APPENDIX H

JACKSON COUNTY LAKE PROJECT FINAL ALTERNATIVES ANALYSIS

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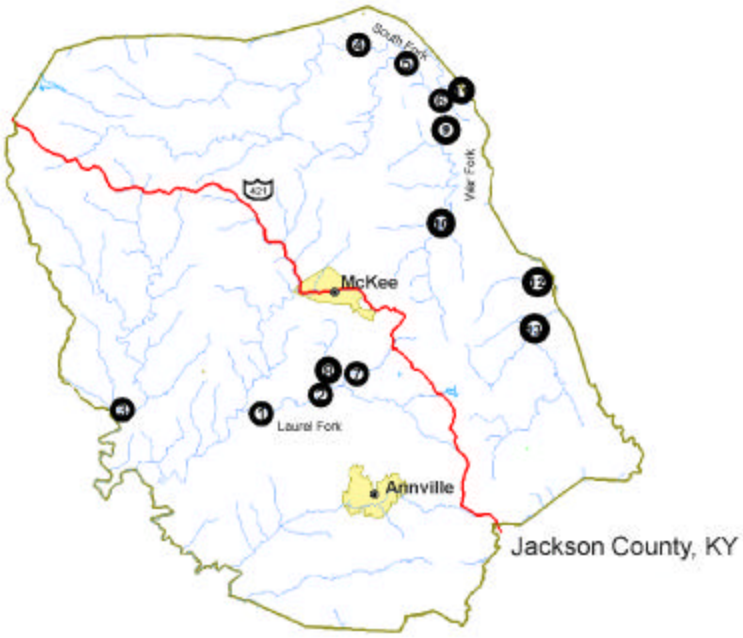
Jackson County Lake Project

Final
Alternatives Analysis



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May 1999

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1.0 INTRODUCTION

1.1 BACKGROUND

This report documents the analysis to identify and screen alternatives for a proposed dam and reservoir project in Jackson County, Kentucky. The purpose of the analysis is to select a list of reasonable alternatives from all the alternatives identified so far. The selected alternatives would be studied further in an Environmental Impact Statement (EIS) as required by the National Environmental Policy Act, 1969 (NEPA).

The Empowerment Zone (EZ) is an initiative to empower rural communities to create jobs and opportunities through federal/state/and local government, and private-sector partnerships. The Empowerment Zone was initiated as part of Title XIII of the Omnibus Budget Reconciliation Act of 1993; Subchapter C, Part 1 - Empowerment Zones, Enterprise Communities and Rural Development Investment Areas. The Kentucky Highlands Investment Corporation (KHIC) manages the Kentucky Highland Empowerment Zone and its activities.

The Jackson County Lake Project (Project), is one of the proposed initiatives developed for the Kentucky Highlands EZ. Originally included in the proposal is the raw water intake and pumps, a water treatment plant upgrade from 1.0 million gallons per day (mgd) to 2.0 mgd, and pipelines necessary for transporting raw water to the Jackson County Water Association's water treatment plant for treatment and distribution to residents in Jackson County and portions of Lee, Madison, Owsley, and Rockcastle Counties. The primary purpose of the project is to improve the water supply to these service areas. In addition, the Project will serve to meet a stated goal of the Kentucky Highland Empowerment Zone's Strategic Plan (Collins and Eller, Date unknown) for increasing local recreational and tourism opportunities in the Jackson County area.

This study takes the original project description a step further. From other referenced studies involving water and recreational need analysis, a water need has been projected to the year 2050. This study assesses potential reservoir sites as "Reasonable Alternatives" for inclusion in an Environmental Impact Statement.

1.2 LITERATURE REVIEW

To develop the methodology and evaluation criteria for this alternatives screening analysis, related environmental studies were reviewed for comparison. The EISs reviewed include:

1. Recreational Lake and Complex on Porter Creek, Franklin County, Mississippi (USFS, May 1998 Final)
2. Randleman Lake, Guilford and Randolph Counties, North Carolina (USACE, June 1997 Draft)
3. Regional Raw Water Study Group, Lower Virginia Peninsula Regional Raw Water Supply Plan (USACE, February 1994 Draft)

The Porter Creek EIS covers a proposed lake to improve the economic condition through nature-based tourism and recreation. The EIS considered seven alternatives, including lakes of various

surface areas at three different locations and the no action alternative. The proposed lake would not be used as a water supply.

The Randleman Lake EIS was done on a proposed dam and reservoir to provide safe and dependable water supply for the region. The EIS considered seven alternatives, including two alternative reservoir locations, a combination of two reservoirs, purchasing water from other municipalities, groundwater development, a combination of a reservoir and groundwater development, and the no action alternative.

The Lower Virginia Peninsula EIS evaluated alternative actions to meet the region's future water needs. The EIS originally considered 31 alternatives, including new dams, new intakes on existing reservoirs, combinations of different water sources, groundwater development, desalination, wastewater reuse, use restrictions, and the no action alternatives. The alternatives were screened in an analysis to rule out the ones that are 1) environmentally fatally flawed, 2) unavailable based on permitting, host approval, or legal constraints, or 3) infeasible based on cost or technological reliability. Only seven alternatives were considered in detail in the EIS.

Even though the proposed Jackson County Lake project is more similar in scale to the Porter Creek and Randleman Lake projects, the alternatives screening process in the Lower Virginia Peninsula EIS was adopted for this analysis because of the similarity in study approach. The screening criteria for this analysis were modified to reflect issues relevant to the project area.

Other related studies that were examined include:

1. *Station Camp Creek Preliminary Jackson County Reservoir Site Analysis*. July 21, 1995. Kentucky River Authority.
2. *Potable Water Projections for Jackson County, Kentucky*. March 1998. Kenvirons, Inc.
3. *Kentucky Highlands Empowerment Zone: A Report to the People of Jackson County by the Jackson County Learning Team*. February 1998. Community Partnership Center, The University of Tennessee.

1.3 EVALUATION CRITERIA

A list of 13 alternative impoundment sites and associated flooded areas were identified by the Rural Utility Service (RUS). A set of evaluation criteria are used to screen these sites for their potential suitability to satisfy Jackson County's water needs, environmental conflicts, recreational impact, and their availability. The six evaluation criteria (discussed in Section 3.0) are:

- What is the estimated reservoir yield from the proposed impoundment, and to what extent would the reservoir satisfy the projected water needs of Jackson County?
- Are any threatened and endangered species present in the drainage area that would be flooded by impoundment, or affected by the reduced downstream flow?
- Would the impoundment affect any stretch of river designated or proposed under Wild and Scenic Rivers Act (1968) or rivers that are afforded some level of protection by a State designation?
- What is the reservoir's estimated impact or benefit to projected recreational needs?

- What is the availability of land for the impoundment and reservoir?
- What is the distance from the proposed impoundment to the Water Treatment Plant?

During this phase of alternative selection, the emphasis is to identify, as early as possible, the suitability and possible environmental impacts of all potential alternatives. Any alternative that is either unsuitable (e.g., because of cost or water quantity limitations) or would have serious environmental impacts (e.g., would impact an endangered species or significant stretch of river) can be eliminated from further analysis. In order to conduct the evaluation, the Mangi Environmental Group, Inc. made use of available, related environmental studies (as described in the Literature Review, Section 1.2) and undertook the following special studies:

Recreational Needs Analysis for the Proposed Jackson County Lake Project. February 1999. The Mangi Environmental Group, Inc. This study compiled available recreational usage statistics for lakes in the Jackson County area, estimates future recreational needs, and identifies the proportion of future need that would be satisfied by a new lake.

Water Needs Analysis for Jackson County, Kentucky. February 1999. Commonwealth Technology, Inc. This document quantifies Jackson County water needs from now until the year 2050. In addition, calculations were made by the Mangi Environmental Group, Inc. to determine shoreline length (feet), reservoir surface area (acres), reservoir storage capacity (acre-feet), and reservoir yield (mgd) for each alternative site.

Endangered Species Screening Study and Field Survey for the Cumberland Bean Pearly Mussel (Villosa trabalis) for a Proposed Reservoir in Jackson County, Kentucky. February 1999. Eco-Tech, Inc. Eco-Tech, Inc. performed a literature search identifying all previous studies concerning rare species in Jackson County, Kentucky. Next field studies were performed at five of the proposed reservoir locations. This document compiles all previous data pertaining to Threatened and Endangered species in Jackson County, Kentucky and all data collected during Eco-Tech, Inc. field studies.

2.0 REGULATORY GUIDELINES

Whenever an organization, or a community, plans to take an action to meet a particular need, ordinary common sense dictates that they seek "the best way" to proceed. To meet a given purpose, they will consider at least some alternative courses of action, perhaps different locations for the project, or different designs.

Study of factors such as the comparative costs, benefits and effectiveness of these different alternatives leads to a sound decision as to which course of action is best. This is routinely done, either formally or informally in every organization, in fact, in most people's everyday lives.

The National Environmental Policy Act (NEPA) merely builds upon this common sense foundation. The law gives every Federal agency the responsibility to help protect the environment through the actions that it takes, funds or permits. Accordingly, NEPA simply tells agencies to add "environmental" costs and benefits to the list of factors that they look at in choosing the best alternative. That is, NEPA calls upon planners to identify the environmental impacts that could arise from each of the reasonable alternatives available, and then consider those impacts alongside cost, effectiveness and other factors in order to identify "the best" choice. Note that NEPA does **not** require agencies to choose the alternative that has the least environmental impacts. NEPA does not dictate the outcome of the decision, merely the process used to reach it.

The Environmental Impact Statement study done under NEPA, must therefore look at the reasonable range of alternatives, and not merely the "least cost" or "most convenient" choices. Determining the reasonable range of alternatives has very often been argued about in law courts. Most of these arguments reduce down to two criteria:

- Does it at least partly meet the purpose(s) of the project?
- Is it practicable, i.e. could it in fact be carried out at a reasonable cost, in a reasonable timeframe, with existing technologies?

Alternative sites, designs and so on for a project that would not accomplish the project's objectives at all, need not be considered. However, the project objectives need to be stated in broad, fundamental terms rather than in such narrow terms that it biases the range of alternatives. For example, this project's purpose(s) can be appropriately stated as:

- Provide adequate water supplies for the JWCA and its customers for the next 50 years

AND

- Provide water-based recreation opportunities for the people in the Jackson County area

It would have been unreasonable to narrow the possibilities at the outset by requiring that the water be impounded on a particular stream.

As to the practicality of an alternative, this is a matter of common sense and judgement. Courses of action that would cost many times what other alternatives cost, or alternatives which would require technological breakthroughs, are not generally considered practicable. They need not be considered.

But all alternatives that do meet these criteria of meeting the need and of being practicable, do need to be studied as to their environmental impact. Even projects that cost somewhat more than the least cost alternative need to be studied. This is because it often happens that the least cost course of action also entails substantial environmental impacts. If an alternative could avoid those impacts, but if it would cost only a little more, then that latter alternative might well be regarded as "the best".

As stated above, NEPA requires a process of broad consideration, but it does not dictate a particular choice. However, another law that is relevant here is somewhat more restrictive. The Clean Water Act requires permits for placing material in waters of the US. The dam will therefore need a permit, issued by the Corps of Engineers. The regulations regarding that permitting process are similar to NEPA's, but they go somewhat further: they do in fact allow a permit only for the practical alternative that has the least impact to the aquatic environment, unless it has significant impacts on other parts of the environment. This can force a weighing of different types of impacts against one another, but at any rate, the Corps' permitting rules clearly can force the selection of something other than the least cost alternative.

To comply with NEPA, therefore, the EIS must study the full range of alternatives that would at least partly meet one or both needs, and which would not be unreasonably expensive or impractical. NEPA also requires an EIS to study the "no-action" alternative, even though taking no action generally does not meet a project's purposes at all. The "no-action" analysis is useful, however, in forming a basis of comparison for the other alternatives.

3.0 EVALUATION CRITERIA

3.1 YIELD

The most important factors in determining the selection of a reasonable alternative are based upon the water needs of the region and the potential yield of a proposed site. The following discussions detail the water needs and the methodology for determining the potential yield of a possible reservoir site. For the purposes of this study, any site that does not produce water sufficient to meet the need would be recommended for exclusion.

3.1.1 Water Needs

The study of present and future water needs of Jackson County is documented in the *Draft Water Needs Analysis for Jackson County, Kentucky*, February 22, 1999, Commonwealth Technology, Inc.

Quantifying Jackson County water needs from now until the year 2050 requires three types of information. The first is water consumption rates, the second is population projections, and the third is regional requirements. All three of these elements are subject to many factors that can either increase or decrease their rates. As a result of the variance in water use and population, ranges of plausible standards were used to determine water needs in Jackson County. Three per capita use rates were computed for the water needs analysis: low, moderate and high. These rates included water for residential, commercial, industrial, and public customers. Three estimates of future population in Jackson County were used: low, moderate, and high. Population projections were made for the year 2000 and every fifth year to the year 2050. Projected water demands were computed by taking each population growth projection (low, moderate, and high) and multiplying it by each of the three per capita water use rates (low, moderate, and high). Growth projections were assumed for industrial demand and these projections were added to the product for every fifth year from 2000 to 2050 to get a total demand in gallons per day. Regional projections were based upon contact with surrounding water associations and their potential use of a possible reservoir in Jackson County.

Currently, the two surface water sources of public drinking water originating in Jackson County are Tyner Lake and McKee Reservoir. The Jackson County Water Authority (JCWA) acquires its drinking water supply from Tyner Lake and the City of McKee uses the McKee Reservoir. According to monthly operating reports, the average monthly maximum withdrawal from Tyner Lake is 874,000 gallon per day (gpd), which exceeds the recommended maximum withdrawal rate of 700,000 gpd (Kenvirons, Inc., 1998). The monthly operating reports on file for calendar year 1998 with the Kentucky Division of Water (KDOW) state that the average monthly maximum withdrawal from McKee Reservoir is approximately 201,600 gpd.

Natural Resources Conservation Services (NRCS) has recently completed a multi-purpose floodwater control and water supply dam on the Bill's Branch tributary of the Pigeon Creek watershed. This dam is called Multi-Purpose Structure #1 (MPS #1) and is located upstream of

the City of McKee's current reservoir. The total land area affected by the structure (dam, emergency spillway, and rural water supply pool) is 28 acres and reservoir storage volume is 367 acre-ft. The rural water supply pool covers about 19 acres surface area, with a volume of 203 acre-ft. This would provide a yield of 271,000 gallons per day (USDA, NRCS, 1990). The combination of the water yield from MPS#1, Tyner reservoir, and McKee reservoir would result in a maximum sustainable yield of approximately one million gallons per day.

Table 1: Projected Jackson County Water Needs (MGD)			
Year	**Low Growth and Use**	**Moderate Growth and Use**	**High Growth and Use**
2000	2.0	2.1	2.7
2050	2.6	3.5	5.4

Table 1, taken from *Water Needs Analysis for Jackson County, Kentucky*, illustrates projected water needs for Jackson County under three different growth and water use scenarios. Table 1 indicates that Jackson County will have a water need of from 2.6 to 5.4 millions of gallons per day by the year 2050. For the purposes of this study, a figure of 3.0 million gallons per day will be used. This figure was derived by subtracting the approximate 1.0 mgd presently available from the moderate growth of 3.5 mgd (see Table 1 Year 2050) resulting in 2.5 mgd. Because this figure does not factor in evaporation and instream flow requirements, it is raised to 3.0 mgd. Therefore, 3.0 mgd is used as the screening criterion. Any reservoir site that would not produce at least 3.0 mgd should not be studied further. Any site that does produce that much should be studied.

3.1.2 Water Yield

For the screening of potential sites to be meaningful (in the sense that the comparative evaluation of sites in the screening investigation produces the same, or nearly the same, ranking as would be produced in a more thorough planning investigation), the screening study needs to take into account the streamflow characteristics of the sites as well as the specific physical characteristics of the sites. Developing information on the physical characteristics of a site is relatively simple if topographic maps are available, as they were in the case of the Jackson County sites. The drainage area and the elevation-area-capacity relationships were determined for each of the thirteen sites using a digitizer and the topographic maps.

