CHAPTER 2 - ALTERNATIVES

2.1 INTRODUCTION

This chapter describes what has been done to identify and evaluate alternative ways to address the flooding potential on non-federal land around Nolichucky Reservoir. Three action alternatives have been evaluated in detail, along with the No Action Alternative. The chapter includes descriptions of each of these alternatives, a comparison of them, and a summary of their potential environmental effects. The last section in this chapter indicates the present status of identifying a preferred alternative to address the potential flooding effects around the reservoir.

2.2 SELECTION OF ALTERNATIVES

Under NEPA, TVA is required to evaluate a reasonable range of alternatives that would accomplish the project purpose and the alternative of taking no action. All of the suggestions about possible alternatives that had been made by the public, various agencies, and TVA staff during the scoping process were reviewed and evaluated. The resulting condensed list of suggestions, presented in Table 1, has been arranged in five broad categories: buying affected land, dredging sediment, modifying the dam, various combinations of these three concepts, and a variety of other ideas. The complete list of suggested alternatives was included in the Scoping Document, issued in March 2000.

Table 1. Condensed list of suggested ways to reduce flooding effects on non-federal land and property around Nolichucky Reservoir.

Categories	Alternatives suggested by agencies and the public
Buy Land	• Purchase the affected land. • Acquire the necessary land rights. • Acquire flood rights to the maximum probable flood level.
Dredge Sediment	• Dredge reservoir to increase storage capacity. • Remove silt at same rate as rate of accumulation. • Dredge and market our own sand removal. • Dredge reservoir; permanent commitment to do maintenance dredging. • Seek other dredging operations to remove silt.
Modify Dam	• Remove dam. • Remove dam and restore river corridor. • Remove powerhouse and create wider spillway. • Lower dam - incrementally.
Combinations	• Purchase land rights and dredge. • Make dam higher (to increase storage) and purchase lands. • If remove dam, must dredge out silt first. • Lower spillway and remove/stabilize sediment subject to flushing. • Purchase land subject to flooding and encourage dredging and sale of sand. • Establish a channel within the accumulated sediment associated with a notch or something in the dam to lower the flood level.
Other	• Ignore the problem; leave everything as it is. • Pay for flood damages. • Flood-proof existing homes; no new houses in floodplain. • TVA deed all property to owners and retain only flood easements. • Reduce flood on TVA property by levees or other engineering. • Evaluate structural and nonstructural (e.g., small watershed) projects to reduce flood and silt levels. • Minimize runoff entering the river. • Stop unregulated clear-cutting. • Build one or more upstream flood control dams. • Build saddle dams, berms, etc., to protect non-federal land. • Create a diversion channel to handle the flood flow. • Reroute the river - use existing reservoir as a settling basin. • Divert water to retention ponds (levees with controlled release). • Create flow diversion canals to other waterways to handle high flood flow situations. • Introduce legislation to control siltation. • Make North Carolina responsible for any silt coming out of state.

All of these suggestions were considered as TVA developed the alternatives to be evaluated in detail as part of this EIS; however, many of them were excluded for various reasons. Some suggestions (such as building new reservoirs, modifying timber harvest practices, or legislative controls on siltation) were considered beyond the purpose of this project – to resolve flooding problems around the present Nolichucky Reservoir. Other suggestions (such as dredging alone or various ways of reducing runoff and sediment in the upstream part of the watershed) were eliminated as independent alternatives because, by themselves, they would not address the flooding effects on all of the non-federal land. Still other suggestions (such as enlarging the size of the reservoir or constructing various types of berms or water diversion channels) were considered to be unreasonable because they would be much more complex and substantially more expensive than necessary to address the project purpose.

The four alternatives that developed during this evaluation process and are discussed in detail in this EIS were: A -- No Action (required under NEPA regulations), B -- acquire the affected land or land rights, C -- lower the spillway in the dam and, D -- remove Nolichucky Dam. Each of the last two alternatives would include some sediment removal and/or stabilization work in the reservoir. All four of these alternatives are described in following sections of this chapter.

2.3 FLOODPLAINS AND LAND RIGHTS

Floodplains

Much of the discussion about the alternatives included in this EIS requires an understanding of two subjects which, in this case, are closely related to each other. One of these subjects is the relationship between a river and various parts of its floodplain. Most people recognize that a stream uses more of the valley in which it flows during a flood than it does during dry weather. What many people do not realize, however, is that the part of the valley occupied by a stream during a flood (its floodplain) should be considered at least as much a part of the stream as it is part of the surrounding land.

Engineers identify different parts of a floodplain using terms which indicate the probability, or chance, that the area will be occupied by the stream. For example, the land which is likely to be covered by water one time during an average 10-year period is called the 10-year floodplain. Land within the 10-year floodplain has a one-in-ten, or 10 percent, chance of being flooded in any given year. Land like this is flooded fairly often, usually is located close to the stream, and most people recognize they should use this land only in ways which would not be bothered by high water.

In contrast, land that is flooded only rarely (for example, on average only once out of every randomly-selected 100 years – the 100-year floodplain) can be some distance away from the stream. Because that large a flood occurs so seldom, many people fail to realize that, every so often, the stream should be expected to use that much of the valley. Many cities and counties, including Greeneville and Greene County, have adopted the 100-year flood elevation as the basis for regulations to avoid constructing buildings in flood-prone areas. When dams or other structures are built across or near streams, the planners often identify the 500-year flood elevation to make sure they understand what land would be affected by the modified stream during these very large and rare flood events.

If all streams were essentially straight and the valleys in which they flowed all were broad and relatively flat, it would be easy to figure out which areas would be covered with water during various flood events. Of course, most streams are not straight; most valleys are wide in some places and narrow in others; and, along many streams, dams and other barriers affect where the water will flow. The natural and man-made features in a valley and, especially, in the stream all affect flood elevations around them. Narrow gorges, dams, and other large structures in, or close to, a stream can cause higher upstream flood levels and, in some places, lower downstream flood levels than if those barriers were not present.

