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MEMORANDUM FOR RECORD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

Executive Summary

I consider Wolf Creek Dam to be in a high risk of dam failure and therefore I am taking necessary emergency measures to reduce imminent risk of human life, health, property, and severe economic loss. Information provided to me by Nashville District, HQUSACE, and several independent studies indicate that three courses of action should be considered immediately as interim emergency measures 1) Lower the pool to the lowest possible level (approximately elevation 610 or lower) utilizing existing discharge capacity; 2) Lower the pool to the lowest elevation possible and modify the project in order to maintain the pool at the lowest level; and/or 3) Incrementally lower the pool. Course of action 2 would require structural modification to the project to increase discharge capacity. Studies are ongoing to determine the long term feasibility of these measures. However, I have determined that for the immediate future, structural modification of the project is not feasible. I have reviewed the remaining possible courses of action and have decided to incrementally lower the pool to elevation 680 to achieve the maximum risk reduction while maintaining (to the maximum extent practicable) certain critical project purposes such as hydropower and water supply. Enclosed herewith is my decision rationale on Interim Risk Reduction Measures (IRRM) for Wolf Creek Dam.

1. Project History

a. Wolf Creek Dam, completed in 1951, is a composite earth and concrete dam located in south central Kentucky at the head of the Cumberland River. The 258-foot high dam impounds up to six million acre-feet of water and is the largest reservoir east of the Mississippi River. The main feature under consideration is the 3940 foot long earth embankment that extends across the flood plain to connect the concrete section of the dam to the right abutment. The embankment, except for a small portion adjacent to the concrete structure, is underlain by up to 50 feet of alluvium materials, which are, in turn, underlain by karst limestone. The design of the dam provided for a

000001

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

clay-filled cutoff trench through much of the karst limestone. Karst limestone is characterized by fissures and clay filled seams which are the cause of concern at Wolf Creek. In late 1967 and 1968, after 17 years of apparently satisfactory operation, signs of distress appeared in the form of muddy flows in the tailrace just downstream of the powerhouse and sinkholes in the downstream toe of the dam. Emergency grouting averted a potential failure of the project and a concrete diaphragm wall was constructed to provide a more permanent seepage cutoff. The cutoff wall was completed in September 1979. Due to budget constraints, the seepage cutoff wall did not extend the entire length of the embankment. It stopped approximately 1700 feet short of the right abutment. With the exception of a wet area on the downstream right embankment toe, distress indicators, i.e. sinkholes, muddy shows, and wet areas disappeared after completion of the grouting and cutoff wall. Prior to the remediation, there were no instruments in the dam. The remediation effort included the installation of 300 piezometers, inclinometers, and settlement plates. Many of the piezometers have been retired due to lack of change in readings, being damaged, or otherwise being rendered unusable. There remain 150 active piezometers that are read on a continual basis making Wolf Creek dam one of the most highly instrumented projects in the Corps of Engineers.

b. Wet areas gradually reappeared, especially in the eastern end of the embankment downstream of the right abutment, prompting installation of a series of French drains to dry the ground surface, which permitted mowing. Wet areas continued to emerge downstream and were somewhat dependent on rainfall and pool elevation. Piezometric levels measured after completion of the cutoff wall did not respond as the designers anticipated. The designers anticipated that the piezometers upstream of the wall would be at upper pool level and the piezometers downstream would register less than the pool level. Piezometric levels upstream of the wall approached pool level as anticipated. The piezometers just downstream of the wall registered approximately 50 ft below the pool levels which was less than the designers anticipated. The piezometers downstream of the wall showed a gradual rise from 1984 to the present with the most activity being in the wrap-around section of the dam. While most of the piezometers registered a gradual rise, there were 6 which rose more than expected. The rise in piezometric levels, increased

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

wet spots, and settlement in one area of the embankment spurred the District to pursue preparation of the Seepage Control Major Rehabilitation Evaluation Report (MRR) which was approved in July 2005 by the Great Lakes and Ohio River Division (LRD).

c. Remedial construction approved in the MRR included grouting and a cutoff wall. The contract for the grouting portion of the work was awarded in September 2006 and grouting in the critical wraparound area will begin in January 2007. The cutoff wall is scheduled for award in December 2007. The project history is discussed in more detail in Appendix A.

2. Consequences of Failure

a. The Corps is analyzing the potential consequences of possible dam failure on a continuing basis. Areas along the Cumberland River include residential, commercial, industrial and agricultural development. Approximately 1.5 million people reside and are employed in the Cumberland River basin. The area impacted by a potential failure of Wolf Creek Dam encompasses the entire length of the Cumberland River. Significant flood damages resulting from failure of the dam could be measured from the dam to Clarksville, Tennessee, which is located 40 miles northwest of Nashville, TN.

b. The MRR developed economic and potential loss of life consequences for the project and those estimates are used in this discussion. These estimates are based on structures and roads damaged primarily in the Davidson County area around Nashville. The MRR noted that there would be 11,617 structures expected to sustain damage costing approximately \$2.9B. Davidson County accounts for \$2.5B of these damages. The estimate of road damages totals \$750M, bringing the total estimated damages to \$3.6B. The damage estimates did not include public properties in Davidson County or damages to structures such as bridges. The MRR assumed that other Corps dams, especially Cordell Hull would be overtopped and collapse. No costs were included in the MRR for those damages. Therefore, it is considered that the economic damage estimates are extremely conservative.

c. Development of the Population at Risk (PAR) indicated that high severity was only in the area immediately downstream

000003

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

of the dam with lessening severity with greater distance due to increased warning times. The PAR was estimated to be 770 persons with an estimated loss of life between 56 and 237. This PAR estimate is based on a dam break scenario that is extremely conservative. The dam break scenario used in the MRR was based on several conservative factors. It was assumed that there was no warning of the dam failure and therefore no advance notification. The breach was assumed to be 200 feet wide at the bottom and fully developed in 5 hours. More detailed failure scenarios developed as a part of the ongoing risk assessment indicate that the most likely failure scenario would be associated with detectable warning signals such as sinkholes, increased piezometer readings, or slides and settlement in the embankment. The ongoing analysis also indicates that the failure would most likely take longer than 5 hours to fully develop.

d. A more detailed discussion of potential consequences is presented in Appendix C.

e. A dam failure could also mean total loss of project purposes, including flood damage reduction (\$33M annually), recreation (\$38M annually), and hydropower (\$77M annually) for a total annual loss of \$149M.