Determining the streamflow characteristics for the sites when there are no streamflow records at any of the sites, as was the case for the Jackson County sites, is a more difficult task. Among the data needed for determination of yield is information on the streamflow quantity and its seasonal variation. Seasonal variation of streamflow, particularly variation with respect to expected demand patterns for water withdrawal from reservoirs and with respect to the magnitude of storage available at the reservoir sites, is a critical factor in yield determinations made in advanced reservoir planning. Experience has shown that the extent to which a screening study takes this into account is a measure of the reliability of the screening results insofar as their utility in more advanced planning studies.

In the case of the Jackson County sites, where no streamflow data is available, a search of streamflow records in that area of the state revealed that there was a station relatively nearby (at Silver Creek near Kingston, KY, in neighboring Madison county). This streamflow gage existed for sixteen years (from 1967 until 1983), and the drainage area at this site (28.6 square miles) was about the size of the average drainage area for the potential reservoir sites in Jackson County. Consequently the Silver Creek streamflow data were used to develop information on the streamflow characteristics for the Jackson County sites.

An examination of streamflow records for Silver Creek near Kingston revealed that the long-term average annual streamflow at the gage was about 44 cubic feet per second, which is equivalent to an annual volume of about 18 inches of runoff over the watershed. Further examination of the entire sixteen years of record revealed that the three lowest flow years were 1969, 1976 and 1980. The streamflow volumes in those years were 10.4 inches, 13.6 inches and 9.7 inches, respectively. Furthermore, it was apparent from examination of the daily streamflows in these three dry years that most of the runoff occurred in the first four months of the year (the percentage of the annual total runoff occurring in these four months ranged from 51 percent in 1969 to 84 percent in 1980). Furthermore, the amount of streamflow occurring in the five-month period when water demands are generally very high was quite low, ranging from 1.6 inches in 1980 to 5.1 inches in 1969. These patterns of streamflow quantity and seasonal variation were applied to the Jackson County sites using ratios of the drainage areas of each of the thirteen Jackson County sites to the drainage area of the Silver Creek gage to develop estimates of the worst dry year streamflow condition (lowest amount of runoff in the four-month [January - April] spring reservoir refill period and lowest amount of runoff in the five month [June - October] high water demand period) and an average" dry year streamflow condition, which was defined as the average streamflow for those two periods in the three driest years. The runoff and refill volumes for each of the Jackson County sites under each low-flow condition were then computed using drainage area ratios. The refill was calculated by subtracting the demand during the low-demand months from the in-flow during those months. Although seasonal drawdowns will occur during average conditions, only the more extreme drawdowns are shown, i.e. those for the worst drought. The drawdown was calculated based on the volume of water that would be taken from the reservoir during high demand periods in excess of the volume of in-flow during that period.

Calculating Yield of a Reservoir

As stated in Section 3.1.2, none of the streams under consideration have a stream gauge. However, a nearby stream in Madison County has a streamflow gauge. Assuming that rainfall is roughly the same in Madison and Jackson Counties, the yield of the gauged station can be used to estimate the yield in Madison/Jackson County basins:

$$\frac{\text{Average streamflow in million gallons per day}}{\text{Area of basin (acres)}} = \text{average yield per acre of basin}$$

To estimate the average yield of a Jackson basin:

Average yield per acre X number of acres in basin

The logic of the yield estimates is as follows. All of the streamflow that occurs during the five-month high demand period will be used to supply the demand. Furthermore, as much of the reservoir storage volume as can be replenished during the refill period will also be used to supply the demand during the high demand period. The sum of these two volumes, converted to an annual demand rate in million gallons per day is estimated to be the yield of the site. This yield estimate is high (because it does not take into account losses to evaporation and releases required to provide streamflow to maintain downstream aquatic ecosystems), but it should be sufficiently accurate to permit comparative evaluation of the thirteen sites in terms of their capability to supply water for water supply purposes.

3.2 THREATENED AND ENDANGERED SPECIES

The Endangered Species Act provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered in the U.S. or elsewhere. Provisions are made for listing species, developing and implementing recovery plans, and designating habitat that is critical for listed species to survive (known as *critical habitat*). Mostly the Fish and Wildlife Service (FWS) govern the Act, with some assistance from the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA).

The purposes of the Act are to:

- Provide a means of conserving the ecosystems upon which endangered and threatened species depend.
- Provide a program for conserving those species.
- Take the steps necessary to achieve the purposes of the related international treaties and conventions.

Congressional policy is that federal agencies must seek to conserve endangered and threatened species and use their authorities in furtherance of the Act's purposes (16 USC 1531).

Critical habitat must be designated for each threatened and endangered species (referred to as *listed species*). The designation must be based on the best scientific data available and take into consideration the economic impact(s) and any other relevant impact(s) of specifying a particular area. An area may be excluded if it is determined that the benefits of exclusion outweigh the benefits of designation, unless it is determined that exclusion will result in extinction of the species (16 USC 1533(b)(2)).

Species that are officially proposed to be added to the endangered and threatened lists are also provided protection. Federal agencies are required to confer with FWS on any action that is likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed critical habitat (15 USC 1536(a)(4)).

All Federal agencies must insure that each action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or destroy or adversely modify any designated critical habitat. In fulfilling these requirements, each agency is to use the best scientific and commercial data available (Final ESA Section 7 Consultation Handbook, March 1998). Agencies must confer with FWS to determine if a listed or proposed species or critical habitat may be affected by an action, what the effect(s) would be, and how the effect(s) could be

mitigated or minimized. This consultation process can be achieved in several ways, including informal, formal, and emergency consultations and formal conferences. As a part of this process, a biological assessment may be completed to report on such an evaluation. Biological assessments are mandatory for actions that also require environmental impact statements. As further means of implementing this coordination, Federal agencies often enter into partnerships and Memoranda of Understanding with the FWS for implementing and funding conservation agreements, management plans, and recovery plans developed for listed species (USFWS & NMFS, March 1998).

The State of Kentucky also has biological species protection laws. The Kentucky Revised Statutes (KRS) sections 150.183 and 150.990 protect endangered animals; KRS 146.600 through 146.619 protect endangered plants. These regulations cover species found in Kentucky with restrictions, allowances, penalties, and other provisions similar to the Federal Endangered Species Act provisions. The Kentucky State Nature Preserves Commission (KSNPC) lists Kentucky species that are provided, or need, protection. The KSNPC lists each species as endangered, threatened, historic, or special concern, which is a species that should be monitored because:

- It exists in a limited geographic area.
- It may become threatened or endangered due to modification or destruction of habitat.
- Certain characteristics/requirements make it especially vulnerable to specific pressures.
- Experienced researchers have identified other factors that may jeopardize it.
- It is thought to be rare or declining but insufficient information exists for assignment to the threatened or endangered status categories (KSNPC Homepage).

For the purposes of this study, an alternative would receive a recommendation to proceed only with the absence of threatened, endangered, proposed, or other status species in or downstream from an impoundment area.

3.3 SPECIAL RESOURCE DESIGNATIONS

The Wild and Scenic Rivers Act (16 USC 1271-1287) (WSRA) established a method to provide Federal protection for some of the country's remaining free-flowing rivers, preserving them and their immediate environments for the use and enjoyment of present and future generations. Rivers are included in the system to benefit from protective management and control of development (NPS & FS, 1982). The Act's preamble establishes this philosophy with the institution of a national policy concerning these pristine rivers:

> "It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their

> free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes" (16 USC 1271(b)).

To be eligible for inclusion in the system, rivers must meet certain criteria judging how natural the river segment is. These criteria are based on several factors, such as being free of impoundments (dams, etc.), accessibility, and the amount of development of the riverbanks and watersheds. Based on these criteria, a listed river section will be classified as wild, scenic, or recreational.

The key to the WSRA is that it is only meant to protect specific outstanding resources of a river portion, not the entire river, nor all the aspects of a particular river portion. This protection is achieved through management plans, which are individually approved for each component of the system (each listed river portion). These plans determine the kinds and amounts of public use that the river area can sustain without impacting the values for which it was designated (NPS & FS, 1982). It is vital to note that the Act and the management plans do *not* expressly prohibit or limit development or activities along a listed river portion.

Study Rivers are those rivers or river segments that are under study by an agency to determine their suitability for addition to the system (NPS & FS, 1982). The purpose of this study is to provide information upon which the President can base a recommendation and Congress can make a decision on whether to add it to the system. The study area usually must cover at least ¼ mile from each bank of the river. Adjacent river areas beyond ¼ mile may be studied if their inclusion could facilitate management of the resources of the river area. Study Rivers are granted even greater protection from development than listed rivers. This extra protection is granted to make sure that any potentially suitable river segments are not degraded by development before they can be listed and have management plans instituted.

Any river portions that meet the system's eligibility criteria may be designated as potential additions to the system. The National Park Service (NPS) adds these rivers to the Nationwide Rivers Inventory (NRI). A Presidential Directive, signed in 1980, requires each Federal agency, as part of its normal planning and environmental review processes, to avoid or mitigate adverse effects on rivers identified in the Nationwide Rivers Inventory. Further, all agencies are required to consult with NPS prior to taking actions that could effectively foreclose wild, scenic or recreational status for rivers on the inventory. Rivers on the NRI may be Study Rivers or they may be awaiting study status, having only been identified by the NPS as meeting the eligibility criteria for inclusion.

USDA agencies have their own requirements concerning this Act and concerned rivers. The USDA/Forest Service regulations protect listed and study rivers:

> "No license, permit, or other authorization can be issued for a Federally assisted water resources project on any portion of a Wild and Scenic River or Study River nor can appropriations be requested to begin construction of such projects, without prior notice to the Secretary of Agriculture, and a determination in accordance with section 7 of the Act" (36 CFR 297.4).

RUS regulations for the WSRA, implemented when the Farmers Home Administration (FmHA) was merged into RUS, are located at 7 CFR 1940, Exhibit E to Subpart G. The regulations include:

- Each application for financial assistance or subdivision approval will be reviewed to determine if it will affect a river or portion of it which is either included in the system, designated for potential addition to the system, or identified in the Nationwide Inventory.
- If NPS or Forest Service (FS) advises that the proposal will have an unavoidable adverse effect on a river segment which is either included in the system or designated for potential addition to the system, the application will be denied.
- If NPS or FS advises that the proposal will have an adverse effect on a river segment identified in the Nationwide Inventory, the reviewer shall further consult with NPS or FS in order to formulate adequate measures or modification to avoid or mitigate the potential adverse effect. The purpose of such measures or modification is to ensure that the proposal does not effectively foreclose the designation of a wild, scenic or recreational river segment.

In Kentucky, there is a similar system that provides additional protection and restrictions for the state's waters. The state's surface water standards (401 KAR 5:031(7)) classifies certain waters as *outstanding resource waters* (ORW). Surface waters that receive this classification include:

- Waters designated under the Kentucky Wild Rivers Act;
- Water that are listed on the Federal Wild and Scenic Rivers System;
- Waters identified under the Kentucky Nature Preserves Act; and
- Waters that support Federally recognized endangered or threatened species.

ORW status is not a use designation nor does it grant specific protection. Instead, waters with ORW classification are eligible to receive potential protection measures, such as biological monitoring, through the permit process. For instance, if an ORW waterway was found to have declining fish populations, then use permits on that waterway may be suspended or modified to repair the water quality. In addition, waters which have a national wild or scenic river designation or have a resource that is considered extremely valuable are classified as *outstanding national resource waters*, and do receive a higher level of protection (Schnider, 1999).

For the purposes of this study, an alternative would receive a recommendation to proceed only if the alternative was free of any Wild & Scenic, Study Status, or Outstanding Resource Waters designations.

3.4 RECREATIONAL NEEDS

A study of present and future recreational needs of Jackson County is documented in the *Recreational Needs Analysis for the Proposed Jackson County Lake Project*, September 1998, by The Mangi Environmental Group, Inc.

The proposed lake would primarily be used as a water supply reservoir for Jackson County and perhaps the surrounding counties. Recreational use of the lake would be an added benefit. Future recreational development around the proposed Jackson County lake may include a public dock, boat landings, picnic and camping areas, and a public beach.

According to the Statewide Comprehensive Outdoor Recreation Plans (SCORP) analysis, created by the Division of Parks and Recreation, a surplus of facilities exists for certain recreational facilities, including fishing, boating, water skiing, and canoeing in the study area of the proposed Jackson County lake. The current facilities will adequately meet the demand for these activities in the study area beyond the year 2020. However, the current facilities will be inadequate for the increasing needs of camping, picnicking, hiking, and swimming facilities in the future. Based on the current facility plans, a proposed Jackson County lake would help meet some of the needs for picnicking facilities, and all of the needs for swimming facilities.

Based on the limited available data, current use of the regional lakes can be described as moderate to heavy. Since population is expected to increase in the study area under moderate and high growth scenarios, the proposed lake may help alleviate the potential heavy use of the surrounding lakes in the future.

As suggested by the Corps of Engineers, lake size was used to predict potential lake usage. The Rec. Needs study used the visitation figures represented in Table 2 to determine the potential use of a Jackson County Reservoir.

Table 2: Available Visitation Data from Lakes in the Study Area.

Name	Size (Acres)	Miles from Jackson County	1997 Visitor Hours*	1997 Visits**
Martins Fork Lake	340	58	400,000	200,000
Carr Fork Lake	750	55	1,521,300	544,300
Dewey Lake	1,100	72	2,827,646	831,378
Paintsville Lake	1,140	65	2,497,341	832,445
Buckhorn Lake	1,230	30	1,434,200	282,600
Laurel River Lake	5,600	32	800,000	300,000
Green River Lake	8,200	70	9,997,100	943,700
Cave Run Lake	8,270	53	1,238,600	540,700
Lake Cumberland	50,250	67	76,400,000	4,900,000

*VISITOR HOUR - A visitor hour of use is the presence of one or more persons on an area of land or water for the purposes of engaging in one or more recreation activities. Visitor hours of use will not include time spent by people passing over, through or along the project, where such travel is unrelated to recreation activities.

**VISITS – A "visit" is defined as one person visiting the project for recreation purposes for any period of time. For instance, one person sightseeing for 15 minutes is 1 visit; one person camping for 14 days is also one visit. This number is available on the VERS report. Round to the nearest hundred.

Table 3 summarizes potential usage estimates. As shown in the example, Martins Fork Lake was used as the model for a projected 300 acre lake. The average of Martins Fork Lake and Carr Fork Lake was used as the model for a 600 acre lake. The average of Carr Fork Lake and Dewey Lake was used as the model for a 900 acre lake. And finally, the average of Dewey Lake, Paintsville Lake, and Buckhorn Lake was used to estimate usage for a 1200 acre lake. The calculation used was as follows: 300 acres/340 acres X 400,000 visitor hours = 353,000 visitor hours.

Table 3. Estimated Usage of a Potential Jackson County Lake.

Size in acres	Average use per acre	Projected Use (visitor hours/year)
300	1,175	353,000
600	1,750	1,057,000
900	1,850	2,115,000
1200	1,950	2,337,000

Overall, there is a demand for recreational facilities in the region. This demand is likely to increase with population growth in the region. Additionally, this growth could be further spurred by the economic impacts associated with the Empowerment Zone. Using the Comparison of Visitor Hours and Lake Size analysis, it is possible to forecast a sizable level of visitation to a proposed lake in Jackson County (Mangi Environmental Group, Inc., 1998).

For the purposes of this study, recreational need would not determine the suitability of one alternative over the other. However, the study will try and present a potential utilization figure to be used as a factor and not as an exclusion.

