

**The Senate
Committee on
Natural Resources**



**Interim Report
to the 81st Legislature**

Dam Safety

February 2009

SENATE COMMITTEE ON NATURAL RESOURCES

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February 9, 2009

The Honorable David Dewhurst
Lieutenant Governor of Texas
Members of the Texas Senate
Texas State Capitol
Austin, Texas 78701

Dear Governor Dewhurst and Fellow Members:

The Senate Committee on Natural Resources of the Eightieth Legislature hereby submits its interim report including findings and recommendations for consideration by the Eighty-first Legislature.

Respectfully Submitted,

Handwritten signature of Senator Craig Estes in black ink.

Senator Craig Estes, Vice-Chair

Handwritten signature of Senator Kip Averitt in black ink.

Senator Kip Averitt, Chair

Handwritten signature of Senator Glenn Hegar in black ink.

Senator Glenn Hegar

Senator Kim Brimer

Handwritten signature of Senator Juan "Chuy" Hinojosa in black ink.

Senator Juan "Chuy" Hinojosa

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Senator Carlos Uresti

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INTERIM CHARGE

Study the safety of major dams, levees, and other flood control structures across Texas, and determine the appropriate responsible agency [Texas Commission on Environmental Quality (TCEQ), Texas Water Development Board (TWDB), or the Governor's Office of Homeland Security] and the level of authority and funding needed to inventory, assess, repair or replace those with impairments. Develop liability and control standards for flood control structures and make recommendations to properly and safely manage these assets in the future.

BACKGROUND

FEDERAL DAM SAFETY DEVELOPMENTS

In 1972, the National Dam Inspection Act was enacted, creating the National Dam Inspection Program (NDIP). The NDIP was broken into two phases. Phase 1 of NDIP was intended to assist states with the improvement of their individual dam safety programs by authorizing the United States Army Corps of Engineers (USACE) to inspect and inventory dams for each state. Dams that did not meet federal standards were listed as unsafe.¹

Phase 2 of NDIP was intended to promote further study of the unsafe dams identified in Phase 1. During Phase 2, the Secretary of the Army was to report a state's unsafe dam listings to that state's governor, including, upon request, a recommended course of action

for mitigation. Although Phase 2 was not funded and therefore not implemented, Phase 1 of NDIP resulted in significant changes in standards used for dam evaluation.²

In 1986, Congress passed the Water Resources Development Act. This act authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID). Since the enactment of this legislation, USACE has continued to update the NID with the cooperation of the Association of State Dam Safety Officials (ASDSO), the Federal Emergency Management Agency, and state and local officials.³

TEXAS DAM SAFETY PROGRAM

Inspections of dams during the construction phase were performed in the 1920s and 1930s by board members of the Texas Board of Water Engineers, but, prior to 1969, there had been no significant effort to inspect dams after construction. The modern Texas Dam Safety Program (TDSP) began with the first inspections of existing dams. These inspections were carried out by the Texas Water Rights Commission in September of 1969.⁴

The first comprehensive dam safety rules for Texas were developed in 1986. Following the establishment of those rules, public concern for dam safety continued to increase as a result of the damage caused by particular dam failures. Additionally, dam inspections that identified possible risks to downstream populations and resultant liabilities for property owners intensified public awareness of problems with dam safety.⁵

In 1998, as a result of legislative and public interest, several efforts were made to study dam safety issues, including one by a taskforce established by TCEQ's predecessor, the Texas Natural Resources Conservation Commission, and one by the Texas House Subcommittee on Dam Safety. Both of these groups recommended updating Texas' dam safety rules. However, new rules were not developed until 2008.

In 2003, the ASDSO, at the request of TCEQ, performed a peer review of TDSP. The *Peer Review of Dam Safety Program of the Texas Commission on Environmental Quality* can be found in Appendix A. In May 2008, the State Auditor's Office released *An Audit Report on the Dam Safety Program at the Commission on Environmental Quality*, which can be found in Appendix B. Both reports recommended that new rules be developed and that TDSP be revitalized. The TCEQ developed new TDSP rules in 2008 that became effective on January 1, 2009.⁶ A full listing of the rules can be found at the following web address:

http://www.tceq.state.tx.us/compliance/field_ops/dam_safety/damsafetyprog.html.

AUTHORITY/JURISDICTION

The authority for TDSP is provided in the Texas Water Code, §12.052. The corresponding rules are contained in the Texas Administrative Code, Chapter 299. Other related sections of the Texas Water Code are §11.126, §11.144, and §12.015. Over 98 percent of the dams in the state are under TCEQ authority, including all dams built as NRCS assisted projects.⁷

CLASSIFICATION OF DAMS

Size Classification

Dams in Texas are classified in several ways, one of which is by size. The size classification of a dam is based on the dam's impoundment storage and height. Minimum size requirements for a dam to fall under TCEQ's authority are either (1) the dam height must be 25 feet or greater and the dam must have a maximum storage capacity of 15 acre-feet or greater; or (2) the dam height must be greater than six feet and the dam must have a maximum storage capacity of 50 acre-feet or greater.⁸ Dams that meet these minimum requirements are then grouped into three different categories. See Appendix C for the three size classifications of dams as noted in the TCEQ rules. Currently in Texas, 87 dams are classified as large, 1,945 dams are classified as intermediate, and 5,120 dams are classified as small.⁹

Hazard Classification

Another type of dam classification in Texas is hazard level. It is a common misconception that the hazard classification of a dam is based on the dam's condition. The hazard classification is actually based on the expected loss of human life and potential economic loss in the event of a dam breach or dam failure. If a dam failure would result in an expected loss of life and an excessive economic loss, the dam is classified as a high-hazard dam. When a dam failure would result in a possible but unexpected loss of life as well as appreciable economic loss, the dam is classified as a significant-hazard dam. If a dam failure would result in no expected loss of life and minimal economic loss, the dam is classified as a low-hazard dam.¹⁰ For the hazard

classifications of dams as designated by TCEQ, see Appendix D. Currently, of the dams under TDSP's authority, 976 are classified as high-hazard, 789 are classified as significant-hazard, and 5,387 are classified as low-hazard.¹¹

OWNERSHIP OF DAMS

Currently, there are approximately 7,000 dams in TCEQ's inventory. Dams in Texas have a variety of owners ranging from public utilities to individuals. See Appendix E for a list of various types of dams and respective owners. While larger dams are usually the most well known, they are limited in number across the state. The majority of the dams in the state are privately owned or owned by individuals. Another large portion of the dams in Texas are owned by local sponsors. Local sponsors include partnerships among soil and water conservation districts (SWCDs), county governments, municipalities, and special districts such as water control and improvement districts. The dams sponsored by SWCDs were built in partnership with the Natural Resources Conservation Service (NRCS), which is described in more detail below.

NATURAL RESOURCES CONSERVATION SERVICE - ASSISTED PROJECT DAMS

In the mid-1930s, Congress began looking at ways to complement the downstream flood control program of the USACE. The federal government passed flood control acts in 1936, 1944, and 1954, and assigned responsibility for the Watershed Protection and Flood Prevention Program to the United States Department of Agriculture Soil Conservation Service, now NRCS.¹²

The NRCS-assisted project dams were initially built to protect agricultural lands and property, rural roads, and small towns from flood damage and required the participation of local sponsors. Local sponsors and NRCS signed an operation and maintenance agreement that outlined the duties and responsibilities of the local and federal sponsors. Generally, local sponsors have been required to obtain and enforce easements, conduct operation and maintenance inspection, maintain the structures, and implement land treatment measures in the watershed. The NRCS has been responsible for providing the local sponsor with technical assistance. The operation and maintenance agreements typically have a 50-year expiration date.¹³

Construction of the majority of the NRCS-assisted project dams began in the 1950s and continued through the 1970s. Most of the dams constructed during that time were built in rural areas and were classified as low-hazard dams. The NRCS has assisted watershed sponsors with the construction of 1,995 flood water retarding structures in 145 watershed projects in Texas.¹⁴

Many of the operation and maintenance agreements between local sponsors and NRCS are now reaching their 50-year expiration dates. Upon the 50-year mark, the NRCS will no longer be obligated to provide technical assistance. While the local sponsors will have no contractual responsibility to NRCS to continue operation and maintenance of the dams, they have always been, and will continue to be, responsible for operation and maintenance under the TDSP. Local sponsors are concerned about the loss of technical assistance from NRCS and have turned to the state for assistance.

The TDSP has experienced an increased number of requests for inspections on NRCS-assisted project dams, which has resulted in the need for additional state resources. Additionally, many sponsors are considering returning the property easements for these dams to the property owners which could result in a change of the original function of the dams and potential loss of flood protection. Staff at TCEQ have been working with local sponsors, the NRCS, and the Texas State Soil and Water Conservation Board (TSSWCB) to try to address this issue.¹⁵

INTERIM EFFORTS/ISSUE STATUS

INTERIM COMMITTEE HEARING

The Senate Committee on Natural Resources held a public hearing in Dallas, Texas, on May 13, 2008. A portion of the testimony focused on dam safety. The Dallas hearing agenda can be found in Appendix F.

SAFETY STANDARDS/INSPECTIONS

The current rate of dam inspections is well below best practice standards established by ASDSO. For example, ASDSO recommends that high-hazard dams be inspected annually and significant-hazard dams be inspected once every two years. However, based on the rate of inspection achieved by TCEQ in fiscal year 2007, an additional 1,098 inspections would have had to have been completed to achieve this target.¹⁶

Although TCEQ took the ASDSO best practice standards into consideration, due to limited resources, the new TDSP rules state that high-hazard dams, significant-hazard dams, and large dams with a low-hazard classification must be inspected every five years.¹⁷ The TCEQ average rate of inspection for 2007 and 2008 was 266 inspections per year. A minimum of 330 inspections per year would need to be performed by TCEQ to maintain the five-year inspection cycle for high and significant-hazard dams. This inspection cycle would not include inspection requests from owners of low-hazard dams or complaints filed about specific dams, which also need to be addressed.¹⁸

Additionally, based on a recommendation made in the State Auditor's report (Appendix B), formal TCEQ risk-assessment criteria has been developed to ensure the identification of dams with the highest risk and to guide the prioritization of inspections. This criteria includes six categories of risk assessment: hazard classification, last date of inspection, size classification, age, condition, and hydraulic adequacy. Evaluation of all of these categories determines where a dam is placed on the inspection cycle.¹⁹

DOWNSTREAM DEVELOPMENT

An issue that has presented challenges is the lack of restriction and oversight related to development downstream of a dam. Across the state, dams exist that were initially built in rural areas with little or no downstream property development. However, over the years, urban and suburban development has taken place in the floodplain of many of these dams. While these dams may have been adequately suited for an agricultural

setting, many of them may now need improvements to sufficiently protect downstream populations and property.

