail access. Sites are rated in accordance with whether or not they have adequate existing rail access or would require additional or new rail spur construction to provide rail access. BLN, PBN and YCN already have rail access but HVN and MH do not. These latter sites were rated lower than the former three sites on this criterion.

Transportation – Barge

The purpose of the third transportation criterion is to rate sites according to the factors contributing to the

relative costs associated with providing barge access. Barge transport can be a comparatively advantageous (on a cost basis) method of transporting components such as reactor vessels, steam generators or large modular units. The primary site factors affecting the relative costs among sites are: 1) whether or not there is an existing, adequate barge facility on-site, 2) an on-site facility that can be upgraded sufficiently; 3) a facility exists nearby to the site, but would require offloading components and then transporting by truck a short distance to the site, or 4) whether or not a barge facility is close (i.e., requiring off-loading and long transport of large components) or is feasible to construct. Sites are rated from highest to lowest in accordance with these factors affecting costs for providing new barge access or providing alternative means of transport for major components. With the exception of PBN, the water body at each of the sites is sufficient to accommodate barge traffic. BLN and YCN currently have barge unloading facilities adequate to support construction of a nuclear facility. HVN and MH both have barge access that would need some upgrading, probably including some dredging. Direct barge access is not possible at PBN (see below), requiring off-loading and ground transport for a considerable distance.

A barge unloading facility and an access road from the barge facility to the site have been constructed at BLN. For YCN, there is a major barge port directly across Yellow Creek from the site, but off-loading and ground transport would still be necessary to bring the large components on site. Although barge transport all the way to PBN is not possible (there is no barge lock at the downstream Cherokee Dam), off-loading at Knoxville, TN to other ground-based transport would be a possibility. When originally constructing the dam, TVA did acknowledge the possibility that someday the agency might need to provide for barge navigation into Cherokee Reservoir. However, during original construction at the PBN site, some large components were off-loaded in Knoxville, trucked to above Cherokee Dam (no lock), reloaded on a barge, moved up the reservoir, off-loaded a second time and land transported to the site. This approach required major effort (i.e., temporary closure and rolling roadblock of a U. S. highway for a few days). No factors contributing to substantive additional costs for utilizing the barge facilities at BLN or YCN were identified. Based on the primary site factors identified above, the alternative sites are rated in Table 22, with BLN and YCN given higher ratings on this criterion for the reasons identified. Table 1 includes the ratings for the factors affecting all three transportation criteria, i.e., highway, rail, and barge costs.

Table 22. Comparative Ratings for Barge Access to the Alternative Sites

Site	Rating	Basis
BLN	5	Existing barge access needing minor refurbishment.
HVN	4	Existing barge access – upgrade needed (probable dredging).
PBN	1	No direct barge access possible, off-load and ground transport substantive distance
YCN	5	Existing barge access needing at most minor refurbishment
MH	4	Existing barge access – upgrade needed (probable dredging).

Transmission Access

Transmission facilities must be constructed or adapted to accommodate plant generation. These costs are substantial and increase per linear mile. For this criterion, characteristics for sites such as mileage of new right-of-way (ROW) and line required, or need for construction of new transmission switchyard are indicative of greater likely cost for transmission access. Sites with lower transmission construction costs are rated higher. In order to minimize land requirements, existing transmission line ROWs are typically paralleled and overlapped where possible.

Preliminary estimates for new transmission lines necessary to connect each site with the existing

transmission network are as follows. The source of information for this criterion was the generation siting transmission screening study and estimate conducted by TVA Transmission Planning in December 2007. This estimate is indicative of the comparative differences between the sites rather than the optimum choice for transmission line routing from a particular site. More detailed surveys and analyses would be required to determine exact routes and interconnections for each line.

Hartsville - The HVN site would require about 40 mi. of 500-kV transmission line to be constructed along two corridors. One corridor would connect the HVN site to the Wilson - Roane 500-kV transmission line (25 mi.), and the other corridor would stretch from the HVN site to the Wilson 500-kV Substation (15 mi.). About 1,000 acres would be encumbered for these transmission ROWs. Depending upon the number of circuits located within corridor segments, ROW widths could vary from 175 to 425 feet. Furthermore, the Wilson - Roane 500-kV transmission line would have to be uprated, which would disturb land across this 120–mi. line. This disturbance would be most similar to that described in the ER for routine maintenance rather than constituting ground disturbance. Additionally, a new 500-kV substation would have to be constructed in Smith County, TN, in order to connect the site to the Wilson - Roane 500-kV transmission line. This substation will occupy approximately 70 acres.

Phipps Bend - The transmission needs for a PBN involve the rebuilding of the John Sevier - White Pine #1 161-kV transmission line (33 mi.). The rebuilding of the John Sevier - White Pine #1 161-kV transmission line will disturb approximately 17 acres of existing ROW. The existing 500-KV transmission infrastructure in the Phipps Bend area is adequate to deliver the power output of two nuclear units located at the PBN site to TVA's network load.

Murphy Hill: Because of the proximity of the MH and BLN sites and the likely tie-in to some of the same existing 500-kV infrastructure, lines and substations, the transmission lines for MH would be roughly equivalent to that constructed earlier and already existing for BLN. Supporting operation of two nuclear units at the MH site would still, however, require off-site construction of approximately 35 mi. of new 500-kV transmission line from Trinity to the East Point 500-kV Substation on a combined total of 750 acres. Furthermore, the existing Trinity 500-kV Substation would have to undergo a major conversion from its existing state into a 4-position ring bus. This activity would disturb approximately 70 acres of existing TVA substation property.

Yellow Creek - The YCN site would require two 500-kV connections between the YCN site and the TVA power system. One connection would be established by connecting to the Pleasant Hill 500-kV Substation and the other to the Jackson 500-kV Substation. These connections would require new transmission lines with 500-kV corridors of approximately 120 mi. traversing approximately 3,397 acres of land. Acquisition of new ROW would be approximately 2,266 acres; the remainder (approximately 1,131 acres) is currently occupied by transmission lines. Approximately 5.2 mi. of 161-kV line would be required, of which about 1.1 mi. (10 acres) would require new ROW. Depending upon the number of circuits located within corridors, the ROWs would vary between 175 and 475 feet.

The HVN, PBN, MH, and YCN sites would require additional assessment for threatened and endangered species, cultural resources, land use, and potential impacts to water resources.

Two factors influence the ratings for this criteria; 1) whether or not there is the need to construct additional transmission facilities (i.e. 500-kV and 161-kV lines or switchyards); and 2) the estimated extent of such transmission lines or facilities required. Based on the information presented above, the BLN and PBN sites are rated more suitable than the other sites with respect to proximity to transmission and switching; the HVN and MH sites are rated intermediately; and YCN is rated the lowest. Table 1 includes the ratings for factors affecting costs for transmission access.

Site Preparation - Land Use and Ownership Assessment

The bases for this criterion are three factors: 1) degree of change to current land use; 2) ownership of proposed sites; and 3) opportunity to use other existing assets (i.e., existing components or major infrastructure in addition to land). For the sites which were previously issued a construction permit, a higher rating is indicated for a site where 1) TVA now owns and controls all or a portion of the land; or 2) where land uses are most compatible, given a site where TVA does not currently own and control the land, or where a change in land use would be more dramatic. Staff of TVA Realty conducted a due diligence review of ownership for the alternative sites.

The BLN site is still owned by TVA and remains dedicated for nuclear generation use. Approximately half of the original HVN plant site has been sold and is intended for use as an industrial park. The construction of a prison has recently begun on a portion of the transferred property. Substantive consideration must be given to the proximity of a nuclear plant on the remaining site owned by TVA and an industrial site immediate adjacent to it. TVA has "sold" a substantial portion of the PBN site, which is now intended for use as an industrial site. However, in a complex arrangement with the local authority, TVA retains control of the "sold" acreage until the entire site property is sold to end users. Use of the PBN site would require TVA to exercise rights to reacquire the site and potentially halt further industrial development on the site. Ownership of the YCN site was originally transferred NASA, was subsequently transferred to the State of Mississippi, and is now managed by Tishomingo County. A moderate degree of development has occurred during the subsequent years. A combination of the former TVA nuclear site and acquisition of a portion of the existing undeveloped or developed portions of the Tristate Industrial Park would potentially be necessary to site a nuclear generating facility on the YCN site. The MH site is undeveloped and fully owned by TVA, but is currently designated for natural resource purposes by TVA.

The BLN site is rated more suitable than the other four sites with respect to land use and ownership assessment, as well as the opportunity to utilize existing assets. On the basis of the above discussion related to the three land use and ownership factors, the ratings for the land use and ownership assessment are shown in Tables 1 and 23.

Table 23. Ratings for Land Use and Ownership Assessment

Site	Degree of Change to Current Land Use	Ownership of Site	Opportunity to Use Existing Assets Other Than Land	Overall Rating
BLN	5	5	5	5
HVN	4	3	1	3
PBN	4	3	1	3
YCN	4	2	1	2
MH	1	5	1	2

Topographic Modifications

The relative costs associated with site grading and earthmoving necessary to prepare the site for construction of a nuclear power plant varies by topography. Sites are rated from highest to lowest in accordance with estimated grading costs. Because construction was started at each of the four brownfield sites, the

topography of the sites has already been altered for the construction of nuclear power plants. The BLN, PBN, and HVN sites are rated equally high with regard to need to alter site topography. Acquisition and grading of undeveloped industrial property surrounding the former TVA YCN site could necessitate higher costs as well as increase impacts to terrestrial resources. The YCN site is consequently rated lower than the other three brownfield sites. As a greenfield site, MH is rated substantively lower due to the limited disturbances of the site. Table 1 includes the ratings regarding the likely extent of need for topography modifications as reflection of cost.

Flood Protection Cost

The purpose of this criterion is to rate sites with respect to differential costs associated with construction of flood protection structures necessary to address probable maximum floods at the sites under consideration. Although the alternative sites are above the PMF, sites with the largest differences between site grade elevation and likely flood elevations are rated highest (least likely to incur costs associated with flood protection; sites with plant grade at or near flood level are rated lowest (most likely to incur costs associated with flood protection). Per the elevation differences noted in the discussion of flooding potential in Plant Safety Evaluation above, YCN, BLN, and HVN rate high, but PBN and MH rate substantially lower (Table 1).

Cooling Water

For cooling water availability, the factors affecting on-site cost are similar across the five alternative sites. Sufficient water volume exists at the alternative sites to accommodate expected closed cooling water systems with no substantive differences between costs of accessing (e.g., need for constructing a reservoir or taking other measures to ensure adequate water supply) and making that water available for on-site use (e.g. substantive differences between required on-site infrastructure); therefore, the five alternative sites are rated the same. Table 1 includes the ratings for the factors (i.e., adequacy and cost for accessing and providing water where needed) that can affect cooling water cost during site preparation.

References to EPRI Siting Guide and TVA Environmental Statements Used Throughout Document