3. Analysis of Risk

a. The risk to Wolf Creek dam has been the subject of four major reviews in the recent past. The MRR, the Screening Portfolio Risk Assessment (SPRA), the Expert Panel for Peer Review of Six Dams (Peer Review), and the Risk-Based Evaluation of Potential Operating Restrictions for Lake Cumberland and Center Hill Lake have all reviewed the project and provided information relating to risk.

b. LRD approved the MRR in July 2005. The MRR called for the construction of a grout curtain and cutoff wall as remedial measures for the dam. The MRR was prepared based on distress indicators at the project, primarily piezometric levels, wet spots, and settlement of the embankment. Instrument data and observations at the project have shown a gradual change in these

000004

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

indicators over the last 20 years which indicates that the project condition is deteriorating. Observations at the project indicate that these distress indicators are related to pool levels. Of primary concern and note are the piezometric levels in the critical wrap around section of the earthen dam immediately adjacent to the concrete. There are six piezometers in this area that have indicated a maximum rise of 13 feet over the past 22 years, an approximate 10% increase. The wraparound area is of most concern for several reasons. First, it was in this area that a near-failure occurred in the late 1960s. The peer review group also highlighted this area as representing the shortest seepage path from the upstream reservoir to the downstream toe of the embankment and, therefore the most likely area of problems. The changes in piezometric levels have been gradual with no abrupt spikes. Extensive study and analysis for the MRR was based on project history, previous remedial work, instrumentation, geotechnical exploration, detailed analyses, consultation with experts and engineering judgment interpreting the distress indicators, other information and data and conditions at the project. Nashville District engineers determined that these indicators and unknown attributes associated with the dam create a high risk of dam failure and therefore preparation of an MRR and remedial construction were recommended.

c. The SPRA was conducted on Wolf Creek Dam in June of 2005. The purpose of the SPRA was to rank Corps of Engineers dams in order of severity. The SPRA placed Wolf Creek Dam in the Urgent and Compelling (Failure in Progress) category, one of six projects in that group. The risk to the Wolf Creek project was considered by the SPRA to be high. The analysis of the SPRA was based on engineering judgment.

d. The Peer Review panel was set up by HQUSACE to validate the SPRA process and review the six projects considered by the SPRA to be in the Urgent and Compelling category. This panel is composed of independent, outside experts in their respective fields. In October 2006, the Peer Review panel recommended immediate operating restrictions at Wolf Creek and considered the risk of dam failure to be high. The Peer Review Panel furnished their draft final assessment of Wolf Creek Dam on 21 December 2006. Their assessment was based on engineering judgment. Their draft recommendations included:

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

(1) Lowering the reservoir until short term corrective action could be taken. The recommended elevation was between 610 and 650. The Panel noted that, if elevation 610-650 was not practical, a higher elevation of 680 should be considered.

(2) Completion of the grouting in the critical sections of the dam by 30 April 2007. The Panel noted the critical areas as monolith 37, the wraparound section, and the right abutment.

(3) In depth review of the scope and contract documents for the grouting portion of the remediation work.

(4) Independent review of the instrumentation program.

(5) Modifications to the system of instruments used to measure settlement and deformation.

(6) Evaluation of alternate means of increasing spillway discharge capacity.

(7) Evaluation of replacement of the existing dam with a roller compacted concrete dam downstream of the existing dam.

(8) Review the depth and feasibility of the planned cutoff wall.

(9) Perform a full scale test section of the cutoff wall.

(10) Consider installing a cutoff wall under the concrete section of the dam.

(11) Review, update, and exercise the Emergency Action Plan for the project.

(12) Determine stress indicators and trigger events for the project.

e. Nashville District, at the recommendation of HQUSACE, contracted with RAC Engineers and Economists (RAC) to perform a risk assessment of Wolf Creek Dam to determine the impact on risk of operating restrictions on the project. This analysis utilizes risk-based methodology to determine the impacts of operating restrictions. The analysis is divided into two parts,

000006

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

a bounding approach and the final report. The bounding approach was utilized to give a preliminary indication of risk and was completed at the end of November 2006. The bounding approach prepared by RAC indicates that the project is in a high risk category.

f. The RAC bounding analysis indicated that the risk is reduced with lower operating pools and that, utilizing the United States Bureau of Reclamation (USBR) guidelines, there are no operating restrictions that meet the USBR recommended 1×10^{-4} guidelines. The District has placed the restrictions into three groups: (1) Incremental pool levels from elevation 723 to elevation 680, (2) Drawing the pool down and maintaining an elevation of 610 utilizing existing drawdown capability, and (3) drawing the pool down and maintaining an elevation of 610 or 562 with additional discharge capacity by removing one or more turbines. Option 3 was determined to be infeasible by the Hydroelectric Design Center (HDC). While probability of failure decreases only minimally for incremental lowering of the pools, impact to project purposes increases greatly as the pool is lowered. Our analysis of the distress indicators at the project indicates that incremental pool lowering will have a positive effect on the dam. A more detailed review of these risk analyses is presented in Appendix B.

4. Risk Mitigation Measures

a. Nashville District has taken steps to mitigate or lower the risk until the remedial construction can be accomplished.

(1) The Dam Safety Inspection Program - Nashville District maintains an active dam safety program. Surveillance and continuing evaluation of the Wolf Creek Project since emergency grouting of the embankment foundation in 1968-1970 have been rigorous and consistent. Nine major periodic inspections have been conducted during the life of the Wolf Creek Project. The last major inspection was conducted October 2004. In addition to these inspections, project personnel maintain a daily vigilance during routine assignments to detect and report conditions which are not normal and warrant further investigations. Because of the present serious seepage condition at Wolf Creek Dam, surveillance of the project has

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

been drastically increased and will continue until the problem has been corrected. Key piezometers and uplift cells are being monitored and the data evaluated on a weekly basis rather than the standard monthly schedule that has been followed since the diaphragm wall was constructed. The project is now under continuous surveillance by trained personnel. The dam is manned twenty-four hours a day and is physically inspected twice a day everyday. In addition, cameras are posted to view all upstream and downstream areas of the project including all construction contractor's staging and storage areas.

(2) Automated Instrumentation - Measures are being taken to install an automated system for collecting piezometric data. An automated system will be more expedient, accurate and dependable than manual readings. Real-time in this instance is defined as a period of time no longer than a 3 minute delay between time of reading and the computations performed for posting all converted raw data into water elevation data. Installation of this automated system will be accomplished early in 2007.

(3) Additional Exploration and Instrumentation - Drilling and exploration support from other districts within the Corps of Engineers is planned for early in 2007. Savannah, Baltimore, Kansas City and Mobile were contacted and plans are being made to gain additional information through use of standard penetration and cone penetrometer methodologies. In addition, new piezometers will be installed in areas of the project where additional information is warranted. This additional work will be started in January 2007.

(4) Emergency Action Planning (EAP) - An EAP for the project was developed several years ago and is periodically updated. Key data in the plan are checked and revised at least on an annual basis. Project EAPs are maintained in the district office, at the project, and in the emergency operations center (EOC). At the Wolf Creek Project the emergency notification plan is posted so workers will readily know who to notify in an emergency situation. Dam safety training for project personnel is conducted every four years and was last conducted for Wolf Creek project personnel in October 2004.