MAINTENANCE OF DAMS

Approximately 85 percent of dams in Texas are over 25 years old, and 27 percent are over 50 years old. In many areas downstream of these dams, development has boomed. As development downstream of a dam increases, so does the hazard classification, requiring structural upgrades and increased maintenance costs. In 2003, ASDSO estimated that it would cost more than \$711 million to rehabilitate the non-federally owned, high-hazard dams in Texas.²⁰

All dam owners are responsible for a dam's upgrade, maintenance, and rehabilitation. However, all dam owners do not have the same resources to accomplish these tasks. Private and individual dam owners have no mechanism for assessing fees on homeowners who live below their dams. Many dam owners feel that they should not be held responsible for increased costs associated with downstream development that is beyond their control, especially when the downstream development is taking advantage of flood control benefits that the dam provides. These factors result in a large number of dams receiving little maintenance and improvements.²¹

With respect to the NRCS-assisted project dams, the partners associated with these dams, which include SWCDs and local governments, are responsible for operation and maintenance of dams. These public dam-owning entities, such as SWCDs, lack taxing

authority for dam improvements and maintenance. Consequently, because TSSWCB is a state entity and responsible for SWCDs' funding, the operation and maintenance requirements will mean that the state will face additional fiscal responsibility.

Liability

Increasing hazard classification levels resulting from downstream development also results in increased liability for dam owners. The state dam safety criteria addresses some liability concerns by requiring dam owners to follow certain design safety standards, although owners still remain liable even when these standards are met. A dam owner's liability is even greater should they not adequately maintain their dam to remain in compliance with state criteria. The TCEQ regulates dams, but the private owner or operator of a dam is considered legally responsible for the consequences of a dam failure or improper operation of a dam.²² Ensuring public safety is the State's top priority and may be threatened by lack of action on the part of dam owners. Establishing guidelines that can apply simultaneously to such a diverse group of dam owners has resulted in significant challenges when attempting to assess problems and generate solutions relating to aging dam infrastructure.

TEXAS DAM SAFETY PROGRAM DEVELOPMENTS

Current Program

The TDSP has suffered due to a lack of a dedicated funding source and the loss of general revenue dollars. However, since December 2003, TCEQ has taken the following steps to improve TDSP:

- rehiring the experienced former Dam Safety Program supervisor to oversee operations and direct activities
- moving all regional dam safety positions back to the central office in Austin
- developing a training program that includes safety evaluation of existing dams and dam operators courses presented by the United States Bureau of Reclamation, hydrologic and hydraulic courses, a geotechnical course, Geographical Information Systems and Global Positioning Systems courses, an erosion and sedimentation control course, risk assessment training, and refresher training for professional engineer licensing
- determining the critical infrastructure listing of dams
- increasing the visibility of the state dam safety program by increasing the numbers of inspections, contacting owners about inspecting, sending reports to owners with a request for response, reviewing owners' and consultants' inspection reports, and responding to owners' questions, and
- amending existing rules²³

New Rules

In 2005, TCEQ began developing new rules for TDSP by conducting two stakeholder meetings. The group of approximately 40 stakeholders consisted of dam owners, professional engineers, associations, sponsors of NRCS-assisted project dams, federal agencies, and state agencies. In 2005 and 2006, TCEQ also met with the Texas Association of Watershed Sponsors, the Texas Water Conservation Association, and the American Society of Civil Engineers to discuss the proposed rule package. Two additional stakeholder meetings were held in 2008 that included several individuals who participated in the 2005 stakeholder meetings.²⁴

The rules that resulted from the stakeholder process more closely align TDSP with federal and other state programs, as well as with current engineering industry practices. The new rules address the design, review, and approval of construction plans and specifications for new dams in Texas. The rules also contain provisions for proposed and existing dams that address issues of construction, operation and maintenance, inspection, repair, removal, emergency management, site security, and enforcement. The new rules better define owners' responsibilities and add requirements for emergency action plans, gate operating plans, and security plans.²⁵ As referenced earlier, the new TDSP rules, that became effective on January 1, 2009, may be found at the following web address: http://www.tceq.state.tx.us/compliance/field_ops/dam_safety/damsafetyprog.html.

Budget

On October 8, 2008, Senator Kip Averitt, Chairman of Senate Committee on Natural Resources, sent a letter to TCEQ requesting that additional funds be expended in order to increase the number of dams inspected prior to January 2009. The communications between Senator Averitt and TCEQ can be found in Appendix G. In response to Senator Averitt's request, TCEQ has reallocated resources from other agency programs to the dam safety program. The TCEQ's budget for the 2008-2009 biennium is \$200,000 in federal funding and \$200,000 in state funding for contract inspections of dams. An additional \$400,000 in state funding has been allocated to increase the number of dam inspections. Five full-time employees have been moved from other TCEQ programs to TDSP to ensure that there is adequate staff to handle oversight of the additional contracts and the increased number of inspection reports. The TCEQ estimates that the reallocation of resources will produce 100 additional dam inspections, which should be completed prior to the legislature's consideration of additional budget requests for the 2010-2011 biennium. The increased inspections will provide the legislature with better data to make decisions regarding necessary appropriations for the future.²⁶

The TCEQ's Legislative Appropriations Request for the 2010-2011 biennium includes an exceptional item request of \$2.5 million for TDSP. The request would fund 12 additional positions in 2010 and another 12 in 2011. This would significantly increase the rate of inspection for high and significant-hazard dams.²⁷

CONCLUSION

An accurate inventory of the number, size, and condition of dams in Texas should be a priority for the State. It is essential that the TDSP yearly dam inspection rate be increased to a level that will enable TCEQ to accurately assemble this inventory and effectively identify and prioritize those structures where rehabilitation is essential to the protection of downstream populations. The workload for TCEQ will continue to increase as additional 50-year agreements of NRCS-assisted project dams expire. Because there is limited funding available to dam owners for rehabilitation, once problems with a dam are identified, the State should ensure that adequate resources are available before the dam's failure is imminent. In recent years, TCEQ has increased efforts to address impending problems with dams in Texas. However, TCEQ has reached a point where it is necessary for the Legislature to step in and aid their efforts through an increase in TDSP funding. Texans could find themselves in a situation in which lives and property are threatened by aging dam infrastructure.

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- ¹ Association of State Dam Safety Officials, Peer Review of the Dam Safety Program of the Texas Commission on Environmental Quality, January 27, 2003.
- ² Id.
- ³ US Army Corps of Engineers Website,
<<http://www.usace.army.mil/Library/Maps/Pages/NationalInventoryofDams.aspx>>
- ⁴ Id at 1.
- ⁵ Warren Samuelson, Testimony before the Senate Committee on Natural Resources, May 13, 2008, Dallas, Texas.
- ⁶ Warren Samuelson, Personal Communication, December 11, 2008.
- ⁷ Id at 8.
- ⁸ Title 30 Texas Administrative Code Section 299.1.
- ⁹ Warren Samuelson, Personal Communication, April 16, 2008.
- ¹⁰ Id at 5.
- ¹¹ Id at 8.
- ¹² Rex Isom, Personal Communication, February 14, 2008.
- ¹³ Richard Egg, Personal Communication, February 6, 2009.
- ¹⁴ Id at 12.
- ¹⁵ Id at 5.
- ¹⁶ Mike Stiernberg, Testimony before the Senate Committee on Natural Resources, May 13, 2008, Dallas, Texas.
- ¹⁷ Title 30 Texas Administrative Code Section 299.42.
- ¹⁸ Id at 5.
- ¹⁹ Warren Samuelson, Personal Communication, March 7, 2008.
- ²⁰ Association of Dam Safety Officials Report on Dams in Texas, 2003
- ²¹ Committee on Natural Resources, Interim Report to the 76th Texas Legislature, November 1998.
- ²² Id.
- ²³ Id at 5.
- ²⁴ Background and Summary of the Factual Basis for the Adopted Rules, Chapter 299 - Dams and Reservoirs, Texas Commission on Environmental Quality.
- ²⁵ Id.
- ²⁶ Mark Vickery, Personal Communication, October 17, 2008
- ²⁷ Warren Samuelson, Personal Communication, August 25, 2008.

Appendix

A

**PEER REVIEW
OF THE
DAM SAFETY PROGRAM
OF THE
TEXAS COMMISSION
ON ENVIRONMENTAL QUALITY**

Prepared by:

Alan E. Pearson (Team Coordinator)

John M. Healy

James H. Weldon

January 27, 2003

**Association of State Dam Safety Officials
(ASDSO)**

**PEER REVIEW
OF THE
DAM SAFETY PROGRAM
OF THE
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY**

EXECUTIVE SUMMARY

1. Background

This report documents the observations, findings, and recommendations made by the Peer Review Team of the Association of State Dam Safety Officials (ASDSO) on the State of Texas Dam Safety Program (DSP) of the Texas Commission on Environmental Quality (TCEQ), conducted October 29 through 31, 2002, at their Central Office in Austin, Texas. The peer review was requested by Mr. Chau Vo, Dam Safety Program Coordinator. The objective of the Peer Review Program is to provide professional guidelines to dam safety agencies to improve the management of their dam safety programs. The Peer Review Program seeks to raise the level of dam safety practice by evaluating an agency's mission, goals, objectives, policies, and procedures, and its compliance with them. The peer review evaluates the competence of the dam safety program relative to the generally accepted standards of practice.

2. Summary of Findings and Conclusions

The Peer Review Team found that the Texas Dam Safety Program is seriously deficient in meeting the statutory and regulatory requirements of the state's dam safety laws. In order to bring the program to a level that would be considered adequate in comparison to satisfactory programs, the following actions are recommended.

- A. Amend the statutory authority to include all the elements of the Model State Dam Safety Program.
- B. Update, revise the regulations to reflect the recommendations from the Executive Director's Task Force on Dam Safety Report, 1998; clarify the ambiguities in the existing regulations; and include the elements for regulation that are recommended in the Model State Dam Safety Program.
- C. Restore the engineering technical staffing to its previous levels in order to carry out the dam safety program in a professional manner.
- D. Increase the administrative staffing for the program to improve efficiency.

In order for the present staff to improve their abilities to analyze dam safety problems, make optimum use of present training funds available from ASDSO, training opportunities available from the Federal Emergency Management Agency, and federal dam safety agencies (i.e. ICODS).

Communication in a decentralized organization is usually a problem area. This was found for the dam safety program. In order to improve communication, it is recommended that the division managers prepare policies on responsibilities among the several managers in the organization, and then procedures can be prepared for assuring adequate communication.

The reader is referred to Section 4 of this report for other specific recommendations offered by the Peer Review Team for improvement of the program.