- Electric Power Research Institute, *Site Selection and Evaluation Criteria for an Early Site Permit Application,* EPRI Technical Report 1006878, Palo Alto, California, March 2002.
- Tennessee Valley Authority, Final Environmental Statement – Bellefonte Nuclear Plant, Units 1 and 2, 1974.
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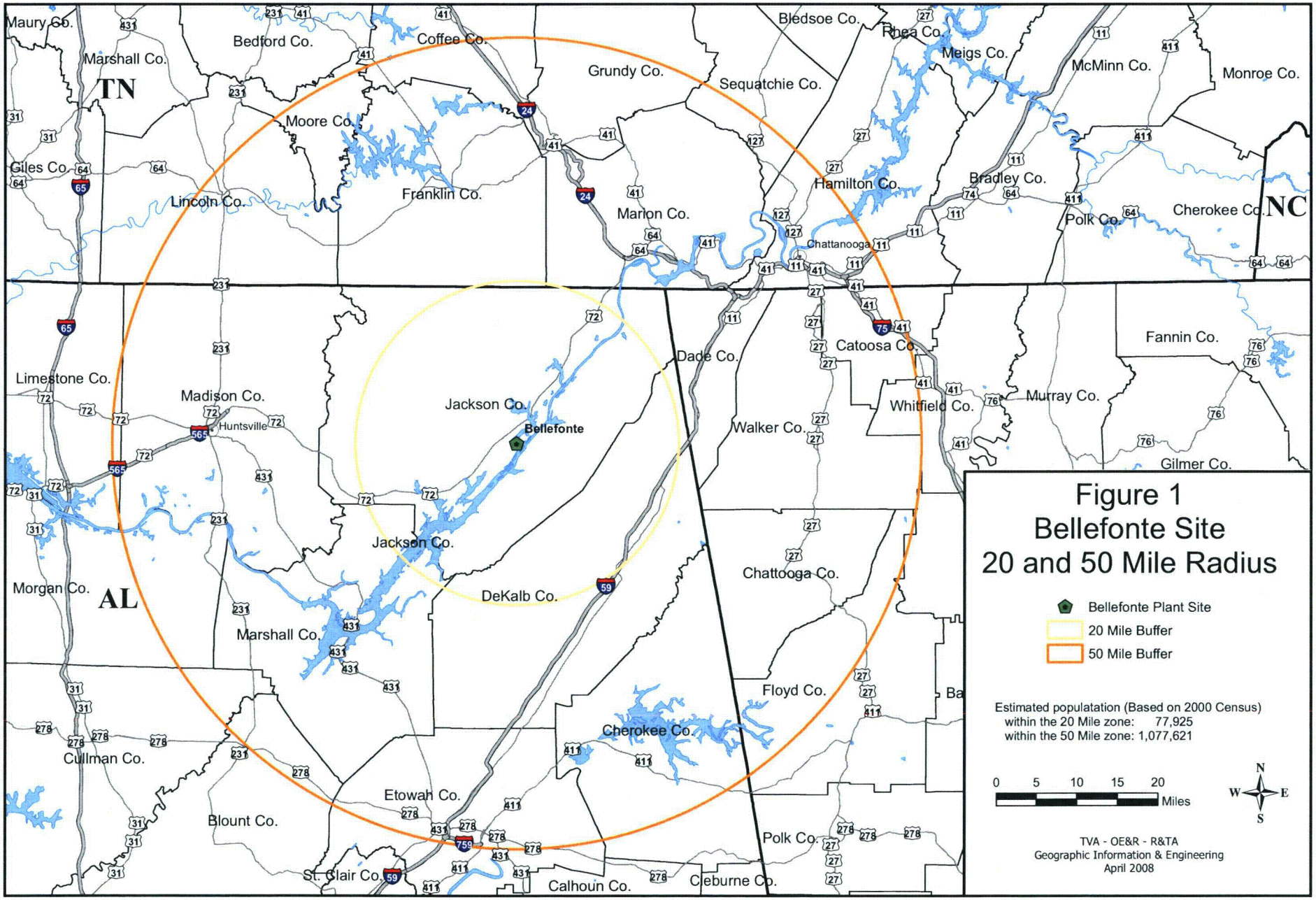
Maury Co.
Marshall Co.
Bedford Co.
Coffee Co.
Grundy Co.
Sequatchie Co.
Bledsoe Co.
Rhea Co.
Meigs Co.
McMinn Co.
Monroe Co.
TN
Moore Co.
Giles Co.
Lincoln Co.
Franklin Co.
Marion Co.
Hamilton Co.
Bradley Co.
Polk Co.
Cherokee Co.
NC
Chattanooga
Limestone Co.
Madison Co.
Huntsville
Jackson Co.
Bellefonte
Dade Co.
Catoosa Co.
Fannin Co.
Walker Co.
Whitfield Co.
Murray Co.
Gilmer Co.
Jackson Co.
Morgan Co.
AL
DeKalb Co.
Chattooga Co.
Marshall Co.
Floyd Co.
Cherokee Co.
Cullman Co.
Etowah Co.
Blount Co.
Polk Co.
St. Clair Co.
Calhoun Co.
Cleburne Co.
Figure 1
Bellefonte Site
20 and 50 Mile Radius
Bellefonte Plant Site
20 Mile Buffer
50 Mile Buffer
Estimated populatation (Based on 2000 Census)
within the 20 Mile zone: 77,925
within the 50 Mile zone: 1,077,621
0 5 10 15 20
Miles
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W E
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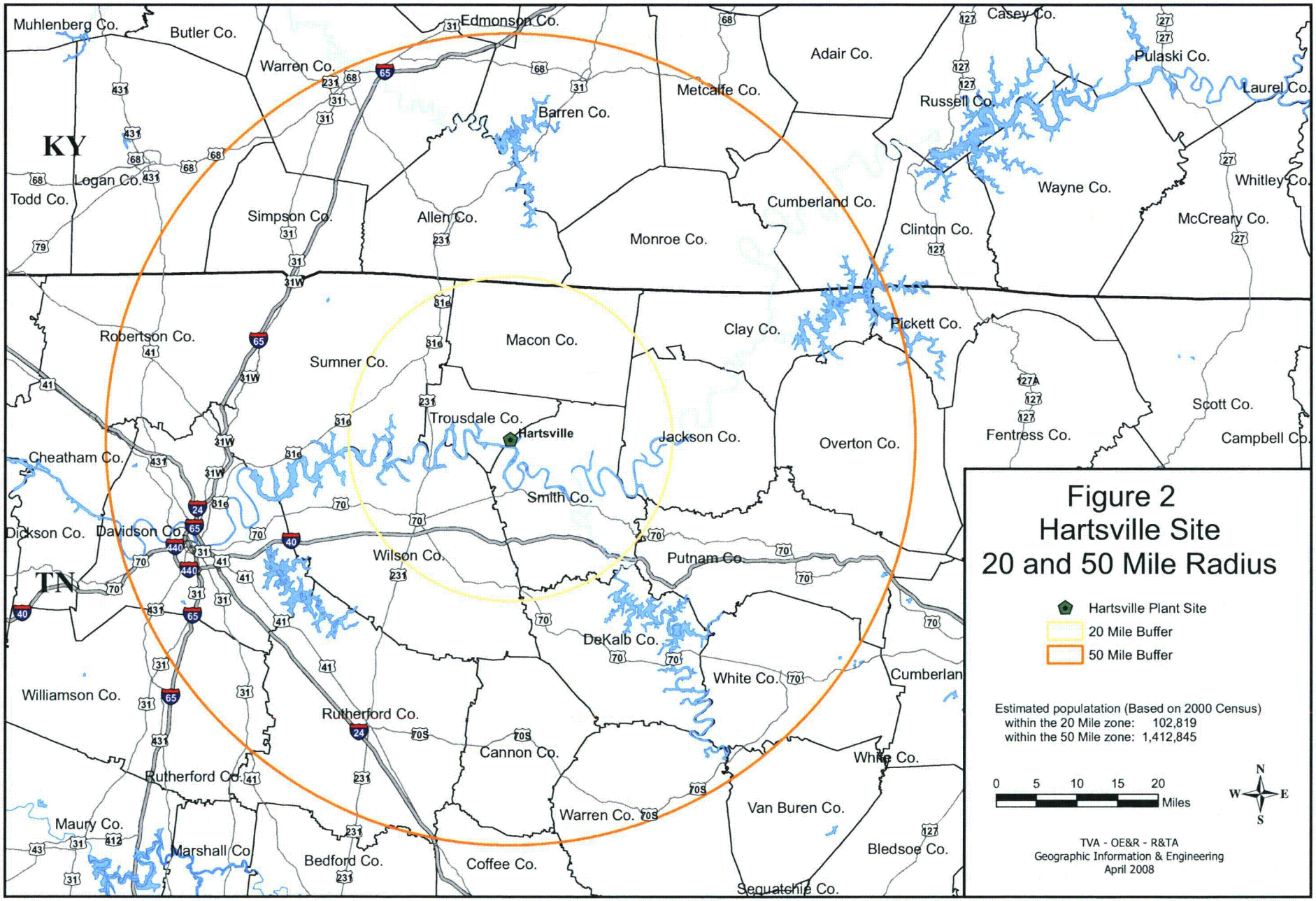
TVA - OE&R - R&TA
Geographic Information & Engineering
April 2008


Muhlenberg Co.
Butler Co.
Edmonson Co.
Warren Co.
Barren Co.
Metcalfe Co.
Adair Co.
Casey Co.
Pulaski Co.
Laurel Co.
Russell Co.
KY
Logan Co.
Todd Co.
Simpson Co.
Allen Co.
Monroe Co.
Cumberland Co.
Wayne Co.
Whitley Co.
McCreary Co.
Clinton Co.
Robertson Co.
Sumner Co.
Macon Co.
Clay Co.
Pickett Co.
Trousdale Co.
Hartsville
Jackson Co.
Overton Co.
Fentress Co.
Scott Co.
Campbell Co.
Cheatham Co.
Smith Co.
Dickson Co.
Davidson Co.
Wilson Co.
Putnam Co.
TN
DeKalb Co.
White Co.
Cumberlan
Williamson Co.
Rutherford Co.
Cannon Co.
White Co.
Van Buren Co.
Warren Co.
Maury Co.
Marshall Co.
Bedford Co.
Coffee Co.
Bledsoe Co.
Sequatchie Co.
Figure 2
Hartsville Site
20 and 50 Mile Radius
Hartsville Plant Site
20 Mile Buffer
50 Mile Buffer
Estimated populatation (Based on 2000 Census)
within the 20 Mile zone: 102,819
within the 50 Mile zone: 1,412,845
0 5 10 15 20
Miles
N
W E
S
TVA - OE&R - R&TA
Geographic Information & Engineering
April 2008