000003

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

(5) Community Involvement (Public Meetings) - A total of fourteen public meeting have been held by Nashville District in the communities surrounding Wolf Creek Dam. These meetings have informed the public concerning the remediation efforts at the project as well as briefed them on emergency planning efforts. The meetings were conducted in the communities both upstream and downstream of Wolf Creek Dam and more than one meeting has taken place to address concern from the communities of Creelsboro and Burkesville. These communities are in closest proximity of the dam and will be informed of both the procedures that have been developed in the event of an emergency, and the Corps current plans to lower pool levels to elevation 680.

(6) Communication Plan - The Public Affairs Office, Dam Safety Officer and the Project Manager assist the team in developing the Communication Plan. The plan specifies project issues and target audiences. Fear of dam failure is the most critical concern to be addressed. The communication activities to date have included briefings, face to face meetings, media response to query, notification of emergency officials, town hall meetings and website updates. The target audiences are local businesses and residents, downstream communities, congressional offices, recreating public, county and community leaders, and environmental interests. Internal Corps audiences include the Lakes and Rivers Division, HQUSACE, and other project field personnel. Agencies such as the US Fish and Wildlife Service (USFWS), the Kentucky Department of Fish and Wildlife Resources (KDFWR), Trout Unlimited, Kentucky State Marina Owners Association, and the Southeastern Power Administration (SEPA) are affected by the decisions being made regarding reservoir management and future project operations.

(7) Hydraulic Mapping and Modeling - Nashville District is currently preparing inundation maps for the one, three, and eight hour time frequencies to provide to the Emergency Management Agencies (EMA) near Wolf Creek. The modeling uses GIS mapping and database formats to identify the populations most vulnerable from dam failure and downstream flooding. Completion of this mapping will be in early 2007 and will be promptly furnished to the EMAs in the affected communities.

(8) Foundation Grouting - Nashville District has contracted with Advanced Construction Techniques, LTD (ACT) as a

000009

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

foundation grouting specialist to install new grout curtains. This contract was awarded in September 2006 and the grouting in the critical wrap around section will begin in January 2007. This grouting is expected to have an immediate effect on the distress indicators in the project. ACT teams with sub-contractors from Gannett Fleming and Intelli-grout that constructed the newly installed cut-off wall at Mississenawa Dam in Indiana.

(9) Reservoir Restrictions - After two especially wet seasons and correspondingly higher pools in 2003 and 2004, the District noted an increase in the number of wet spots in the area immediately downstream of the dam. An interim operating restriction was agreed on which reduced the peaks that normally occur in the January-March timeframe. The Nashville District in consultation with LRD and HQUSACE decided to keep the pool within the Southeastern Power Administration (SEPA) operating band and reduce the pool levels as quickly as possible when rainfall events did occur. This reduction, which began in January 2005, has had a positive effect on the wet spots, reducing them by approximately 50%. This reduction also had a positive effect on the critical piezometers. The piezometric levels in the critical wraparound section were reduced by an average of 4 feet. The project has been operating under the modified procedures for two years now, and the dam appears to be responding favorably. Intensified observations and instrumentation readings at the project indicate that the wet areas, particularly at the toe, as well as piezometric levels have been reduced. The proposed lowering to elevation 680 is anticipated to have a correspondingly positive effect on distress indicators.

(10) Future Emergency Exercises - The next emergency exercise is scheduled in March 2007. The exercise will involve local emergency management personnel as well as the Corps of Engineers design, power plant and construction teams. In addition, the National Weather Service, the Tennessee Emergency Management Agency (TEMA), and the Kentucky Division of Emergency Management for the three surrounding counties of Russell, Clinton and Adair will participate. The purpose of the exercise will be to test emergency action planning, response times, and communication procedures.

000010

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

(11) Future Studies - The District will evaluate construction of a new cut-off wall, a new roller compacted concrete dam, and additional spillway capacity either through the existing structure or the right abutment.

(12) Future Expert Panel - Nashville District established a board of some of the most respected members of the geotechnical community when the 1968 problems were experienced. The District hired a panel of experts in 2004 to review the project status and advise the District on preparation of the MRR. The District will hire a new panel in 2007 to assist with the design and construction of the remedial efforts at the project.

5. Impacts to project purposes of proposed restrictions

The proposed operating restrictions are expected to impact project purposes as follows:

a. Hydropower - The impacts to hydropower will be severe. The hydropower losses, when combined with the potential related impacts to three coal fired steam plants within the Cumberland Basin, present a significant threat to the regional power network. Southeastern Power Administration (SEPA) estimates the impact to be greater than \$20-40M dollars per year.

b. Navigation - An operating level of elevation 680 at Wolf Creek would have minimal impacts to navigation in the Cumberland system. Modification of the Cumberland system could translate to increased dredging requirements by the Mississippi Valley Division due to extended low flows downstream of Lock and Dam 53 and on the Mississippi River.

c. Fish and Wildlife - Reducing the elevation of the pool to elevation 680 severely reduces the amount of cold water storage. This would place the cold water fisheries at risk of experiencing major fish kills. If the operating level of elevation 680 is maintained during the full construction period (estimated 7 years), Kentucky Department of Fish and Wildlife Resources (KDFWR) estimates an impact of \$11.6M per year in the lake and \$7.1M per year in the tail water.

000011

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

d. Recreation - The impact to recreation would be severe. All 11 major marinas would be impacted. Most boat access ramps would be unusable. Based on 2005 statistics, there were 4.9M visitors who spent \$115M in the area. It is estimated that 50% of this visitation and income would be lost with an operating level of 680. Water safety would also be a concern with a lowered lake. Boaters would not always be able to travel the same routes that they are accustomed to due to the presence of unfamiliar and often unmarked underwater obstructions. This would increase the risk of boating related accidents and could lead to an increase in injuries and fatalities on the lake.

6. Limits on Pool Restrictions

a. Critical water supply intakes in the upstream pool are at elevation 673. Lake Cumberland supplies water to more than 60,000 people in the area, including the communities of Albany, Burnside, Jamestown, Monticello, and Somerset KY. Lake Cumberland is the only source of water for these communities and there is no alternative source. Discussions with the water supply users indicate that the costs of relocating their intakes to a lower elevation would be substantial and require a minimum of 6 months to accomplish. Water supply directly affects public safety through drinking water, sanitary services, and fire protection. Our risk mitigation measures will include planning for the lowering of the intakes but this cannot be accomplished in the near term. The Nashville District will issue letters to the water supply users advising them to lower their intakes as soon as practicable. Establishing an elevation of 680 for the pool allows for some degree of fluctuation due to the unpredictability of rainfall and subsequent pool levels. Therefore, the pool cannot be lowered below elevation 680 in the near future.

b. A review of the foundation of the dam indicates that, at elevation 670, a substantial portion of the embankment foundation interface with the underlying bedrock will be exposed. This area is near the right abutment of the dam and is part of the dam in which there is no cutoff wall. This is a concern as it potentially introduces a failure mode associated with cyclic loading of the embankment and reduction of the pressure on the Karst foundation. This was noted as a concern by the peer review panel. This could result in the creation of

000012

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

sinkholes downstream as the pressure is reduced in the Karst openings and the material in the voids collapses. This could result in new seepage paths being created which could fail the embankment as the pool goes up and down with inflows. Installation of the grout curtain in this area will reduce this concern.

c. Installation of the grout curtain in the right abutment and the lowering of the water intakes will allow the reservoir to be lowered below elevation 670 should conditions at the project warrant.