3.5 AVAILABILITY (LAND AND WATER RIGHTS, PERMITS, ETC.)

Legal, regulatory and institutional issues can severely delay or even prevent a water development project from being implemented. Necessary land and water rights must be acquired, and in some cases defended in litigation; permits from federal, state, and local agencies obtained; and approvals from other localities obtained in cases of a project located outside the boundaries of the project's owner. An alternative may be considered unavailable if legal, regulatory, or institutional obstacles are insurmountable (e.g., the USACE, EPA, State Water Control Board, or another state, federal, or local agency determines that an alternative is not permitted). Any determination of unavailability will be based on documentation of severe delays, uncertainties associated with potential permit denials, or other insurmountable legal or institutional constraints.

As a result, it would be impossible to determine the ultimate success or failure in acquiring lands for the purpose of a reservoir. This study, therefore will simply detail the types of land available and present this as a factor and not as an exclusion.

3.6 DISTANCE TO WATER TREATMENT PLANT

The action involving the proposed reservoir includes an expansion of the existing water treatment plant. The entire pipe network for the distribution system emanates from this treatment plant. An expansion of the current facility would be more cost effective and have the advantage of being able to take advantage of the current distribution system.

For the purposes of this report, the approximate distance along the most probable roadway route from the proposed alternative site to the water treatment plant will be presented as a factor and not as an exclusion.

4.0 RESERVOIR SITE ALTERNATIVES

Section 4 describes the physical characteristics and location of each site, water needs/reservoir yield information, river resource designations, the existence of Threatened and Endangered species, recreational needs information, land availability, and distance to the Water Treatment Plant.

Each section is arranged in the following manner:

- Introduction: This section introduces the proposal accompanied with charts to assist the reader in the location of the potential impoundment. All information pertaining reservoir location has been acquired via 7.5 minute series (topographic) quadrangle maps provided by the United States Geological Survey (USGS).

- Yield Analysis: This section describes the estimated yield of the potential impoundment. Pool elevation, watershed size, capacity and volume are displayed in two graphs. A third table presents the yield analysis in average and worst drought conditions. These depictions are followed by a discussion. The terms used in the third table are defined in the following sentences. Runoff is something that runs off, as rain in excess of the amount absorbed by the ground. Refill is to fill again. Yield is to give in return, produce as a result, profit, etc., and drawdown is the lowering of the water level of a well, reservoir, etc. Although meeting the need at some of the sites would require greater seasonal drawdowns than at other sites, the amount of drawdown was not used as a screening factor for this study. For those sites to be studied in detail, the amount of drawdown will be one of many evaluative factors that must be considered.

- Threatened or Endangered Species: This section gives a brief description of any Threatened, Endangered, or otherwise protected species found within or downstream of the proposed impoundment. All information concerning all species was gathered by Eco-Tech through a literature search, with the exception of the information concerning *Villosa trabalis* (Cumberland Bean Pearly Mussel), which Eco-Tech gained by a field survey. The literature and methodologies used are discussed in Eco-Tech's *Endangered Species Screening Study and Field Survey for the Cumberland Bean Pearly Mussel for a Proposed Reservoir in Jackson County, Kentucky*.

- Special Resource Designations: This section describes any special designation for the waterway stemming from the Federal Wild & Scenic Rivers Act or Kentucky Outstanding Resource Water program.

- Availability: This section gives a brief description of the type of land, public or private, included within the potential impoundment.

- Distance to Water Treatment Plant: This section gives an approximate distance to the water treatment plant along the most probable roadways. These are rough estimates only, and were originally developed as a rough indicator of construction and

operation cost. In the event that one or more of the sites had been found to be significantly more expensive and clearly more inferior to all other sites, in every other factor, then such sites could also have been screened out from further study. As it happens, however, no sites could be ruled out on this basis. A similar rationale led to the inclusion of recreational opportunity data. For this same reason, the recreation data did not result in any sites being screened out. This data may be useful at a later stage to aid in the comparison of alternatives.

- This section gives the study's recommendation.

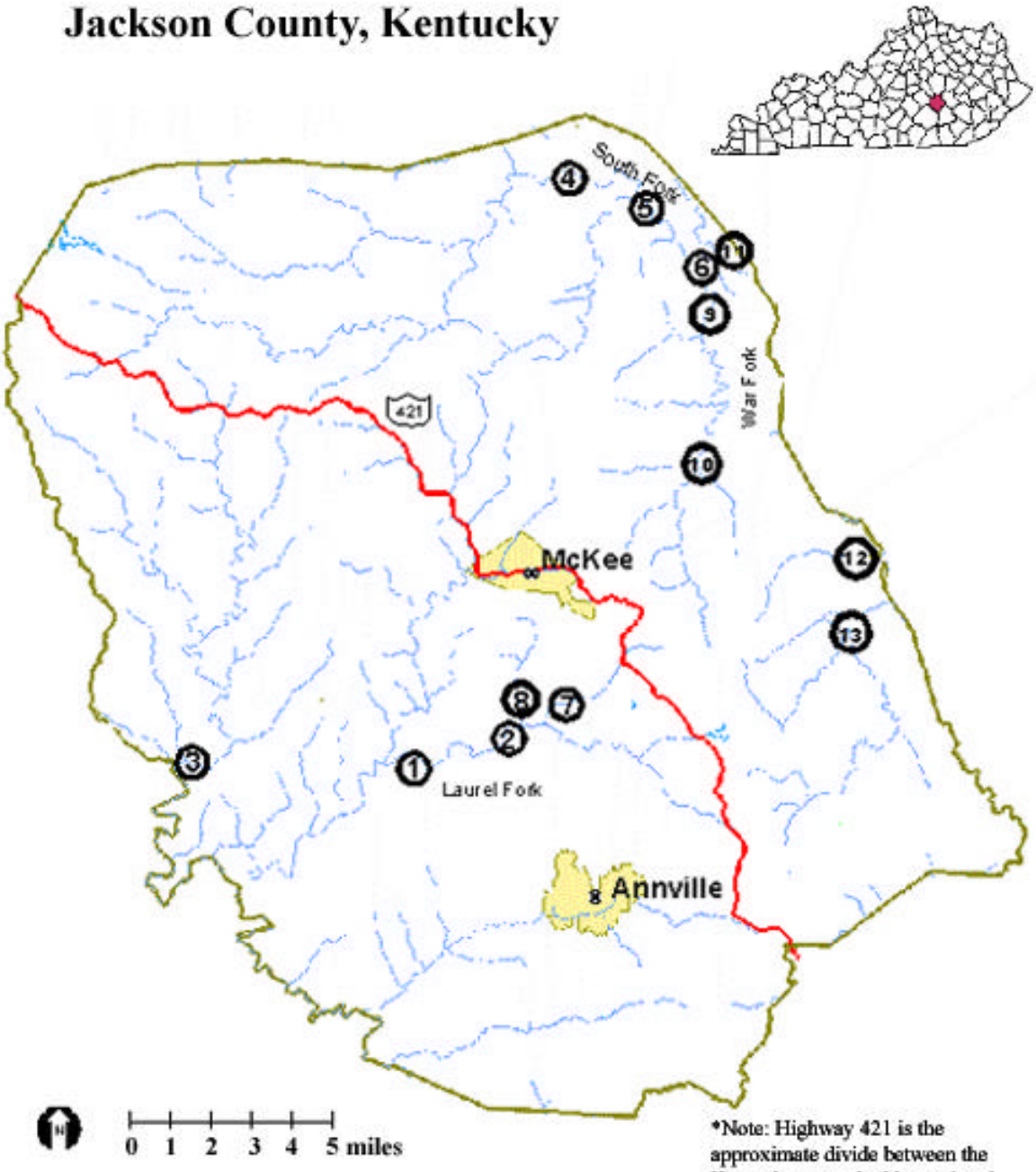
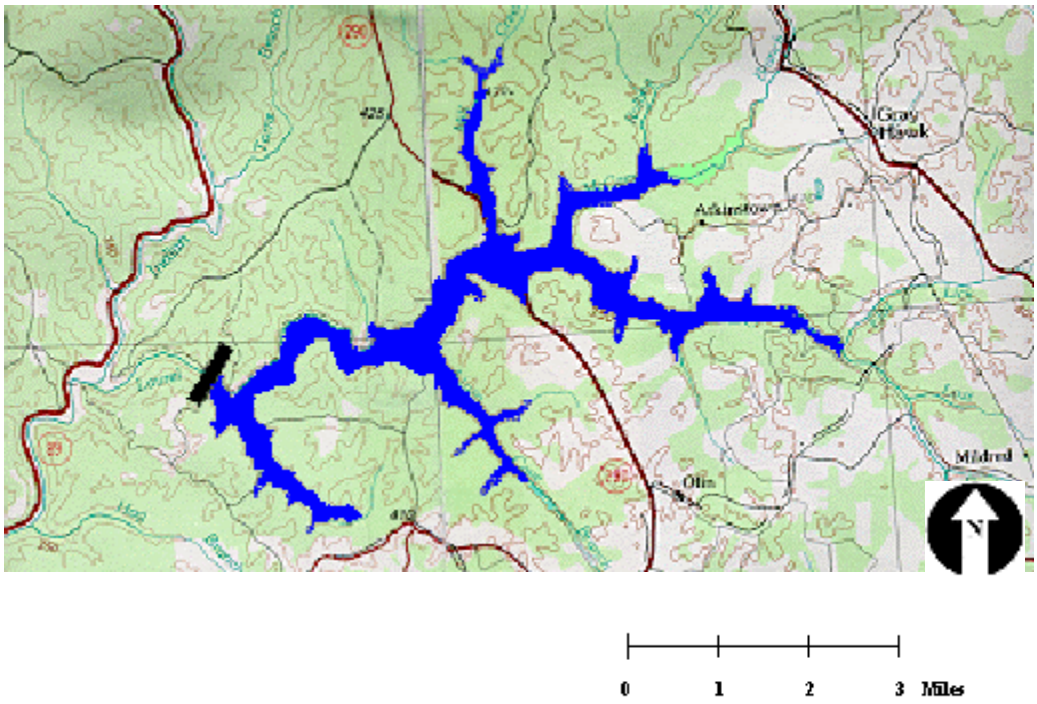


Figure 1: Alternative Dam Sites for the Jackson County Lake Project

4.1 LAUREL FORK AND BUZZARD BRANCH

Site 1 is located approximately 2.5 miles north of the town of Dabolt in the southern half of Jackson County. The dam would be situated on the Laurel Fork River approximately 1 mile above the confluence with Indian Creek. The pool elevation of the reservoir would be approximately 1,040 feet above mean sea level (MSL).



4.1.1 Yield Analysis

Table 4: Laurel Fork and Buzzard Branch				
Watershed Area = 20,830 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	1060	952.9	49,677	16.18
Pool	1040	750.7	32,645	10.63
	1020	573.1	19,407	6.32
	1000	387.3	9,803	3.19
	980	220.7	3,723	1.21
	960	75.8	758	0.25

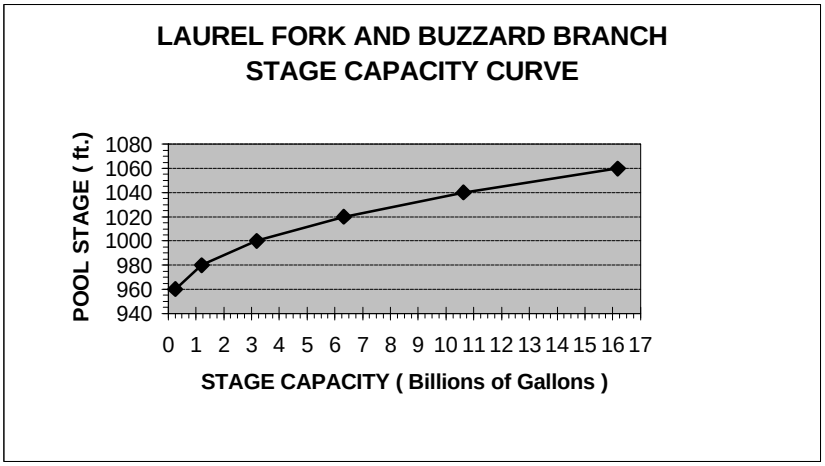


Figure 2: Laurel Fork and Buzzard Branch Stage Capacity Curve

Table 5: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
1.7	4.5	6.2	17.0	0.9	3.0	3.9	10.6	18

The above tables represent the analysis of capacity and yield for a proposed impoundment at the Laurel Fork and Buzzard Branch site. At pool elevation of approximately 1,040 feet above mean sea level, there would be an impoundment of approximately 750 surface acres, and a volume of 32,600 acre feet and a capacity of 10.6 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 17.0 million gallons of water per day and a yield of 10.6 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.1.2 Threatened or Endangered Species

According to the 1999 Eco-Tech, Inc. field survey the following Endangered species inhabits the area of the proposed reservoir:

- *Villosa trabalis* (Cumberland Bean) federally and KSNPC listed as Endangered.

Other Threatened and Endangered species known to exist in the Rockcastle River Drainage but not identified by Eco-Tech, Inc. include:

- *Pleurobema oviforme* (Tennessee Clubshell) KSNPC listed as Endangered.
- *Percina squamata* (Olive Darter) KSNPC listed as Endangered.
- *Villosa lienosa* (Little Spectaclecase) KSNPC listed as a Special Concern.
- *Etheostoma cinereum* (Ashy Darter) KSNPC listed as a Special Concern.

- *Ophiogomphus howei* (Pygmy Snaketail) KSNPC listed as a species of Special Concern.

4.1.3 Special Resource Designations

The State of Kentucky has designated this portion of the Laurel Fork River as an Outstanding Resource Water (Miller, 1999).

4.1.4 Recreation

Laurel Fork and Buzzard Branch at pool elevation would cover 750 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 1,350,000 visitor hours per year.

4.1.5 Availability

Approximately 35% of the reservoir site would be located on National Forest Service lands (USGS, 1983d; USGS, 1989; USGS, 1983c; USGS, 1983e).

4.1.6 Distance to the Water Treatment Plant

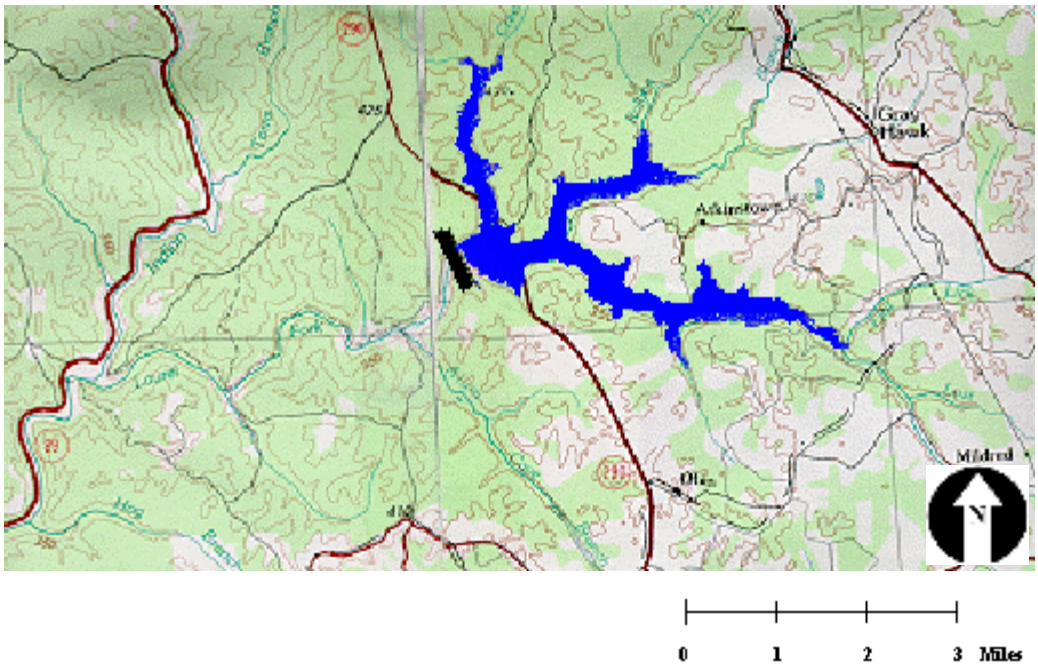
The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 11.5 miles.