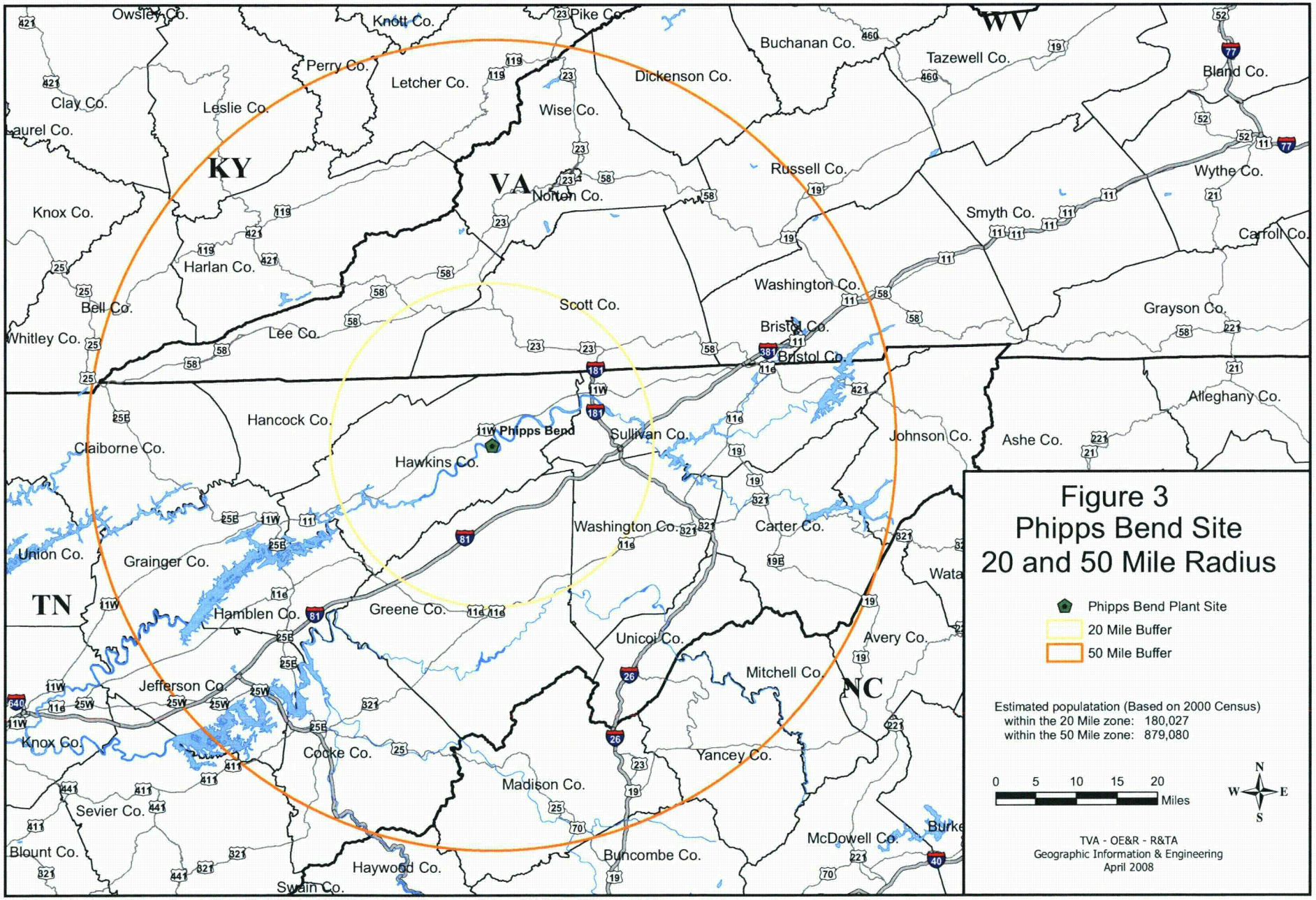


Figure 3
Phipps Bend Site
20 and 50 Mile Radius
Phipps Bend Plant Site
20 Mile Buffer
50 Mile Buffer
Estimated populatation (Based on 2000 Census)
within the 20 Mile zone: 180,027
within the 50 Mile zone: 879,080
0 5 10 15 20
Miles
N
W E
S
TVA - OE&R - R&TA
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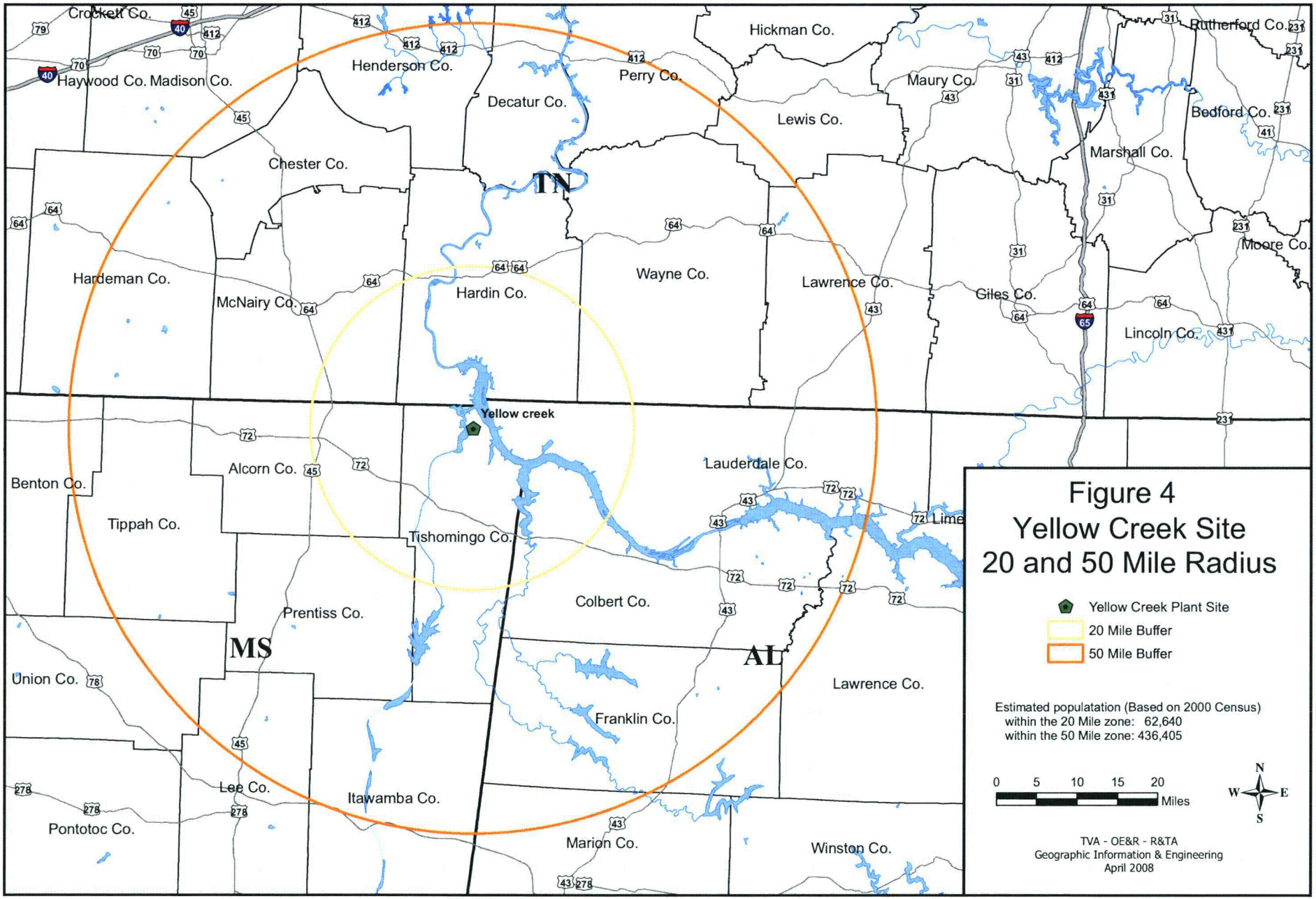
KY
VA
WV
TN
NC
Owsley Co.
Knott Co.
Pike Co.
Buchanan Co.
Tazewell Co.
Bland Co.
Perry Co.
Letcher Co.
Dickenson Co.
Clay Co.
Leslie Co.
Wise Co.
Russell Co.
Wythe Co.
Knox Co.
Norton Co.
Smyth Co.
Carroll Co.
Harlan Co.
Washington Co.
Scott Co.
Grayson Co.
Bell Co.
Whitley Co.
Lee Co.
Bristol Co.
Alleghany Co.
Hancock Co.
Claiborne Co.
11W Phipps Bend
Sullivan Co.
Johnson Co.
Ashe Co.
Hawkins Co.
Union Co.
Grainger Co.
Carter Co.
Hamblen Co.
Greene Co.
Unicoi Co.
Avery Co.
Jefferson Co.
Mitchell Co.
Knox Co.
Cocke Co.
Yancey Co.
Madison Co.
Sevier Co.
Blount Co.
Haywood Co.
Buncombe Co.
McDowell Co.
Swain Co.


Crockett Co.
Haywood Co.
Madison Co.
Henderson Co.
Decatur Co.
Perry Co.
Hickman Co.
Maury Co.
Rutherford Co.
Lewis Co.
Bedford Co.
Marshall Co.
Chester Co.
TN
Moore Co.
Hardeman Co.
McNairy Co.
Hardin Co.
Wayne Co.
Lawrence Co.
Giles Co.
Lincoln Co.
Yellow creek
Benton Co.
Alcorn Co.
Lauderdale Co.
Tippah Co.
Tishomingo Co.
Colbert Co.
Prentiss Co.
MS
AL
Union Co.
Lawrence Co.
Franklin Co.
Lee Co.
Itawamba Co.
Pontotoc Co.
Marion Co.
Winston Co.
Figure 4
Yellow Creek Site
20 and 50 Mile Radius
Yellow Creek Plant Site
20 Mile Buffer
50 Mile Buffer
Estimated populatation (Based on 2000 Census)
within the 20 Mile zone: 62,640
within the 50 Mile zone: 436,405
0 5 10 15 20
Miles
N
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TVA - OE&R - R&TA
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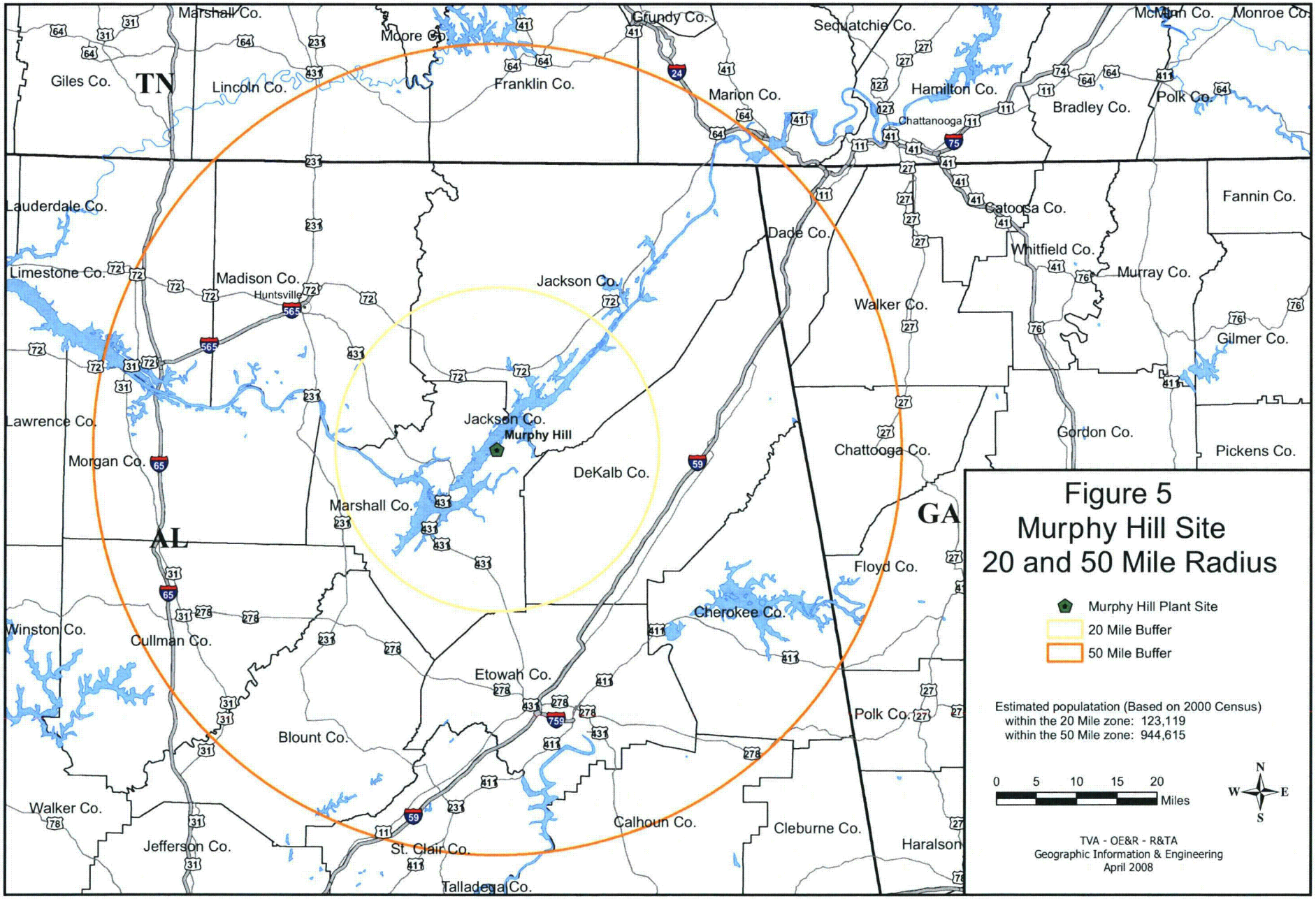
April 2008


Marshall Co.
Moore Co.
Grundy Co.
Sequatchie Co.
McMinn Co.
Monroe Co.
Giles Co.
TN
Lincoln Co.
Franklin Co.
Marion Co.
Hamilton Co.
Bradley Co.
Polk Co.
Chattanooga
Lauderdale Co.
Fannin Co.
Catoosa Co.
Dade Co.
Whitfield Co.
Limestone Co.
Madison Co.
Huntsville
Jackson Co.
Murray Co.
Walker Co.
Gilmer Co.
Lawrence Co.
Jackson Co.
Murphy Hill
Gordon Co.
Chattooga Co.
Pickens Co.
Morgan Co.
DeKalb Co.
Marshall Co.
GA
AL
Floyd Co.
Cherokee Co.
Winston Co.
Cullman Co.
Etowah Co.
Polk Co.
Blount Co.
Walker Co.
Calhoun Co.
Cleburne Co.
Haralson
Jefferson Co.
St. Clair Co.
Talladega Co.
Figure 5
Murphy Hill Site
20 and 50 Mile Radius
Murphy Hill Plant Site
20 Mile Buffer
50 Mile Buffer
Estimated populatation (Based on 2000 Census)
within the 20 Mile zone: 123,119
within the 50 Mile zone: 944,615
0 5 10 15 20
Miles
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TVA - OE&R - R&TA
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April 2008