3. Overall Review of Program Effectiveness

From the staff interviews and review of the documents provided by the dam safety office, we found that in spite of the limited resources presently available to the program, the managers and staff are motivated to perform the best they can to assure the safety of dams in Texas. In order to improve the effectiveness, Texas should consider developing a strategic plan that identifies what the managers and staff have accomplished to date, where they want to be in five years, what resources they need to accomplish their goals, and what performance measures will be used. The plan should include a mission statement for the Dam Safety Program, its goals, objectives, and tactics.

4. Acknowledgements

The Peer Review Team wishes to acknowledge the support of Mr. Chau Vo, Dam Safety Program Coordinator, and his dam safety staff for assembling the information required for the review and their participation in the interviews; of Mr. Elston Johnson, Water Section Manager, Field Operations Division for his contributions to the review; and Mr. Jeff Tate, Ms. Donna Phillips, and Mr. Steve Smith, Regional Team Leaders, for their participation.

**PEER REVIEW
OF THE
DAM SAFETY PROGRAM
OF THE
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY**

1 INTRODUCTION

1.1 Scope

This report documents the observations, findings and recommendations made by the Peer Review Team of the Association of State Dam Safety Officials (ASDSO) on the dam safety program of the Texas Commission on Environmental Quality (TCEQ). The peer review was conducted on October 29 – 31, 2002, at the central office of the TCEQ, Austin, Texas.

This report is divided into five sections: (1) Introduction, (2) TECQ Dam Safety Program, (3) Observations and Findings, (4) Recommendations and (5) Certification. Each section is based on the interviews and observations made by the Peer Review Team of staff members chosen by the agency responsible for or assisting with the dam safety program of the agency.

1.2 Objective

The objective of the Peer Review Program is to provide professional guidance to dam safety agencies to improve the management of their dam safety programs. The Peer Review Program seeks to raise the level of dam safety program practice by evaluating an agency's mission, objectives, policies and procedures, and then examining its compliance with those policies and procedures. The Peer Review evaluates the competence of the program relative to the generally accepted standards of practice of dam safety.

The Peer Review is limited in scope and cannot determine, ascertain or guarantee an agency program complies with all applicable state, federal or provincial regulations or standards of practice. A team of engineers and dam safety professionals performs the Peer Review. The Peer Review produces a technical opinion, not a legal opinion. The state attorney general, federal attorney, or other appropriate legal authority must render a legal opinion.

It is recognized that the success of any dam safety program depends upon adequate program funding, the quality of physical inspections, dedication and commitment of the regulatory agencies, and especially the due diligence of the dam owner or operator.

The Peer Review Team provides this written report, which documents their findings and recommendations. However, the Team does not perform any follow-up, nor provide sanctions for not following recommendations. It is the responsibility of the reviewed dam safety agency and its state legislature, congress, or enabling body to implement any recommendations.

Further, the Peer Review Team does not inspect any dam as part of the Peer Review Program. The program does not, therefore, involve safety inspection of structures, or even the review of any specific inspection undertaken by the agency.

While an appropriate and well-managed dam safety program is vital to the interests of public health and safety, ultimately dam safety is contingent upon the commitment of the dam owner/operator.

1.3 Key Points

The key points to remember in interpreting this report are the following aspects of the ASDSO Peer Review Program:

A peer review is voluntary. This Peer Review was requested by the TCEQ. The access to certain materials and the documents reviewed was given voluntarily by the agency. The documents reviewed may or may not be representative of the agency's practice. Likewise, certain individuals who were interviewed, whether they were suggested by the Engineer/Director or chosen by the Peer Review Team, may not be entirely representative of the agency, nor fully responsive to the Peer Review Team. Nevertheless, the best efforts were made on these limited views of the agency.

A peer review is confidential. The team will maintain confidentiality with respect to the sources of various observations that are reported here. The Peer Review Team informed the staff that all comments would be treated in a confidential manner. The Peer Review Team asks that the agency does not probe beyond what is stated in the report concerning the sources of the comment or suggestions.

A peer review is to evaluate practices and procedures. It is believed that a healthy agency must have definite policies in the seven areas of practice that the Peer Review program identified. These seven areas are: (1) Organizational Management, (2) Management, (3) Emergency Management Procedures, (4) Technical Practice and Procedures, (5) Human Resources Management, (6) Financial Management, and (7) Public Relations Practices. The Peer Review Team tried to cover all seven of these areas adequately. However, in the review of the projects, not all technical aspects of the designer's approach to the project have been examined. No calculations for their correctness, nor confirmation of the results of the calculations are reflected in the contract drawings or in the reports. Similarly, the documents that were furnished were reviewed only from the standpoint of apparent conformance with the policies of the agency as to work planning, production, and adherence to the quality control/quality assurance policies.

1.4 Procedures

The interview and procedures followed by the Peer Review Team followed the manual, "Peer Review for Dam Safety Agencies," issued by the Association of State Dam Safety Officials (ASDSO) in September 2000. This document was also made available to the Dam Safety Office of TCEQ prior to the peer review. Documents that were needed for review prior to the peer review were submitted by the agency to the members of the Peer Review Team in advance. Confidential interviews were made with personnel involved with dam safety. A tour of the office and cursory review of several dam safety files and an Inventory of Dams were also made.

1.5 Confidentiality

Because each member of the peer review team would have access to confidential information, each member submitted to the Dam Safety Office of TCEQ and ASDSO, prior to the formal process of the peer review, a signed "Peer Reviewer Statement of Nondisclosure." This was required in order to preserve the confidentiality of the responses of the agency's staff members. The statement of nondisclosure states in part that the signatory will, "...neither copy nor disclose such information in whole or in part to anyone other than members of the review team, the Peer Review Committee and the Administrator without the prior consent of the [agency]." It is not intended that this report and documentation of the findings and recommendations in any way violate the statement of nondisclosure or reveal matters that would be considered confidential by the agency. Further, this document was reviewed for consistency and appropriateness by the agency and the Peer Review Team.

1.6 Members of Peer Review Team

The Peer Review Team that visited the Texas Commission on Environmental Quality was composed of the following members:

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A short biographical sketch on the members of the Peer Review Team is included in the Appendix.

2. THE STATE OF TEXAS DAM SAFETY PROGRAM, COMMISSION ON ENVIRONMENTAL QUALITY

2.1 History

The Texas Dam Safety Program has developed through five distinct phases.

- **Board of Water Engineers**

The origins of the Texas Dam Safety Program began with the Board of Water Engineers, the original predecessor agency to the TNRCC. In the 1920s and 1930s, the board members themselves inspected dams under construction. (Approximately 350 dams, which are still in use, were constructed between 1920 and 1939.) Routine operation and maintenance inspections of existing dams were not a common practice, and dam safety monitoring and compliance were left to the dam owners.

- **Texas Water Rights Commission - 1968 to 1977**

The modern program began with three staff members in 1968 because of the realization that dam safety concerns must be addressed. (Approximately 4,700 dams had been constructed by this time.) Initially, the staff focused on plan reviews and construction inspections for proposed projects that required water use permits. These structures were reviewed for general compliance with accepted (but not codified) design/construction practices and standards in the area of geotechnical and structural engineering.

However, there were no defined state standards for hydrologic criteria during this period; dam safety hydrologic philosophy was still in development. Hydrologic and hydraulic assessments were not the responsibility of the Dam Safety Team. A separate Hydrology Team was responsible for water availability modeling and assessments of spillway adequacy. The Hydrology Team first used the Commons Hydrograph, and later, the Soil Conservation Service (SCS) methodology to evaluate proposed dams. Although the concept of probable maximum precipitation (PMP) as a basis for hydrologic criteria was

utilized in the SCS method, the ability to technically assess and predict the potential impact from a dam failure was still limited. Hazard classifications were normally based on subjective engineering judgment. Other resources, such as supporting computer technology and software, were also limited.

The first routine inspections of existing, authorized dams began late in 1969. Dams with known maintenance or safety problems were monitored as necessary and/or advised to be corrected. Routine inspections were generally scheduled on a five-year basis. By 1976, the Dam Safety Team included about 12 members and was supported by the Hydrology Team of approximately five members.

- **1977 to 1981 Phase I, National Dam Safety Inspection Program**

Phase I of the National Dam Safety Inspection Program, authorized and funded by Congress (PL 92-367), was brought about by a number of significant dam failures in the United States: Buffalo Creek (1972), Teton (1976), and Kelly Barnes (1977). The Phase I Program was intended to help the states initiate or improve their own dam safety programs. Phase I consisted of the creation of a National Inventory of Dams, and a quick, one-time evaluation (using federal criteria) of all high hazard dams identified from the inventory effort in each state. Dams that were found to be structurally inadequate, and/or those that were unable to safely pass at least 50 percent of the spillway design flood (e.g. 50 percent PMF for high hazard dams) required by the Phase I Program, were listed as "unsafe." The "unsafe" status was a simple approach to identify and prioritize the high hazard dams that were most in need of attention. Phase II of the program was intended to conduct detailed studies of the "unsafe" dams identified by the Phase I evaluations. Unfortunately, Phase II was never funded by Congress nor by the state Legislature.

The Phase I Program was carried out in Texas by a number of contractors under direction of the U.S. Army Corps of Engineers. Most of the dams evaluated were contracted to the Texas Department of Water Resources (TDWR), which was created in 1977 by combining the Texas Water Rights Commission, the Texas Water Development Board, and the Texas Water Quality Board.

With the additional financial support from federal funds, the staffing level of the Dam Safety Program during the Phase I Program approached a peak of 30 members, consisting of engineers, geologists, and technicians. Approximately 15 additional hydrologists were added to the Hydrology Team to provide support to the Dam Safety Team. While the federal program focused on the assessments of high hazard dams, routine duties associated with water rights and new construction were continued.

Several important features of the national program greatly assisted the state dam safety effort in Texas: 1) Resources became available for identifying and inventorying all existing significant and high hazard dams in Texas, not just those with water use permits; 2) A set of national guidelines was universally applied; and 3) New technical approaches and resources became readily available.

The character of the Texas Dam Safety Program began to change under the influence of these resources, especially in the field of hydrology and with the assessment of spillway adequacy. Studies had shown that more than one-third of all dam failures were due to inadequate spillway capacity. Spillway adequacy thus became a major feature of the evaluation, in addition to the physical inspections. The Phase I Program used the probable maximum flood (PMF) as the standard for dam safety hydraulic criteria.

Equally important, the state introduced alternative approaches and options to dam safety analysis. For example, breach analyses were used in determining hazard classification and in supporting downstream incremental damage studies (i.e., studies of increased flood damages due to a failure as compared to non-dam failure flood damages).