4.1.7 Conclusion

Although the yield for this alternative would be well above that required, the presence of threatened or endangered species, especially the Cumberland Bean, and the Outstanding Resource Water designation would make this a difficult alternative to pursue. The recommendation is that this proposal be excluded from consideration.

4.2 LAUREL FORK AND MCCAMMON BRANCH

Site 2 is located approximately 3.5 miles south of the town of McKee in the southern half of Jackson County. The dam would be situated on the Laurel Fork River just upstream from the relocated Highway 290 bridge. The pool elevation of the reservoir would be approximately 1,060 feet above MSL.



4.2.1 Yield Analysis

Table 6: Laurel Fork and McCammon Branch				
Watershed Area = 15,225 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	1,080.0	497.7	24,627.0	8.0
Pool	1,060.0	395.9	15,695.0	5.1
	1,040.0	290.3	8,837.0	2.9
	1,020.0	192.4	4,010.0	1.3
	1,000.0	94.2	1,144.0	0.4
	980.0	10.1	101.0	0.0

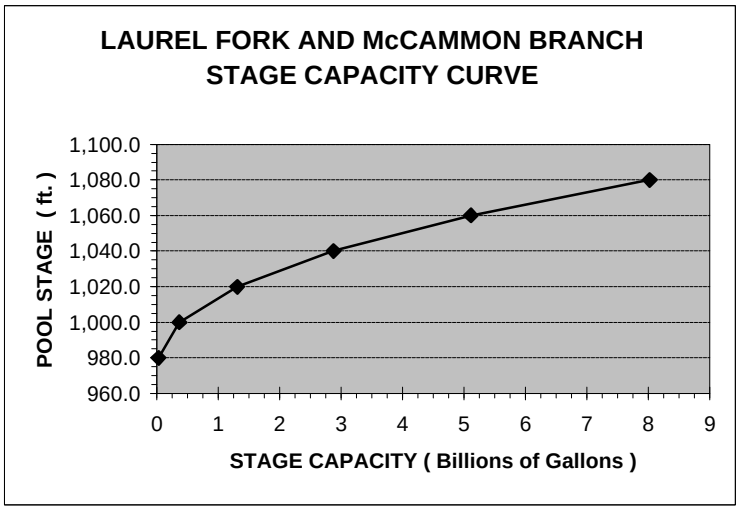


Figure 3: Laurel Fork and McCammon Branch Stage Capacity Curve

Table 7: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
1.2	3.3	4.5	12.5	0.7	2.2	2.9	7.8	20

The above tables represent the analysis of capacity and yield for a proposed impoundment at the Laurel Fork and McCammon Branch site. At pool elevation of approximately 1,060 feet above mean sea level, there would be an impoundment of approximately 396 surface acres, and a volume of 15,700 acre feet and a capacity of 5.1 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 12.5 million gallons of water per day and a yield of 7.8 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.2.2 Threatened or Endangered Species

According to the 1999 Eco-Tech, Inc. field survey the following Endangered species inhabits the area of the proposed reservoir:

- *Villosa trabalis* (Cumberland Bean) federally and KSNPC listed as Endangered.

Other Threatened and Endangered species known to exist in the Rockcastle River Drainage but not identified by Eco-Tech, Inc. include:

- *Pleurobema oviforme* (Tennessee Clubshell) KSNPC listed as Endangered.
- *Percina squamata* (Olive Darter) KSNPC listed as Endangered.
- *Villosa lienosa* (Little Spectaclecase) KSNPC listed as a Special Concern.
- *Etheostoma cinereum* (Ashy Darter) KSNPC listed as a Special Concern.

- *Ophiogomphus howei* (Pygmy Snaketail) KSNPC listed as a Special Concern.

4.2.3 Special Resource Designations

The State of Kentucky has designated this portion of the Laurel Fork River as an Outstanding Resource Water (Miller, 1999).

4.2.4 Recreation

Laurel Fork and McCammon Branch at pool elevation would cover 395 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 540,000 visitor hours per year.

4.2.5 Availability

Approximately 35% of the reservoir site would be located on National Forest Service lands (USGS, 1983c; USGS, 1989).

4.2.6 Distance to the Water Treatment Plant

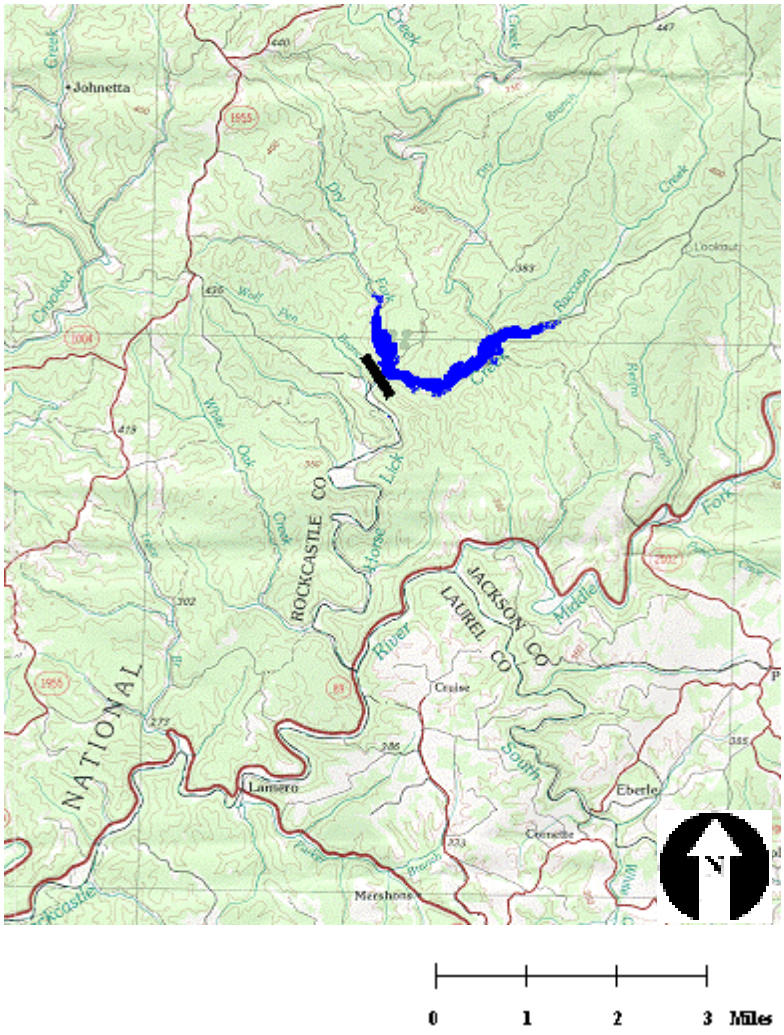
The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 7.5 miles.

4.2.7 Conclusion

Although the yield for this alternative would be well above that required, the presence of threatened or endangered species, especially the Cumberland Bean, and the Outstanding Resource Water designation would make this a difficult alternative to pursue. The recommendation is that this proposal be excluded from consideration.

4.3 Horse Lick Creek

Site 3 is located along the Jackson/Rockcastle County boundary line and is located approximately 1 mile west of Carpenter School in western Jackson County. The dam would be situated on Horse Lick Creek just below the confluence with Dry Fork. The pool elevation of the reservoir would be approximately 985 feet above MSL.



4.3.1 Yield Analysis

Table 8: Horse Lick Creek				
Watershed Area = 32,260 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	1,000.0	628.6	21,288.0	6.9
Pool	980.0	421.6	10,786.0	3.5
	960.0	225.9	4,311.0	1.4
	940.0	102.9	1,026.0	0.3

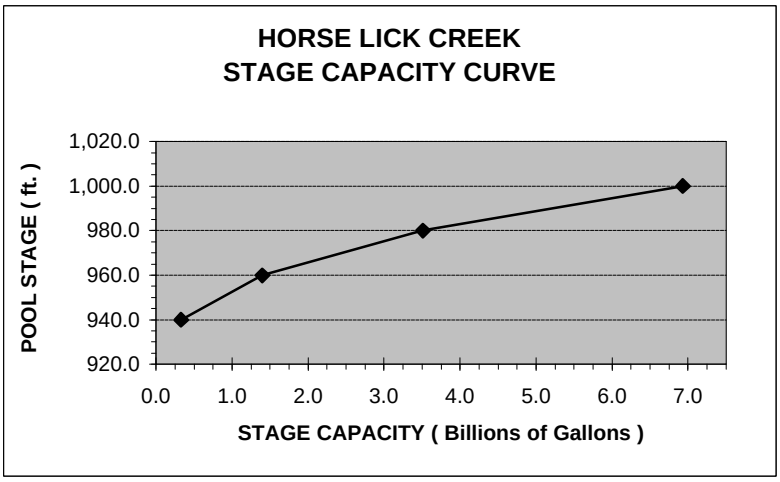


Figure 4: Horse Lick Creek Stage Capacity Curve

Table 9: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
2.6	4.4	7	19.3	1.4	4.4	5.8	15.9	45

The above tables represent the analysis of capacity and yield for a proposed impoundment at the Horse Lick site. At pool elevation of approximately 980 feet above mean sea level, there would be an impoundment of approximately 422 surface acres, and a volume of 10,800 acre-feet and a capacity of 3.5 billion gallons of water. During average drought conditions, there would be a sustainable yield of 19.3 million gallons of water per day and a yield of 15.9 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.3.2 Threatened or Endangered Species

Several Threatened and Endangered species of bivalve mussels have been identified within the boundaries of the proposed reservoir. Threatened and Endangered mussels known to inhabit Horse Lick Creek include:

- *Villosa trabalis* (Cumberland Bean) federally and KSNPC listed as Endangered.
- *Pegias fabula* (Little-Wing Pearly Mussel) federally and KSNPC listed as Endangered.
- *Toxolasma lividus* (Purple Lilliput) KSNPC listed as Endangered.
- *Ptychobranchus subtentum* (Fluted Kidneyshell) KSNPC listed as Threatened.
- *Pleurobema oviforme* (Tennessee Clubshell) KSNPC listed as Endangered.

The following plant species have also been identified at the site and may be impacted by the construction of the reservoir:

- *Vallisneria americana* (Eel-Grass) listed as a species of KSNPC special concern.

4.3.3 Special Resource Designations

The State of Kentucky has designated this portion of Horse Lick Creek as an Outstanding Resource Water (Miller, 1999).

4.3.4 Recreation

Horse Lick Creek at pool elevation would cover 422 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 600,000 visitor hours per year.

4.3.5 Availability

Approximately 60% of the reservoir site would be located on National Forest Service lands (USGS, 1983b; USGS, 83d; USGS, 83e; USGS, 83a).

4.3.6 Distance to the Water Treatment Plant

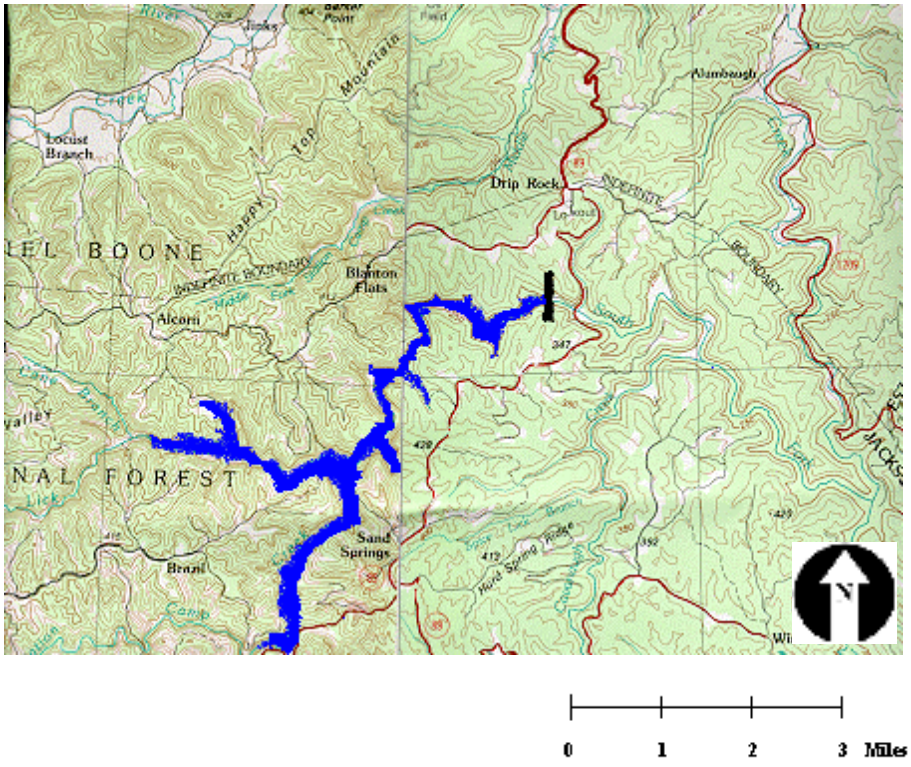
The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 18.5 miles.

4.3.7 Conclusion

Although the yield for this alternative would be well above that required, the presence of threatened or endangered species - especially the Cumberland Bean - and the Outstanding Resource Water designation would make this a difficult alternative to pursue. The recommendation is that this proposal be excluded from consideration.

4.4 SOUTH FORK OF STATION CAMP CREEK AND ROCK LICK CREEK

Site 4 is located in the northeastern corner of Jackson County approximately 1 mile southeast of the town of Drip Rock. The dam would be situated on the South Fork near the Highway 89 bridge. The pool elevation of the reservoir would be approximately 900 feet above MSL.



4.4.1 Yield Analysis

Table 10: South Fork and Rock Lick				
Watershed Area = 26,800 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	920.0	868.9	70,439.0	22.9
Pool	900.0	768.1	54,069.0	17.6
	880.0	626.6	40,122.0	13.1
	860.0	510.8	28,748.0	9.4
	840.0	395.0	19,690.0	6.4
	820.0	302.0	12,720.0	4.1
	800.0	250.0	7,200.0	2.4
	780.0	163.9	3,061.0	1.0
	760.0	68.1	741.0	0.2
	740.0	3.0	30.0	0.0

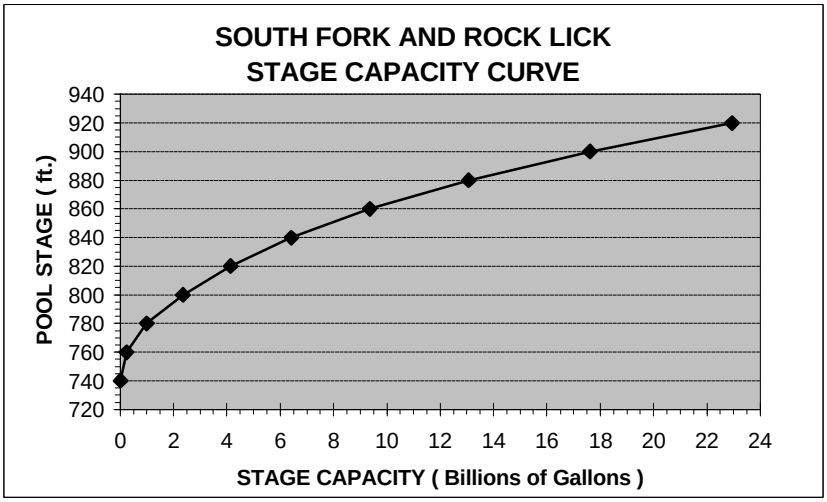


Figure 5: South Fork and Rock Lick Branch Stage Capacity Curve

Table 11: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
2.2	5.8	8.0	21.9	1.2	3.8	5.0	13.7	16

The above tables represent the analysis of capacity and yield for a proposed impoundment at the South Fork of Station Camp Creek and Rock Lick Branch site. At pool elevation of approximately 900 feet above mean sea level, there would be an impoundment of approximately 770 surface acres, and a volume of 54,700 acre feet and a capacity of 17.6 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 21.9 million gallons of water per day and a yield of 13.7 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.4.2 Threatened or Endangered Species

The Karst topography and drainage patterns within this area create an ideal habitat for regional bat species. Several Threatened and Endangered bat species have been identified within the boundaries of the proposed reservoir including:

- *Myotis sodalis* (Indiana Bat) federally and KSNPC listed as Endangered.
- *Corynorhinus townsendii virginianus* (Virginia Big Eared Bat) federally and KSNPC listed as Endangered.
- *Corynorhinus rafinesquii* (Rafinesque's Big Eared Bat) KSNPC listed as Threatened (Eco-Tech, Inc., 1999).