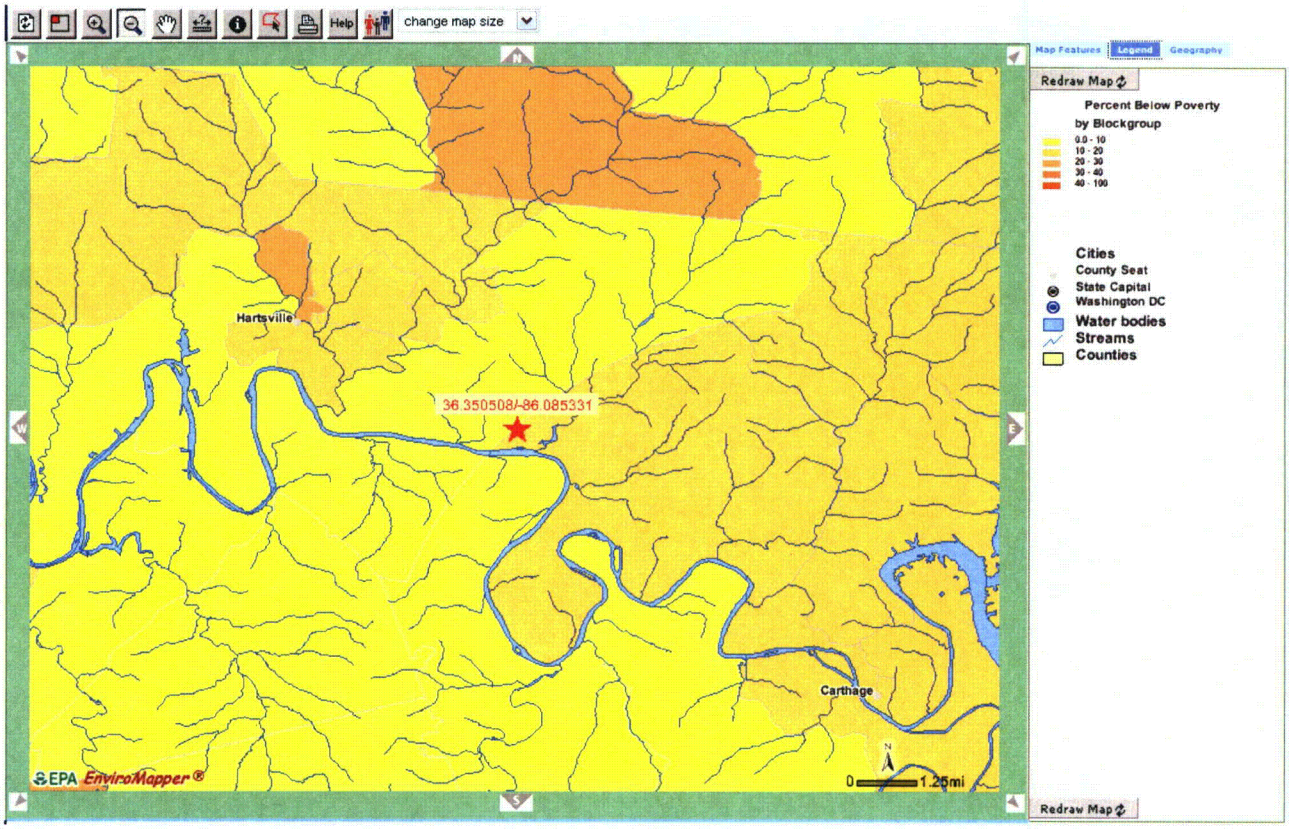


Figure 6 - Hartsville % Poverty by Blockgroup

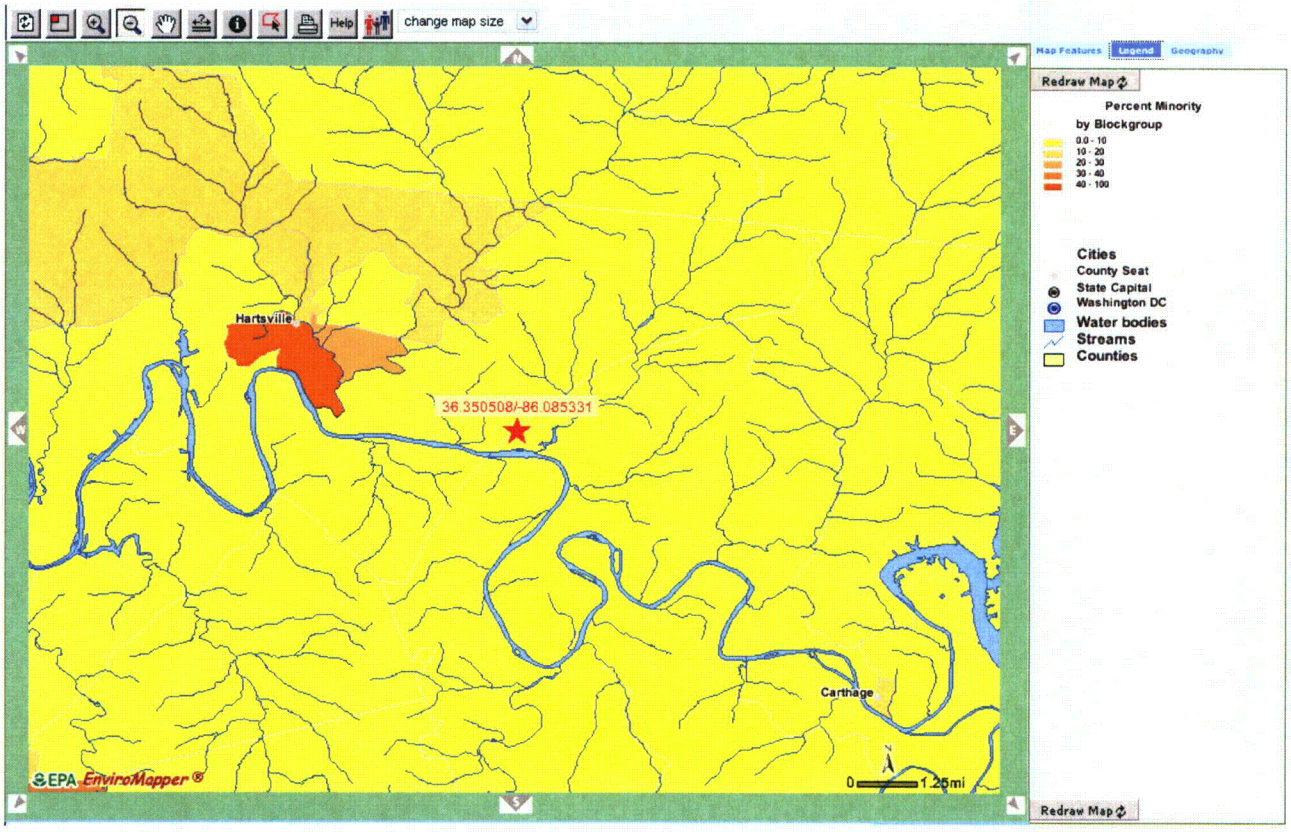


Figure 7 - Hartsville % Minority by Blockgroup

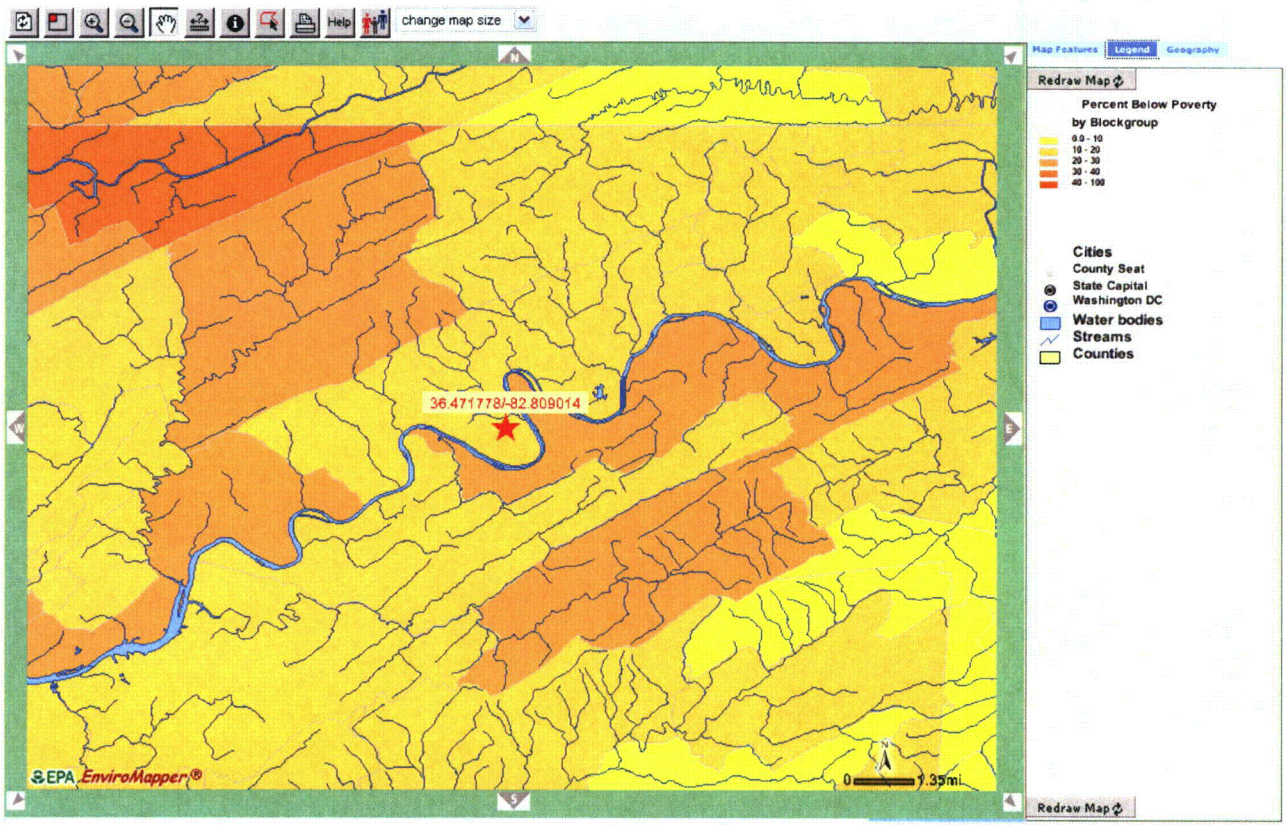


Figure 8 - Phipps Bend % Poverty by Blockgroup

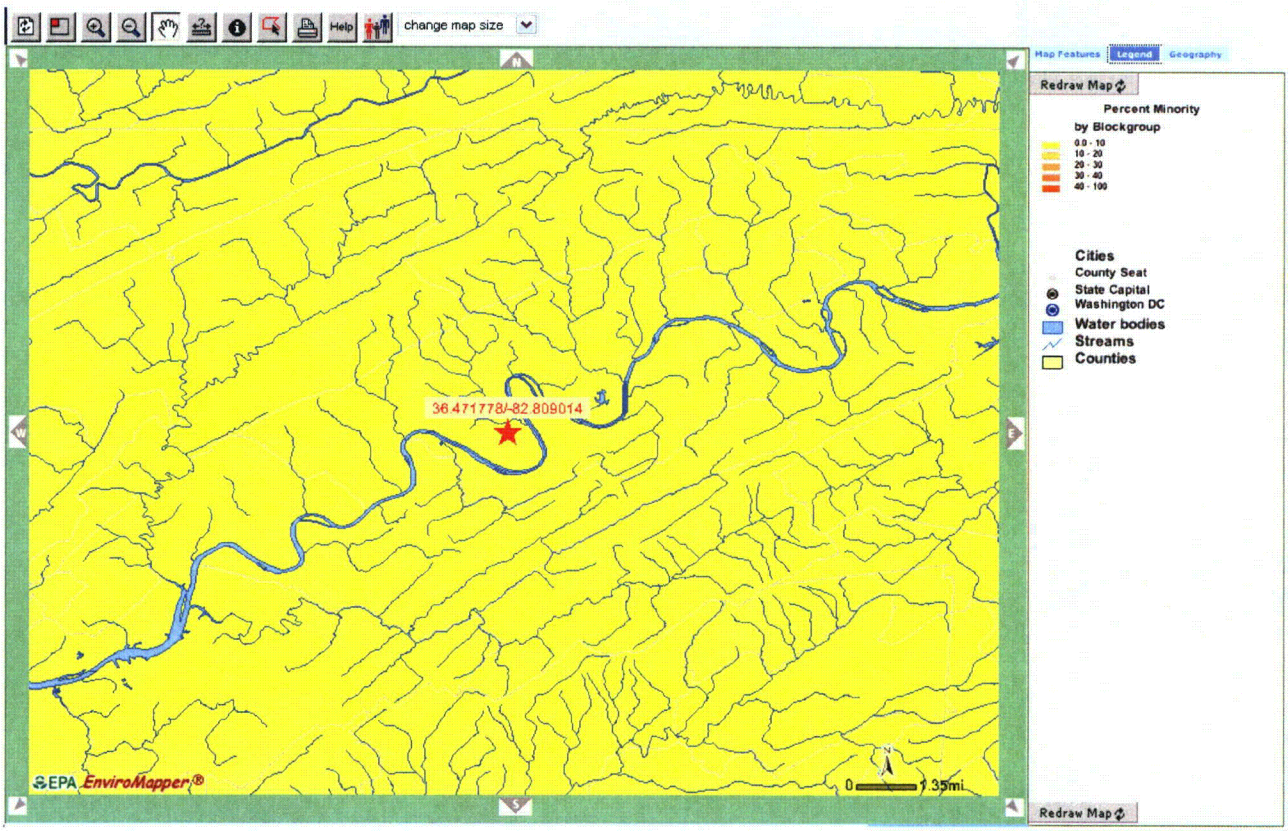


Figure 9 - Phipps Bend % Minority by Blockgroup

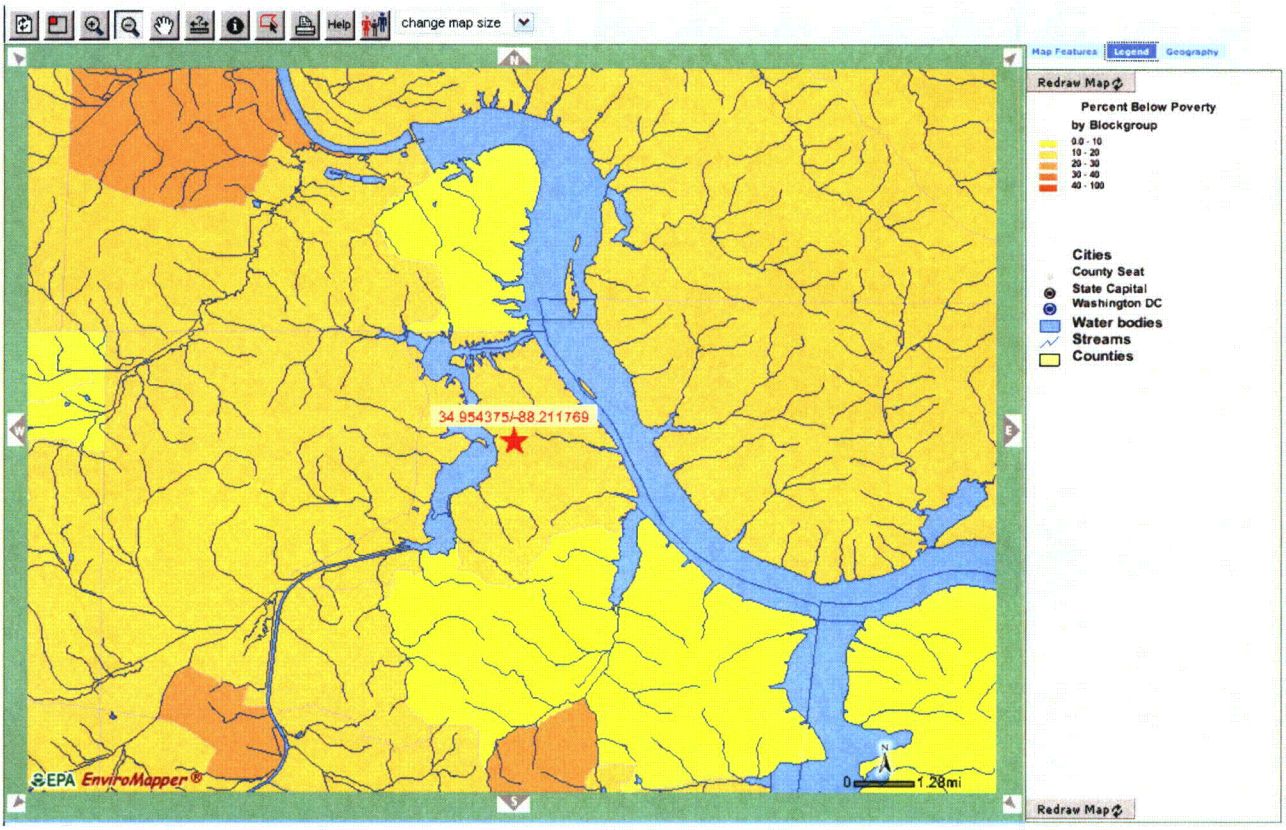


Figure 10 - Yellow Creek % Poverty by Blockgroup

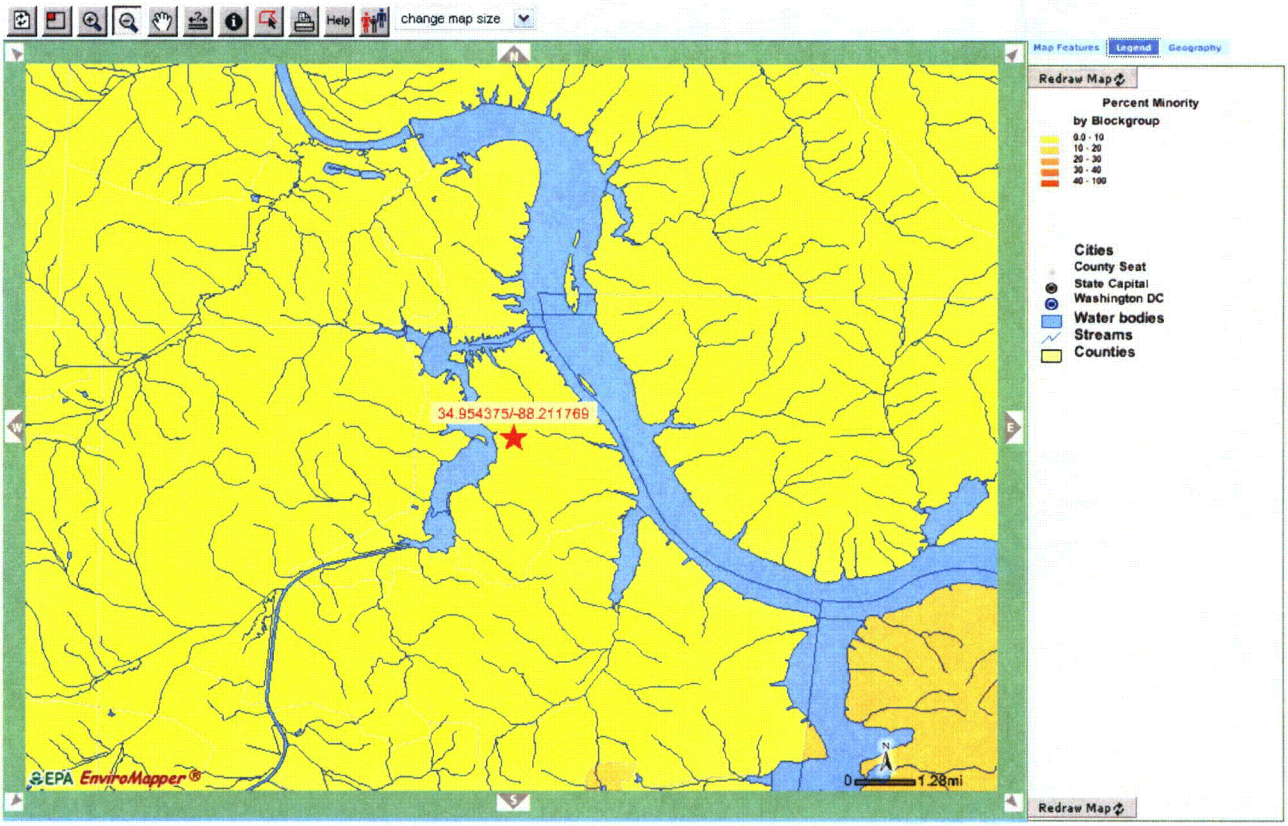


Figure 11 - Yellow Creek % Minority by Blockgroup

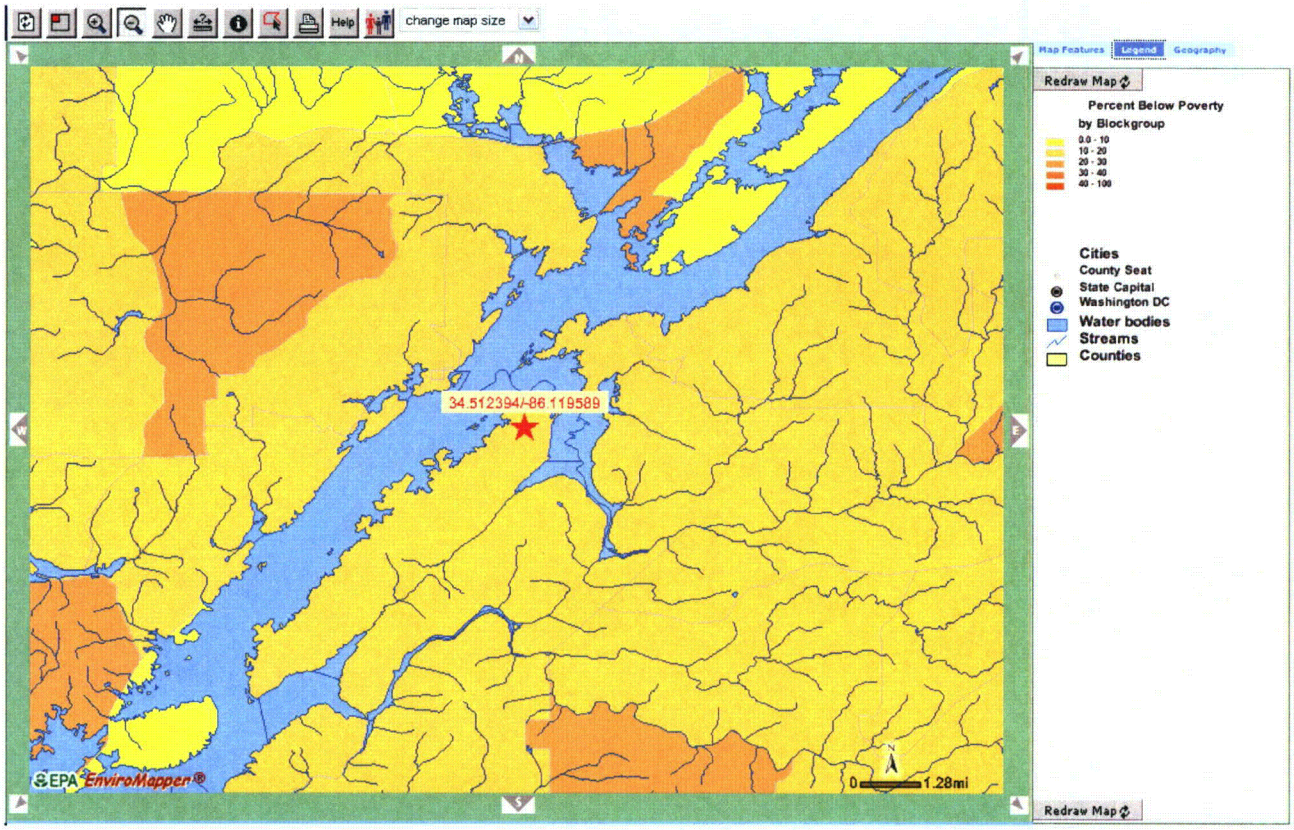


Figure 12 - Murphy Hill % Poverty by Blockgroup

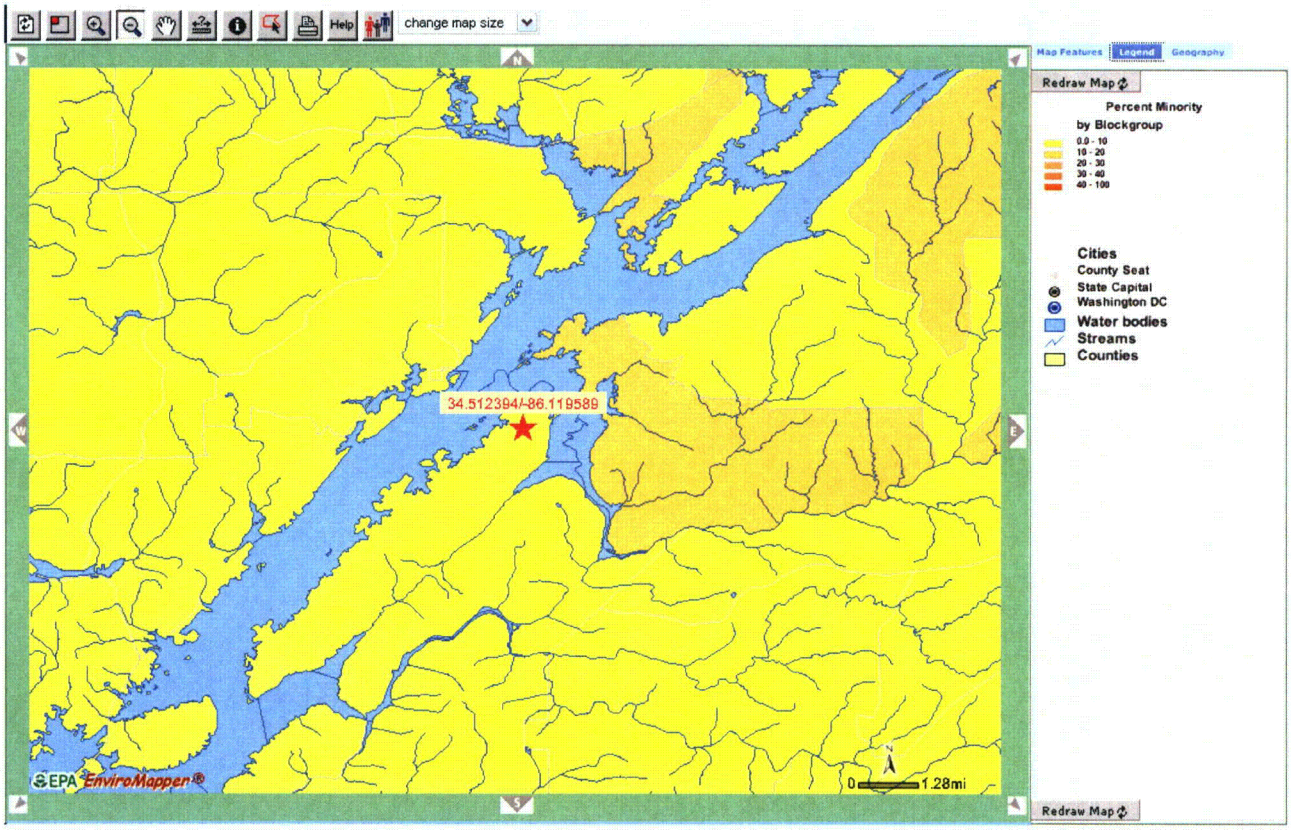


Figure 13 - Murphy Hill % Minority by Blockgroup

APPENDIX A

LIST OF TABLES

This appendix provides site-specific summaries and sources of technical information utilized in characterizing aquatic and terrestrial environments for rating the following environmental criteria:

- Construction-Related Effects on Aquatic Ecology
- Construction-Related Effects on Terrestrial Ecology

Hartsville Site

Wildlife Resources

Distinct groups of terrestrial wildlife are found in association with the vegetation types occurring on this site. Common amphibians and reptiles often found in old field habitats include American toad, upland chorus frog, and black racer. Birds found in this type of habitat include song sparrow, eastern towhee, eastern wild turkey, and black vulture. Resident mammals include eastern cottontail rabbit, white-tailed deer, and coyote. Amphibians and reptiles commonly found in riparian habitats include bullfrog, green frog, red-spotted newt, and northern water snake. Birds found in this type of habitat include Carolina wren, eastern phoebe, barred owl, and American woodcock. Mammals include beaver, muskrat, raccoon, and white-tailed deer. Seeps and damp rock outcrops with small pools of water are found on the site. These areas provide suitable habitat for frogs and salamanders and are likely used as a water source by a variety of wildlife species.

Amphibians and reptiles found in upland woodlands include spring peeper, gray tree frog, eastern box turtle, and gray rat snake. Birds commonly found in this type of habitat include red-tailed hawk, American crow, eastern tufted titmouse, and Carolina chickadee. Mammals common to the area include eastern gray squirrel, white-footed mouse, woodland vole, and eastern chipmunk.

Several species of game animals occur on the project area. The heavily modified habitats, which are abundant on the site, provide suitable habitat for white-tailed deer and eastern wild turkey. These species are quite common in the project area. Other game species such as beaver, eastern gray squirrel, eastern cottontail rabbit, American woodcock, and northern bobwhite quail are also found on the site. Ponds and wetlands on the area provide resting and foraging habitat for waterfowl including wood duck, Canada goose, mallard, and hooded merganser.