The introduction of computer-supported breach analyses allowed a more objective determination of hazard classification and public risk assessment. For the first time, engineers were able to conduct an evaluation of the effects of a breach wave in terms of what would actually be flooded in case of a dam failure, and whether the increase in flooding actually represented an increase in risk to the public. A determination of increased risk, however, was limited only to consideration of an increase in flooding depths.

Incremental damage studies are an elementary form of risk assessment which recognize that some dam failures will not significantly impact downstream development at all

expected levels of breach flooding. In many cases, incremental damage studies were used to reduce the required spillway design flood from the basic criteria of the Phase I Program. This concept was later included in the state's first dam safety rules -- Chapter 299, Dams and Reservoirs -- which were adopted in 1986.

There were several general limitations to the Phase I Program: 1) It was only intended to help the states improve or initiate their dam safety programs; 2) It was never intended to "fix" the problem dams identified by the effort; 3) It was never intended to be a federal mandate; and 4) The continued direction and funding of dam safety in regard to correcting deficient dams, setting criteria, and refining procedures were left to each of the participating states.

The Phase I Program also presented several important technical limitations. Although computer-supported breach analyses allowed a more objective definition of hazard classification, the definition of what actually constituted acceptable levels of hazard was rather vague. No detailed method of prioritizing the potential threat posed by dams was presented, partially because the public was reluctant to set a monetary value on the loss of life. No detailed methods of risk assessment were introduced. Hydraulic routing methods of floods and breach waves were in their formularize stage.

- **Time Period of 1981 - 1986**

The influence of the Phase I Program continued after its conclusion in 1981. Although the state reduced staffing of the Dam Safety Program in 1981, staffing levels initially remained above the pre-Phase I levels to maintain the inspection and monitoring schedules for the many additional dams added to the state inventory of dams (approximately 5,800 dams had been inventoried by this time), to perform routine spillway adequacy studies, and to address the 242 "unsafe" dams that had been identified in the Phase I Program. The scope of effort had greatly increased.

The biggest challenge faced by the Dam Safety Team was to assist the owners of unsafe dams in the further evaluation and upgrading of their dams. As previously noted, the federal government never funded the proposed "Phase II" of the federal program to reevaluate and refine the studies for these structures. With federal money no longer available, the state program was not able to conduct technical research to improve

engineering procedures for risk assessment, define regional PMP values, perfect hydraulic routing and breach methods, etc. However, the state did initiate attempts to address the "unsafe" dam issue.

In 1985, the Texas Department of Water Resources (TDWR) was reorganized into the Texas Water Development Board and the Texas Water Commission. The Texas Water Commission assumed the regulatory and enforcement functions of the dissolved TDWR, including dam safety oversight.

The Hydraulics Team was formed in 1985, as part of the Dam Safety Section, to provide hydrologic and hydraulic analyses for dams. However, the state reduced the staffing level of the Dam Safety Team, resulting in no net gain of staff in the section.

- **1986 to 1998**

Based on the federal guidelines from the Phase I Program, the Dam Safety Team developed specific rules for dam safety criteria. The rules were formally adopted in 1986 in Chapter 299 of the Texas Administrative Code (TAC). These rules are currently governing the state's Dam Safety Program. Cross training of the Dam Safety Team and the Hydraulics Team staffs was instituted to improve the effectiveness of both teams. However, staff reductions during the late 1980s, due to the state's declining economy, hampered this initiative.

The problem of population pressures on floodplain development, resulting in the subsequent upgrading of the hazard classifications for many dams, was recognized. Thus, the state identified the desirability of relating the Dam Safety Program with floodplain management.

During the 1990-91 period, the Dam Safety Program investigated elementary risk analyses to prioritize allocation of resources. The program also issued the *Guidelines for Operation and Maintenance of Dams in Texas* in September 1990 to serve as the state's first published safety guide for dam owners. This safety guide was part of the Dam Safety Program's concerted effort for public education.

Both the public impact of the 1986 rules and downsizings led the staff to draft proposed changes to the rules in 1991. (The rules had significantly increased the hydrologic safety criteria at a time when public perception of the regulatory role of government was changing. The decline of the state economy also had a significant impact.) Included in the proposed changes were considerations to reduce the hydrologic criteria in some instances, to allow mitigation of dam safety risks to the public through non-structural solutions, and to reduce state involvement by placing more of the inspection burden on the dam owners themselves.

Continued downsizing in experienced staff and resources, however, hampered the Dam Safety Program's ability to fully implement and monitor the program requirements. In 1991, the Hydraulics Team was dissolved and the remaining staff was combined with the Dam Safety Team. The various initiatives to improve the program were discontinued or greatly reduced due to the lack of resources.

In 1993, the Texas Water Commission merged with the Texas Air Control Board, the Water Well Drillers Board, the Board of Irrigators, and a portion of the Texas Department of Health (the Water Hygiene Division and the Solid Waste Bureau) to form the Texas Natural Resource Conservation Commission (TNRCC).

By 1996, the Dam Safety Program (DSP) staff was down to six team members. In addition to maintaining the normal duties of the program, the Dam Safety Team was also called upon from time to time to assist with ground water studies, agricultural permitting, water rights studies, drought response, and floodplain management issues. With normal duties including the support of water use permit applications, plan reviews, routine inspections, hydrologic analyses, complaint response, and maintenance of the inventory, the Dam Safety Team was unable to fulfill even its basic program objectives.

By 2001, DSP staff was down to five members separated into three regional locations. One member was in Austin, while two inspectors were relocated to the Houston and Fort Worth regions due to an initiative to decentralize state government.

With the retirement and reassignment of key personnel, the staff is now at a very low technical and experience level relative to dam safety. Also, the four field inspectors report,

both administratively and functionally, directly to their respective regional water section managers and not to the DSP manager in Austin. In response to severe understaffing and resources, the DSP has contracted out about 40percent of its dam inspections to the Natural Resources Conservative Service (NRCS). Also, a private dam consulting firm has been contracted to provide services for emergency safety assessments in the case of a severe flood event.

Statutory Authority

Statutory authority for the dam safety program in Texas are found in Chapters 11 and 12 of the Texas Water Code (TWC). TWC Section 12.052 is the primary or "umbrella" section and includes Chapter 299 setting the standards for Dams and Reservoirs. Other pertinent sections for dam safety are TWC Sections 11.126, 11.144, and 12.015.

2.2 Organizational Structure

The Dam Safety Program (DSP) is presently operating under the Office of Compliance and Enforcement, Field Operations Division of the Texas Commission on Environmental Quality (TCEQ). There are five full time staff assigned to the DSP; one member in the Central Office Water Program Support and four inspectors, two each assigned to the Dallas-Fort Worth Region 4 and Houston Region 12 offices.

The principal duties of the Central Office are dam construction design and plan approval, project reviews for water rights permitting, hydrologic and hydraulics analysis, emergency action plan reviews, state and federal grant administration and dam safety technical support for the regions.

The principal duties of the regional dam inspectors are the initial and formal dam safety inspections of "existing dams" or permitted dams. They operate under the supervision of team leaders in their respective regional offices.

The organization charts for the TCEQ are shown in the Appendix.

2.3 Publications

Following is a list of publications that the agency uses to implement or enforce the dam safety program.

- Chapter 299, Commission Rules on Dams and Resources
- Design and Submittal Check Lists for Review and Approval
- Texas Dam Safety Program "Guidelines for Operation and Maintenance of Dams"
- Texas Inventory of Dams

3. OBSERVATIONS AND FINDINGS

The following observations were made of the State of Texas Dam Safety Program (DSP) during the Peer Review Team study on October 29 – 31, 2002. As mentioned in Section 1.3, the following is structured and divided among the seven areas of practice in a typical dam safety program:

3.1 Organizational Management

- There is a goal and requirement that a certain number of dams classified as "high" hazard be inspected on an annual basis. This goal is being met.
- There appears to be no clear mission statement or long term plan that identifies the goals and objectives of the Texas Dam Safety Program.
- There appears to be three separate management methodologies utilized within the dam safety programs.
- There also appears to be no documents that clearly and concisely outline the dam safety purpose, professional goals and objectives.
- The goals and objectives of the DSP are determined by the water program manager in consultation with the regional managers during annual planning meetings. Their objectives are to conduct about 40 safety inspections of high hazard dams per dam inspector annually. These inspections are by supplemented contracted inspections to consultants and NRCS. The dam safety staff generally accomplishes the inspections to meet the objectives.
- There is an organizational structure, which is shown in the appendix, that defines reporting relationships on an administrative level. It is not obvious that there is a functional and technical relationship between the main and regional offices.
- There are no written policies and procedures to guide the operation of the program. The program largely depends on tradition and innovative procedures implemented by the regional offices.
- No written job descriptions were made available for the peer review. The peer review team is aware by interview that there are general job descriptions, but there were no specific dam safety job descriptions provided for the program.

- There appears to be good communications between the regional team leaders and the dam safety program coordinator. Communication is limited however, between the DSP coordinator and the regional managers.
- The central office conditions, physical facilities and office environment are satisfactory. There appears to be ample space for the review, handling and storage of documents. The peer review team did not visit the regional offices.
- No contracts were reviewed; however, interviews indicated that all consultant contracts were negotiated properly.

3.2 Management

The program for inspection of dams is currently developed and implemented in the regional offices. Based on interviews and the fact that inspection goals are being met, this program is being carried out. The regional directors select the personnel who will conduct the dam safety inspections. This process is similar to the other programs administered in the regional offices. General inspection guidelines are provided; however, the individual inspectors are allowed to adapt specific dam inspection procedures as they find necessary. The inspection program goals are being met, but there is no clear and consistent methodology for prioritizing the work plan of individual inspectors.

- The inspection program has a considerable administrative task that, at times, reduces the efficiency of the program. Team leaders are routinely involved in tracking and guiding the program. Team leaders and dam inspectors interact on a frequent basis. The inspection program is being adequately planned at the regional office. However, under the present organization only limited input on priorities is possible from the central office.
- The staff is adequate to meet the inspection goals established by management each year. The quantity of dam inspections is less than desirable however, based on the total number of "high" and "significant" hazard dams that exist in Texas. Currently forty percent of this inspection quota is done by outside contractors.
- There are no written policies and procedures for determining the adequacy and acceptable quality of dam inspection work products. Based on interviews, team leaders located in the regional offices review and check the dam inspection reports for

quality. However, in some cases the technical background of the team leader is limited to properly discern the adequacy and quality in technical areas such as dam design, construction and maintenance.