TVA is not aware that any previous flood elevations were ever identified for the area around Nolichucky Reservoir. As part of the preliminary work for this EIS, TVA collected the appropriate information and developed present flood elevations along the river from Nolichucky Dam (River Mile 46) upstream to

beyond where the project would have any effect on the flood levels (about River Mile 62). The results of that effort are presented on a large-scale map of the reservoir (included in Appendix A). On the seven panels of this map, the red and yellow lines indicate the limits of the 100-year and 500-year floodplains, respectively, along this part of the river. This information also has been provided to Greene County for use in floodplain protection.

Land Rights

As indicated in Section 1.2, when TVA acquired Nolichucky Dam and Reservoir in 1945, knowledge about the project indicated that it included ownership over approximately 750 acres of land and flowage easements over approximately 300 additional acres. In the mid-1970s, when the purpose of the project was modified to be a waterfowl sanctuary and environmental education area, TVA purchased fee title to approximately 330 acres of previous flood easement land and fee title to approximately 163 acres of additional land adjacent to the reservoir. By 1980, descriptions of the Nolichucky Project indicated that it included 901 acres in fee and approximately 178 acres of flowage easements (TVA 1980).

As another part of the preparations for this EIS, TVA has reviewed the federal land rights around Nolichucky Reservoir and has used Geographic Information System (GIS) computer mapping and analysis software to compare those results with tax maps obtained from Greene County. Among other features, the GIS software has the ability to calculate the total area within many separated pieces of land (tracts) or parts of tracts.

The seven panels of the map presented in Appendix A show all of the land tracts around Nolichucky Reservoir which include any area within the present 500-year floodplain. On this 7-panel map, each affected tract is color-coded to indicate if it is owned by the federal government, if part or all of the tract is covered by a federal easement (typically a flood easement), or if the land is in private ownership. The GIS calculations indicate that the federal government owns a total of approximately 1,400 acres of land under and around Nolichucky Reservoir and holds easements over approximately 370 acres of land along this part of the river (Table 2). Together, these federal land rights affect approximately 1,780 acres.

Table 2. Federal land ownership rights associated with Nolichucky Reservoir and all ownership rights within the 500-year and 100-year floodplains around the reservoir.

Ownership Category	Federal land rights in the area (acres)	Acres within the 500-year floodplain	Percent	Acres within the 100-year floodplain	Percent
Nolichucky Reservoir	490	490	20.0	490	24.4
Federal ownership	915	548	22.3	489	24.3
Federal easements	373	292	11.9	275	13.7
[All Federal land rights]	[1778]	[1330]	[54.2]	[1254]	[62.4]
Upstream river channel	--	123	5.0	123	6.1
Private ownership	--	997	40.6	632	31.4
Roads	--	4	0.2	2	0.1
Totals	1778	2454	100.0	2011	100.0

Only part of the federal land is located within the 500-year floodplain around Nolichucky Reservoir. Table 2 also presents the calculated number of acres in several categories within both the 500-year and the 100-year floodplain areas around the reservoir. As indicated in this table, the GIS evaluation indicates that the federal government owns the approximately 490 acres of land under Nolichucky Reservoir, approximately 550 acres within the present 500-year floodplain around it, and holds flood easements over approximately 290 acres within the 500-year floodplain around to the reservoir. The difference between the entries in the federal land rights column and the federal entries in the 500-year Floodplain column in Table 2 indicates that the government owns 367 acres of land and 81 acres of easements (rights over a total of 448 acres) located outside of the 500-year floodplain around Nolichucky Reservoir. This land includes higher ground adjacent to the dam site, transmission line rights-of-way, and access roads to property along the reservoir. Entries in this table also indicate that the federal land rights under and around the reservoir represent approximately 54 percent of the approximately 2,450 acres within the 500-year floodplain and approximately 63 percent of the just over 2,000 acres within the 100-year floodplain.

Most of the remaining approximately 1,125 acres of land in the 500-year floodplain is in private ownership; however, the upstream part of the river channel occupies about 125 acres and roads cover approximately 4 acres. The private land accounts for about 41 percent of the area within the 500-year floodplain and about 31 percent of the area within the 100-year floodplain. Both the floodplain boundaries and the ownership rights are important background features associated with each of the alternatives evaluated in this EIS.

2.4 ALTERNATIVE A - NO ACTION

Under this alternative, TVA would not take any action to address the potential flood impacts on non-federal lands that could occur because of the presence of Nolichucky Dam and the sediment accumulation in Nolichucky Reservoir. TVA would not acquire any additional land rights, take any action to remove sediment from the reservoir, or reduce the potential for flooding in any way. Information about the boundaries of various projected flood levels would be provided to appropriate agencies in Greeneville, Greene County, and to landowners in the affected areas. TVA would assist agencies and individuals in understanding the potential flooding effects around the reservoir but would not attempt to influence what individual owners would do on their land. Greene County probably would require compliance with applicable local floodplain regulations during any future development of the land around the reservoir. Nolichucky Dam and Powerhouse would continue to be maintained as required by federal Dam Safety regulations and to preserve their historic value.

Adoption of this alternative would result in no change in the floodplain elevations around Nolichucky Reservoir (Appendix A map). The federal government would retain ownership of approximately 1400 acres of land under and around Nolichucky Reservoir and easements over approximately 370 acres in the area. TVA also would continue the existing agreements with TWRA and other agencies concerning waterfowl management and operation of the environmental education area associated with the reservoir. Providing appropriate floodplain information to landowners and agencies in the area

could be accomplished in a few months and would not involve any construction costs.