Important Terrestrial and Aquatic Species

The TVA Regional Natural Heritage Program database indicated that three state-listed animal species, Bewick's wren, Allegheny woodrat, and southeastern shrew, occur in Smith and Trousdale Counties. The gray bat, which is on the federal list of endangered species, is also known to occur in Smith County (Table hv1).

The USFWS' threatened, endangered and candidate species list for Smith and Trousdale Counties includes twelve plant and animal species including one mammal species, ten mollusk and one plant species. Of the federally listed species potentially present, only the gray bat has been observed near the Hartsville site. No federally listed threatened or endangered species were known to occur on, or immediately adjacent to, the Hartsville site.

Table hv1. Federally Listed Species Reported From Smith and/or Trousdale Counties, Tennessee

Common Name	Scientific Name	Federal Status	State Status
Mussels			
Dromedary pearlymussel	*Dromus dromas*	Endangered	Endangered
Cumberland combshell	*Epioblasma brevidens*	Endangered	Endangered
Orangefoot pimpleback	*Plethobasus cooperianus*	Endangered	Endangered
Ring pink	*Obovaria retusa*	Endangered	Endangered
White wartyback pearlymussel	*Plethobasus cicatricosus*	Endangered	Endangered
Yellow-blossom pearlymussel	*Epioblasma florentina florentina*	Endangered	Endangered
Purple catspaw	*Epioblasma obliquata obliquata*	Endangered	Endangered
Pink mucket	*Lampsilis abrupta*	Endangered	Endangered
Rough pigtoe	*Pleurobema plenum*	Endangered	Endangered
Appalachian monkeyface	*Quadrula sparsa*	Endangered	Endangered
Mammals			
Gray bat	Myotis grisescens	Endangered	Endangered
Plants			
Short's bladderpod	Lesquerella globosa	Candidate	

Table hv2. State-listed Animals Reported From Smith and Trousdale Counties, Tennessee			
Common Name	**Scientific Name**	**State Status**	**Federal Status**
Birds			
Bewick's wren	*Thryomanes bewickii bewickii*	Threatened	-
Bald eagle	*Halaieetus lecocephalus*	In Need of Management	-
Mammals			
Allegheny woodrat	*Neotoma magister*	In Need of Management	-
Southeastern shrew	*Sorex longirostris*	In Need of Management	-
Fish			
Dirty darter	*Etheostoma olivaceum*	In Need of Management	-

Aquatic Animals

Aquatic habitats that could be impacted by development on the Hartsville site are the Cumberland River (Old Hickory Reservoir), and several streams and constructed ponds present on the site. Aquatic communities in adjacent areas of Old Hickory Reservoir may be impacted by activities undertaken in riparian zones that change the topography of the shoreline, reduce the usefulness of shoreline areas for spawning and feeding, or alter shoreline vegetation, particularly the loss of a wooded shoreline.