Other species identified during the Eco-Tech, Inc. field study were:

- *Villosa lienosa* (Little Spectaclecase) KSNPC Special Concern.

Plant species potentially impacted by the flooding of the area include:

- *Taxus canadensis* (Canadian Yew)) KSNPC Threatened.
- *Spiranthes lucida* (Shining Ladies'-Tresses) KSNPC Threatened.

4.4.3 Special Resource Designations

The South Fork of Station Camp Creek is a Study River for possible inclusion in the Wild & Scenic River system. Even though the Forest Service's recommendation is to not include this river in the system, the Study status of the river remains in effect until removed (Hersel 1999). The recommendation is that this proposal be excluded from consideration.

4.4.4 Recreation

The reservoir located on the South Fork of Station Camp Creek and Rock Lick at pool elevation would cover 768 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 1,380,000 visitor hours per year.

4.4.5 Availability

Approximately 30% of the reservoir site would be located on National Forest Service lands (USGS, 1987b; USGS, 1987a).

4.4.6 Distance to the Water Treatment Plant

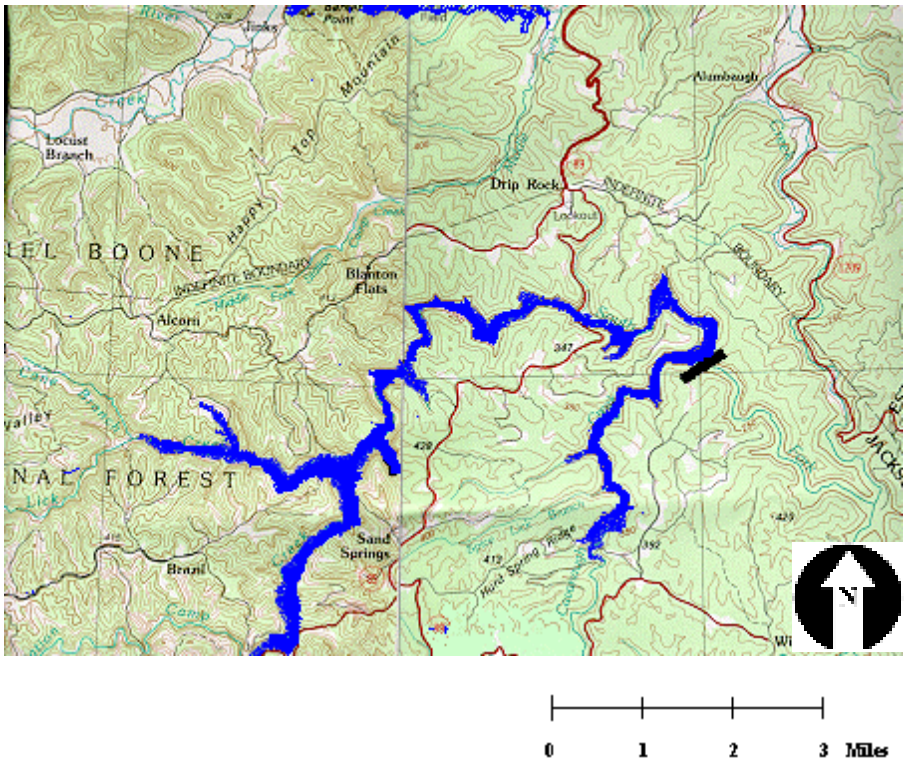
The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 23 miles.

4.4.7 Conclusion

The yield for this alternative is well above the necessary requirement. However, due to Study River status of this portion of South Fork, the recommendation is for this alternative to be excluded from further consideration.

4.5 SOUTH FORK OF STATION CAMP CREEK AND CAVANAUGH CREEK #2

Site 5 is located in the northeastern corner of Jackson County approximately 2.5 miles southeast of the town of Drip Rock. The dam would be situated on the South Fork just below the confluence with Cavanaugh Creek. The pool elevation of the reservoir would be approximately 820 feet above MSL.



4.5.1 Yield Analysis

Table 12: South Fork and Cavanaugh Creek #2				
Watershed Area = 36,655 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	840.0	869.5	51,175.0	16.7
Pool	820.0	709.6	35,384.0	11.5
	800.0	588.9	22,399.0	7.3
	780.0	431.4	12,200.0	4.0
	760.0	258.9	5,293.0	1.7
	740.0	108.7	1,617.0	0.5
	720.0	23.3	297.0	0.1
	700.0	3.2	32.0	0.0

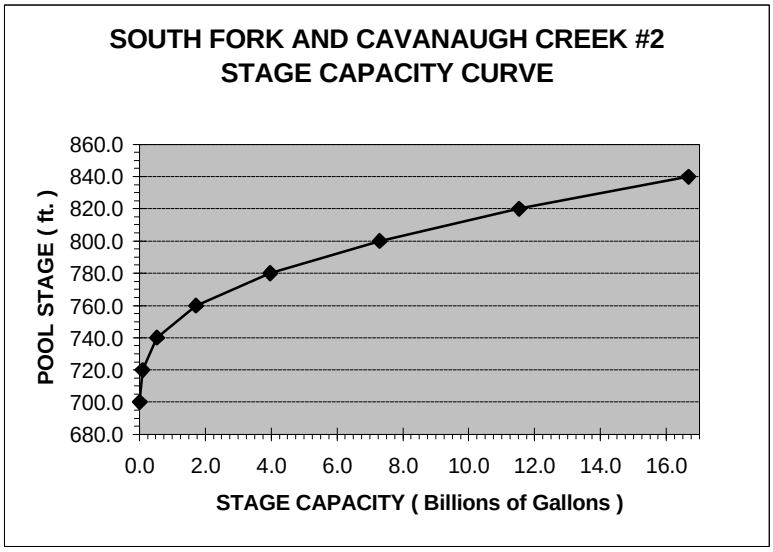


Figure 6: South Fork and Cavanaugh Creek #2 Stage Capacity Curve

Table 13: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
3.0	8.0	11.0	30.0	1.6	5.2	6.8	18.7	27

The above tables represent the analysis of capacity and yield for a proposed impoundment at the South Fork and Cavanaugh Creek #2 site. At pool elevation of approximately 820 feet above mean sea level, there would be an impoundment of approximately 710 surface acres, and a volume of 35,400 acre feet and a capacity of 11.45 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 30.0 million gallons of water per day and a yield of 18.7 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.5.2 Threatened or Endangered Species

The Karst topography and drainage patterns within this area create an ideal habitat for regional bat species. Several Threatened and Endangered bat species have been identified within the boundaries of the proposed reservoir including:

- *Myotis sodalis* (Indiana Bat) federally and KSNPC listed as Endangered.
- *Corynorhinus townsendii virginianus* (Virginia Big Eared Bat) federally and KSNPC listed as Endangered.
- *Corynorhinus rafinesquii* (Rafinesque's Big Eared Bat) KSNPC listed as Threatened (Eco-Tech, Inc., 1999).

Other species identified during the Eco-Tech, Inc. field study were:

- *Villosa lienosa* (Little Spectaclecase) KSNPC Special Concern.

Plant species potentially impacted by the flooding of the area include:

- *Taxus canadensis* (Canadian Yew) KSNPC Threatened.
- *Spiranthes lucida* (Shining Ladies'-Tresses) KSNPC Threatened.

4.5.3 Special Resource Designations

The South Fork of Station Camp Creek has been a Study River for possible inclusion in the Wild & Scenic River system. Even though the Forest Service's recommendation is to not include this river in the system, the Study status of the river excludes it from further consideration (Hersel 1999).

4.5.4 Recreation

South Fork and Cavanaugh Creek #2 at pool elevation of 710 acres, using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 1,270,000 visitor hours per year.

4.5.5 Availability

Approximately 25% of the reservoir site would be located on National Forest Service lands (USGS, 1987b; USGS, 1987a).

4.5.6 Distance to the Water Treatment Plant

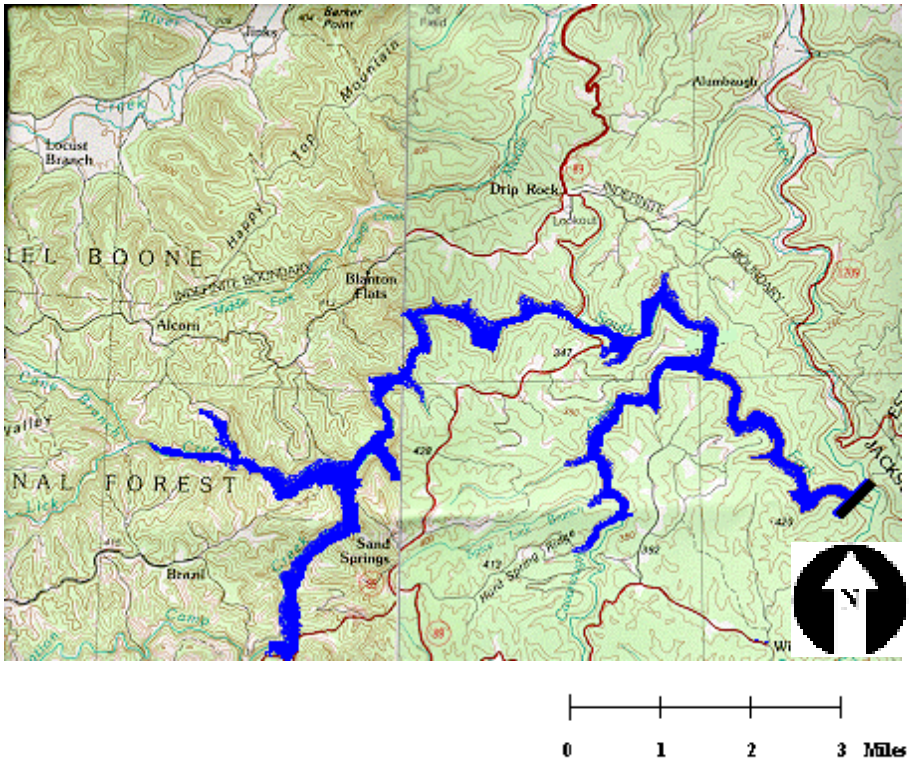
The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 20 miles.

4.5.7 Conclusion

The yield for this alternative is well above the necessary requirement. However, due to Study River status of this portion of South Fork, the recommendation is for this alternative to be excluded from further consideration.

4.6 SOUTH FORK OF STATION CAMP CREEK AND CAVANAUGH CREEK

Site 6 is located near the Lee County boundary line in northeastern Jackson County and is approximately one mile southwest of the Jackson/Estill/Lee County conjunction. The dam would be situated on the South Fork just above the confluence with War Fork. The pool elevation of the reservoir would be approximately 800 feet above MSL.



4.6.1 Yield Analysis

Table 14: South Fork and Cavanaugh Creek				
Watershed Area = 38,555 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	820.0	951.8	54,436.0	17.7
Pool	800.0	807.3	36,845.0	12.0
	780.0	617.0	22,606.0	7.4
	760.0	409.7	12,317.0	4.0
	740.0	234.2	5,896.0	1.9
	720.0	120.6	2,348.0	0.8
	700.0	56.7	575.0	0.2
	680.0	0.4	0.0	0.0

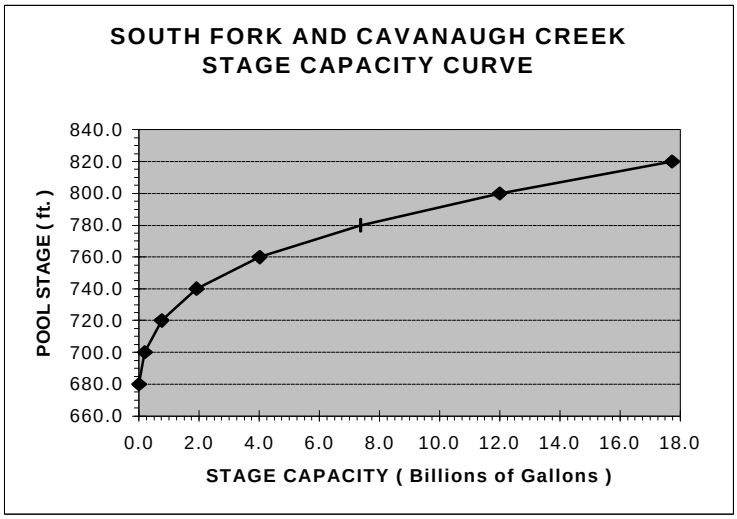


Figure 7: South Fork and Cavanaugh Creek Stage Capacity Curve

Table 15: Yield Estimates								
Average Drought Condition				**Worst Drought Condition**				
Runoff (BG)	**Refill (BG)**	**Yield (BG)**	**Yield MGD**	**Runoff (BG)**	**Refill (BG)**	**Yield (BG)**	**Yield (MGD)**	**Drawdown (Feet)**
3.1	8.4	11.5	31.5	1.7	5.5	7.2	19.7	25

The above tables represent the analysis of capacity and yield for a proposed impoundment at the South Fork and Cavanaugh Creek site. At pool elevation of approximately 800 feet above mean sea level, there would be an impoundment of approximately 810 surface acres, and a volume of 36,800 acre feet and a capacity of 12.0 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 31.5 mgd and a yield of 19.7 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.6.2 Threatened or Endangered Species

The Karst topography and drainage patterns within this area create an ideal habitat for regional bat species. Several Threatened and Endangered bat species have been identified within the boundaries of the proposed reservoir including:

- *Myotis sodalis* (Indiana Bat) federally and KSNPC listed as Endangered.
- *Corynorhinus townsendii virginianus* (Virginia Big Eared Bat) federally and KSNPC listed as Endangered.
- *Corynorhinus rafinesquii* (Rafinesque's Big Eared Bat) KSNPC listed as Threatened (Eco-Tech, Inc., 1999).

Other species identified during the Eco-Tech, Inc. field study were:

- *Villosa lienosa* (Little Spectaclecase) KSNPC Special Concern.

Plant species potentially impacted by the flooding of the area include:

- *Taxus canadensis* (Canadian Yew) KSNPC Threatened.
- *Spiranthes lucida* (Shining Ladies'-Tresses) KSNPC Threatened.

4.6.3 Special Resource Designations

The South Fork of Station Camp Creek has been a Study River for possible inclusion in the Wild & Scenic River system. Even though the Forest Service's recommendation is to not include this river in the system, the Study status of the river excludes its further study (Hersel 1999).

4.6.4 Recreation

South Fork and Cavanaugh Creek at pool elevation would cover 807 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 1,470,000 visitor hours per year.

4.6.5 Availability

Approximately 20% of the reservoir site would be located on National Forest Service lands (USGS, 1987b, USGS, 1987a).