2.5 ALTERNATIVE B - ACQUIRE LAND RIGHTS

Under this alternative, TVA would address the potential flooding effects on non-federal land by acquiring either fee title or easements with the right to flood all of the non-federal land within the present 500-year flood boundary around Nolichucky Reservoir (about 1,000 acres). TVA would decide whether to acquire fee title or a flood easement on any given tract based on a tract-specific evaluation of the potential flooding effects. Fee simple acquisition would mean that TVA would buy the affected land, all structures built on it, and would hold all rights concerning the use of that land. If TVA acquired only a flood easement, TVA would buy the right to overflow and flood specific parts of the property on an intermittent and temporary basis. The owner could continue to use the easement land in many ways, but would relinquish the right to build structures below a specific elevation on the affected property and would have to receive TVA approval prior to developing the affected land to ensure no conflict with the easement conditions. Nolichucky Dam and Powerhouse would continue to be maintained as required by federal Dam Safety regulations and to preserve their historic value.

When TVA needs to acquire land or land rights, agency staff members follow a careful and well-documented approach. Specialists research the legal description and ownership status of each tract while appraisers gather general and specific information about property values in the area. After the preliminary work is done, TVA appraisers contact the property owners for permission to inspect the property and invite them to be present during the inspection. The appraisers also explain how the property would be affected by the project and how the appraisal process is conducted. Once an appraisal is completed and reviewed for consistency with accepted practices, TVA uses this information to develop an offer for the property. A TVA realty specialist then contacts each property owner to explain the project again, answer questions, and present the offer to purchase the land rights. If the owner accepts the offer, the conveyance documents are signed and the payment is made. If the owner does not accept the offer and a mutual

agreement on the purchase cannot be reached, it may become necessary to have a court decide the amount of compensation for the required property rights.

At the completion of this alternative, no change would occur in the floodplain elevations around Nolichucky Reservoir; however, the federal government would own or have easement rights over all of the approximately 2,350 acres of non-river channel land within the 500-year floodplain around the reservoir (plus the 448 acres of existing land and easement rights outside of the 500-year floodplain – a combined total of about 2,800 acres). TVA probably would work with TWRA and other agencies to incorporate some or all of the additional land into the existing waterfowl management and environmental education areas associated with the reservoir. Acquisition of the approximate 1,000 acres of additional land and easement rights could take approximately 3 years and is estimated to cost somewhere between $15 and $20 Million.

2.6 ALTERNATIVE C - LOWER NOLICHUCKY DAM

Under this alternative, TVA would address the potential flooding effects on non-federal land and property by lowering the spillway part of Nolichucky Dam after removing or stabilizing sediment in the reservoir. The intent of this alternative would be to lower the spillway by approximately 40 feet (to elevation 1200) so that the 500-year flood elevation associated with the modified dam would only affect land already in federal ownership or covered by existing flood easements. Site-specific details of this project would be determined as part of the pre-construction design process; however, the following paragraphs describe the types of activities that would be included. A general evaluation of the environmental effects associated with this alternative is included in this EIS. If this alternative was adopted, the site-specific environmental effects evaluation would be added in a supplement to the final EIS.

While the focus of this project would be on lowering the height of the spillway, the bulk of the work would be related to removing or stabilizing the sediment in the reservoir. Early in the project, approximately 1,000 acre-feet (1.6 million cubic yards) of sediment would be removed from the first mile of the

river channel just upstream from Nolichucky Dam. The initial dredging of this part of the reservoir and any necessary re-dredging from this area would create and maintain a settling trap for large sediment particles moving down the river. Additional dredging or in-place stabilization would occur all along the impounded part of the river to remove sediment that has accumulated in the upper 40 feet of the reservoir depth. Also during this work, any necessary modifications would be made to maintain the stability of the approach roads and the four bridges which cross this part of the Nolichucky River. Overall, approximately 8,000 - 12,000 acre-feet (13 - 20 million cubic yards) of sediment would be removed or stabilized in place during this project.

The sediment that would be moved out of the reservoir would be picked up and transported using suction dredges. Barge-mounted or land-based pumps would be used to suck sediment and water out of the bottom of the reservoir and to push that material through large pipes to nearby upland disposal sites. Federal land along the length of Nolichucky Reservoir outside of the floodplain area that would substantially affect a 100-year flood event (the 100-year floodway) would be used for some of these disposal sites. More than likely, other land, owned by willing private entities, also would be required. Pumping costs probably would restrict the choice of disposal sites to locations within three miles of the dredging sites.

Each disposal site would consist of one or more natural or excavated depressions, associated settling ponds, and maintained drainway channels. Dredged sediment would be pumped into the deposition sites, fine sediment would be removed from the transport water in the settling ponds, and the filtered water would be returned to the reservoir or river down the drainways. Once each disposal site was filled, the sediment deposits would become the property of the landowner. Permanent fill areas would be contoured to match the surrounding land, covered with topsoil, and planted with appropriate native or agricultural vegetation.

Before any work was done on the spillway, a water control structure would be built on the upstream face of Nolichucky Dam. Detailed plans for this structure have not been developed; however, it would include a cofferdam with a deep water control gate that would let water flow into a modified form

of the existing spillway gate, a new discharge tunnel through the dam, or the reopened penstocks through the powerhouse. Once it was completed, this control structure could be used to lower the water level in the reservoir far below the present spillway elevation (1240.9 feet). When it was being used, the control structure would be designed to maintain at least 500 cubic feet per second of flow in the river downstream from the dam. The periodic dredging of the sediment trap would include work to ensure that sediment did not accumulate around the water control gate.

Once most of the sediment had been removed from the reservoir and the water control structure had been built, work would begin on lowering the height of the spillway in the dam. Approximately 75,000 cubic yards of rock from a local quarry would be trucked to the site and used to build an equipment platform all the way across the upstream side of the dam several feet below the present reservoir surface. When the platform was complete, the water level in the reservoir would be lowered to expose this working surface and impact machinery would be used to break off pieces of the spillway. The pieces of concrete would be deposited in a dewatered work area at the base of the dam, from where they probably would be moved to armor adjacent side slopes of the river valley. Steel, lead, and other recyclable materials would be separated from the concrete and sold for reuse. The impact machinery would continue working until the spillway had been lowered about 40 feet (to elevation 1200). After the spillway was lowered, the water control structure would be used to fill the reservoir pool to the new spillway elevation while maintaining at least 500 cubic feet per second of flow in the river downstream from the dam.