The bank along the Cumberland River is almost entirely wooded, with sparse understory vegetation in areas immediately adjacent to the river. Most areas on top of the riverbank, and adjacent to formerly cleared areas are very dense, woody, old field habitats, except for small areas where access points and structures were constructed in association with the canceled nuclear plant.

TVA biologists collected monthly experimental gill net and electrofishing samples in the vicinity of the site from September 1992 through January 1993. Thirty-five species, none of which is protected species, were collected (Hartsville Appendix I). Gizzard and threadfin shad comprised the largest group of fish in the sample; more abundant game fish were bluegill, largemouth bass, and sauger.

Important Aquatic Species

Dirty darters (*Etheostoma olivaceum*), which are considered in need of management by the Tennessee Wildlife Resources Agency (TWRA), have been reported from Dixon Creek adjacent to the Hartsville site. Several federally listed mussel species were identified in previous surveys and were expected to be found in the Cumberland River near the proposed industrial park. Surveys by divers in January 2001 in the Cumberland River, in the vicinity of the site revealed that a once-thriving population of endangered mussels could no longer be found.

Botany

The Hartsville alternative site is located in the Outer Nashville Basin Ecoregion III, a part of the Interior Plateau Ecoregion IV (Griffith et al. 2001). The Interior Plateau is diverse and extends from southern Indiana and Ohio to northern Alabama. The natural vegetation is primarily oak-hickory forest, with some areas of bluestem prairie and cedar glades. Specifically, the Outer Nashville Basin has a rolling hilly topography with higher elevations than the Inner Basin. The region's limestone rocks and soils are high in phosphorus and support commercial phosphate mining. Deciduous forest with pasture and cropland are dominant land covers. Cedar glades are commonly found within the Nashville basin and globally rare glade communities are recognized from the region around the Hartsville project area. According to NatureServe (2007), the following is a list of rare plant communities known to occur in the Nashville Basin of Tennessee: Interior Low Plateau Limestone Glade Ephemeral Pool (G3), Southern Limestone Glade Margin Shrubland (G3), Central Limestone Glade (G2), Limestone Seep Glade (G2), Limestone Glade Streamside Meadow (G2), and Limestone Annual Grass Glade (G3).

A review of the TVA heritage database indicates that no federal and one state-listed species (*Arenaira fontinalis*-water stitchwort) is known to occur within five miles of the Hartsville alternative site (Table hv3). In addition, an historical record of *Leavenworthia exigua var. exigua* (glade cress), a species of special concern, was recorded from a rocky wet cedar glade and the federal candidate species, *Lesquerella globosa* (Short's bladderpod) is present in both Smith and Trousdale Counties, TN.

Table hv3. Species of conservation concern within five miles of Hartsville Alternative Site, Smith and Trousdale Counties

Common name	Scientific name	F-status	S-rank/Status
Glade cress	*Leavenworthia exigua var. exigua*	--	S3/SPCO (H)
Short's bladderpod	*Lesquerella globosa*	C	S2/END
Water stitchwort	*Arenaria fontinalis*	--	S3/THR

Federal status abbreviations: C=candidate

State status abbreviations: END=endangered; SPCO=Special Concern; THR=Threatened; H=historical record

State rank abbreviations: S2 – Imperiled often with <20 occurrences, S3 – rare or uncommon often with <80 occurrences

Due to the disturbance associated with the Hartsville alternative site and a review of maps and knowledge of rare plants and rare plant communities in the region, habitat for these rare species or the globally rare plant communities are not likely to occur within or adjacent to the Hartsville site; therefore no significant impacts to these botanical resources are expected if this site were selected.

References

Tennessee Valley Authority. 2002. Environmental Assessment and Finding of No Significant Impact Hartsville Nuclear Plant Site Trousdale and Smith Counties, Tennessee Transfer of TVA Property for Industrial Park. Tennessee Valley Authority. March 2002.

Fish Collected in Monthly Netting and Electrofishing Samples at the Hartsville Site, September 1992 through January 1993

Species	Netting		Electrofishing		Total Number	Relative Abundance
	Number	CPUE*	Number	CPUE*		
Longnose gar	36	0.9	4	0.5	40	4.4
Skipjack herring	17	0.4	-	-	17	1.9
Gizzard shad	80	2.0	218	26.0	298	33.0
Threadfin shad	-	-	166	19.8	166	18.4
Mooneye	69	1.7	-	-	69	7.7
Carp	-	-	28	3.3	28	3.1
Silver chub	-	-	1	0.1	1	0.1
Emerald shiner	-	-	18	2.1	18	2.0
Spotfin shiner	-	-	1	0.1	1	0.1
River carpsucker	21	0.5	4	0.5	25	2.8
Quillback	2	0.1	-	-	2	0.2
Smallmouth buffalo	27	0.7	11	1.3	38	4.2
Bigmouth buffalo	1	t**	3	0.4	4	0.4
Black buffalo	-	-	2	0.2	2	0.2
Spotted sucker	8	0.2	14	1.7	22	2.4
Black redhorse	4	0.1	4	0.5	8	0.9
Golden redhorse	5	0.1	13	1.5	18	2.0
Yellow bullhead	1	t**	-	-	1	0.1
Channel catfish	9	0.2	-	-	9	1.0
White bass	1	t**	-	-	1	0.1
Yellow bass	1	t**	2	0.2	3	0.3
Striped bass	2	0.1	-	-	2	0.2
Warmouth	-	-	1	0.1	1	0.1
Redbreast sunfish	-	-	2	0.2	2	0.2
Green sunfish	-	-	3	0.4	3	0.3
Bluegill	-	-	52	6.2	52	5.8
Longear sunfish	-	-	1	0.1	1	0.1
Redear sunfish	1	t**	3	0.4	4	0.4
Hybrid sunfish	1	t**	-	-	1	0.1
Spotted bass	-	-	2	0.2	2	0.2
Largemouth bass	-	-	31	3.7	31	3.4
White crappie	-	-	1	0.1	1	0.1
Sauger	11	0.3	-	-	11	1.2
Walleye	2	0.1	-	-	2	0.2
Freshwater drum	6	0.2	12	1.4	18	2.0
Total (35 species)	305		597		902	

CPUE* - Catch per Unit Effort

t** - trace (value too low to record)

Phipps Bend Site

Wildlife Resources

The latest available data describing the resources at or near the Phipps Bend site are included in the earlier FES for the Phipps Bend Nuclear Plant (1).

Important Terrestrial Species

The USFWS' Hawkins County, Tennessee, threatened, endangered and candidate species list includes eleven animal species, including two mammal species, one fish, and eight mollusk species. The TVA Regional Natural Heritage database identified two federally listed terrestrial animal species that, because of their foraging range may occur on or adjacent to the Phipps Bend site (Table pb1). Of the two federally listed species potentially present, only the gray bat has been observed near the Phipps Bend site. No federally listed threatened or endangered plant species are known, to occur on, or immediately adjacent to, the Phipps Bend site. No important wading bird colonies are reported within three miles of the Phipps Bend site. Two state-listed terrestrial species (barn owl and Virginia rail) have been seen on the Phipps Bend site.

Table pb1. Federally Listed Species Reported from Hawkins County, Tennessee

Common Name	Scientific Name	Federal Status	State Status
Mussels			
Birdwing pearly mussel	*Lemiox rimosus*	Endangered	Endangered
Fine-rayed pigtoe pearly mussel	*Fusconaia cuneolus*	Endangered	Endangered
Cumberland bean pearly mussel	*Villosa trabalis*	Endangered	Endangered
Turgid blossom pearly mussel	*Epioblasma turgidula*	Endangered	Endangered
Shiny pigtoe	*Fusconaia edgariana*	Endangered	Endangered
Cumberland monkeyface pearly mussel	*Quadrula intermedia*	Endangered	Endangered
Green blossom pearly mussel	*Epioblasma torulosa gubernaculum*	Endangered	Endangered
Purple bean	*Villosa perpurpurea*	Endangered	Endangered
Fish			
Spotfin chub	*Cyprinella monacha*	Threatened	Threatened
Mammals			
Gray bat	*Myotis grisescens*	Endangered	Endangered
Indiana bat	*Myotis sodalis*	Endangered	Endangered

Source:

Tennessee Valley Authority, *Environmental Report — Phipps Bend Nuclear Plant, Units 1 and 2,* Revision 6, 1977.

Table pb2. State-listed Species Reported from Hawkins County, Tennessee

Common Name	Scientific Name	Federal Status	State Status
Fish			
Tangerine Darter	*Percina aurantiaca*	-	In Need of Management
Blotchside Logperch	*Percina burtoni*	-	In Need of Management
Tennessee Dace	*Phoxinus tennesseensis*	-	In Need of Management
Highfin Carpsucker	*Carpiodes velifer*	-	In Need of Management
Birds			
Common Barn-owl	*Tyto alba*	-	In Need of Management
Common Raven	*Corvus corax*	-	Threatened
Virginia Rail	*Rallus limicola*	-	NOST
Bald eagle	*Haliaeetus lecocephalus*	-	In Need of Management
Mammals			
Woodland Jumping Mouse	*Napaeozapus insignis*	-	In Need of Management
Allegheny Woodrat	*Neotoma magister*	-	In Need of Management
Hairy-tailed Mole	*Parascalops breweri*	-	In Need of Management
Common Shrew	*Sorex cinereus*	-	In Need of Management
Southeastern Shrew	*Sorex longirostris*	-	In Need of Management
Eastern Big-eared Bat	*Corynorhinus rafinesquii*	-	In Need of Management
Southern Bog Lemming	*Synaptomys cooperi*	-	In Need of Management

Aquatic Animals

TVA employs an Index of Biotic Integrity (IBI) (Appendix Phipps Bend I) to assess environmental quality of free-flowing streams and some tailwater areas in the Tennessee River system by applying ecologically based metrics to resident aquatic communities. TVA has a "fixed station" IBI site at Holston River mile (HRM) 118, just downstream of the Phipps Bend site. This site was sampled yearly from 1990 to 1997 (with the exception of 1995), and has been sampled every other year beginning in 2001. This locality has consistently rated in the 'fair/good' or good categories during recent sampling (2001 - 2007). This river supports a good warmwater fishery including largemouth, smallmouth and spotted bass.

Important Aquatic Species

Several state- and federally listed aquatic species are known from Hawkins County, Tennessee. (Tables pb1 and pb2). The spotfin chub (federally listed as Threatened) is routinely collected at the HRM 118 IBI site and is likely present in the Holston River adjacent to the Phipps Bend site. None of the eight federally listed mussel species reported from Hawkins County has been collected from the mainstem of the Holston River in the vicinity of the Phipps Bend site. No state- or federally listed aquatic species are known to occur on the Phipps Bend site itself. The Cumberland bean mussel and purple bean mussel are reported from Beech Creek, at tributary to the Holston River that enters the river at approximately HRM 109, but are not known to occur in the mainstem Holston River.

Botany

Phipps Bend, located in the Southern Shale Valleys Ecoregion IV, a subdivision of the Ridge and Valley Ecoregion III occurs between the Blue Ridge Mountains on the east to the Cumberland Plateau on the west and is a relatively low lying region made up of roughly parallel ridges and valleys that were formed through extreme folding and faulting events in past geologic time (Griffith et al. 2001). The Southern Shale Valleys consist of lowlands, rolling valleys and slopes and hilly areas dominated by shale materials. Small farms and rural residences occur throughout where land is used for grazing or farming tobacco, corn, or hay (Griffith et al. 2001). Much of the area has been highly disturbed and partially cleared, leaving only a small portion of the site in woody vegetation.

A review of the Natural Heritage Database listed one plant occurrence (an historic record of Appalachian bugbane) within five miles of Phipps Bend. A wider search of 10 miles was conducted and an additional six species were found to occur within 10 miles of the site (Table pb3).

Table pb3. Species of conservation concern within 10* miles of Phipps Bend Alternative Site, Hawkins County, TN

Common name	Scientific name	F-status	S-rank/Status
American barberry	*Berberis canadensis*	--	S2/SPCO
Appalachian bugbane	*Cimicifuga rubifolia*	--	S3/THR (H)
Pink lady-slipper	*Cypripedium acaule*	--	S4/E-CE
Mountain honeysuckle	*Lonicera dioica*	--	S2/SPCO
American ginseng	*Panax quinquefolius*	--	S3S4/S-CE
Canby's mountain-lover	*Paxistima canbyi*	--	S1/END
Mountain fetter-bush	*Pieris floribunda*	--	S2/END

State status abbreviations: E-CE=Endangered-commercially exploited; END=endangered; S-SE=Special Concern-commercially exploited; SPCO=Special Concern; THR=Threatened; H=historical record

State rank abbreviations: S1 – critically imperiled often with 5 or fewer occurrences, S2 – Imperiled often with <20 occurrences, S3 – rare or uncommon often with <80 occurrences, S4--apparently secure in the state with many occurrences.