7. NEPA Compliance

The Corps believes that the need for action regarding the Wolf Creek Dam is so urgent and compelling that there is no time to follow the usual National Environmental Policy Act (NEPA) procedures before the Corps makes decisions and begins to implement them. The Corps is, therefore, invoking its authority relating to "Emergency Actions" under 33 CFR 230.8. The Corps is hereby declaring an emergency, making decisions on an emergency basis, and taking necessary actions accordingly. The Corps will establish a new temporary target pool elevation at Wolf Creek Dam to reduce the pressure on the foundation. These guide curves would be in effect for as long as is necessary to deal with the risks and problems of Wolf Creek Dam, possibly for as long as seven years. In the interim, the Corps has consulted the President's Council on Environmental Quality (CEQ) regarding alternative arrangements under NEPA pursuant to 40 CFR 1506.11. These proposed alternative arrangements and further NEPA discussion are outlined in Appendix D, which is an integral part of this decision document. After the Corps has taken the necessary emergency actions that must be accomplished immediately, the Corps will initiate the NEPA process, with the intent that of preparing an Environmental Impact Statement (EIS). Coordination will be initiated with the U.S. Fish and Wildlife Service pursuant to the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, and other relevant authorities (e.g., NEPA), and with the Environmental Protection Agency and coordination will continue with other appropriate Federal, state, and local governments. The Commonwealth of Kentucky and the State of Tennessee will be contacted with regard to compliance with the Clean Water Act and the National

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

Historic Preservation Act. The decision to lower the pool elevation at Lake Cumberland is expected to be highly controversial. Impacts to environmental and economic resources could be significant. The Corps' emergency decisions could have significant adverse effects on environmental and economic resources and interests. The Corps will make future decisions as to the operation of the lakes with information from technical evaluations, the EIS process, and other appropriate sources.

8. Plan to mitigate impacts to project purposes

a. There will be impacts to authorized project purpose due to the operating restrictions imposed. Plans are being developed to mitigate to the maximum extent possible those impacts.

b. Navigation - The Nashville District and LRD Regional water management staffs are preparing a plan to operate the Cumberland River system to minimize impacts to navigation in the Cumberland, Ohio, and Mississippi river systems. Impacts to the Cumberland system will be minimal and impacts to the Ohio and Mississippi systems will be limited to periods of low flow. The Nashville District will discuss with the Tennessee Valley Authority the possibility of using their Tennessee River projects to mitigate adverse impacts to navigation on the Ohio and Mississippi Rivers.

c. Flood Control - A Cumberland system operating plan will be adopted that prioritizes evacuation of Lake Cumberland. This plan will not compromise flood damage reduction capability within the Cumberland system. Consideration will also be given to downstream impacts on the Cumberland, Ohio, and Mississippi river systems.

d. Hydropower - Nashville District will work with Southeastern Power Administration and Tennessee Valley Authority staffs to minimize impacts to hydropower production.

e. Water Quality - Nashville District will operate according to the established drought contingency plan which places water quality as a top priority for the Cumberland System.

000014

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

f. Fish and Wildlife - There is little that can be done with the lake elevation at 680 to affect the impacts to the upstream fisheries. Nashville District will work with the US Fish and Wildlife Service and the Kentucky Department of Fish and Wildlife to minimize impacts to the downstream fishery and the hatchery located just downstream of the Wolf Creek dam.

g. Recreation - Nashville District will work with the Lake Cumberland stakeholders to minimize to the extent practicable the impact to recreation. This will include measures such as extensions of boat ramps, relocation of marinas, relaxation of user fees, and enhancement of other recreation opportunities in the area.

h. It is recognized that the Corps of Engineers has authority to perform mitigation in certain areas. For those mitigation efforts that fall outside our authority, we will work with our stakeholders to determine the best path forward to accomplish the mitigation effort.

i. Nashville District will request funds in the FY 07 O&M workplan to accomplish those actions that are within existing authorities.

9. Recommendation and Path Forward

a. The analyses and data presented in this document, including the Appendices, form the basis for my decision. My decision is that an incremental approach to risk management will be adopted. This approach will lower the pool to elevation 680 immediately and hold that elevation for an indefinite period, unless and until the Corps determines that a different pool elevation level is more appropriate. The grouting program will be accelerated with the goal of having the grout in the critical wraparound section of the dam completed on or about 1 April 2007. The risk analysis being conducted by RAC will also be completed in that same timeframe. Review of project conditions and the findings of the risk analysis will be evaluated and a decision made on continued operating restrictions. If the decision is made to raise the pool further, the maximum elevation considered will be elevation 700, unless new information or changed circumstances demonstrate that a higher level would be safe and appropriate.

000015

CELRD

SUBJECT: Wolf Creek Dam Interim Risk Reduction Measures

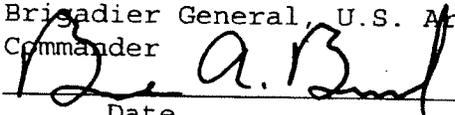
b. Reduction of pool levels reduces the pressure on the foundation, reduces the probability of failure, and reduces the consequences of dam failure if that should occur. My decision is to lower the pool to the lowest practicable level while still maintaining vital project purposes. The project will be constantly monitored. If positive effects are not seen from this incremental lowering or if other conditions warrant, the pool may be lowered further.

c. This decision is based on weighing the reasonable likelihood of severe adverse effects on human life, health, property, severe economic loss, and safety along with the possibility of dam failure, as well as the adverse effects of modifying the lake pool elevation, while the repairs are being performed. The grouting in the critical areas will begin in January 2007 and that work is anticipated to have a positive effect on the distress indicators. Constant monitoring of the project, enhanced emergency action planning, and accelerated construction will increase the reliability of the project and reduce the risk.

10. Summary

In summary, I have decided to incrementally lower the pool at Wolf Creek Dam. As discussed above, constant review, monitoring, and evaluation of the project will be maintained throughout the year. This is an interim decision. The project will be continuously evaluated based on the results of the grouting program, additional instrumentation, enhanced monitoring, and the final report of the risk assessment team, information generated during the NEPA process, and all other relevant data and information.