During all phases of this project, appropriate best management practices would be used to minimize construction and sedimentation effects on the river and the surrounding area. The dredging and disposal facilities would be constructed and used by TVA staff or contractors in compliance with all applicable federal and state dam safety, water pollution control, and other pertinent laws and regulations. Any commercial reprocessing of the sand and other materials in the sediment in the disposal sites would be conducted in compliance with all applicable state and local laws and regulations. Appropriate measures would be taken to minimize erosion on areas where

sediment would be removed or deposited, to stabilize those areas as quickly as possible, and to establish vegetation on them soon after they were stabilized. Erosion control measures to be used during this part of the project would likely include building appropriate grade-control structures and lateral dikes, using erosion-control fabric, placing riprap, and installing native material revetments. Revegetation measures to be used along the smaller reservoir and disturbed upland areas would likely include bioengineering techniques, various types of specific seeding measures, and tree planting.

At the conclusion of this project, Nolichucky Reservoir would still exist; however, it would be much smaller is size (about 160 acres instead of the present 490 acres). TVA would develop revised flood elevations for this part of the Nolichucky River and would make that information available to appropriate agencies in Greeneville and Greene County. Figure 4 presents an idea of how the size of this reservoir and the associated 500-year floodplain might differ from present conditions. The federal government would continue to own approximately 1800 acres of land and flowage easement rights under and around this smaller reservoir. All federal land around the reservoir would continue to be used for wildlife management, environmental education, and public parks. TVA would determine how the federal land and easements would be used in cooperation with appropriate state and local agencies. Nolichucky Dam and Powerhouse would continue to be maintained as appropriate under federal Dam Safety regulations and to preserve their historic value.

All together, the sediment removal, lowering of the dam, and stabilization work would take between 5 and 10 years to complete and would cost between $45 and $70 Million. This project would require a variety of work crews which, at any one time, might involve as many as 50 people. Most of this time and effort would be involved in removing or stabilizing the 8,000 - 12, 000 acre feet (13 - 20 million cubic yards) of sediment in the reservoir that would have to be addressed.

Link to Figure 4. Possible floodplain boundaries around a lowered Nolichucky Reservoir with a spillway at elevation 1200 feet.
(684 Kb PDF file)

NOTE: Converting this image to a pdf file decreased the resolution. Higher resolution hard copies of this document are available in public libraries in the Greeneville, TN, area and from TVA's Cherokee-Douglas Watershed Team at (423) 587-5600.

2.7 ALTERNATIVE D - REMOVE NOLICHUCKY DAM

This alternative would address the flooding effects of Nolichucky Dam and reservoir on the adjacent non-federal lands using the same general approach as Alternative C -- lowering the 500-year flood elevation by lowering the dam and removing or stabilizing the accumulated sediment. Under this alternative, however, TVA would completely remove all visible components of Nolichucky Dam and powerhouse from the river valley. The general types and sequence of activities included in this alternative would be the same as those described under Alternative C; however, some specific differences would occur associated with removing the remainder of the dam, the powerhouse, and more of the accumulated sediment. The following general description highlights the differences between this alternative and Alternative C. If this alternative was adopted, site-specific details of the project would be determined as part of the pre-construction design process and the site-specific environmental effects would be added in a supplement to the general evaluation presented in this EIS.

As under Alternative C, an early part of this project would be the removal of most of the sediment that has accumulated in the first mile or so of the river channel just upstream from Nolichucky Dam. This material would be removed using suction dredges and deposited on TVA or private land within three miles of the dredging sites as that work was described under Alternative C. The only difference which might be involved in this project would be a possible increase in the volume of sediment that would be removed from this sediment trap, perhaps including as much as 1,800 acre-feet (3 million cubic yards) of material. Additional dredging would occur when required to remove sediment that had moved downstream into this trap, for example after major flood events or after the water level in the reservoir had been lowered.

An additional activity in this project would be the removal of the Nolichucky Powerhouse. Both the dam and powerhouse would be documented in accordance with National Historic Preservation Act requirements, all remaining equipment in these structures would be removed and preserved or recycled, and the powerhouse building would be demolished. All appropriate measures would be taken to identify and properly handle asbestos and any other potentially hazardous materials in the building. Reasonable efforts

would be made to find uses for the brick and other materials that would be available, then all remaining debris would be transported to one or more appropriate landfill sites in the area.

The water control structure would be built on the upstream face of the dam and used to lower the reservoir pool level as described under Alternative C; however, the bottom elevation of this structure might be lower than it would have been under Alternative C. Construction and use of the rock-filled equipment platform would be as described under Alternative C; however, the impact machinery would be used to remove the full width of the dam instead of just the spillway. In addition, the working platform and the water level in the reservoir would have to be lowered at least one more time to allow the impact machinery to reach parts of the dam closer to the river bed. Near the end of the dam removal work, all of the working platform, the control structure, and components of the dam higher than the river bed would be removed. The final work at the dam site would consist of establishing natural-looking stream bed and banks along the river channel.

Throughout the construction period, suction dredges and other earthmoving equipment would be used to move sand and other fine sediment out of the remainder of the former river channel. As described under Alternative C, this sediment would be placed or stabilized in a number of controlled dewatering and storage sites located on federal and private land outside of the 100-year floodway. Also as described under Alternative C, any necessary modifications would be made to maintain the stability of the approach roads and the four bridges which cross this part of the Nolichucky River. Whenever possible, level floodplains would be constructed along the new river channel. These areas would function to trap some sediment moving down the river and could partially compensate for the loss of sediment storage in the present reservoir pool. The final shape of the excavated areas would be designed to minimize any risk of slope failure. All of these new and stabilized deposits would be contoured to match or establish a natural landscape and planted with native or agricultural vegetation.

As described under Alternative C, appropriate best management practices would be used during each of these activities to minimizing erosion and

sedimentation effects in the reservoir, in any receiving stream, and in the river downstream from the dam site. The dredging and disposal work would be conducted in compliance with all applicable laws and regulations, and appropriate erosion and stabilization measures would be used to minimize impacts related to the land disturbance activities.