- Because of the limited resources, essential functions such as follow up of safety inspections, construction inspections and enforcement of the rules are not accomplished.
- There appears to be good communication between the dam inspection personnel and the team leaders in the regional offices. However, this regional group does not have a clear communication system established between the regional and central office.
- No written policies were provided for storing records. Records on the dams are stored in a protected central storage area in Austin. This facility appears to be adequate and well maintained. There are some historical records stored in the office of the Dam Safety Program Coordinator, and if not duplicates, should be transferred to the central records facility.
- Currently, only paper copies of engineering drawings are being submitted and stored by the central records section. The central records supervisor reported that some of the dam drawings being stored are on reproducible media.
- Written reports on the dams are also stored in central records. The peer review team inspected a few representative records and found them to be adequate.
- The procedure for the field offices to obtain records is to prepare a written request to central records in Austin. These original records are usually sent by mail to the region. After the region is finished with them, they are returned to the central office by mail, or in person.
- The regulations require that the owner monitor the construction of new dams or repair of old dams and report their progress to central office. There is no requirement that the DSP personnel field verify the adequacy and completion of the project.

3.3 Emergency Management Procedures

- The rules provide for ordering a dam owner to take emergency action to remedy problems at dams. There is no requirement to develop or maintain emergency action plans and procedures. A limited number of federal and river authorities dam owners have Emergency Action Plans. No emergency plans were reviewed by the peer review team.
- The dam safety program personnel have been asked by the State Division of Emergency Management to participate in, and consult on, actual emergencies in the recent past in accordance with the TCEQ Response Plan.

3.4 Technical Practice and Procedures

- There were no written quality assurance programs made available for review to ensure a product was reasonable for the agency's policy. Regional team leaders review inspection reports for quality assurance. All actions and approval do receive oversight by them.
- Recent retirements and decentralization has resulted in an inexperienced staff.
- Due to the limited resources, the DSP is not able to recruit personnel with dam safety experience.
- Only two of the five personnel in the DSP are registered professional engineers.
- Training is provided to DSP staff through NDSP assistance grants, USBR Safety Evaluation of Existing Dams training, ASDSO training, seminars and conferences. Travel to these training venues has not been approved recently, even with training grant money available from ASDSO.
- Professional engineering development and progression is limited by the lack of senior professional dam safety engineers within the program.
- Budgetary constraints do not provide supervisors with the resources to hire professional engineers at the entry level.
- There is a large library of technical materials located in the central office. There appears to be a limited amount of technical books and references specifically related to dams.

- Standard references for the design and construction of dams are maintained in the central office, but interviews with field personnel indicated that their offices have limited references to use in dam safety analysis.
- Limited use is made of computer programs for analysis of dams due to lack of experience of the staff and lack of time to learn how to use the programs.
- There is a design and submittal checklist for review and approval of construction plans and specifications provided to applicants for new dams or rehabilitation of existing dams.
- There appears to be no standard criteria for design of dams.
- O & M guidelines have been used to provide dam owners with information on how a dam functions and how to inspect a dam to look for deficiencies. This guideline is out of print and has not been updated recently.
- There are no standard details or specifications available.
- It appears as if the staff receives some training and are equipped with computer equipment.

3.5 Human Resources Management

- The TECQ appears to have adequate recruitment and orientation procedures.
- Based on interviews, the employees seem to have a good attitude towards their work and strive to perform their duties in a professional manner.
- Adequate staffing of programs is hampered due to the state's specific limits on full time employees, or cap.
- There are specific procedures for employee evaluations and performance in place.
- There are no career development opportunities for dam safety program personnel in management and technical areas.
- The "senior executive committee" within the TECQ determines the standard level of compensation available for each program.

- Compensation and benefits for DSP personnel appear comparable to other TCEQ program personnel at equivalent levels, but they do not compare well with private industry levels.

3.6 Financial Management

- Financial management policies and procedures were not reviewed in detail.
- A system exists for developing both operational and program budget estimates.
- The financial management of the dam safety program appeared to be acceptable to the staff and management.
- Quarterly reports comparing expenditures to department inspection goals are prepared for the legislature.

3.7 Public Relations Practices

- The TCEQ has a separate section that is responsible for interaction with the media. Occasionally, the DSP staff is required to respond, with guidance from this section, to the requesting media outlet.

3.8 Statutes and Regulations

The Texas Commission on Environmental Quality (TCEQ) has not participated in the ASDSO project that evaluated their program against the Model State Dam Safety Program. Only general legislative authority exists for conduct of the dam safety program. This primary authority exists in Chapter 11 and 12 of the Texas Water Code (TWC). Section 11.126 provides for the engineering review of plans and specifications of dams associated with water right applications. Section 11.144 requires the agency to review plans for modifications; Section 12.015 describes the Commission's power to condemn works which are unsafe; Section 12.052 provides authority for the regulations for the safe construction, maintenance, repair and removal of dams. These regulations contain many appropriate rules for the governance of dams. There are some elements from these regulations compared to the Model Dam Safety Program as follows:

- Dam owner should implement Emergency Action Plans for all "high" and "significant" hazards dams;
- Dam owners should be required to provide minimum instrumentation that is

appropriate for establishing an understanding of the performance of dams;

- Dam owner should retain, on a continuous basis, historical records on their dams;
- Dam owner should provide proof of financial responsibility for their dams,
- Dam owner should have a reporting procedure for dam incidents to National Performance of Dams Program (NPDP); and
- The regulations should contain authority to establish fee structures for dam review and inspections.

4. RECOMMENDATIONS

From the interview and documents reviewed by the Peer Review Team, the following recommendations are made.

- Chapter 299 regulations of the TCEQ regulations need to be updated to conform with currently established dam safety practices as outlined in the ASDSO Model Dam Safety Program (1998).
- Regulations should include provisions for enforcement of the dam safety regulations.
- The Texas Water Code should be amended to reflect the elements found in the ASDSO Model State Dam Safety Program.
- The TCEQ should adopt the guidance and recommendations on dam safety as presented in the "Executive Director's Task Force on Dam Safety: Final Report" published in June 1998.
- Update and re-publish the Texas DSP Guidelines for Operation & Maintenance of Dams for owners and distribute them during inspections and training.
- Evaluate the dam safety program's position in the organizational structure of the TCEQ to determine if it should be moved to the Office of Permitting, Remediation and Registration, Water Supply Section.
- The dam safety program's job classifications should include the requirements for an engineering degree relevant to dam design and construction with the goal of the individual obtaining a professional license.
- A compensation plan needs to be developed that is commensurate with the desired qualifications in order to attract experienced people to the Dam Safety Program.
- Pursue adding the words "safety of dams" to the TCEQ mission statement so that the importance of the dam safety program is identified.
- Develop a specific mission statement for the dam safety program outlining consistent goals, objectives and work plans resulting in a uniform program throughout the offices within the dam safety organization.
- In order to maintain control of the DSP state wide, a strong functional authority should reside in the central office.

- Increase engineering technical staffing in Austin to provide adequate and efficient review of plans and specification for new and modified dams; and to provide dam safety expertise to the regional offices when needed.
- Increase the administrative support in Austin to update and maintain the dam inventory.
- Increase the administrative support in the regions to increase efficiency of dam inspection processes.
- Develop a procedure for identifying, prioritizing and scheduling the required annual inspections.
- Develop a procedure and tracking method to ensure the dam deficiencies that are identified during inspections have follow-up inspections.
- Reduce travel time and increase efficiency of the dam safety program by staffing one or two other regions with dam safety inspection personnel.
- Require the final submittal of as-built plans be on reproducible media.
- Provide additional funding for training opportunities in dam safety including workshops and conferences that are available. Approve the use of ASDSO training grant money for this training.
- Conduct public workshops for dam owners, emergency agencies and the general public.

5 CERTIFICATION

This report was prepared by the undersigned members of the Peer Review Team of the Association of State Dam Safety Officials (ASDSO) as requested by Mr. Chau Vo, Dam Safety Program Coordinator of the Dam Safety Program, Texas Commission on Environmental Quality in Austin, Texas. The statements in the report reflect the engineering and professional observations, findings and judgments of the Peer Review Team based on interviews and review of documents presented by the Dam Safety Group of the Division.



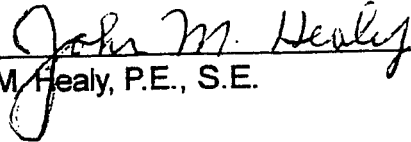
Alan E. Pearson, P.E. Team
Coordinator

Date: 1/09/2003



James H. Weldon, P. E.

Date: 1/13/2003



John M. Healy, P.E., S.E.

Date:

1/25/03

Appendix

Biographical Data

Alan E. Pearson

Alan has 40 years of experience in the design and construction of dams, and management of dam safety programs. He is registered as a Professional Engineer in Colorado and California, graduating from Michigan Technological University, in Houghton, Michigan in 1962 with a Bachelor of Sciences degree in Civil Engineering.

Alan spent the first ten years of his professional career working on the California State Water Project in the Upper Feather River Region on the construction of Frenchmen, Antelope Valley, Grizzly Valley, and Oroville dams; In the Northern District Office administering the Davis-Grunsky Loan Program for the construction of small water projects; and with the California Division of Dam Safety working as a Design Review Engineer.

For the past 30 years, Alan has been working for the State of Colorado, Division of Water Resources, in their Dam Safety Program. He worked as a Dam Safety Engineer inspecting dams, then reviews of plans for construction and repair; supervised the Design Review Unit, and became Program Manager of the Dam Safety Program in 1980.

Alan has been a member of the Association of State Dam Safety Officials since 1984, and was a member of the Board of Directors from 1992 to 1998, serving as Vice President, President-elect, and President. He had the opportunity to work on several ASDSO tasks and publications including; "Training Aids for Dam Safety", "Environmental Permitting of Dam Projects", "National Performance of Dams Program Guidelines"; "ASDSO Peer Review Manual"; "Model Dam Safety Program"; Implementation Plan for National Dam Safety Act"; and "Hazard Classification Guideline". Alan is also a member of the American Society of Civil Engineers. Alan has participated in the peer reviews of dam safety programs for North Carolina in 1994, BC Hydro (Canada) in 1996, Maryland in 2001 and Washington in 2002.

John M. Healy, P.E., S.E.

Mr. Healy is a registered professional engineer and structural engineer in the State of Illinois and was formerly registered as a P.E. in 9 other States. He has over 40 years of engineering experience. During his employment with Hanson Professional Services he has gained experience in all 50 states and five international locations on a variety of projects ranging from dams, storage structures, highways and railroad soil surveys, communication structures, buildings, industrial projects and buried blast-resistant structures. Prior to his retirement in December 1994, he served as a senior vice president and director of Hanson Engineers and had operational management responsibilities for the geotechnical and hydrology/hydraulics engineering consulting practice and the quality control/materials testing service. He now serves as special consultant to Hanson Professional Services.