There are no known uncommon terrestrial plant communities or federally listed Threatened and Endangered species occurring in the vicinity of the Phipps Bend site. In addition, there are several state-listed plant species known to occur within 10 miles of the project site, but a review of maps and knowledge of rare plants in the region indicates habitat for these species do not occur within or adjacent to the site; therefore, no significant impacts to these botanical resources are expected if this site selected.

TVA Index of Biotic Integrity (IBI)

An Index of Biotic Integrity (IBI) is used to assess environmental quality by applying ecologically based metrics to resident aquatic communities. TVA uses a 12-metric fish IBI to assess tailwater quality. Each metric rates the condition of one aspect of the community. Metrics are scored against the expected condition of regional un-impacted stream communities. Potential scores are 1-poor, 3-intermediate, or 5-best condition.

The 12 metrics used in the fish IBI are as follows:

1. Number of native species
2. Number of native darter species
3. Number of sunfish species
4. Number of native sucker species
5. Number of intolerant species
6. Percentage of fish as tolerant species
7. Percentage of fish as omnivores and stoneroller species
8. Percentage of fish as specialized insectivores
9. Percentage of fish as piscivores
10. Catch rate (average number per standardized sampling effort)
11. Percentage of fish as hybrids
12. Percentage of fish with disease, tumors, body damage, or other anomalies

To produce a site rating, scores for the 12 metrics are summed. Sites attain 1 of 6 possible ratings: (1) no fish, (2) very poor (12-22), (3) poor (28-34), (4) fair (40-44), (5) good (48-52), or (6) excellent (58-60) (Karr et al. 1986).

The worst rating, no fish, indicates that repetitive sampling fails to turn up any fish. Sites rating very poor have few fish present, fish tend to be introduced or tolerant species, hybrids are common, and disease and anomalies occur regularly on fish. Poor sites are dominated by omnivores (fish that eat plants, animals, and sometimes detritus), fish are tolerant of pollution and are habitat generalists, few top piscivores are present, and hybrids and disease are present. Sites attaining a fair rating have lowered species diversity, few intolerant forms, skewed trophic structure (increasing number of omnivores), and older age classes of top predators may be rare. Good ratings are attained when species richness is only slightly below regional expectations, mostly due to loss of most sensitive species, abundances or size distribution is not quite optimal, and trophic structure shows some signs of stress (more omnivores than usual and fewer piscivores than natural conditions). The highest rating, excellent, is attained by sites that are comparable to the best natural situations without influence of humans. Excellent sites have all regionally expected species for the habitat and stream size, including tolerant forms, a normal age-size distribution, all sex classes, and a balanced trophic structure.

Holston River Mile 118 IBI Ratings

Year	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**2001**	**2003**	**2005**	**2007**
IBI Score	fair/good	good	good	fair/good	fair	not sampled	Fair	fair	good/ excellent	fair/good	good	good

Literature Cited

Chapman, S.S, G.E. Griffith, J.M. Omernik, J.A. Comstock, M.C. Beiser, D. and Johnson, 2004. Ecoregions of Mississippi, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,000,000).

Griffith, G.E., J.M. Omernik, S. Azevedo, 2001. Ecoregions of Tennessee, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1: 250,000)

Griffith, G.E., J.M. Omernik, J.A. Comstock, S. Lawrence, G. Martin, A. Goddard, V.J. Hulcher, and T. Foster, 2001, Ecoregions of Alabama and Georgia, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,700,000).

Nature Serve. 2007. Nature Serve Explorer: An online encyclopedia of life [web application]. Version 6.1. Nature Serve, Arlington, Virginia. Available: http://www.natureserve.org/explorer (Accessed 13 August 2007).

Yellow Creek Site

Wildlife Resources

Much of this site has been disturbed by previous construction activities and terrestrial habitat consists primarily of early to mid-successional vegetation. Relatively undisturbed forest areas are dominated by oak (*Quercus spp.*) and hickory (*Carya spp.*) species mixed with some pines (*Pinus spp*). The surrounding landscape consists of similar forested habitat. There are no records of important wading colonies within three miles of the project site.

The deciduous forested areas provide habitat for bird species such as wild turkey, Carolina chickadee, downy woodpecker, American crow, red-eyed vireo, and tufted titmouse. Other animals likely occurring in this habitat include white-tailed deer, eastern gray squirrel, white-footed mouse, slimy salamander, eastern box turtle, and copperhead.

Birds common in early successional habitats include Carolina wren, eastern bluebird, white-eyed vireo, northern cardinal, and indigo bunting. Common mammals include striped skunk, eastern cottontail rabbit, white-tailed deer, Virginia opossum and various rodents. Reptiles often found in early successional habitats include racers, black rat snake, and eastern garter snake.

Important Terrestrial Species

The USFWS' Tishomingo County, Mississippi, threatened, endangered and candidate species list includes four plant and animal species including two mammal species and two mollusk species. The TVA Regional Natural Heritage database identified three terrestrial animal species that may occur on or adjacent to the Murphy Hill site (Table yc1). Of the federally listed species potentially present, only the gray bat has been observed near the Yellow Creek site. No federally listed threatened or endangered plant species were known to occur on, or immediately adjacent to, the Yellow Creek site. No important wading bird colonies are reported within three miles of the Yellow Creek site.

Table yc1. Federally Listed Species Reported from Tishomingo County, Mississippi

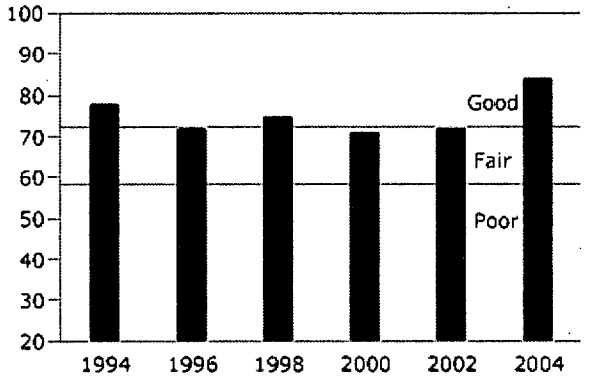
Common Name	Scientific Name	Federal Status	State Status
Mussels			
Cumberlandian combshell	*Epioblasma brevidens*	Endangered	Endangered
Slabside Pearlymussel	*Lexingtonia dolabelloides*	Candidate	Protected
Mammals			
Gray bat	*Myotis grisescens*	Endangered	Endangered
Indiana bat	*Myotis sodalis*	Endangered	Endangered

Aquatic Animals

TVA monitored Pickwick Reservoir annually from 1991 through 1994 to establish baseline data on the reservoir's ecological health under a range of weather and flow conditions. Pickwick Reservoir is now evaluated every other year. The overall ecological condition in Pickwick Reservoir rated good in 2004,

with the highest score to date. The inflow rating, which is based on fish and benthos, also was the highest to date in 2004 and contributed to the overall higher score for the reservoir. Pickwick has scored about the same every year — either "high fair" or good — depending primarily on chlorophyll concentrations, which are affected by reservoir flows, and conditions in the Bear Creek embayment, which generally rate lower than at other monitoring locations on the reservoir.

Pickwick Reservoir Ecological Health Ratings, 1994-2004



The table below shows the ratings for individual ecological health indicators at Pickwick in 2004. These ratings are briefly explained in the paragraphs that follow.

Ecological Health Indicators for Pickwick Reservoir, 2004

Monitoring locations	Dissolved oxygen	Chlorophyll	Fish	Bottom life	Sediment
Forebay	Good	Poor	Good	Fair	Good
Mid-reservoir	Good	Good	Fair	Good	Good
Bear Creek embayment	Fair	Poor	Good	Fair	Good
Inflow (near Wilson Dam)			Good	Good	

See definitions of the five ecological health indicators and locations of monitoring sites.

Dissolved oxygen

Dissolved oxygen rated good at the forebay and mid-reservoir locations and fair at the embayment location. The fair rating in the embayment was due to an area of low dissolved oxygen (<2 mg/L) in June and July. Dissolved oxygen typically rates good in the forebay except in years with low reservoir flows, such as 2000 and 2002, when it rated fair. Dissolved oxygen has rated good at the mid-reservoir location for each of the years monitored.

Chlorophyll

Chlorophyll rated good at the mid-reservoir and poor at the forebay and embayment locations. These were the only poor ratings for the reservoir in 2004. The influence of reservoir flow on chlorophyll levels is illustrated by this reservoir, especially the mid-reservoir, where chlorophyll rated poor during drought conditions in 2000 and 2002. Years with low reservoir flows tend to allow more time for algal populations to become established.

Fish

The fish community rated good at each of the monitoring locations in 2004. This is consistent with previous monitoring results. Fish community ratings have fluctuated between good and "high fair" ratings at each of the monitoring locations.

Bottom life

Similar to previous years, the bottom life rated fair or good at each of the monitoring locations.

Sediment

Sediment samples collected from the reservoir bottom were free of pesticides and PCBs, and concentrations of metals were within expected background levels, resulting in good ratings for sediment quality at each of the monitoring monitoring locations.

Important Aquatic Species

Several state- and federally listed aquatic species are known from Tishomingo County, Mississippi (Tables yc1 and yc2). However, due to the impoundment of Yellow Creek during the creation of Pickwick Reservoir and habitat alterations in streams on the Yellow Creek site, none of these species is currently known to occupy areas on or adjacent to the Yellow Creek site.

Table yc2. State-Listed Species Reported from Tishomingo County, Mississippi

Common Name	Scientific Name	Federal Status	State Status
Mussels			
White Heelsplitter	*Lasmigona complanata*	-	NOST
Pink Heelsplitter	*Potamilus alatus*	-	NOST
Reptiles			
Southern Coal Skink	*Eumeces anthracinus pluvialis*	-	NOST
Ouachita Map Turtle	*Graptemys ouachitensis*	-	NOST
Mole Kingsnake	*Lampropeltis calligaster rhombomaculata*	-	NOST
Black Kingsnake	*Lampropeltis getula nigra*	-	NOST
Queen Snake	*Regina septemvittata*	-	NOST
Fish			
Spotfin Shiner	*Cyprinella spiloptera*	-	NOST
Steelcolor Shiner	*Cyprinella whipplei*	-	NOST
Greenside Darter	*Etheostoma blennioides newmanii*	-	NOST
Fantail Darter	*Etheostoma flabellare*	-	NOST
Stripetail Darter	*Etheostoma kennicotti*	-	NOST
Redline Darter	*Etheostoma rufilineatum*	-	NOST
Bandfin Darter	*Etheostoma zonistium*	-	NOST
Rosefin Shiner	*Lythrurus fasciolaris*	-	NOST
Black Redhorse	*Moxostoma duquesnei*	-	NOST
Shorthead Redhorse	*Moxostoma macrolepidotum*	-	NOST
Bigeye Shiner	*Notropis boops*	-	Endangered
Rosyface Shiner	*Notropis micropteryx*	-	NOST
Suckermouth Minnow	*Phenacobius mirabilis*	-	Endangered
Blacknose Dace	*Rhinichthys atratulus*	-	NOST
Birds			
Sharp-shinned Hawk	*Accipiter striatus*	-	NOST
Bewick's Wren	*Thryomanes bewickii bewickii*	-	NOST
Bald eagle	*Haliaeetus lecocephalus*	-	Endangered
Mammals			
Northern Long-eared Bat	*Myotis septentrionalis*	-	NOST
Amphibians			
Green Salamander	*Aneides aeneus*	-	Endangered
Eastern Hellbender	*Cryptobranchus alleganiensis alleganiensis*	-	NOST
Cave Salamander	*Eurycea lucifuga*	-	Endangered
Spring Salamander	*Gyrinophilus porphyriticus*	-	Endangered
Four-toed Salamander	*Hemidactylium scutatum*	-	NOST
Southern Zigzag Salamander	*Plethodon ventralis*	-	NOST
Mountain Chorus Frog	*Pseudacris brachyphona*	-	NOST
Red Salamander	*Pseudotriton ruber*	-	NOST

NOST - These species have no official state status, but are tracked as sensitive species by the State of Mississippi Natural Heritage program.

Botany

The Yellow Creek site occurs within the Transition Hills Ecoregion III that is a subdivision of the Southeastern Plains Ecoregion IV. The Transition Hills contains characteristics of both the Southeastern Plains and the Interior Plateau Ecoregions. It has some of the higher-most elevations of the Southeastern Plains. Many streams in this transition zone have cut down into the Mississippian and Devonian-age rocks and look very similar to those of the Interior Plateau. Although there are small areas of cropland and pasture in the valleys and on gently sloping ridges, the region is mostly forested with oak-hickory-pine forest (Chapman et al. 2004). There are no known uncommon terrestrial plant communities known to occur in the vicinity of Yellow Creek.

A review of the Natural Heritage Database indicates there are 159 records of rare plant occurrences within five miles of the Yellow Creek site. There is one federally listed species and 60 state listed species known from within five miles of the site (Table yc3). The federal Candidate species, *Platanthera integrilabia* (Monkey face orchid), was found during initial field reviews of the site in 1974. Due to construction activities in the area around Tackett Branch, Monkey face orchid plants have not been seen since 1991 and the population is thought to have been destroyed.