At the conclusion of this project, the federal government would own approximately 1800 acres of land and flowage easements along an unimpounded reach of the Nolichucky River. TVA would develop revised flood elevations for this river reach and would make that information available to appropriate agencies in Greeneville and Greene County. All federal land around the reservoir would remain in public ownership and would continue to be used for wildlife management, environmental education, and public parks. TVA would determine how the federal land and easements would be used in cooperation with appropriate state and local agencies.

All together, removing the dam and powerhouse, and the sediment removal or stabilization work would be completed in approximately 10 to 12 years and would cost between $90 and $150 Million. This project would result in relocating or stabilizing between 15,000 and 19,000 acre-feet (24 to 30 million cubic yards) of sediment and would require crews ranging up to 70 persons in size.

2.8 ALTERNATIVES NOT EVALUATED IN DETAIL

Several other suggestions for resolving the potential flooding effects around Nolichucky Reservoir might appear to be possible alternatives; however, they have not been evaluated in detail as part of this EIS. The reasons why these suggestions have not been evaluated further are presented in the following paragraphs.

Remove Nolichucky Dam and Powerhouse with No Dredging

If Nolichucky Dam is causing upstream flooding problems on non-federal land and, especially, if the dam is no longer associated with a usable power production facility, it would seem logical to evaluate simply removing the dam and letting the river deal with the accumulated sediment. TVA has seriously

considered this concept; however, results of the evaluation have indicated that removing the dam without dealing with the accumulated sediment is not a reasonable alternative. Studies conducted by several resource areas indicate that taking the dam out and allowing the 19,000 acre-feet of accumulated sediment to migrate downstream would result in a wide variety of adverse effects both in the Nolichucky River and across much of the floodplain. Initial calculations indicate that large amounts of sediment would be deposited in the river a short distance downstream from Nolichucky Dam and would not disperse for a long time. Until most of this sediment moved all the way downstream into Douglas Reservoir, it would continue to cause some flood effects on non-federal land upstream from Nolichucky Dam. In addition, this sediment would cause flood effects on large areas of non-federal land all along the 46 miles of river downstream from the dam. The mass of sediment moving down the river also would smother areas where bottom-dwelling aquatic species occur, virtually eliminate most fish habitat in the river, substantially modify many terrestrial habitats in the river corridor, severely degrade wetlands and the extensive agricultural lands in the river floodplain, and disrupt much of the local agricultural economy. These severe adverse effects indicated that there was no reason to complete a detailed evaluation of removing the dam without also including the removal or stabilization of the accumulated sediment. That is the project evaluated as Alternative D.

Dredge Sediment out of the Reservoir

If the accumulation of sediment in the reservoir is causing the flooding on non-federal land and property, simply dredging, or allowing another entity to dredge, the sediment out of the water would seem to be a logical alternative which should be evaluated. In fact, however, the accumulation of sediment in Nolichucky Reservoir is only serving to make an old problem somewhat worse. The results of recent evaluations indicate that, even if all 19,000 acre-feet (30.6 million cubic yards) of the sediment was removed from the reservoir pool, the 500-year flood elevation upstream from Nolichucky Dam (at its present elevation of 1240.9 feet) would still affect some private land over which TVA does not have flowage easements. In addition, to maintain those lower flood levels, sediment would have to dredged out of the reservoir on a continuing basis. Simply dredging out the sediment, then, would not resolve all of the flooding on non-federal land but would be the start of a long-

term, continuing maintenance commitment. TVA concluded that such a dredging program was neither a complete nor a reasonable solution to the flooding effects on non-federal land and property around Nolichucky Reservoir.

Divert the Flood Water Around the Reservoir

Several ideas included in Table 1 suggest finding ways to divert the flood water around Nolichucky Reservoir without affecting the present pool level and adjacent private land. These suggestions include rerouting the river or constructing diversion canals to move flood water around the reservoir; however, they do not take into account the extremely large volume of water that would be involved during a major flood event. TVA calculations indicate that, during a 500-year flood event, the flow in the river at Nolichucky Dam would be approximately 158,000 cubic feet per second. If this water could be moved around the reservoir through a single pipe, tunnel, or canal, that structure would have to be at least 100 feet in diameter. If the pipe, tunnel, or canal system was not large enough to handle all of the flow, the water would back up and flood some land not now in federal ownership. Based on this analysis, TVA determined that construction of a diversion system was not a workable or reasonable way to address the flooding effects around Nolichucky Reservoir.

2.9 COMPARISON OF ALTERNATIVES

Table 3 presents a brief summary of the concepts and components involved in each of the four alternatives evaluated in detail. The abbreviated entries in this table are derived from the information presented in Sections 2.4 through 2.7.

The following paragraphs and the entries in Table 4 present a summary of the potential effects of the alternatives on the full range of environmental resources. All of the information in these summaries is derived from the discussions presented in Chapter 4.

Table 3. Summary comparison of the four alternatives being evaluated in detail. Entries in this table are derived from information presented in Sections 2.4, 2.5, 2.6, and 2.7.