Mr. Healy has been responsible for all aspects of the dam and levee engineering in all areas of Illinois and at numerous locations in other states. Dam and levee engineering services provided consisted of siting of new structures, design of proposed structures, preparation of plans/specifications and supervision of construction. For existing dams, he has been involved in the inspection, evaluation of failures, development of recommendations for repair/modifications and the supervision of construction.

Mr. Healy is a member of the Affiliate Member Advisory Committee of the Association of State Dam Safety Officials (ASDSO). He has participated in 9 state peer reviews. He was a member of the team in 1998 which performed the peer review of the U.S. Department of Labor, Mine Safety and Health Administration Impoundment Safety Program. In 2001 he was a member of the team that peer reviewed the U.S. Army Corps of Engineers Dam Safety Program.

James H. Weldon

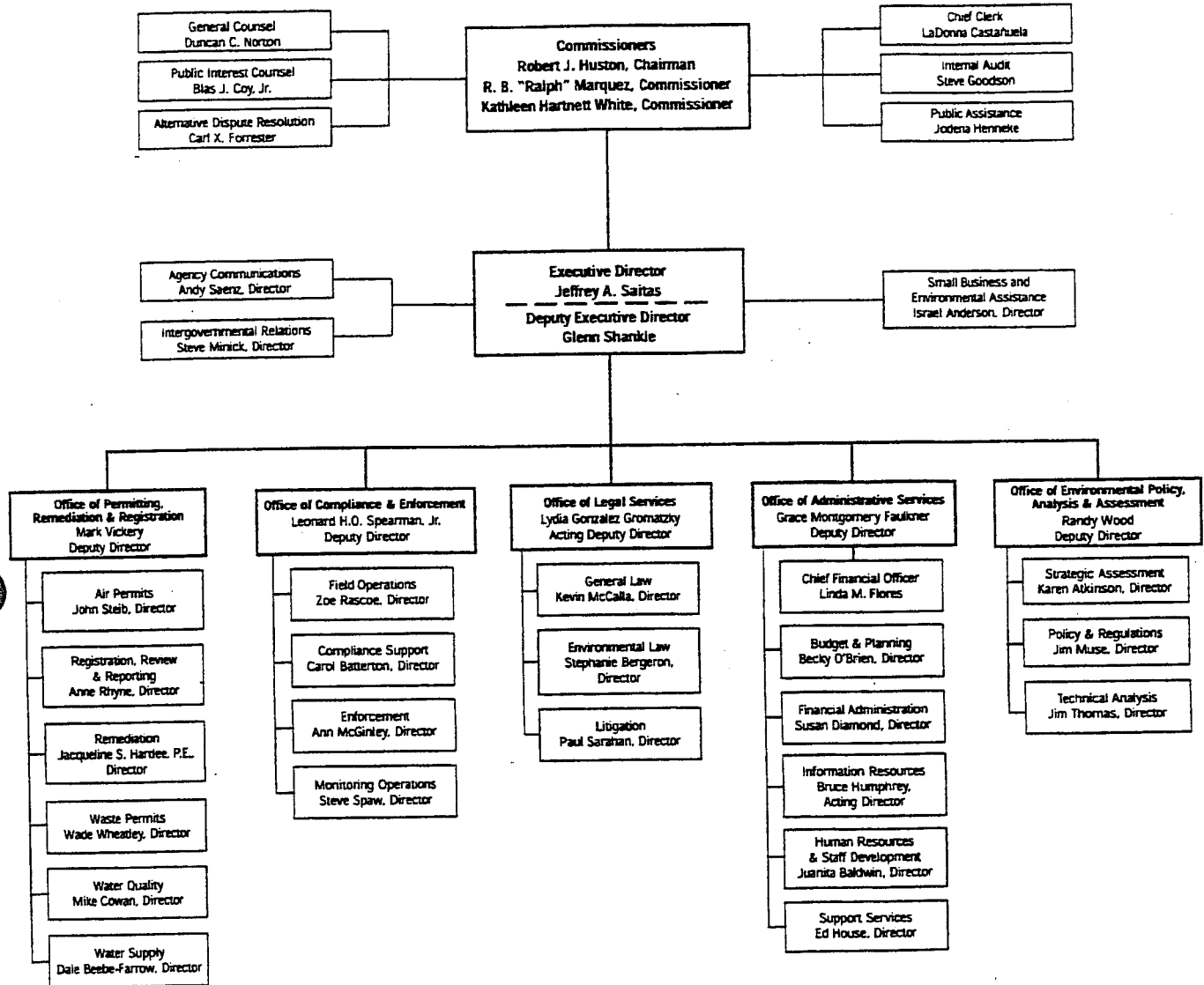
For the past 31 years Jim Weldon has worked at Denver Water. As an Engineering Manager and Dam Safety Engineer, he is responsible for budgeting, technical supervision, and quality control of raw water resource and development projects. Jim administers the Dam Safety Program at Denver Water and is responsible for the 17 dams (10 high hazard dams). As a senior engineer, he provides expert engineering support to the Engineering and other Divisions in the organization.

Jim is an active member of United States Society of Dams (USSD), Association of State Dam Safety Officials (ASDSO) serving on the Affiliate Advisory Committee, and Peer Review Committee. Jim also serves on Board of the National HydroPower Association (NHA) and the Executive Committee of the National Performance for Dams Program (NPDP). Jim has also served on several American Society of Civil Engineering Task Committees.

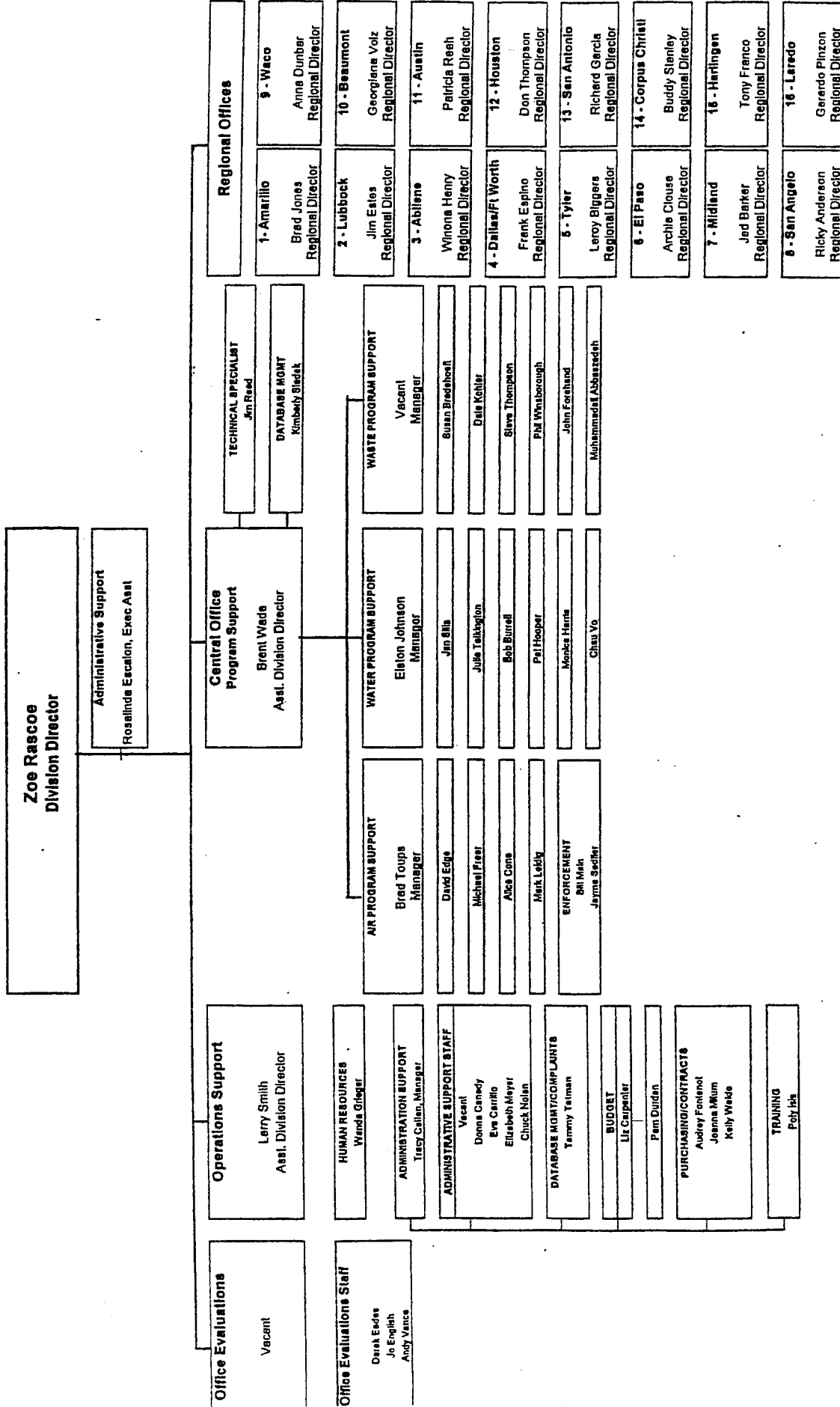
Jim received his B. S. Civil and Environmental Engineering degree from University of Colorado at Denver, and is a registered professional engineer in Colorado.

TCEQ ORGANIZATION

September 10, 2002



Texas Natural Resource Conservation Commission
 Field Operations Division
 Central Office



COMMISSIONERS

ED DIRECTOR

COMPLY & ENFORCEMENT

FIELD OPERATIONS

PROGRAM SUPPORTS

WATER SECTION

DAM SAFETY PROGRAM

REGION 4 INSPECTION

CONTRACT INSPECTION

REGION 12 INSPECTION

Appendix

B



John Keel, CPA
State Auditor

An Audit Report on

The Dam Safety Program at the Commission on Environmental Quality

May 2008

Report No. 08-032



An Audit Report on

The Dam Safety Program at the Commission on Environmental Quality

SAO Report No. 08-032
May 2008

Overall Conclusion

The Commission on Environmental Quality's (Commission) dam safety program, as currently designed and operating, is not able to accomplish its statutory mandate to ensure the safe construction, maintenance, repair, and removal of dams in the state of Texas. Although management has made improvements to the dam safety program over the past four years, the Commission still is not able to perform timely inspections of all high- and significant-hazard dams, ensure that deficiencies identified in inspection reports are corrected, or obtain key information needed to assess the risk posed by many of the state's dams. The size of the state's dam inventory (7,603 state-regulated dams) in relation to dam safety program resources is a major contributing factor. Additionally, the administrative rules governing dam safety do not address key dam safety practices established by federal and industry guidelines.