Table yc3. Species of conservation concern within five miles of Yellow Creek Alternative Site, Tishomingo County, MS

Common Name	Scientific Name	F Status	S Rank
Alabama snow-wreath	*Neviusia alabamensis*	-	S1
Allegheny-spurge	*Pachysandra procumbens*	--	S3
American bladdernut	*Staphylea trifolia*	--	S3
American ginseng	*Panax quinquefolius*	--	S3
Autumn goldenrod	*Solidago sphacelata*	--	S1S2
Big shellbark hickory*	*Carya laciniosa*	--	S2S3
Black bugbane	*Cimicifuga racemosa*	--	S1S2
Black-stem spleenwort	*Asplenium resiliens*	--	S1
Blue ash	*Fraxinus quadrangulata*	--	S2
Canada wild-ginger	*Asarum canadense*	--	S2S3
Canadian milkvetch	*Astragalus canadensis*	--	S2
Carolina tassel-rue	*Trautvetteria caroliniensis*	--	S1
Crested Fringed orchid*	*Platanthera cristata*	--	S3
Downy Yellow violet	*Viola pubescens var. eriocarpa*	--	S1S2
Dutchman's breeches	*Dicentra cucullaria*	--	S1
Dwarf larkspur*	*Delphinium tricorne*	--	S2
Eastern leatherwood	*Dirca palustris*	--	S2
Ernest's spider-wort	*Tradescantia ernestiana*	--	S1
Giant alumroot	*Heuchera villosa var. macrorhiza*	--	S1
Giant chickweed	*Stellaria pubera*	--	S2S3
Greek valerian	*Polemonium reptans*	--	S2S3
Green violet*	*Hybanthus concolor*	--	S2
Hairy lipfern	*Cheilanthes lanosa*	--	S2
Heart-leaved foam-flower	*Tiarella cordifolia*	--	S2
Kentucky coffee-tree	*Gymnocladus dioicus*	--	S2
Large-leaf water-leaf	*Hydrophyllum macrophyllum*	--	S1
Lovage	*Ligusticum canadense*	--	S1S2
Mock-orange	*Philadelphus hirsutus*	--	S1
Monkey-face orchid*	*Platanthera integrilabia*	C	S1

Table yc3. Species of conservation concern within five miles of Yellow Creek Alternative Site, Tishomingo County, MS			
Mountain holly	*Ilex montana*	--	S3?
Muhly	*Muhlenbergia tenuiflora*	--	S1S2
Nodding trillium	*Trillium flexipes*	--	S1
Perideridia	*Perideridia americana*	--	S1S2
Phacelia	*Phacelia bipinnatifida*	--	S1
Purple cliff-brake*	*Pellaea atropurpurea*	--	S1S2
Puttyroot	*Aplectrum hyemale*	--	S1
Sedge	*Carex jamesii*	--	S1S2
Sedge	*Carex picta*	--	S2S3
Sedge	*Carex prasina*	--	S1
Sedge*	*Carex stricta*	--	S2
Shooting star*	*Dodecatheon meadia*	--	S2
Sicklepod	*Arabis canadensis*	--	S2S3
Silvery glade fern	*Athyrium thelypterioides*	--	S2S3
Single-head pussytoes	*Antennaria solitaria*	--	S3?
Slender toothwort*	*Dentaria heterophylla*	--	S2S3
Smoother sweet-cicely	*Osmorhiza longistylis*	--	S3
Spotted wintergreen*	*Chimaphila maculata*	--	S2
Stonecrop*	*Sedum ternatum*	--	S2
Turk's Cap lily	*Lilium superbum*	--	S3
Two-leaf toothwort	*Dentaria diphylla*	--	S1S2
Virginia bluebells	*Mertensia virginica*	--	S1S2
Virginia pine*	*Pinus virginiana*	--	S2
Wahoo	*Euonymus atropurpureus*	--	S2S3
Walking fern	*Asplenium rhizophyllum*	--	S1S2
Waterleaf	*Hydrophyllum appendiculatum*	--	S2?
White turtlehead	*Chelone glabra*	--	S3
Wild columbine	*Aquilegia canadensis*	--	S1S2
Wild hyacinth*	*Camassia scilloides*	--	S2S3
Woodrush	*Luzula acuminata*	--	S3
Yellow trout-lily*	*Erythronium rostratum*	--	S1S2
Yellowwood	*Cladrastis kentukea*	--	S2

* 17 species of conservation concern recorded from within the Yellow Creek Reservation.

Federal status abbreviations: C=candidate

State rank abbreviations: S1 – critically imperiled often with 5 or fewer occurrences, S2 – Imperiled often with <20 occurrences, S3 – rare or uncommon often with <80 occurrences, S4--apparently secure in the state with many occurrences.

State status: Mississippi does not give status to state listed species; NOST=no state status

Along with the historic record of the federal Candidate species, *Platanthera integrilabia* (monkey-face orchid), there are 16 state-listed species recorded from the Yellow Creek Reservation. Even though much of the Yellow Creek site has been highly disturbed, a review of maps and knowledge of rare plants in the region indicates that remnant habitat for these species could occur within or adjacent to the site; therefore substantive impacts to local populations of these state-listed species could occur if this site were chosen.

Murphy Hill Site

Wildlife Resources

Habitats for terrestrial animals at the Murphy Hill site are similar to conditions at the Bellefonte Site. These two sites are located in the same physiographic region, and both sites border Guntersville Reservoir.

Important Terrestrial Species

The USFWS' Marshall County, Alabama, threatened, endangered and candidate species list includes fourteen plant and animal species including two mammal species, one bird, one turtle, one amphibian, six mollusk and three plant species. Of the federally listed species potentially present, only the gray bat has been observed near the Murphy Hill. No federally listed threatened or endangered plant species were known to occur on, or immediately adjacent to, the Murphy Hill site.

Table mh1. Federally Listed Species Reported from Marshall County, Alabama

Common Name	Scientific Name	Federal Status	State Status
Mussels			
Pink mucket pearlymussel	*Lampsilis abrupta*	Endangered	Protected
Shiny pigtoe pearlymussel	*Fusconaia cor*	Endangered	Protected
Fine-rayed pigtoe mussel	*Fusconaia cuneolus*	Endangered	Protected
Orange-footed pimpleback mussel	*Plethobasus cooperianus*	Endangered	Protected
Rough pigtoe mussel	*Pleurobema plenum*	Endangered	Protected
Slabside pearlymussel	*Lexingtonia dolabelloides*	Candidate	Protected
Amphibians			
Black Warrior waterdog	*Necturus alabamensis*	Candidate	Protected
Fish			
Snail darter	*Percina tanasi*	Threatened	Protected
Turtles			
Flattened musk turtle	*Sternotherus depressus*	Candidate	Protected
Birds			
Red-cockaded woodpecker	*Picoides borealis*	Endangered	Protected
Mammals			
Gray bat	*Myotis grisescens*	Endangered	Endangered
Indiana bat	*Myotis sodalis*	Endangered	Endangered
Plants			
Price's potato bean	*Apios priceana*	Threatened	
Green pitcher plant	*Sarracenia oreophila*	Endangered	

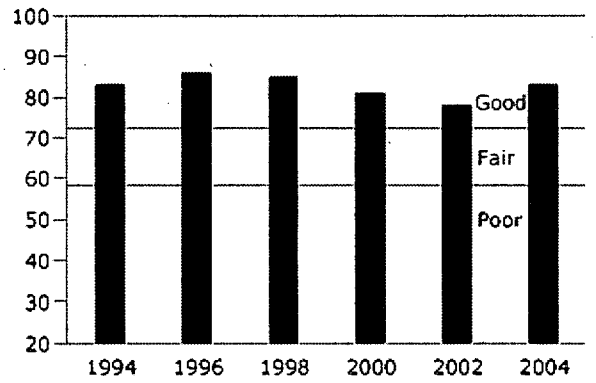
Table mh2. State-listed Animals Reported From Marshall County, Alabama			
Common Name	**Scientific Name**	**State Status**	**Federal Status**
Birds			
Bewick's wren	*Thryomanes bewickii bewickii*	Protected	-
Osprey	*Pandion haliaetus*	Protected	-
Peregrine Falcon	*Falco peregrinus*	Protected	-
Bald eagle	*Haliaeetus leucocephalus*	Protected	-
Amphibians			
Eastern Hellbender	*Cryptobranchus alleganiensis alleganiensis*	Protected	-
Green Salamander	*Aneides aeneus*	Protected	-
Tennessee Cave Salamander	*Gyrinophilus palleucus*	Protected	-
Mammals			
Eastern Big-eared Bat	*Corynorhinus rafinesquii*	Protected	-
Fish			
Southern Cavefish	*Typhlichthys subterraneus*	Protected	-

State status: Rare animals in Alabama are listed as "Protected" by Alabama Regulations.

Aquatic Animals

TVA monitored Guntersville Reservoir annually from 1991 through 1994 to establish baseline data on the reservoir's ecological health under a range of weather and flow conditions. Guntersville is now evaluated every other year. The ecological health condition of Guntersville Reservoir has rated good consistently since TVA's monitoring program began. As in past years, ecological health indicator scores for the reservoir were among the highest observed for all of TVA reservoirs.

Guntersville Reservoir Ecological Health Ratings, 1994-2004



The table below shows the ratings for individual ecological health indicators at Guntersville in 2004. These ratings are briefly explained in the paragraphs that follow.

Ecological Health Indicators for Guntersville Reservoir, 2004

Monitoring locations	Dissolved oxygen	Chlorophyll	Fish	Bottom life	Sediment
Forebay	Good	Good	Fair	Good	Fair
Mid-reservoir	Good	Good	Fair	Good	Fair
Inflow			Fair	Fair	

See definitions of the five ecological health indicators and locations of monitoring sites.

Dissolved oxygen
Dissolved oxygen levels rated good at both monitoring locations in 2004, similar to previous years.

Chlorophyll
Chlorophyll concentrations in 2004 were within the expected range at both locations and rated good. In 2002, chlorophyll concentrations were slightly elevated at the forebay monitoring location during several sample periods, resulting in a fair rating. Chlorophyll levels at the mid-reservoir monitoring location have consistently rated good.

Fish
As in previous years, low catch rates contributed to fair ratings for the fish community at all locations. While the fish assemblage generally rates fair at the forebay and mid-reservoir, ratings at the inflow have fluctuated between fair and good and even poor in 2000 (one point from fair), the lowest score to date for the reservoir. This fish rating rebounded to good in 2002 and to a "high fair" in 2004, possibly indicating that the poor rating was a sampling anomaly.

Bottom life
Ratings for bottom life were similar to those for previous years. The benthic community at the forebay, which rated fair in 2000 and 2002 compared to a consistently good rating in each of the previous years, returned to good. The fair rating for the benthic community at the inflow was due to the collection of fewer animals, and in particular fewer mayflies, compared to other years.

Sediment
Sediment quality rated fair at both monitoring locations in 2004. Sediment quality rated fair at the mid-reservoir site because chlordane was detected and fair at the forebay due to the presence of PCBs and elevated levels of zinc. The sediment rating at the mid-reservoir has fluctuated between good and fair due primarily to chlordane, which was detected in 1996, 2002, and 2004; PCBs were detected at this location in 2002. Sediment quality typically rates fair at the forebay due to the presence of one or more contaminants: PCBs, chlordane, or zinc.

Important Aquatic Species

Several state- and federally listed aquatic species are known from Marshall County, Alabama (Tables mh1 and mh2). However, due to the impoundment of the Tennessee during the creation of Guntersville Reservoir, none of these species is currently known to occupy areas on or adjacent to the Murphy Hill site.

Botany

The Murphy Hill site area lies within the Sequatchie Valley Ecoregion III, portion of the Southwestern Appalachian Ecoregion IV and stretches from Kentucky to Alabama with low mountains containing a mosaic of forests and woodlands with some croplands and pastures. From the Tennessee border, the elongated Sequatchie Valley extends nearly one hundred miles southwest into Alabama. Structurally associated with an anticline, where erosion of broken rock scooped out the linear valley, it is composed mostly of Mississippian to Ordovician-age limestones, dolomites, and shales, with some low, cherty ridges. In the north, the open, rolling, valley floor, 600 feet in elevation, is nearly 1000 feet below the top of the Cumberland Plateau and Sand Mountain. South of Blountsville, the topography becomes more hilly and irregular with higher elevations. The Tennessee River flows through the Sequatchie Valley, until it turns west near Guntersville and leaves the valley. Similar to parts of the Ridge and Valley, this is an agriculturally productive region, with areas of pasture, hay, soybeans, small grain, corn, and tobacco (Griffith et al. 2001). There are no known uncommon terrestrial communities known to occur within the vicinity of the Murphy Hill site.

A review of the Natural Heritage Database indicates there are no federal and four state-listed species known to occur within five miles of the project area (Table mh3). One state listed species, Granite gooseberry, is an historic record last observed in 1967. *Apios priceana*, a federally listed threatened species, occurs at the bottom of a limestone sink 6.5 miles northwest of Murphy Hill.

Table mh3. Species of conservation concern within five miles of the Murphy Hill Alternative and federally listed species from Marshall County, AL

Common Name	Scientific Name	F-Status	S-Rank
False Helleborne	*Melanthium parviflorum*	--	S1S2
Granite Gooseberry	*Ribes curvatum*	--	S2 (H)
Price's potato bean*	*Apios priceana*	LT	S2
Southern Red Trillium	*Trillium sulcatum*	--	S1
Waterweed	*Elodea Canadensis*	--	S1

* known from the county but not from within five miles of the project area

Federal status abbreviations: LT=Listed threatened

State rank abbreviations: S1 – critically imperiled often with 5 or fewer occurrences, S2 – Imperiled often with <20 occurrences, H=historical record

A review of maps and knowledge of rare plants in the region; indicates habitat for waterweed, along the banks of Guntersville Reservoir, is present in the project area. In addition the wooded undisturbed areas of Murphy Hill provides suiTable habitat for false helleborne and southern red trillium; therefore, substantive impacts to local populations of these state-listed species could occur if these species were found to be present in site-specific studies.