STEVEN J. ROEMHILDT, P.E.
LTC, EN
Commanding
19 Jan 07
Date

BRUCE A. BERWICK
Brigadier General, U.S. Army
Commander

19 Jan 2007
Date

- 4 Encls
1. Appendix A
2. Appendix B
3. Appendix C
4. Appendix D

APPENDIX D
COMPLIANCE WITH NEPA AND OTHER ENVIRONMENTAL
LAWS

Background

Several engineering studies have identified a high level of risk of dam failure at Wolf Creek Dam. Concern exists that the water pressure from the lake is causing erosion of the foundation materials, creating seepage paths under and through the dam. Public safety is of grave concern given the size of the Lake Cumberland impoundment (which is the largest reservoir east of the Mississippi), the potential impacts from flooding should the dam actively fail (flooding not only at the dam but all the way down the Cumberland River to include the Nashville area), loss of all the dam's existing benefits of hydropower generation, water supply, navigation, flood control, recreation, and reduced water quality for both the human and natural environment.

NEPA Compliance

The Corps believes that the need to take interim emergency measures to lower pool levels at the Wolf Creek Dam is so urgent and compelling that there is no time to follow the usual National Environmental Policy Act (NEPA) procedures before the Corps makes decisions and takes actions to reduce the risk of dam failure. The Corps is, therefore, invoking its authority relating to "Emergency Actions" under 33 CFR 230.8. The Corps is hereby declaring an emergency, making decisions on an emergency basis, and taking necessary actions accordingly. The Corps will establish a new temporary target pool elevation at Wolf Creek Dam to reduce the pressure on the foundation. These guide curves would be in effect for as long as is necessary to deal with the risks and problems of Wolf Creek Dam, possibly for as long as seven years or more. In the interim, the Corps has consulted the President's Council on Environmental Quality (CEQ) regarding alternative arrangements under NEPA pursuant to 40 CFR 1506.11. These alternative arrangements are found at the end of this appendix in Exhibit 1. , The Corps also will initiate the NEPA process, with the intent of preparing an Environmental Impact Statement (EIS). Coordination will be initiated with the U.S. Fish and Wildlife Service (FWS) pursuant to the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, and other relevant authorities (e.g., NEPA). Coordination with the Environmental Protection Agency and other appropriate Federal, state, local, and tribal governments will continue. The Commonwealth of Kentucky and the State of Tennessee will be contacted with regard to Clean Water Act and the National Historic Preservation Act compliance. The decision to lower pool levels at Wolf Creek Dam is expected to be highly controversial. The Corps' emergency decision and actions could have significant adverse effects on environmental and economic resources and interests. The Corps will make future decisions as to the operation of the Wolf Creek Dam and Lake Cumberland using all available information from technical evaluations, the EIS process, and other appropriate sources.

ALTERNATIVES CONSIDERED INCLUDING THE PROPOSED ACTION. The Corps has considered a variety of alternatives to immediately reduce the risks associated with potential

dam failure. Some are patently impracticable and have been dismissed from detailed consideration; other theoretically available alternatives are beyond the Corps' jurisdiction and authorities, and thus impracticable so far as the Corps can determine. The Corps has, therefore, tried to focus on alternatives that are practicable, provide the greatest possible reduction in risk, and at the same time minimize the negative impacts as far as possible.

A. Alternatives Eliminated. Several alternatives were briefly considered and eliminated because they are impracticable at this time. These include reducing the lake levels to the inverts of the sluice gates, notching the spillways, removing the turbines, and constructing a roller-compacted concrete dam below the existing dam.

1. Reducing the lake level to the invert of the sluice gates. The sluice gates are the lowest openings in the dam through which water can be withdrawn. At Wolf Creek Dam this is elevation 610 feet above mean sea level (msl). By way of comparison, the normal summer pool at Wolf Creek is elevation 723. Although lowering the pool to this elevation would achieve the greatest possible reduction in risk, it would also cause the greatest amount of negative impacts. Furthermore, this level would be impossible to achieve under normal conditions because the inflow entering the lake is greater than the sluices can pass downstream. This alternative will not, therefore, receive further consideration at this time.

2. Notching the spillways. It has been suggested that the concrete spillway could be notched to allow the lake to be lowered. Doing so without detailed study could easily destabilize the dams and cause the very disastrous dam failure that the Corps is trying to prevent. Furthermore, implementing the action would take longer than effecting repairs to the dam. This alternative will not, therefore, receive further consideration.

3. Removing the turbines. Another alternative considered was to remove the turbines from the dam to allow free passage of the water downstream. This is impracticable for several reasons. First, only one turbine can be removed at a time and the operation of removing a turbine can take several months. Even if other arrangements were made, removing all of the turbines could take a year. Removing the turbines would forego all hydropower benefits and, in the end, the pool would only be lowered a few feet. For these reasons, this alternative will not receive further consideration.

4. Constructing a roller-compacted concrete dam below the existing dam. A new roller-compacted concrete dam could be constructed and tied into the existing dam. Excavating to stable, unflawed bedrock to build such a dam could undermine the existing dam and precipitate the dam failure the Corps is trying to avoid. In addition, the design and actual construction of a new dam would take far longer than effecting repairs to the existing dam. This alternative will not, therefore, receive further consideration.

B. Alternatives Beyond the Corps' Jurisdiction. Downstream populations at risk could be ordered to evacuate their homes and business for an extended period of time, until risks of dam failure have been greatly reduced or eliminated. However, the Corps has no authority to order or enforce such a mandatory evacuation. Even if state or local governments might

possibly have such authority, a mandatory evacuation for a period of years is impracticable for many reasons and would entail unacceptably adverse economic and human consequences. In addition, the Corps has been communicating with, and will continue to consult with, the relevant state, local, and tribal governments regarding whether any sort of temporary evacuation plans should be considered or implemented.

C. No Action Alternative (i.e., Current Conditions). The current conditions are defined by the established project's guide curves, also referred to as the SEPA Power Marketing Zones. Under normal operating conditions the pool is drawn down by late November to store heavy winter rains to prevent downstream flooding. Between February and May the lake is slowly allowed to fill to provide summer recreational benefits. Then, in mid-June, the water is slowly discharged for hydropower generation and to reduce the pool to winter levels. These bands were developed to achieve the greatest possible balance among all of the project's authorized purposes. The No Action alternative would see a continuation of this cycle. Due to the nature of the current emergency, the Corps believes it is necessary to temporarily abandon this routine and draw the pool to lower levels.

D. Alternatives Considered. Due to the urgency of the problem, there is insufficient time to complete a definitive analysis of all alternatives. The Corps recognizes that any of the alternatives contemplated under this section would have significant consequences, even if such an alternative were to be implemented only for a temporary period. See Figure 1.