Although the Commission regulates dams, owners are ultimately responsible for the safety of their dams. However, federal and state funding available to assist dam owners in making repairs is limited. In 2003, the Association of State Dam Safety Officials estimated that it would cost more than \$711 million to rehabilitate the non-federally owned, high-hazard dams in Texas.

The Commission should establish a model dam safety program for the State. To accomplish this, the Commission should develop goals for the program and determine what additional resources will be needed to achieve these goals. The goals should include:

- Establishing an inspection frequency that is consistent with best practices.

Background Information

The Commission on Environmental Quality's (Commission) dam safety program is responsible for regulating:

- 872 high-hazard dams.
- 817 significant-hazard dams.
- 5,871 low-hazard dams.
- 43 other dams.

The Commission employs seven people who conduct dam inspections: three professional engineers (including the program manager), two graduate engineers, and two geologists. The Commission also contracts with two outside entities to inspect dams. The Commission's dam safety program received \$350,000 in General Revenue and \$240,601 from the Federal Emergency Management Agency (FEMA) in fiscal year 2007.

Downstream Hazard Classifications (Expected Results of a Dam Failure)

High-hazard - Expected human life loss; excessive economic loss.

Significant-hazard - Possible human life loss, not expected; appreciable economic loss.

Low-hazard - No human life loss expected; minimal economic loss.

- Obtaining additional information on the hydraulic adequacy of high- and significant-hazard dams.¹
- Following up on deficiencies identified in inspection reports to ensure that dam owners have corrected them.
- Strengthening the enforcement function to ensure that dam owners comply with Texas Administrative Code requirements and mitigate the risk associated with deficient dams.
- Estimating the cost to rehabilitate the state's structurally deficient and hydraulically inadequate dams.

In the near-term, the Commission should take a number of interim steps. These include:

- Completing the revision of administrative rules governing dam safety to increase the effectiveness of the dam safety program.
- Developing formal risk-assessment criteria to ensure that the highest-risk dams are identified and prioritized for inspections.
- Developing a strategy to identify low-hazard dams that should be upgraded to high- or significant-hazard due to new downstream development.
- Developing criteria for screening and prioritizing requests for inspections of low-hazard dams.
- Ensuring that all data entered into the dam inventory database is complete and accurate.

Key Points

The Commission should reassess dam safety program goals and resources needed to implement key dam safety practices.

The Commission has improved its dam safety program during the past four years by increasing its frequency of dam inspections and implementing some recommendations in a 2003 peer review report conducted by the Association of State Dam Safety Officials.² The Commission has fully or substantially implemented 5 of 11 key recommendations. However, the Commission still needs

¹ Hydraulic adequacy is a measure of a dam's ability to store and pass a particular storm without being overtopped and suffering damage or failure. For purposes of this report, "hydraulic study" refers to both the hydraulic and hydrologic studies needed to determine whether a dam is hydraulically adequate.

² *Peer Review of the Dam Safety Program of the Texas Commission on Environmental Quality*, Association of State Dam Safety Officials, January 2003.

to implement several key peer review recommendations that are critical to establishing a sound dam safety program.

The Commission should ensure timely inspections of high- and significant-hazard dams.

The Commission's target, a Legislative Budget Board non-key performance measure, is to inspect 70 percent of the nearly 1,700 high- and significant-hazard state-regulated dams every five years. However, it has inspected only 43 percent of those dams in the past five years.

The current rate of inspection is well below best practice standards established by the Association of State Dam Safety Officials and the National Dam Safety Act. For example, the Association of State Dam Safety Officials recommends that high-hazard dams be inspected annually and significant-hazard dams be inspected once every two years. However, at the rate of inspection achieved by the Commission in fiscal year 2007, an additional 1,098 inspections would have needed to be completed to achieve this target.

As a result of the Commission's low frequency of inspections, the Commission lacks information about the condition of many high- and significant-hazard state-regulated dams.³ The condition of 57 (6.5 percent) high-hazard dams and 321 (39 percent) significant-hazard dams in the Commission's inventory is unknown.

The Commission also lacks formal risk-assessment criteria to ensure that the highest-risk dams are identified and prioritized for inspections. Until the Commission achieves a higher inspection frequency, it is particularly important that the Commission identify the highest-risk dams and ensure they are inspected on a timely basis.

The Commission should obtain additional information on the hydraulic adequacy of high- and significant-hazard dams, including some of the largest dams it regulates.

The Commission should work to obtain information about the hydraulic adequacy of all high- and significant-hazard state-regulated dams. This information is important because a hydraulically inadequate dam may fail as a result of a severe flood event. The hydraulic adequacy for 193 (22 percent) of the 872 high-hazard dams and 611 (75 percent) of the 817 significant-hazard dams in the Commission's inventory is not known by the Commission. This lack of information includes many of the state's largest dams.

The State does not currently require dam owners to obtain a hydraulic study for existing dams. Cost estimates for contracted hydraulic studies range from \$20,000 to \$50,000 for large dams and from \$5,000 to \$10,000 for small dams.

³ Condition assessments refer to the physical condition of a dam. Condition assessments are usually "good," "fair," or "poor."

The Commission should ensure dam owners comply with administrative rules and mitigate the risk associated with deficient dams.

The Commission does not ensure that dam owners take corrective action to address deficiencies identified during an inspection. In nearly half of the inspection files tested by auditors, dam owners did not submit requested corrective action plans. Also, the Commission did not consistently follow up with dam owners to ensure that the identified deficiencies had been corrected.

Additionally, the Commission did not utilize its enforcement function to ensure that dam owners made needed repairs to existing dams and complied with statute and Commission rules. No penalties have been assessed by the Commission against noncompliant dam owners, and only one notice of violation has been issued in the last four years.

Limited public funding is available to assist dam owners in making needed repairs.

In 2003, the Association of State Dam Safety Officials estimated that it would cost more than \$711 million to rehabilitate the non-federally owned, high-hazard dams in Texas. However, federal and state funding available to dam owners to make repairs is limited.

The National Dam Rehabilitation and Repair Act of 2007, passed by the U.S. House of Representatives in October 2007, would provide publicly-owned dams \$200 million nationally over five years to make repairs. However, should this bill become law, the funding that would be allocated to Texas falls far short of estimated costs to rehabilitate Texas dams. Seventeen states have some form of financial assistance program for dam repair or removal (see Appendix 9).

The Commission should revise administrative rules governing dam safety to address key dam safety practices established by federal guidelines and best practices.

The provisions of the Texas Administrative Code that govern dam safety have not been revised since 1986 and do not adequately address key dam safety practices established by federal and industry guidelines. This hinders critical aspects of the Commission's dam safety program, including inspections, enforcement, and emergency response. The Commission began the process to rewrite the administrative rules in December 2007 and expects to publish proposed rule changes in July 2008.

The Commission should consider revisions in a number of key areas. For example, the Commission should consider including a requirement that dam owners develop emergency action plans for all high- or significant-hazard state-regulated dams. The Commission should also consider requiring dam owners to develop and follow maintenance and operating plans to protect dams against deterioration and prolong their lifespan.

The Commission should improve its collection and maintenance of dam inspection data.

The Commission does not consistently update the information in its dam inventory database. For example, 5 of 29 (17 percent) dam construction or modification project approval files auditors reviewed did not have complete and accurate information in the database about the dam's hydraulic adequacy even though the hard copy file contained this information.

Although the Commission has some controls in place over its dam inventory database, it should take additional measures to ensure the reliability of the data. The Commission should also ensure that new systems being planned comply with State database development requirements.

Summary of Management's Response

The Commission agrees with the recommendations in this report, and it provided the following summary of its responses:

Commission management appreciates the Texas State Auditors Office recognition that we have improved the dam safety program during the past four years. The 2003 review we commissioned was conducted by the Association of State Dam Safety Officials and has served as a benchmark for us to address program issues. We acknowledge that with additional resources and statutory authority, there are considerably more improvements to be made before the program can be considered a model dam safety program.

Commission Management generally agrees with the recommendations and has already initiated implementation or is contemplating implementation to address many of the recommendations presented, however, the ability to complete implementation of the recommendations contained in this audit report is contingent upon legislative support for additional FTEs and funding needed to modify the dam safety program as proposed.

Detailed management responses are included in the Detailed Results section of this report.

Summary of Information Technology Review

The Commission has controls in place to prevent unauthorized access to its network and the electronic folders containing dam safety data. Dam safety data is stored in two outdated databases. Although some controls in these databases exist to help ensure data accuracy, such as edit checks, auditors identified weaknesses in general and application controls that could compromise reliability and security of the data.

All dam safety program staff at the Commission have access to these databases and the ability to modify the information in the databases. The same password is used for both systems and has never been changed. Some of the information in these databases is sensitive (such as dam hazard classifications) and warrants special protection. In addition, the Commission does not regularly perform data reconciliations.

According to the Commission, these databases will be replaced in the near future. As it develops these new systems, the Commission should ensure that they comply with state requirements. It should also take measures to ensure data reliability by strengthening its access controls and performing regular data reconciliations.

Summary of Objectives, Scope, and Methodology

The objectives of this audit were to:

- Determine whether the Commission has established and adheres to policies, procedures, and administrative rules that govern the safe construction, maintenance, repair, and removal of dams in Texas.
- Evaluate the Commission's progress toward addressing recommendations in the *Peer Review of the Dam Safety Program of the Texas Commission on Environmental Quality* conducted by the Association of State Dam Safety Officials and released on January 27, 2003.

The scope of this audit included the operations of the Commission's dam safety program, including inspections and plan review files for fiscal years 2005 through 2007 and information in the dam safety program's two databases. Auditors also reviewed information relating to the Commission's progress toward implementing the recommendations made in the January 2003 peer review report by the Association of State Dam Safety Officials. This audit specifically excluded any work related to levees.

The audit methodology included collecting information and documentation, performing selected tests and other procedures, analyzing and evaluating the results of tests, performing data analysis on the Commission's databases related to its dam inventory, interviewing Commission staff and management, and accompanying staff inspectors on dam inspections.

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Detailed Results

Chapter 1

The Commission Should Reassess Program Goals and Resources Needed to Implement Key Dam Safety Practices

The Commission on Environmental Quality (Commission) has improved its dam safety program during the past four years by increasing its frequency of dam inspections and implementing some recommendations in a 2003 peer review report conducted by the Association of State Dam Safety Officials. However, auditors identified weaknesses in nearly all key areas of the dam safety program, including inspections, enforcement, information management, and emergency response procedures. These findings are similar to those included in the 2003 peer review report.

While the Commission must ultimately decide the appropriate level of regulatory oversight, it should consider the recommendations made in this audit report, federal guidelines, best practices, and criteria listed in the Association of State Dam Safety Officials' publication *Model State Dam Safety Program* as a framework for improving its program.