4.6.6 Distance to the Water Treatment Plant

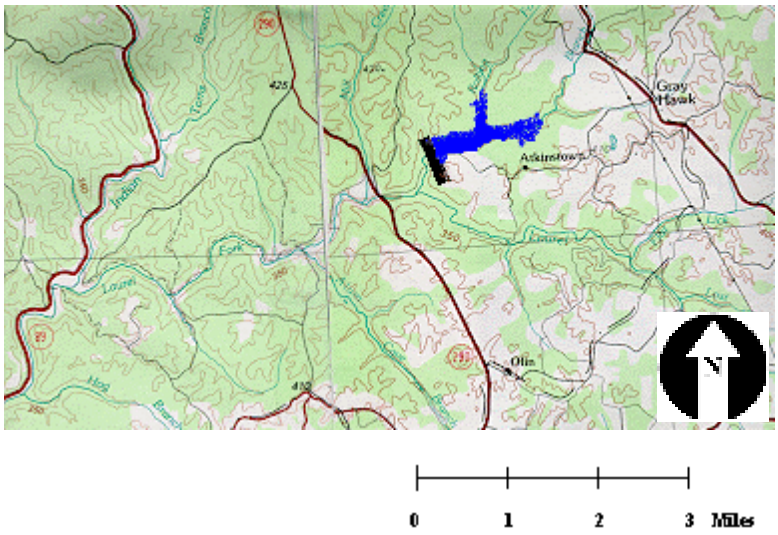
The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 17.5 miles.

4.6.7 Conclusion

The yield for this alternative is well above the necessary requirement. However, due to Study River status of this portion of South Fork, the recommendation is for this alternative to be excluded from further consideration.

4.7 MCCAMMON BRANCH

Site 7 is located approximately 1 mile west of Atkinstown in the southern half of Jackson County. The dam would be situated on McCammon Branch approximately half a mile upstream from the confluence with the Laurel Fork River. The pool elevation of the reservoir would be approximately 1,160 feet above MSL.



4.7.1 Yield Analysis

Table 16: McCammon Branch				
Watershed Area = 4,525 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	1,180.0	337.4	23,154.0	7.5
Pool	1,160.0	281.3	16,967.0	5.5
	1,140.0	223.6	12,388.0	4.0
	1,120.0	176.6	8,386.0	2.7
	1,100.0	135.3	5,267.0	1.7
	1,080.0	95.9	2,955.0	1.0
	1,060.0	61.3	1,383.0	0.5
	1,040.0	28.7	483.0	0.2
	1,020.0	9.8	98.0	0.0

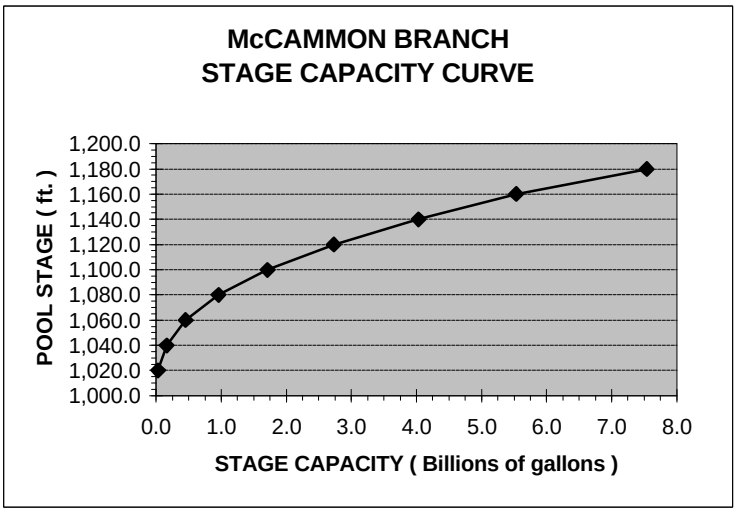


Figure 8: McCammon Branch Stage Capacity Curve

Table 17: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
0.4	1.0	1.4	3.7	0.2	0.7	0.9	2.3	10

The above tables represent the analysis of capacity and yield for a proposed impoundment at the McCammon Branch site. At pool elevation of approximately 1,160 feet above mean sea level, there would be an impoundment of approximately 280 surface acres, and a volume of 17,000 acre feet and a capacity of 5.5 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 3.7 mgd and a yield of 2.3 mgd during worst drought conditions. The sustainable yield meets the requirement of 3.0 mgd to be considered reasonable, however, worst drought conditions fall below the requirement.

4.7.2 Threatened or Endangered Species

There are no known endangered, threatened, or special concern plants or animals that have been reported within the boundaries of the proposed reservoir (Eco-Tech, Inc., 1999). There are, however, reported *Villosa trabalis* (Cumberland Bean) downstream of the proposed site.

4.7.3 Special Resource Designations

This portion of McCammon Branch does not have any status under the Wild and Scenic Rivers Act or the Kentucky Outstanding Resource Water program. However, the waters of McCammon Branch feed into waters that the State of Kentucky has designated as an Outstanding Resource Water (Miller, 1999).

4.7.4 Recreation

For McCammon Branch at pool elevation would cover 281 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 320,000 visitor hours per year.

4.7.5 Availability

Approximately 80% of the reservoir site would be located on National Forest Service lands (USGS, 1983c).

4.7.6 Distance to the Water Treatment Plant

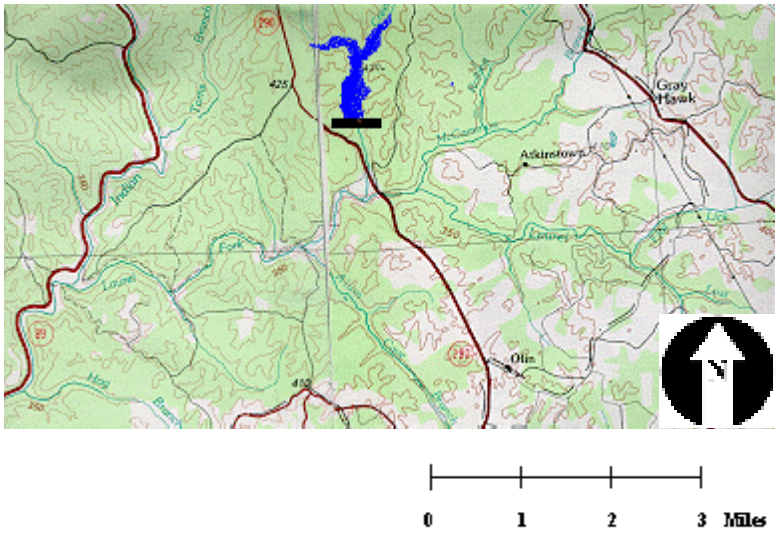
The approximate distance from Site 7 to the Tyner Lake water treatment facility along roadways, is approximately 5.5 miles.

4.7.7 Conclusion

Although the yield for this alternative would be above that required limit during average drought conditions, the yield falls below the required limit during worst drought conditions. For the purposes of this study, the presence of a protected species, the Cumberland bean pearly mussel, downstream of the proposed site would make this a difficult alternative to pursue. In addition, stream waters that feed into waters with Outstanding Resource Water designation also contribute to its exclusion as a reasonable alternative. The recommendation is that this proposal be excluded from further consideration.

4.8 MILL CREEK

Site 8 is located approximately 3 miles south of the town of McKee in the southern half of Jackson County. The dam would be situated on Mill Creek near the Highway 290 bridge. The pool elevation of the reservoir would be approximately 1,135 feet above MSL.



4.8.1 Yield Analysis

Table 18: Mill Creek				
Watershed Area = 1,675 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	1,160.0	122.1	6,979.0	2.3
Pool	1,140.0	95.5	4,803.0	1.6
	1,120.0	64.5	3,203.0	1.1
	1,100.0	50.9	2,044.0	0.7
	1,080.0	35.8	1,182.0	0.4
	1,060.0	24.2	582.0	0.2
	1,040.0	14.1	199.0	0.1
	1,020.0	2.9	29.0	0.0

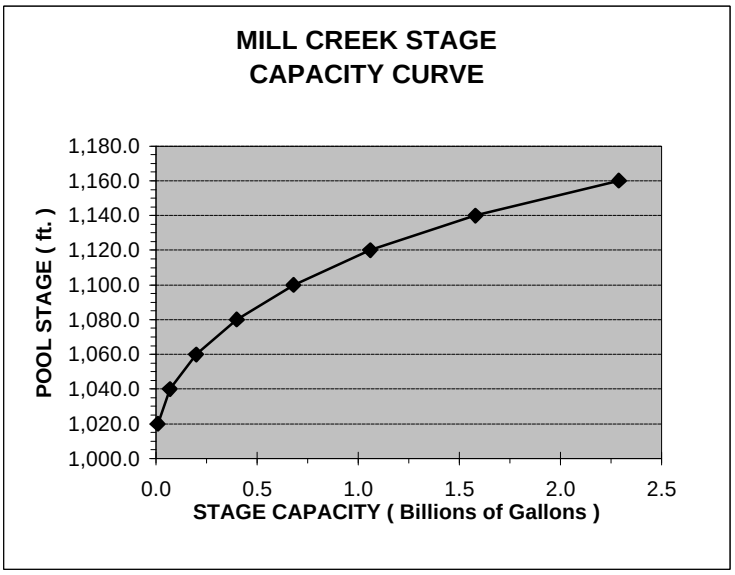


Figure 9: Mill Creek Stage Capacity Curve

Table 19: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
0.1	0.4	0.5	1.4	0.1	0.2	0.3	0.9	8

The above tables represent the analysis of capacity and yield for a proposed impoundment at the Mill Creek site. At pool elevation of approximately 1,140 feet above mean sea level, there would be an impoundment of approximately 96 surface acres, and a volume of 4,800 acre feet and a capacity of 1.6 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 1.4 mgd and a yield of 0.9 mgd during worst drought conditions. This is well below the requirement of 3.0 mgd to be considered reasonable.

4.8.2 Threatened or Endangered Species

There are no known endangered, threatened, or special concern plants or animals that have been reported within the boundaries of the proposed reservoir (Eco-Tech, Inc., 1999).

4.8.3 Special Resource Designations

This portion of Mill Creek does not have any status under the Wild and Scenic Rivers Act or the Kentucky Outstanding Resource Water program (Miller, 1999).

4.8.4 Recreation

Mill Creek at pool elevation would cover 96 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 74,000 visitor hours per year.

4.8.5 Availability

100% of the reservoir site would be located on National Forest Service lands (USGS, 1983c).

4.8.6 Distance to the Water Treatment Plant

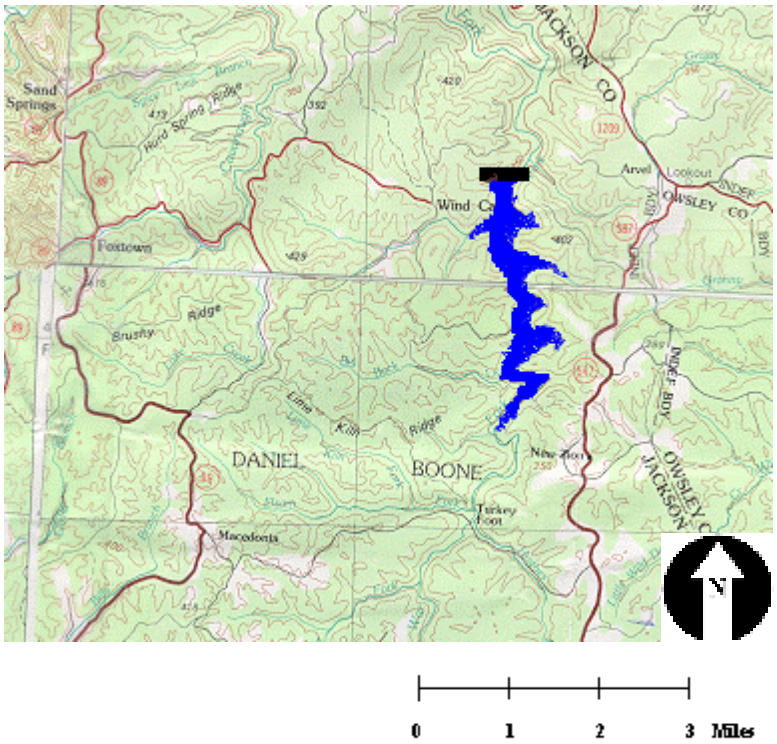
The approximate distance from Site 8 to the Tyner Lake water treatment facility along roadways, is approximately 7.5 miles.

4.8.7 Conclusion

The yield for this proposed site is below that required to be considered reasonable. For this reason the recommendation is for this site to be excluded form further consideration.

4.9 WAR FORK AND ALCORN BRANCH

Site 9 is located approximately one mile east of Wind Cave in eastern Jackson County. The dam would be situated on War Fork approximately 2 miles south of the confluence with South Fork. The pool elevation of the reservoir would be approximately 795 feet above MSL.



4.9.1 Yield Analysis

Table 20: War Fork and Alcorn Branch				
Watershed Area = 17,440 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	820.0	203.2	10,134.0	3.3
Pool	800.0	155.9	6,543.0	2.1
	780.0	110.0	3,884.0	1.3
	760.0	67.0	2,114.0	0.7
	740.0	50.0	944.0	0.3
	720.0	20.9	235.0	0.1
	700.0	1.3	13.0	0.0

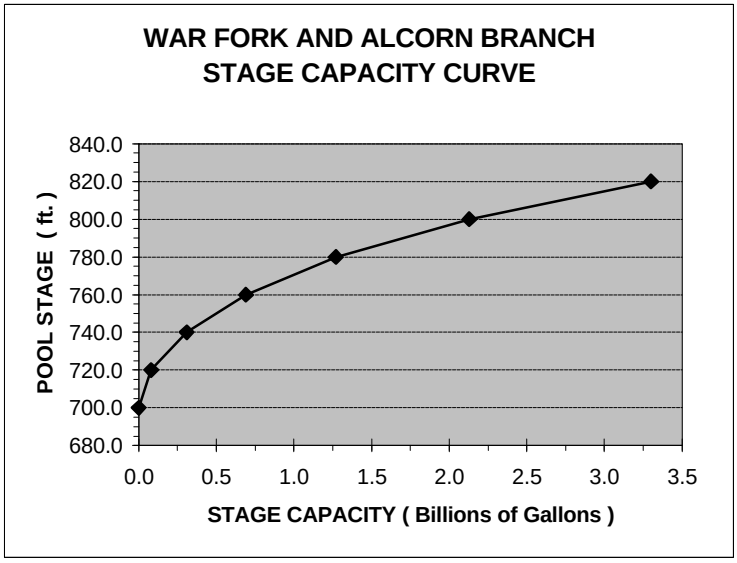


Figure 10: War Fork & Alcorn Branch Stage Capacity Curve

Table 21: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
1.4	1.9	3.3	9.1	0.8	1.9	2.7	7.3	95

The above tables represent the analysis of capacity and yield for a proposed impoundment at the War Fork and Alcorn Branch site. At pool elevation of approximately 800 feet above mean sea level, there would be an impoundment of approximately 155 surface acres, and a volume of 6,500 acre feet and a capacity of 2.1 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 9.1 mgd and a yield of 7.3 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.9.2 Threatened or Endangered Species

The Karst topography and drainage patterns within this area create an ideal habitat for regional bat species (USFS, 1996). A survey completed by John MacGregor, T&E Specialist for the Daniel Boone National Forest, identified a significant concentration of colonies and hibernaculums in this drainage which include:

- *Myotis sodalis* (Indiana Bat) federally and KSNPC Endangered.
- *Corynorhinus townsendii virginianus (*Virginia Big Eared Bat) KSNPC Endangered.
- *Corynorhinus rafinesquii* (Rafinisque Big Eared Bat) KSNPC Threatened.

Plant species potentially impacted by the reservoir construction include:

- *Taxus Canadensis* (Canadian Yew) KSNPC Threatened.
- *Saxifraga micranthidifolia* (Lettuce-Leaf Saxifrage) KSNPC Endangered.
- *Dryopteris carthusiana* (Spinulose Wood Fern) KSNPC Special Concern (Eco-Tech, Inc., 1999).

4.9.3 Special Resource Designations

This area is under Study River status for possible inclusion under the Federal Wild and Scenic Rivers Act. Further, the U.S. Forest Service has recommended to the Department of Interior/National Park Service that the portion of War Fork between Turkey Foot campground and the mouth of the South Fork of Station Camp Creek be included in the National Wild and Scenic River System. This alternative lies within these boundaries and should be excluded from further consideration (Hersel, 1999).