Components	**A: No Action**	**B: Acquire Land Rights**	**C: Lower Nolichucky Dam**	**D: Remove Nolichucky Dam**
Basic Concept	TVA would take no action to reduce potential flooding on non-federal land and property	TVA would acquire title or flood easements on all land within the 500-year floodplain around Nolichucky Reservoir	TVA would lower the spillway enough so that Nolichucky Dam would not affect private land	TVA would remove all of the dam and powerhouse from the river valley
Resulting TVA Land Rights	Approximately 1,800 acres in fee and flood easements (no change)	Approximately 2,800 acres in fee and/or flood easements (an addition of 1000 acres)	Approximately 1,800 acres in fee and flood easements (no change)	Approximately 1,800 acres in fee and flood easements (no change)
Sediment Storage Areas	None required	None required	To hold up to 12,000 acre-feet of sediment	To hold up to 19,000 acre-feet of sediment
Potential for Flooding on Non-federal Land	Approximately 1000 acres of private land within the 500-year floodplain (no change)	None; all land or land rights within the 500-year floodplain would be under federal control	None related to the presence of the dam and remaining sediment	None related to the remaining components of the Nolichucky project
Effect on Nolichucky Dam and Powerhouse	No change	No change	Spillway would be lowered to elevation 1200; powerhouse and rest of dam would not be affected	All visible signs of dam and powerhouse would be removed from the river valley
Effect on Nolichucky Reservoir & Wildlife Management Area	No change	Some management changes might occur on the larger area around the reservoir	Reservoir would be about 160 acres in size; management area might adjust focus on other uses	Reservoir would be eliminated; management area might be refocused on other uses
Estimated Time to Complete	3 months	3 years	5 - 10 years	10 - 12 years
Estimated Project Cost	None	$15 to $20 Million	$45 to $70 Million	$90 to $150 Million

Table 4. Summary of the potential environmental effects of the four alternatives being evaluated in detail. Table entries are derived from the identified sections in Chapter 4.

Resource Areas	A: No Action	B: Acquire Land Rights	C: Lower Nolichucky Dam	D: Remove Nolichucky Dam
Geology, Climate and Soils (Section 4.2)	No effects	Potential increased long-term protection of soils due to public ownership	Some soils disturbed around reservoir; insignificant effects on soils downstream	Some soils disturbed around reservoir; insignificant effects on soils downstream
Ground Water (Section 4.3)	No effects	No effects	Local water table could drop 40 feet near dam; mitigation identified	Local water table could drop 70 feet near dam; mitigation identified
Surface Water and Sedimentation (Section 4.4)	No changes in water quality or existing sedimentation trends	Local water quality might improve; no change in existing sedimentation trends	Increased downstream turbidity during construction period; insignificant post-construction increases in downstream sedimentation	Increased downstream turbidity during construction period; significant changes in downstream river bed composition after dam removed
Aquatic Life (Section 4.5)	No change in present conditions, communities, and long-term trends	Possible minor improvement in present conditions and communities; no change in long-term trends	Insignificant effects during construction period and in downstream reach afterward; beneficial long-term effects in upstream half of present reservoir	Insignificant effects during construction period; beneficial long-term effects in former reservoir area; significant adverse effects downstream for many years after dam removal
Wetlands (Section 4.6)	No change in present communities and long-term trends	Potential benefits due to public ownership; no change in long-term trends	Approximately 310 acres of existing wetlands would be eliminated; at least partial mitigation identified	Approximately 310 acres of existing wetlands would be eliminated; at least partial mitigation identified
Floodplains (Section 4.7)	No change in flood elevations or potential to flood non-federal land and property	No change in flood elevations; expanded federal rights would avoid project-related effects on private land and property	Flood elevations upstream from dam would be lower; no private property would be affected by project-related flooding	Flood elevations upstream from dam would be lower; no private property would be affected by project-related flooding
Terrestrial Life (Section 4.8)	No change in present communities or long-term trends	Potential benefits due to more land in public ownership; no change in long-term trends	Significant adverse effects on species now using the reservoir and wetlands; insignificant effects downstream	Significant adverse effects on species now using the reservoir and wetlands; insignificant effects downstream

Table 4 (Continued)

Resource Areas	A: No Action	B: Acquire Land Rights	C: Lower Nolichucky Dam	D: Remove Nolichucky Dam
Endangered and Threatened Species (Section 4.9)	No change in present communities or long-term trends	Some possible benefits due to public ownership; no change in long-term trends	Potential significant adverse construction effects on endangered aquatic species; commitments to minimize them; insignificant post-construction effects	Potential significant adverse construction effects on endangered aquatic species; commitments to minimize them; significant adverse post-construction effects on some protected aquatic species
Land Use (Section 4.10)	No change in present trends; flooding potential continues on 1,000 acres of private land	1,000 acres would be acquired in fee or easement from private owners; some uses would require TVA approval	Private land around the reservoir would no longer be affected by project-related flooding	Private land along the river would no longer be affected by project-related flooding
Visual/Recreation/ Managed Areas (Section 4. 11)	No change in present status or long-term trends	Enlarged federal lands could enhance recreation and management areas	Disruptions during the construction period; part of area would become river-like; recreation and management activities would change	Disruptions during the construction period; large river setting would be restored; river likely to become the focus of recreation and management activities
Cultural Resources (Section 4.12)	Continued potential flooding effects on eligible structures	Continued potential flooding effects on eligible structures	Flooding effects eliminated on eligible structures; some buried sites could be exposed	Flooding effects eliminated on eligible structures; Nolichucky Dam and Powerhouse would be removed; more buried sites could be exposed
Socioeconomics (Section 4.13)	No change in status of local population or economy	Possible minor benefits to local economy due to enhanced recreation opportunities	Economic benefits during the construction period; possible minor long-term population and economic benefits	Economic benefits during the construction period; possible minor long-term population and economic benefits
Environmental Justice (Section 4.14)	No disproportionate effects on any segment of the population	No disproportionate effects on any segment of the population	No disproportionate effects on any segment of the population	No disproportionate effects on any segment of the population

Adoption of the No Action Alternative (**Alternative A**) would mean that TVA would not do anything on the ground to address the potential flooding effects on non-federal land and property around Nolichucky Reservoir. TVA already has provided updated flood level information to Greene County officials and all proposed development within the 100-year floodplain would continue to be subject to local floodplain regulations (Section 4.7). Present environmental conditions and ongoing trends would continue both in the water (Sections 4.4, 4.5, and 4.9) and on the land surrounding the reservoir (Sections 4.2, 4.3, 4.6, 4.8, 4.9, 4.10, and 4.11). Present flood elevations upstream from Nolichucky Dam would not be affected by this alternative and approximately 1,000 acres of land not in federal ownership or covered by flood easements would continue to be located within the 500-year floodplain affected by the dam (Sections 4.7 and 4.10). Approximately 64 privately-owned structures occur within this 500-year floodplain (Section 4.10), 19 of which might be eligible for listing on the National Register of Historic Places (Section 4.12). This alternative would not have any effect on the present population or economic conditions in the area adjacent to Nolichucky Reservoir (Sections 4.13 and 4.14).