1. Lower Bounding Limit. The lowest practicable limit considered at Wolf Creek is elevation 680. Below elevation 680, several water supply intake facilities will be left without the ability to withdraw water from Lake Cumberland. This would leave several communities without drinking water, fire suppression water, or sanitation. Further, this is also the elevation at which the hydropower generation is significantly impacted. Although it is possible to draw the lake down even further, lower elevations can not be maintained because inflows would exceed the sluice gates' capacities for outflow.

2. Upper Bounding Limit. The upper limit would be the No Action Plan described above.

3. Temporary Intermediate Guide Curve. Several intermediate lake levels have been examined in the limited time available. Although there was not enough time to complete a thorough investigation of all alternatives, elevation 705 at Wolf Creek appears to be a break point at which in a typical year the various authorized project purposes are subjected to minor to moderate adverse effects and stresses. Various alternatives that would drop the pool level below elevation 700 would change the adverse effects on authorized project purposes to the moderate to severe range. However, reduction of the pool level to a level above 680 would not achieve sufficient reduction in stresses to the dam's foundation to achieve dam safety, in the judgment of the Corps, based on our current information and analyses.

4. Recommended Alternative. Based on the available data, the Corps has determined the target elevation at Wolf Creek Dam would be 680 until such time as a change is

determined to be appropriate. At present the Corps has determined that this level is necessary to reduce the imminent risks to human life, health, property, and severe economic loss associated with possible dam failure. At this elevation virtually all project purposes except for flood damage reduction will be moderately to severely impacted (see Figure 1). This is an incremental level and will be studied to determine if even lower levels are necessary and warranted. This should not be viewed as a final guide curve. Due to the uncertainty and dynamics of the situation it may be necessary to lower the lake even further at some future date. The maximum drawdown possible without major renovations to the dam is elevation 610.

Impacts of Reduced Pool

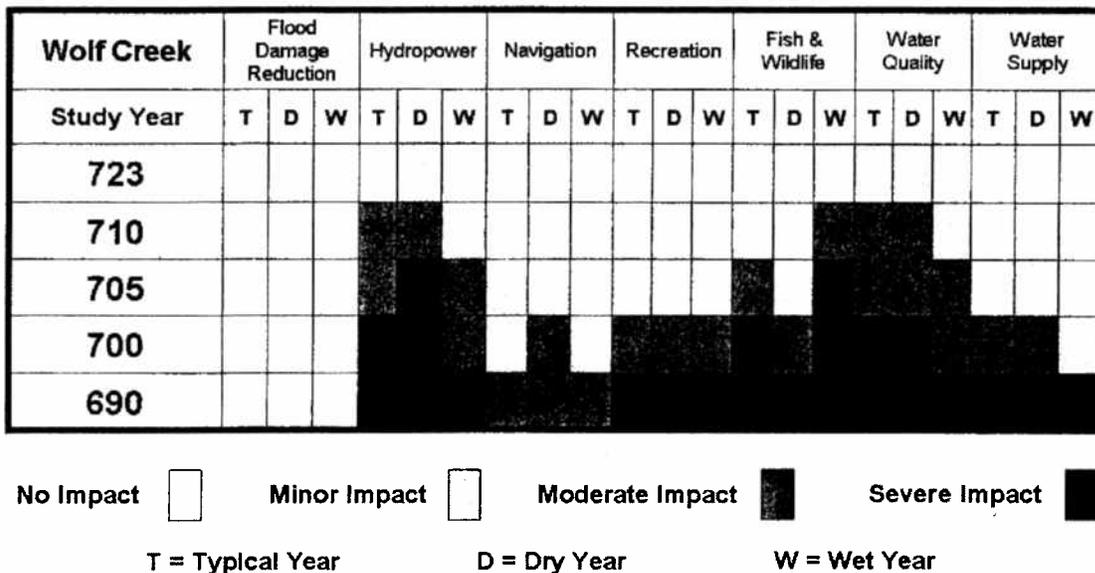


Figure 1 – Drawdown Impacts

E. Ongoing Actions to Reduce Risk. Several actions have already been taken to reduce risk. Prior to 2005, spring rains were captured in the reservoir to maximize downstream flood protection and hydropower generation. Beginning in 2005 the pool was managed more aggressively to reduce the peaks and adhere more closely to the prescribed guide curves. Recently 24-hour surveillance was initiated at the dam. This involves providing patrols of the dam, known wet and trouble spots, and downstream areas. Additional coordination and exercises have been held with state and local emergency management agencies. These agencies have been provided with flood inundation maps to help coordinate emergency

evacuations if needed. The Corps has improved its emergency notification procedures, increased instrumentation in and on the dam, and conducted numerous public meetings to advise the public of problems with the dam.

F. Mitigation Features. After the lake level has been lowered to reduce risk of dam failure, water supply intakes will have to be adjusted to draw from the lowered lake levels. In addition, state and local governments will have to be made aware of the emergency action. Special emphasis will be made to keep the public informed and educated as to the current project conditions, the need for the actions being taken, and emergency notification procedures.

ENVIRONMENTAL CONSEQUENCES

A. No Action. The No Action alternative would continue to maximize all of the authorized project purposes. This alternative would, however, do nothing to alleviate the risk of dam failure associated with maintaining the pool at the higher operational levels. Damages from potential dam failure were estimated at about \$3.6B. Potential loss of life depends on many variables, including the speed of dam failure, warning times, severity of the flood event, and the effectiveness of evacuation measures. Further explanations of socio-economic consequences from dam failure are described in Appendix C of the decision document.

B. Temporary Intermediate Guide Curve. A temporary guide curve of 700 in the summer and 685 in the winter at Wolf Creek provides for some continuation of authorized project purposes. It would have significant impacts on the fisheries, hydropower, recreation, and water quality, and moderate impacts on navigation and water supply. It does not provide sufficient reduction to stress factors on the dam's foundation and needed reduction in the risk to human life, health, property and severe economic loss that could result from a dam failure.

C. Lower Bounding Limit. Elevation 680 at Wolf Creek Dam would reduce the risk associated with dam failure to the greatest degree practicable. It would do so, however, at the expense of authorized project purposes. Flood damage protection and hydropower production would be seriously curtailed. Recreation and its attendant economic benefits would be seriously impacted. There would be a secondary economic ripple throughout the region as jobs, property values, and taxes suffered and communities were disrupted. At Wolf Creek Dam and Lake Cumberland eleven commercial marinas would be negatively impacted. Eight marinas would have to be partially moved. Three marinas would be stranded and completely inaccessible to the lake or would have to move to new locations that are not readily available. Wolf Creek's single public beach would be closed, as would 40 out of 48 launching ramps; moreover, 329 private boat docks would be adversely affected. Water quality throughout the Cumberland River would suffer and a number of municipal water intakes both in the lake and downstream from the lake would be adversely affected. Water and wastewater treatment costs would be increased significantly. Navigation would also experience some negative consequences.