4.9.4 Recreation

War Fork and Alcorn Branch at pool elevation would cover 156 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 140,000 visitor hours per year.

4.9.5 Availability

Approximately 80% of the reservoir site would be located on National Forest Service lands (USGS, 1987b; USGS, 1983c).

4.9.6 Distance to the Water Treatment Plant

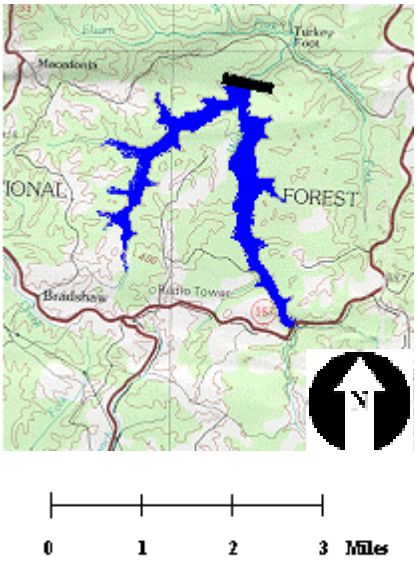
The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 18 miles.

4.9.7 Conclusion

The yield for this alternative is well above the necessary requirement. However, due to Study River status of this portion of War Fork, the recommendation is for this alternative to be excluded from further consideration.

4.10 WAR FORK AND STEER FORK

Site 10 is located approximately half a mile southwest of Turkey Foot in eastern Jackson County. The dam would be situated on War Fork approximately 0.75 miles north of the confluence with Steer Fork. The pool elevation of the reservoir would be approximately 1,050 feet above MSL.



4.10.1 Yield Analysis

Table 22: War Fork and Steer Fork				
Watershed Area = 6,945 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	1,080.0	468.1	30,627.0	10.0
Pool	1,060.0	377.5	22,171.0	7.2
	1,040.0	279.7	15,599.0	5.1
	1,020.0	212.7	10,681.0	3.5
	1,000.0	162.3	6,937.0	2.3
	980.0	113.0	4,184.0	1.4
	960.0	78.6	2,268.0	0.7
	940.0	48.2	1,000.0	0.3
	920.0	25.9	259.0	0.1

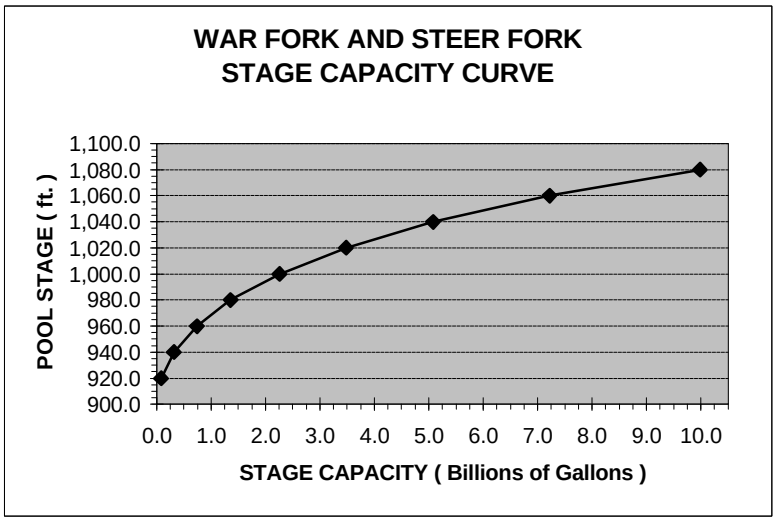


Figure 11: War Fork & Steer Fork Stage Capacity Curve

Table 23: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
0.6	1.5	2.1	5.7	0.3	1.0	1.3	3.6	10

The above tables represent the analysis of capacity and yield for a proposed impoundment at the War Fork and Steer Fork site. At pool elevation of approximately 1,060 feet above mean sea level, there would be an impoundment of approximately 380 surface acres, and a volume of 22,000 acre feet and a capacity of 7.2 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 5.7 mgd and a yield of 3.6 mgd during worst drought conditions. This is above the requirement of 3.0 mgd to be considered reasonable.

4.10.2 Threatened or Endangered Species

A survey completed by John MacGregor, T&E Specialist for the Daniel Boone National Forest, identified a significant concentration of colonies and hibernaculua in close proximity to the proposed reservoir site (USFS, 1996). Included are:

- *Myotis sodalis* (Indiana Bat) federally and KSNPC Endangered.
- *Corynorhinus townsendii virginianus (*Virginia Big Eared Bat) KSNPC Endangered.
- *Corynorhinus rafinesquii* (Rafinisque Big Eared Bat) KSNPC Threatened.

Further analysis must be performed in order to conclude whether or not these bat species would be effected by the construction of the proposed reservoir.

Plant species potentially impacted by the reservoir construction include:

- *Taxus Canadensis* (Canadian Yew) KSNPC Threatened.
- *Saxifraga micranthidifolia* (Lettuce-Leaf Saxifrage) KSNPC Endangered.
- *Dryopteris carthusiana* (Spinulose Wood Fern) KSNPC Special Concern (Eco-Tech, Inc., 1999).

4.10.3 Special Resource Designations

The U.S. Forest Service has recommended to the Department of Interior/National Park Service that the portion of War Fork between Turkey Foot campground and the mouth of the South Fork of Station Camp Creek be included in the National Wild and Scenic River System. This portion of War Fork does not fall within the previously described area and therefore does not have any status under the Wild and Scenic Rivers Act or the Kentucky Outstanding Resource Water program (Miller, 1999).

4.10.4 Recreation

War Fork-Steer Fork at pool elevation would cover 378 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 500,000 visitor hours per year.

4.10.5 Availability

Approximately 60% of the reservoir site would be located on National Forest Service lands (USGS, 1983c).

4.10.6 Distance to the Water Treatment Plant

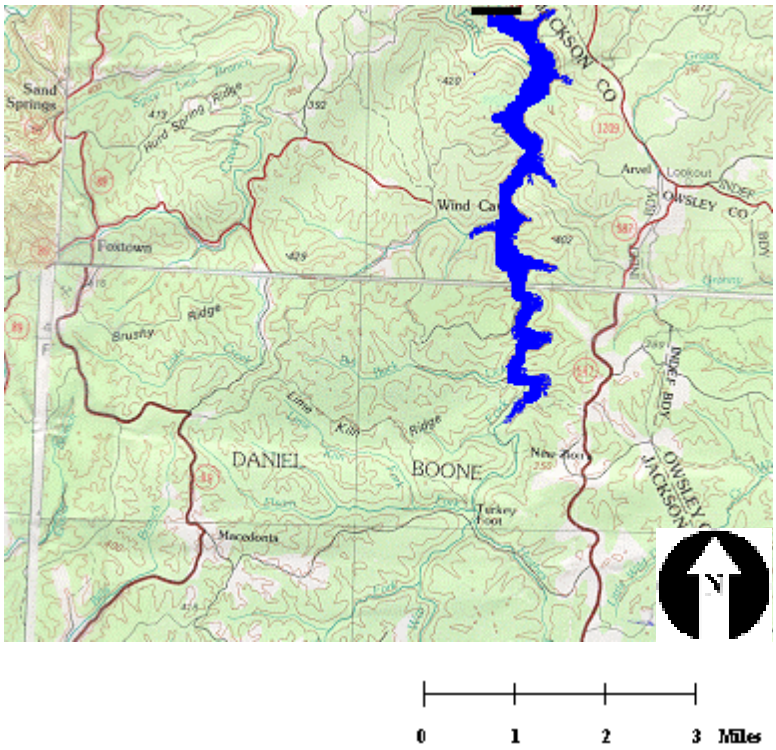
The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 12 miles.

4.10.7 Conclusion

The yield for this alternative is above the necessary requirement. Due to the presence of potential bat habitat within this region, a bat survey should be conducted in order to definitively include or exclude this alternative. Until such time as a bat survey can be accomplished, the recommendation is to include this proposal as a Reasonable Alternative.

4.11 SOUTH FORK OF STATION CAMP CREEK AND WAR FORK

Site 11 is located near the Lee County boundary line in northeastern Jackson County and is approximately one mile southwest of the Jackson/Estill/Lee County conjunction. The dam would be situated on War Fork just upstream from the confluence with South Fork. The pool elevation of the reservoir would be approximately 800 feet above MSL.



4.11.1 Yield Analysis

Table 24: South Fork and War Fork				
Watershed Area = 56,900 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	820.0	1,386.7	85,937.0	28.0
Pool	800.0	1,171.2	60,358.0	19.7
	780.0	908.9	39,561.0	12.9
	760.0	636.1	24,089.0	7.9
	740.0	426.0	13,486.0	4.4
	720.0	264.6	6,580.0	2.1
	700.0	161.1	2,323.0	0.8
	680.0	35.6	356.0	0.1

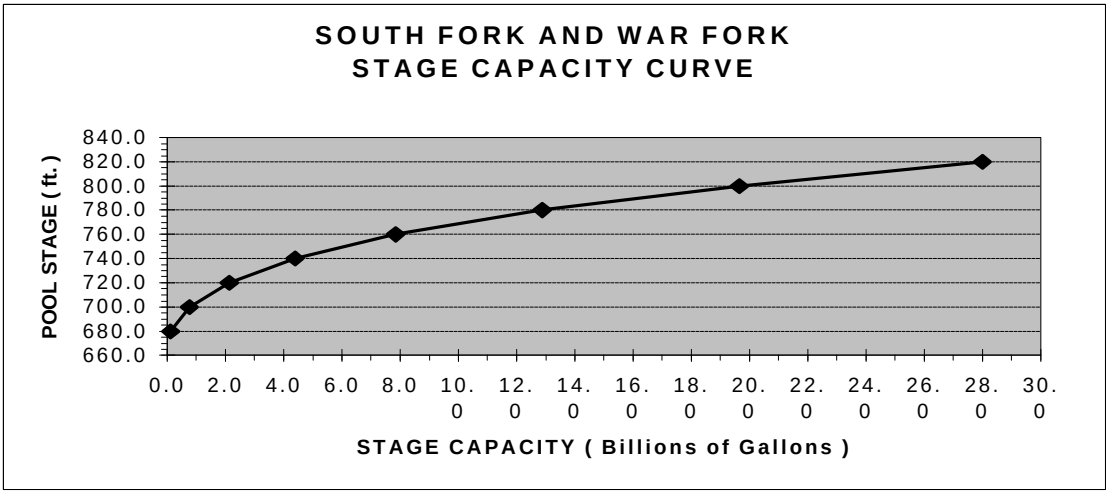


Figure 12: South Fork & War Fork Stage Capacity Curve

Table 25: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
4.6	12.4	17.0	46.5	2.5	8.1	10.6	29.1	26

The above tables represent the analysis of capacity and yield for a proposed impoundment at the South Fork and War Fork site. At pool elevation of approximately 800 feet above mean sea level, there would be an impoundment of approximately 1,170 surface acres, and a volume of 60,000 acre feet and a capacity of 19.7 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 46.5 mgd and a yield of 29.1 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.11.2 Threatened or Endangered Species

The Karst topography and drainage patterns within this area create an ideal habitat for regional bat species. Several Threatened and Endangered bat species have been identified within the boundaries of the proposed reservoir including

- *Myotis sodalis* (Indiana Bat) federally and KSNPC listed as Endangered.
- *Corynorhinus townsendii virginianus* (Virginia Big Eared Bat) federally and KSNPC listed as Endangered.
- *Corynorhinus rafinesquii* (Rafinesque's Big Eared Bat) KSNPC listed as Threatened (Eco-Tech, Inc., 1999).

Other species identified during the Eco-Tech, Inc. field study were:

- *Villosa lienosa* (Little Spectaclecase) KSNPC Special Concern.

Plant species potentially impacted by the flooding of the area include:

- *Taxus canadensis* (Canadian Yew) KSNPC Threatened.
- *Spiranthes lucida* (Shining Ladies'-Tresses) KSNPC Threatened.
- *Saxifraga micranthidifolia* (Lettuce-Leaf Saxifrage) KSNPC Endangered.
- *Dryopteris carthusiana* (Spinulose Wood Fern) KSNPC Special Concern.

4.11.3 Special Resource Designations

This area is under Study River status for possible inclusion under the Federal Wild and Scenic Rivers Act. Further, the U.S. Forest Service has recommended to the Department of Interior/National Park Service that the portion of War Fork between Turkey Foot campground and the mouth of the South Fork of Station Camp Creek be included in the National Wild and Scenic River System. This alternative lies within these boundaries and has the protection provided for a Study River (Miller, 1999).

4.11.4 Recreation

South Fork and War Fork at pool elevation would cover 1,171 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 2,270,000 visitor hours per year.

4.11.5 Availability

Approximately 70% of the reservoir site would be located on National Forest Service lands (USGS, 1987b, USGS, 1983c).

4.11.6 Distance to the Water Treatment Plant

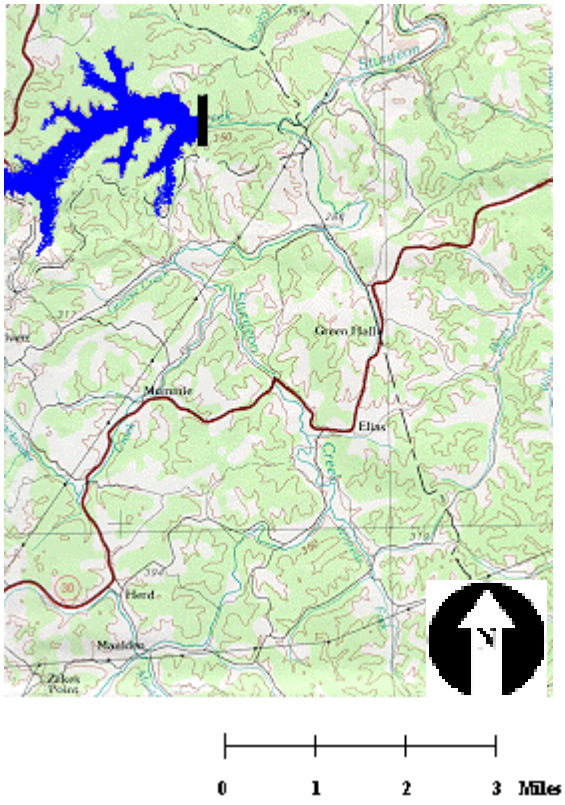
The approximate distance from Site 11 to the Tyner Lake water treatment facility along roadways, is approximately 18.5 miles.

4.11.7 Conclusion

The yield for this alternative is well above the necessary requirement. However, due to Study River status of this portion of War Fork, the recommendation is for this alternative to be excluded from further consideration.

4.12 TRAVIS CREEK

Site 12 is located near the Jackson/Owsley County boundary line in eastern Jackson County and is located approximately 3 miles north of the town of Mummie. The dam would be situated on Travis Creek just north of Travis School. The pool elevation of the reservoir would be approximately 1,100 feet above MSL.