If the Acquire Land Rights Alternative (**Alternative B**) was adopted, present flood elevations around Nolichucky Reservoir would not be affected (Section 4.7) but TVA would acquire either fee title or flood easements over approximately 1,000 acres of privately-owned land within the 500-year floodplain upstream from the dam. Most of the new land acquired in fee probably would be added to the existing wildlife management area, presently managed by the Tennessee Wildlife Resources Agency (Sections 4.10 and 4.11). Uses of the land within this floodplain area would be controlled to minimize the potential for flooding effects (Section 4.10), and all structures on this land, including potentially eligible historic structures, probably would be floodproofed, relocated to higher ground, or removed (Sections 4.7 and 4.12).

Environmental conditions and ongoing trends in the water and on the land surrounding the reservoir would not be adversely affected and, in fact, public ownership or control over the entire floodplain area could lead to improved terrestrial habitat conditions, more resource protection, and increased recreation potential (Sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.8, 4.9, 4.10, and 4.11).

If increased recreation use did occur, this alternative could result in modest positive effects on economic conditions in the area surrounding Nolichucky Reservoir (Section 4.13).

Adoption of the Lower Nolichucky Dam Alternative (**Alternative C**) would lead to a number of changes in, around, and downstream from Nolichucky Reservoir. While the site-specific effects of this alternative would be evaluated in a supplement to this EIS that would be prepared following completion of the detailed design work (if this alternative was adopted), the general types and likely significance of these effects have been identified in this analysis. Lowering the spillway and removing sediment from the reservoir would reduce flood elevations to the point that the 500-year floodplain associated with Nolichucky Dam would not affect private land and property (Sections 4.7 and 4.10); however, some presently buried archaeological and historic sites might be exposed as sediment was relocated out of the reservoir pool (Section 4.11). All federal land around the reservoir would remain in public ownership and would continue to be used for wildlife management, environmental education, and public parks, while private land no longer in flood-prone areas would be available for other uses (Section 4.10).

Lowering the pool level by 40 feet would lower the groundwater level adjacent to the reservoir, in some places enough that nearby well performance could be adversely affected (Section 4.3). Lowering the reservoir pool level also would drain approximately 310 acres of high quality wetlands around and in the reservoir (Section 4.6), which would adversely modify the habitats of a variety of terrestrial plants and animals that typically occur only in wetlands (Section 4.8). Lowering the spillway and disturbing the sediment in Nolichucky Reservoir could result in some increased sedimentation in the river downstream from Nolichucky Dam during the construction period; however, the inclusion of sediment control measures and monitoring requirements would result in only insignificant effects on downstream aquatic life (Sections 4.4 and 4.5). Adoption of this alternative might still result in significant adverse construction effects on one or more silt-intolerant protected aquatic species living only where the dam presently protects them from excessive sedimentation (Section 4.9). Recreation and resource

management opportunities in the area would be different from present uses around the reservoir and probably would shift to focus more on river-related activities (Section 4.11). The local economy would receive a short-term benefit from the construction activities included in this alternative and a possible minor long-term benefit if recreation use did increase in the area (Section 4.13).

The general types and likely significance of the environmental effects of the Remove Nolichucky Dam Alternative (**Alternative D**) have been identified in this analysis. If this alternative was adopted, site-specific effects of this work would be evaluated in a supplement to this EIS which would be prepared following completion of the detailed design studies. Adoption of this alternative would result in the removal of all visible components of Nolichucky Dam from the valley and the restoration of a free-flowing river through this area. The resulting 500-year flood elevation would be well within the existing federal landrights in the area (Section 4.7). All federal land around the reservoir would remain in public ownership and continue to be used for wildlife management, environmental education, and public parks (Section 4.10). Some presently buried archaeological and historic sites might be exposed as sediment was relocated out of the full length of the reservoir pool (Section 4.11).

Lowering the reservoir pool by 70 feet would lower the groundwater level adjacent to the reservoir, in places enough that nearby well performance could be adversely affected (Section 4.3). Approximately 310 acres of wetlands upstream from the dam would be drained (Section 4.6), which would adversely modify the habitats of a variety of terrestrial plants and animals typically found only in wetlands (Section 4.8). The land disturbance activities associated with this project would include sedimentation control measures and monitoring requirements which would result in insignificant effects on surface water quality, sedimentation, and aquatic life in the Nolichucky River during the construction period (Sections 4.4 and 4.5). Following the complete removal of the dam, however, the river bed downstream from the dam site would be blanketed with sand and other coarse sediment, which would have immediate and significant adverse effects on some aquatic species (Sections 4.4 and 4.5). Freshwater mussels

and other uncommon bottom-dwelling species, including two listed federal endangered species, might be extirpated from the river (Sections 4.5 and 4.9). Once the dam was removed, recreation activities in the former reservoir area could expand to include tubing, float fishing, and possibly as good or better canoeing potential as exists in the first 10 miles upstream or downstream from the reservoir (Section 4.11). The net impact of this alternative on the local economy and employment probably would be positive, especially over the long term (Section 4.13).

Comparison

The adoption of Alternative A or B would result in very similar effects on the environment; however, Alternative B would address the potential flooding effects on non-federal land and property while Alternative A would not. Alternative B would involve the acquisition of fee title or flood easement rights over approximately 1,000 acres of private land within the present 500-year flood elevation upstream from Nolichucky Dam. Alternative A would not affect the ownership of this land; however, homes, historic structures, and other property located on that land would continue to be subject to flooding.