Overall there will be a reduction in hydropower generation in the region. A lower pool level results in lower hydropower production at the project, and the need to keep the pool level down will mean that electricity generation will sometimes occur at periods other than high demand periods. Generation may have to be shifted to other projects in the Cumberland system. If that is not possible, power demand would have to be met by other power production facilities. The reliable operation of three fossil fuel plants would be at risk due to the reduction of cool water needed for cooling. The Corps would work closely with Southeastern Power Administration so that they may best balance their power supply requirements through all sources available to them.

While the intent would be to operate Lake Cumberland at lower levels throughout the year, water supply will continue to be an important operating consideration. Water intakes likely will be adversely affected. The Corps recommends that all intake users consider using this period to lower their intake structures, and the Corps will work with them to facilitate the permitting process.

Water quality impacts would be dependent on the amount and timing of rainfall. For generally dry conditions there would be only limited impacts to the immediate Lake Cumberland area. Low Cumberland River flows resulting from the combination of a Lake Cumberland restricted operation and dry conditions would have more of a water quality impact to the Cumberland River from Cordell Hull through Barkley. Wet conditions would threaten the coldwater regime and associated fisheries in the lake and in the river downstream. The Corps would increase water quality modeling and operate the system in a manner to protect these resources to the extent practicable.

There are potential historic property impacts from lowering pool elevations at Wolf Creek Dam. Section 106 of the National Historic Preservation Act requires Federal agencies to take into account the effect of their activities or undertakings on historic properties, and to provide the State Historic Preservation Officer (SHPO) and the President's Advisory Council on Historic Preservation an opportunity to comment. The Corps will consult with the SHPOs for Kentucky and Tennessee pursuant to Section 106./

Pre-inundation archeological surveys and subsequent survey of very limited scope of above pool recreation sites along the shoreline of Lake Cumberland have identified approximately 366 archeological properties on government fee land, including land now lying beneath the reservoir. Except for archeological sites located within recreation areas, the National Register eligibility of these properties has not been specifically evaluated. No survey of the fluctuation zone between the current Summer and Winter pool elevation has been conducted, and most archeological properties, if they occur within this fluctuation zone, would have suffered severely from erosion. However, coffins from at least one historic cemetery are regularly exposed during extreme low water events. The bodies from this cemetery were removed and re-buried in above pool cemeteries prior to inundation, but the remaining occurrence of relatively intact coffins at the very extremes of the current fluctuation zone is a strong indication that cemeteries, other historic features associated with small towns, farms, and homesteads, and archeological sites are likely to be present and exposed with additional lowering of pool elevations.

It is unlikely that archeological properties exposed by a limited lowering of current winter pool elevations will remain intact, and most may not be considered historic properties eligible for listing on the National Register; however, that determination would require survey and individual site evaluation. Archeological properties, both prehistoric and historic, if exposed, would likely be targets for the illegal collection of artifacts in violation of the Archeological Resources Protection Act.

Perhaps the most significant long-term impact would be to the cold water fisheries in the lakes and tailwaters. The Kentucky Department of Fish and Wildlife (KDFW) has estimated that if Lake Cumberland is lowered to the level now proposed to deal with the current emergency, there would be a complete loss of the cold water fisheries in the lake and in the tailwater. Economic losses in the first year would be in the neighborhood of \$200M. After a return to normal lake operations it would take 15 years to restock and restore the fisheries at a cost of about \$65M. Lowering and maintaining the lake at elevation 680 would also deplete the cold water reserve in Wolf Creek and would likely result in closure of the National Fish Hatchery located on the downstream side of the dam. The hatchery's direct benefits are estimated at \$50M per year and \$75M in indirect benefits.

There may be some remnant populations of Threatened or Endangered mussels left in the tailwaters. If remnants remain they may benefit from a warmer water regime, but dissolved oxygen is likely to be lower than desirable. Remnants of the warm water fisheries in the tailwaters may also benefit from a return to the natural water regime if dissolved oxygen is adequate.

PUBLIC INVOLVEMENT, CONSULTATION & NEPA COMPLIANCE

A. Public Awareness Program. The Corps has conducted 14 meetings with the public, stakeholders, and emergency management agencies to keep them informed of the problems at the Wolf Creek Dam and regarding the plans to repair the dam, and to plan appropriate emergency responses in the event of a dam failure. A web page has been set up to keep the public informed, and numerous information notices and interviews have been provided to the media. The Corps will continue these efforts, and will inform the communities near Wolf Creek Dam of the Corps' current plans to lower pool levels to 680 feet above msl..

B. Required Interagency Coordination. The various Federal and state agencies have been kept advised of the ongoing problems and the Corps' efforts to correct them as a part of the public involvement program, and because some of the activities contemplated would require permits. The FWS, KDFW, Tennessee Wildlife Resources Agency (TWRA), Tennessee Department of Environment and Conservation (TDEC), Kentucky Environmental and Public Protection Cabinet, and other relevant agencies have been notified of the emergency conditions that exist. The Corps will continue these efforts also.

C. CEQ consultation, NEPA alternative arrangements, and how NEPA compliance will be achieved. The President's Council on Environmental Quality (CEQ) was notified in early

January of 2007 of the Corps' intent to take emergency action and to temporarily draw down lake elevations at Wolf Creek Dam under its emergency authority provided in 33 CFR 230.8. These proposed arrangements are outlined in Exhibit 1. The Corps consulted with CEQ and requested concurrence with the alternative arrangements in accordance with 40 CFR 1506.11. CEQ approved the alternative arrangements on January 18, 2007. The Corps intends to take these interim emergency measures, and acknowledges the likelihood of significant adverse effects to the human environment and to a variety of economic interests as a result. The Corps also will publish a Notice of Intent in the Federal Register, and will initiate scoping for an Environmental Impact Statement (EIS). The EIS will address the potential consequences of not only the current proposed emergency lake level, but other pool levels or possible future remedial actions to the dam as well. If conditions change or if there is new information after the EIS is complete, a supplement will be prepared. It is expected that temporary emergency measures would not be continued beyond December, 2012. The Corps intends to base its decisions regarding future operations at Wolf Creek Dam on all available information from all available reliable sources, including information generated by the NEPA process. The Corps acknowledges that there would be severe impacts from the emergency measures prior to completion of environmental analysis. Communication with Federal, state, and local agencies and with the public will be paramount throughout the development of the EIS.