4.12.1 Yield Analysis

Table 26: Travis Creek				
Watershed Area = 1,305 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	1,120.0	564.0	39,575.0	12.9
Pool	1,100.0	452.2	29,413.0	9.6
	1,080.0	354.9	21,342.0	7.0
	1,060.0	276.8	15,025.0	4.9
	1,040.0	203.6	10,221.0	3.3
	1,020.0	152.5	6,660.0	2.2
	1,000.0	109.4	4,040.0	1.3
	980.0	72.8	2,218.0	0.7
	960.0	46.7	1,023.0	0.3
	940.0	17.9	377.0	0.1
	920.0	8.2	116.0	0.0
	900.0	1.7	17.0	0.0

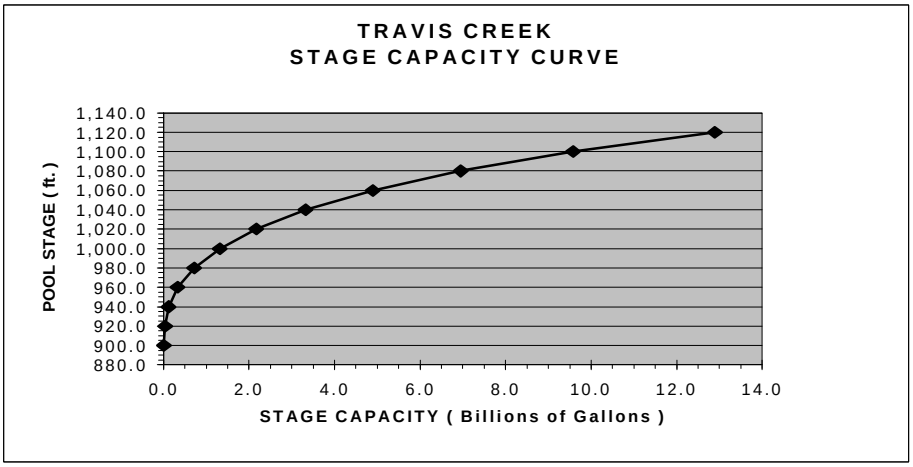


Figure 13: Travis Creek Stage Capacity Curve

Table 27: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
0.1	0.3	0.4	1.1	0.1	0.2	0.3	0.7	1

The above tables represent the analysis of capacity and yield for a proposed impoundment at the Travis Creek site. At pool elevation of approximately 1,100 feet above mean sea level, there would be an impoundment of approximately 450 surface acres, and a volume of 29,400 acre feet and a capacity of 9.6 Billion gallons of water. During average drought conditions, there would

be a sustainable yield of 1.1 mgd and a yield of 0.7 mgd during worst drought conditions. This is well below the requirement of 3.0 mgd to be considered reasonable.

4.12.2 Threatened or Endangered Species

There are no known endangered, threatened, or special concern plants or animals that have been reported within the boundaries proposed reservoir (Eco-Tech, Inc., 1999).

4.12.3 Special Resource Designations

This portion of Travis Creek does not have any status under the Wild and Scenic Rivers Act or the Kentucky Outstanding Resource Water program (Miller, 1999).

4.12.4 Recreation

Travis Creek at pool elevation would cover 452 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 670,000 visitor hours per year.

4.12.5 Availability

No portion of the reservoir site is located on National Forest Service lands. Privately owned properties would have to be acquired (USGS, 1983f, USGS, 1983c).

4.12.6 Distance to the Water Treatment Plant

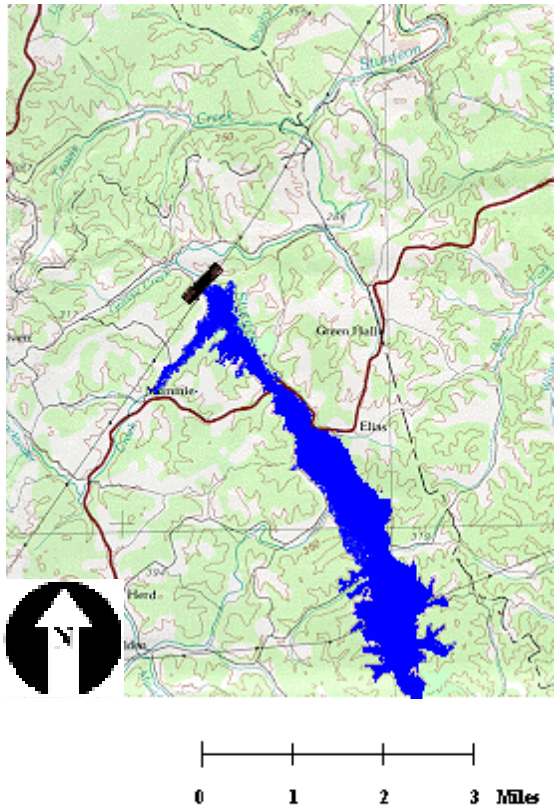
The approximate distance from Site 12 to the Tyner Lake water treatment facility along roadways, is approximately 7.5 miles.

4.12.7 Conclusion

The yield for this proposed site is below that required to be considered reasonable. For this reason the recommendation is for this site to be excluded form further consideration.

4.13 STURGEON CREEK

Site 13 is located near the Jackson/Owsley County boundary line in eastern Jackson County and is located approximately 1.5 miles northeast of the town of Mummie. The dam would be situated on Sturgeon Creek just below the confluence with Blackwater Creek. The pool elevation of the reservoir would be approximately 980 feet above MSL.



4.13.1 Yield Analysis

Table 28: Sturgeon Creek				
Watershed Area = 13,585 acres				
	Stage Elev. (Feet)	Area (Acres)	Volume	
			(Acre-feet)	(Billions of gallons)
	1,000.0	609.8	16,622.0	5.4
Pool	980.0	368.0	6,844.0	2.2
	960.0	117.7	1,987.0	0.7
	940.0	31.2	498.0	0.2
	920.0	9.3	93.0	0.0

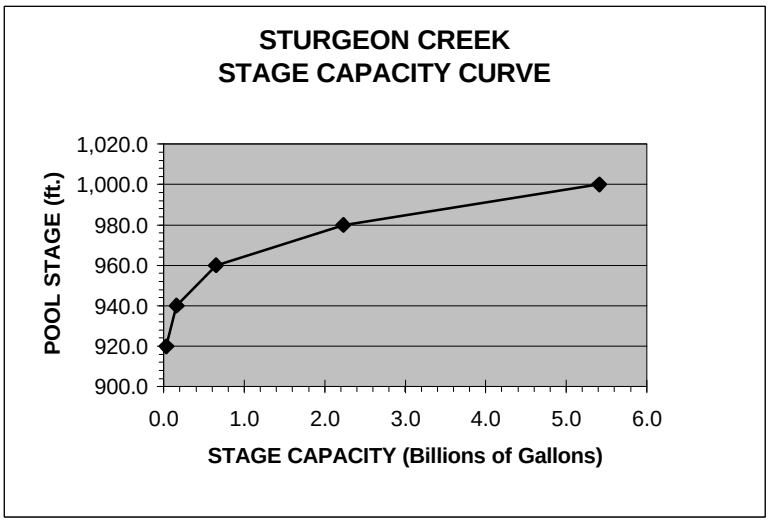


Figure 14: Sturgeon Creek Stage Capacity Curve

Table 29: Yield Estimates								
Average Drought Condition				Worst Drought Condition				
Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Runoff (BG)	Refill (BG)	Yield (BG)	Yield (MGD)	Drawdown (Feet)
1.1	3.0	4.1	11.1	0.6	1.9	2.5	7.0	35

The above tables represent the analysis of capacity and yield for a proposed impoundment at the Sturgeon Creek site. At pool elevation of approximately 980 feet above mean sea level, there would be an impoundment of approximately 370 surface acres, and a volume of 6,800 acre feet and a capacity of 2.2 Billion gallons of water. During average drought conditions, there would be a sustainable yield of 11.1 mgd and a yield of 7.0 mgd during worst drought conditions. This is well above the requirement of 3.0 mgd to be considered reasonable.

4.13.2 Threatened or Endangered Species

There are no known federally listed threatened or endangered species in the proposed area. The *Villosa lienosa* (Little Spectaclecase) has been documented from Sturgeon Creek (Eco-Tech, Inc., 1999) but was not observed during the 1999 Eco-Tech, Inc. field study. This native mussel has been designated as a species of KSNPC Special Concern.

4.13.3 Special Resource Designations

This portion of Sturgeon Creek does not have any status under the Wild and Scenic Rivers Act or the Kentucky Outstanding Resource Water program (Miller, 1999).

4.13.4 Recreation

Sturgeon Creek at pool elevation would cover 368 acres. Using the calculations from Section 3.4 and interpolating the estimated usage, the potential recreational usage of this site would be approximately 480,000 visitor hours per year.

4.13.5 Availability

No portion of the reservoir site is located on National Forest Service lands. Privately owned properties would have to be acquired (USGS, 1983f).

4.13.6 Distance to the Water Treatment Plant

The approximate distance to the Tyner Lake water treatment facility along roadways, is approximately 5.5 miles.

4.13.7 Conclusion

The yield of this alternative is well above the necessary requirement. There are no known threatened or endangered species. The waters have not been granted any special designations. The only possible negative is the requirement for acquisition of privately owned lands, which is not exclusionary. For this reason, the recommendation is to include this proposal as a Reasonable Alternative.

Table 30 is a summary table of alternatives and evaluation results.

Alternative	Reservoir Yield (Need = 3.0 mgd)		Threatened and Endangered Species	Special Resource Designations	Recreation (visitor hrs/ yr)	Available	Distance to Plant
	Average	Worst					
1. Laurel Fork & Buzzard Branch	17.0	10.6	Cumberland bean pearly mussel (3, p.14)	Designated KY ORW (4)	1,350,000	35% NFSL* property	11.5 miles
2. Laurel Fork & McCammon Branch	12.5	7.8	Cumberland bean pearly mussel (3, p. 14)	Designated KY ORW (4)	540,000	35% NFSL* property	7.5 miles
3. Horse Lick Creek	19.3	15.9	Cumberland bean pearly mussel (1, p.254), Nature preserves concern (1, p.16)	Designated KY ORW (4)	600,000	60% NFSL* property	18.5 miles
4. South Fork & Rock Lick	21.9	13.7	Indiana, Virginia Big Eared and Rafinisque Big Eared bats (3, p.14)	South Fork is a Wild & Scenic Study River (4)	1,380,000	30% NFSL* property	23 miles
5. South Fork & Cavanaugh Creek #2	30.0	18.7	Indiana, Virginia Big Eared and Rafinisque Big Eared bats (3, p.14)	South Fork is a Wild & Scenic Study River (4)	1,270,000	25% NFSL* property	20 miles
6. South Fork & Cavanaugh Creek	31.5	19.7	Indiana, Virginia Big Eared and Rafinisque Big Eared bats (3, p. 14)	South Fork is a Wild & Scenic Study River (4)	1,470,000	20% NFSL* property	17.5 miles
7. McCammon Branch	3.7	2.3	Cumberland bean pearly mussel downstream. (1, p. 254)	No designation; downstream feeds to an ORW (4)	320,000	80% NFSL* property	5.5 miles
8. Mill Creek	1.4	0.9	No known T&E species. (1, p. 254)	No designation (4)	74,000	100% NFSL* property	7.5 miles
9. War Fork & Alcorn Branch	9.1	7.3	War Fork – Indiana, Virginia Big Eared and Rafinisque Big Eared bats (2, p. 3-6)	This portion of the War Fork is a Wild & Scenic Study River (4)	140,000	80% NFSL* property	18 miles
10. War Fork & Steer Fork	5.7	3.6	War Fork – Indiana, Virginia Big Eared and Rafinisque Big Eared bats (2, p. 3-6)	No designation (4)	500,000	60% NFSL* property	12 miles
11. South Fork & War Fork	45.5	29.1	War Fork – Indiana, Virginia Big Eared and Rafinisque Big Eared bats (2, p. 3-6)	This portion of the War Fork is a Wild & Scenic Study River (4)	2,270,000	70% NFSL* property	18.5 miles
12. Travis Creek	1.1	0.7	No known T&E Species. (3, p. 14)	No designation (4)	670,000	100% Private property	7.5 miles
13. Sturgeon Creek	11.1	7.0	No known T&E Species. (3, p. 14)	No designation (4)	480,000	100% Private property	5.5 miles

Sources: 1 – (KDW & NPS, 1992) 2 – (USFS, 1996) 3- (Eco-Tech, Inc., 1999) 4- (Miller, 1999) 5- (Hersel, 1999)
*National Forest Service lands

5.0 CONCLUSIONS

As indicated earlier, the purpose of this alternatives study was to identify a set of reservoir sites that would be worth studying in detail. From this set of alternative sites the Federal agencies will choose, after the detailed EIS and engineering studies are done, the specific alternative site, if any, to fund. Thus, the present report does not identify "the best" site; it only identifies the set of reasonable sites. It does this primarily by eliminating the sites that are unreasonable. The "unreasonable" sites are those which would not meet the need, or would clearly involve significant legal and regulatory difficulties.

While the eventual choice made by the agencies must come from this list of reasonable alternatives, this list is not necessarily static. As the subsequent detailed environmental and engineering studies progress, one or more of these detailed study sites may be found to have such substantial economic, engineering or environmental costs and problems as to warrant being dropped from all further consideration. Conversely, it is also possible that as the detailed studies progress, and more information about each site becomes available, it may emerge that one or more of the sites that were screened out at this stage may be seen as being no worse than sites which weren't screened out. If that case arises, one or more of the screened-out sites may be added back in to the list of sites for detailed study and consideration.

Table 30 summarizes the findings about each of the sites in regard to each of the screening criteria.

Based on this summary, the following sites can be screened out as unreasonable because they would not meet even minimum water needs:

- Alternative # 7- McCammon Branch
- Alternative # 8- Mill Creek
- Alternative # 12- Travis Creek

The following sites can be screened out based on the known presence of a Federal Endangered Species:

- Alternative # 1- Laurel Fork & Buzzard Branch
- Alternative # 2- Laurel Fork & McCammon Branch
- Alternative # 3- Horse Lick Creek
- Alternative # 7- McCammon Branch

The following sites can be screened out because of their legal protection under the Wild and Scenic Rivers Act or Outstanding Resource Water:

- Alternative # 1 - Laurel Fork & Buzzard Branch
- Alternative # 2 - Laurel Fork & McCammon Branch
- Alternative # 3 - Horse Lick Creek
- Alternative # 4 – South Fork and Rock Lick
- Alternative # 5 – South Fork and Cavanuagh Creek #2

- Alternative # 6 – South Fork and Cavanaugh Creek
- Alternative # 9 – War Fork and Alcorn Branch
- Alternative # 11 - South Fork and War Fork

The remaining sites therefore considered to be reasonable alternatives worth more detailed study are:

- Alternative # 10- War Fork & Steer Fork
- Alternative # 13- Sturgeon Creek

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Appendix A

Acronyms and Abbreviations

CFR	Code of Federal Regulations
EIS	Environmental Impact Statement
EZ	Empowerment Zone
FmHA	Farmers Home Administration
FWS	Fish and Wildlife Service
gpd	gallons per day
JCWA	Jackson County Water Authority
KAR	Kentucky Administrative Regulations
KDOW	Kentucky Division of Water
KHIC	Kentucky Highlands Investment Corporation
KRS	Kentucky Revised Statutes
KSNPC	Kentucky State Nature Preserves Commission
MSL	Mean Sea Level
MPS#1	Multi-Purpose Structure #1
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRI	National Rivers Inventory
NRCS	Natural Resource Conservation Services
ORW	Outstanding Resource Waters
RUS	Rural Utility Service
SCORP	Statewide Comprehensive Outdoor Recreation Plans
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
WSRA	Wild and Scenic Rivers Act

Appendix B

Methodology Used to Calculate Volume of Reservoirs

The Average End Area Method

Using a topographic chart depicting the proposed impoundment:

1. The area of the enclosed by the lowest contour line within the proposed impoundment is determined using a digitizing pallet and cad program.

2. The area enclosed by the next higher contour line is determined as in 1. above.

3. The areas determined in 1. and 2. above are added, and the average value determined by dividing by 2.

4. The average area determined in steps 1, 2, and 3 is then multiplied by the contour interval to give the approximate volume of the proposed reservoir when filled to the level of the 2nd contour line.

5. The area enclosed by the 3rd contour line is determined and averaged with the area determined for the 2nd contour line to give the volume of the proposed reservoir between these contour lines. And the two volumes are summed to give the volume of the proposed reservoir when filled to the level of the 3rd contour line.

6. The method outlined above is continued until the last contour line enclosed by the height the proposed dam has been calculated.

7. To formulate a stage capacity curve the volume of water, as calculated with the above method, below each contour line in the proposed lake, is plotted on the vertical axis of a set of Cartesian coordinates. The water levels or "pool stages" are plotted horizontal axis of these coordinates. A curve can then be plotted that will yield the approximate volume at any pool stage.