The adoption of Alternative C or D also would result in similar environmental effects; however, those effects would be very different from what would occur under Alternative A or B. Both C and D would involve modifications to the dam that would reduce the flood elevations around the reservoir and avoid the project-related flooding effects on private land and property, including homes and historic structures. Results of this general evaluation indicate that both of these projects also could drain about 310 acres of significant wetlands, lower groundwater levels in wells close to the reservoir, expose some buried archaeological or historic sites, and cause adverse effects on aquatic life in the river downstream from Nolichucky Dam. Largely because it would involve the complete removal of Nolichucky Dam, Alternative D would likely result in more extensive adverse effects on the downstream part of the river and aquatic life than Alternative C. Once the dam was removed, Alternative D would result in significant changes in the downstream river substrate, which could eliminate some types of bottom-dwelling animals, including two federal endangered mussel species. Alternative D also would reconnect the upstream and downstream parts of the river and refocus local

recreation activities on the free-flowing river. Both of these alternatives would include a variety of ways to avoid, minimize, or mitigate the potential adverse effects; however, some of those effects (such as the loss of the wetlands and elimination of endangered aquatic species) would be extremely difficult to mitigate completely.

As indicated in Table 3, the estimated costs of implementing these alternatives are: minimal for Alternative A, between $15 and $20 Million for Alternative B, between $45 and $70 Million for Alternative C, and between $90 and $150 Million for Alternative D. Alternative A would take approximately three months to complete, while Alternative B could be completed in 3 years, Alternative C would take 5 - 10 years, and Alternative D would take between 10 - 12 years. The construction activities associated with both Alternatives C and D would provide some short-term economic benefit to the local area. All of the action alternatives (Alternatives B, C, and D) might result in some long-term economic benefits; however, the extent of those potential benefits would depend on decisions that would be made by many individuals and governmental agencies.

2.10 PREFERRED ALTERNATIVE

At this time, TVA has not selected a preferred alternative way to address the flooding effects caused by Nolichucky Dam and Reservoir on non-federal land and property. TVA encourages members of the public and representatives from interested agencies to study the content of this draft EIS and to comment on the analysis it contains. Those comments will help determine the scope and content of any revisions to be made in the final EIS and the identification of a preferred alternative.

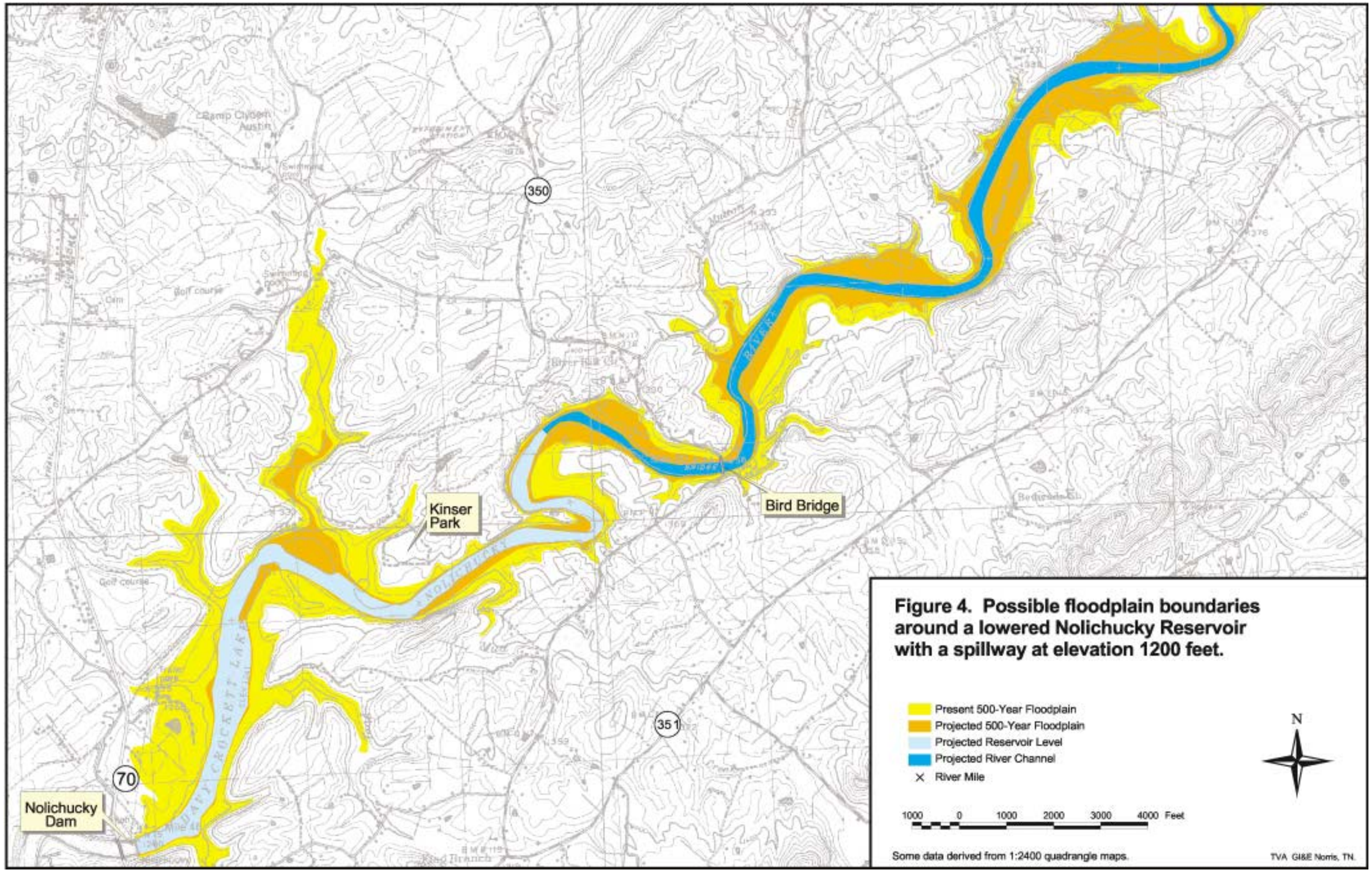

Figure 4. Possible floodplain boundaries around a lowered Nolichucky Reservoir with a spillway at elevation 1200 feet.