D. Public Involvement. The public will be given every opportunity to provide comments as the NEPA process goes forward. Initial scoping will invite the participation of all interested Federal, state, and local agencies and governments, stakeholders such as the marina operators, the local media, members of the public who have attended past public meetings, other interested members of the public, etc. In addition, requests will be made to the marinas for their mailing lists of current dock lessees and any other interested parties so that those persons can receive notice of all relevant developments. Our address and telephone numbers for points of contact will be published. An electronic mailbox has been established for people to submit electronic comments.

PREVIOUS NEPA DOCUMENTS

US Army Corps of Engineers. March 1976. Environmental Impact Statement, Continued Operation Maintenance and Management of Wolf Creek Dam, Lake Cumberland, Kentucky.

US Army Corps of Engineers. January 2005. Environmental Assessment, Wolf Creek Dam Seepage Reduction Study. FONSI signed 20 January 2005

US Army Corps of Engineers. March 2006. Environmental Assessment, Halcomb's Landing Relocation Study Environmental Assessment. FONSI signed 27 Mar 2006

Proposed Alternative NEPA Arrangements
For Wolf Creek Dam Emergency Measures
And Continuing Monitoring, Assessment and Construction

I. Nature and scope of the emergency: Several engineering studies have identified a high level of risk of dam failure at Wolf Creek Dam. Concern exists that the water pressure from the lake is causing erosion of the foundation materials, creating seepage paths under and through the dam. Public safety is of grave concern given the size of the Lake Cumberland impoundment, which is the largest reservoir east of the Mississippi. Potential adverse effects from dam failure would include: the impacts from flooding should the dam actively fail (flooding not only at the dam but all the way down the Cumberland River to include downtown Nashville), plus loss of all the dam's existing benefits of hydropower generation, water supply, navigation, flood control, recreation, and reduced water quality for both the human and natural environment.

II. Actions necessary to control the immediate impacts of the emergency: Because public safety is paramount, the Corps is implementing a range of emergency measures at the dam that reduce the likelihood of failure. The Corps is taking an incremental approach to implement these emergency measures. The most immediate step is to lower Lake Cumberland to elevation 680 feet above mean sea level for an indefinite period, unless and until the Corps determines that a different pool elevation level is more appropriate. Concurrently, the Corps will accelerate a grouting program in the most crucial areas of the embankment to further reduce seepage under the dam. Throughout all of this effort, the Corps will continually monitor and assess the situation to determine if further lake level drawdown or other alternatives to address the emergency are available and necessary.

Other steps taken to address the emergency will include the implementation of a comprehensive communication plan, establishment of a working group to advise the Corps on the appropriate engineering and scientific steps needed to deal with the problem, coordination with the U.S. Fish and Wildlife Service pursuant to the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, and other relevant authorities, and coordination with the EPA and other appropriate Federal, state, and local agencies.

III. Potential adverse effects of the proposed action: There will be adverse effects on power generation, water quality, fisheries, and recreation, among other things, from drawing down the level of the lake. At lake elevation 680, hydropower generation will be reduced significantly, such that the Southeastern Power Administration will not be able to use the facilities at Wolf Creek dam for peak power demand period requirements. Water quality in the Cumberland River will suffer from a reduced amount of dissolved oxygen and from warmer temperatures, potentially resulting in significant fish fatalities, loss of the cold-water fishery, and sulphuric ("rotten egg") odors that could be experienced all the way to Nashville. Recreation at Lake Cumberland will be severely

impacted as most boat ramps will be unusable, and boating may become much more hazardous with shallower waters creating more unseen underwater hazards.

IV. Components of NEPA process that can be followed and that can provide value to future agency decision-making (e.g. coordination with affected agencies and the public):

A. Interim emergency measures decision document: will include the basis for emergency action under Corps' implementing regulations (33 CFR 230.8), discussion of alternatives and likely environmental effects as they are currently known, coordination with the U.S. Fish and Wildlife Service pursuant to the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, and other relevant authorities, and with the EPA and other appropriate Federal, state, and local leaders and agencies, and a communication plan for the public and stakeholders.

B. Longer term: The Corps will issue a Notice of Intent to prepare an EIS and intends to complete either a full-scale EIS or the nearest approximation thereof that the circumstances will allow (the NEPA document). The NEPA document will address the Corps' existing and future efforts to preserve, repair, strengthen, and operate the Wolf Creek Dam and Lake Cumberland, including mitigation measures that can be implemented to minimize adverse effects from lowered lake levels and other measures. That NEPA document will offer the following:

1. Usual components of public scoping, discussion of purpose and need, alternatives analysis, discussion of baseline environmental conditions, impacts analysis including short- and long-term, and cumulative effects, and one or more decision documents making use of information generated by the NEPA process.

2. The Corps expects that it will encounter a number of interim decision points at which the Corps would contemplate, and possibly implement, additional emergency measures to reduce the likelihood of dam failure, such as changes to the Lake Cumberland pool level, before a final ROD based on the EIS can be completed and signed. One such decision point could occur as soon as April 2007, when the piezometric readings results are available after the grouting of the critical areas of the embankments has been completed. The Corps will evaluate those results and determine whether an additional drawdown of lake levels might be necessary, or implement other changes. Such decision points and interim decisions will take full advantage of whatever information has been generated by the NEPA process, and must be contemplated under our alternative NEPA arrangements. If the Corps determines that we must make other interim decisions before completion of the NEPA process (e.g., other decisions to lower or raise lake levels), the Corps will immediately notify the CEQ, other involved federal agencies, and state, local, and tribal officials. The Corps will also prepare and make public as quickly as feasible an environmental analysis regarding the impact of those interim decisions, if practicable, but not necessarily (depending upon safety considerations), prior to implementation of the interim decision. Nevertheless, the NEPA process will continue to move ahead notwithstanding any additional necessary interim

decisions and associated environmental analyses, and will be adapted to reflect any changed circumstances brought about by the interim decisions.

V. Duration of the emergency: Until such time as monitoring and assessment of effects of repairs show that seepage has subsided and that the risk of dam failure has been reduced to an acceptably low level.

VI. Potential mitigation measures: To minimize adverse effects from the initial drawdown of lake water levels, to the degree practicable and for as long as is practicable, the Corps plans to limit the drawdown to one or more water levels that will still allow some of the project purposes to be implemented, albeit to a reduced degree, as discussed in the decision document.

After receiving official notification of the impending drawdown of the water level of Lake Cumberland, the Corps will encourage the environmental departments of the Kentucky and Tennessee state governments to implement mitigation measures to restrict discharges currently authorized under state Clean Water Act (CWA) Section 402 permits, to compensate for the reduced amount of dilution of pollutants in the Cumberland River downstream of the dam.

The Corps will notify municipalities, industries, and other users of water from Lake Cumberland and from the Cumberland River downstream from the dam as early as is practicable of the Corps' plans to draw down the water levels in Lake Cumberland, so that those water users can modify their intake structures and take other measures to adapt to the change in circumstances.