The Commission currently has a staff of seven inspectors and contracts with two outside entities to inspect 7,603 dams. It should evaluate what additional resources are needed to achieve the inspection frequency and enforcement goals it sets for its dam safety program. (See Appendices 8 and 9 for information about other states' dam safety programs, including program funding, grant and loan programs, fee assessments, and inspection duties.)

The Commission should continue to implement key recommendations made in the peer review report.

During October 2002, the Association of State Dam Safety Officials conducted a peer review of the Commission's dam safety program at the Commission's request. The peer review team's report⁴, issued on January 27, 2003, included a number of recommendations for improving the dam safety program. The Commission has fully or substantially implemented 5 of 11 key recommendations. Specifically, the Commission:

- Published updated operation and maintenance guidelines for dam owners and began distributing these guidelines during inspections.

⁴ *Peer Review of the Dam Safety Program of the Texas Commission on Environmental Quality*, Association of State Dam Safety Officials. January 2003.

- Updated the dam safety program job classifications to include engineering degrees, and the Commission raised salaries for these classifications accordingly.
- Developed a revised compensation plan to attract experienced staff.
- Provided additional funding for training opportunities for staff.
- Conducted public workshops for dam owners, emergency agencies, and the general public.

However, the Commission still needs to implement several key peer review recommendations that are critical to establishing a sound dam safety program. These include recommendations relating to the revision and enforcement of administrative rules, the prioritization of inspections, and following up on inspection reports. Implementation of these recommendations is an important step toward the development of a model dam safety program for Texas. (See Appendix 2 for a list of the peer review's key recommendations and their implementation status.)

Recommendations

The Commission should:

- Conduct a comprehensive review of its dam safety program using the recommendations listed in this audit report, federal guidelines, best practices, and criteria listed in the Association of State Dam Safety Officials' publication *Model State Dam Safety Program* as a framework for improvement. This review should include:
 - ♦ Establishing goals and performance standards for the dam safety program.
 - ♦ Evaluating resources and alternatives needed to achieve its dam safety inspection goals and standards; this should include an evaluation of dam safety standards implemented by other states.
- Continue to implement the recommendations in the Association of State Dam Safety Officials' 2003 peer review report.

Management's Response

TCEQ Management accepts the recommendation to conduct a comprehensive review of the dam safety program using the recommendations listed in this audit report, federal guidelines, best practices, and criteria listed in the Association of State Dam Safety Officials' publication Model State Dam Safety Program as a framework for improvement. This review will include:

- *Establishing goals and performance standards for the dam safety program.*
- *Evaluating resources needed to achieve the goals and standards.*

Additionally, we will continue to implement the recommendations in the State Dam Safety Officials' 2003 peer review report.

The Field Operations Support Division is responsible for conducting this review with a target completion date of December 31, 2008. Please note that the ability to complete implementation of the recommendations in the SAO report and those coming out of this review recommended by SAO may be contingent upon legislative support for additional FTEs and the funding needed to modify the dam safety program as proposed.

The Commission Should Assess the Physical Condition of All High- and Significant-hazard Dams and Ensure Timely Inspections of These Dams

The Commission's dam safety program does not inspect high- and significant-hazard dams as frequently as recommended by best practices. In addition, the Commission lacks a formal method for prioritizing inspections of the highest-risk dams.

Best practices recommend that high- and significant-hazard dams be inspected every year to once every five years, depending on the standard. However, at the Commission's rate of inspections during fiscal year 2007, dams currently identified as posing a high or significant hazard would be inspected once every 9.2 years. With more than 7,600 dams in its inventory and 7 full-time equivalent (FTE) employees, the Commission should reassess its staffing in relation to inspection workload, with consideration given to the costs and benefits of contracting out more inspections.

The Commission's dam inventory database contains a condition assessment, which is derived from a physical inspection of a dam, for 2,076 of 7,603 (27 percent) state-regulated dams (see Table 1). However, many of these assessments are outdated and may not reflect the dams' current condition. The Commission lacks condition assessments for the other 5,527 dams in its inventory.

Table 1

Condition Assessment of State-regulated Dams ^a				
Hazard Classification	Dams in Good Condition	Dams in Fair Condition	Dams in Poor Condition	Dams Lacking a Condition Assessment
High	549	190	76	57
Significant ^b	253	178	64	321
Low	408	248	66	5,149
Totals	1,210	616	206	5,527

^a A total of 43 additional dams are not listed in this table because there is no downstream hazard classification for those dams.

^b One additional significant-hazard dam is not functional; therefore, it was not categorized as in good, fair, or poor condition and is not listed in this table.

Source: Commission dam inventory database.

The Commission also needs a prioritization process to identify the highest-risk dams and ensure they are inspected on a timely basis. The Commission's lack of a formal prioritization process was cited as a weakness in a 2003 peer review conducted by the Association of State Dam Safety Officials (see

Chapter 1). Additionally, the Commission lacks criteria to prioritize the inspections of low-hazard dams. In fiscal year 2007, 43 of 117 (37 percent) staff inspections were of low-hazard dams.

Chapter 2-A

The Commission Should Establish, and Adhere to, an Inspection Frequency Target for High- and Significant-hazard Dams That Is Consistent with Best Practices

The Commission's target, a Legislative Budget Board non-key performance measure, is to inspect 70 percent of the high- and significant-hazard state-regulated dams every five years. However, the Commission has inspected only 43 percent of the 1,689 high- and significant-hazard dams in its inventory in the past five fiscal years. At this rate of inspection, all dams currently identified as posing a high or significant downstream hazard would be inspected once every 11.5 years. However, the Commission has been increasing the number of inspections its staff conducts in each of the past five fiscal years (see Table 2). At the rate of inspections achieved in fiscal year 2007, all dams currently identified as posing a high or significant hazard would be inspected once every 9.2 years.

Table 2

Source of Dam Inspections Fiscal Years 2003 through 2007					
Source of Inspection	Fiscal Year 2003	Fiscal Year 2004	Fiscal Year 2005	Fiscal Year 2006	Fiscal Year 2007
Commission Staff	45	51	80	106	117
Commission-contracted (includes Natural Resource Conservation Service)	87	8	127	113	83
Obtained by Owner	11	17	48	22	37
Total Inspections	143	76	255	241	237

Source: Commission's Dam Inventory Database.

The Commission's current rate of inspections falls significantly short of the inspection rate recommended by best practices. Standards for inspection frequency are established by (1) the Association of State Dam Safety Officials' *Model State Dam Safety Program*, (2) the National Dam Safety Act, and (3) a Legislative Budget Board non-key performance measure. The goal for the frequency of inspections for each of these standards and the number of inspections that the Commission fell short in fiscal year 2007 under each standard is shown in Table 3.

Table 3

Recommended Inspection Frequency Standards		
Source of Standard	Recommended Inspection Frequency	Number of Additional Inspections Needed to Meet Standard ^a
Model State Dam Safety Program	High-hazard Dams—Annually Significant-hazard Dams—Every Two Years	1,098
National Dam Safety Act	Dams Posing a “Significant Threat”—Every Five Years	155
Legislative Budget Board Non-key Performance Measure	High- and Significant-hazard Dams—70 percent Inspected Every Five Years	53

^a This is based on the Commission’s fiscal year 2007 rate of inspections, which includes inspections conducted by Commission staff, inspections conducted by contractors, and owner-submitted inspections.

Condition assessments are made by dam inspectors after they perform a visual inspection of a dam’s surface and all parts of the structure, including its adjacent environment. Assessments are typically stated as “good,” “fair,” or “poor.” As of October 2007, the Commission lacked information about the condition of 57 of 872 (6.5 percent) high-hazard dams and 321 of 817 (39 percent) significant-hazard dams in its inventory. This includes some of the largest dams in the state; the Commission lacked condition assessments for 53 (18 percent) of the 300 largest state-regulated dams. A condition assessment for high- and significant-hazard dams is particularly important because these dams could pose a risk to lives and property.

Additionally, the Commission does not have clear criteria or written definitions for the condition categories (good, fair, or poor). Written criteria help to ensure that assessments are consistent when different inspectors make assessments.

Also, for 300 of the 1,311 (23 percent) high- and significant-hazard dams for which the Commission has a condition assessment, the assessment was conducted more than 10 years ago. Relying on old condition assessments increases the risk that dams have developed unidentified deficiencies.

The Commission should establish criteria for inspections submitted by dam owners. The Commission accepts inspection reports prepared by engineers under contract with dam owners, by the dam owners’ in-house engineers, and by inspectors with other governmental agencies. Of the 237 inspections recorded in fiscal year 2007, 37 (16 percent) were conducted by one of these sources. The Commission reviews these inspection reports and counts them when it calculates the number of inspections conducted on high- and significant-hazard dams during a specific time period. The Commission also enters the information, including the dam’s condition assessment and downstream hazard classification, into its dam inventory database.

While these outside inspection reports can provide valuable information, the Commission lacks written criteria that these outside inspections must meet. Establishing and applying minimum criteria, such as a requirement that the inspection be conducted by a registered professional engineer who has experience in dam design and construction, would provide assurance that the inspection reports are of an acceptable and consistent quality for the Commission's use.

Recommendations

The Commission should:

- Determine the acceptable frequency of inspections in light of best practices and giving sufficient consideration to the public's safety.
- Determine what additional resources will be needed to achieve its inspection frequency target. This analysis should consider the relative costs and benefits of contracting for inspections versus conducting inspections with its staff.
- Develop clear, detailed, written criteria for each condition classification—good, fair, and poor.
- Develop specific criteria for the acceptance of inspection reports submitted by dam owners and other governmental agencies.

Management's Response

TCEQ Management accepts the recommendations. The current rules package, if approved by the Commission, will:

- *Establish the acceptable frequency of inspections in light of best practices and giving sufficient consideration to the public's safety.*
- *Establish specific criteria for the acceptance of inspection reports submitted by dam owners and other governmental agencies.*

TCEQ will complete development of the Standard Operating Procedures (SOPs) that document the condition classification for dams in Texas. The classification will include, satisfactory, fair, poor, unsatisfactory, and not rated. This will ensure that the dam inventory will contain clear and concise condition information and will be compatible with the US Army Corps of Engineers data systems.

Additionally, TCEQ Management will evaluate what additional resources will be needed to achieve its inspection frequency target, including costs associated with contract inspections.

The Field Operations Support Division is responsible for implementing these recommendations with a target date of December 10, 2008 for adoption of the dam safety rules, however, final dam safety rules is contingent upon Commission adoption of the proposed rules; August 31, 2008 for completion of the data system SOPs; December 31, 2008 for implementation of the inspection frequency target.

Chapter 2-B

The Commission Should Develop Formal Risk-assessment Criteria to Ensure That the Highest-risk Dams Are Prioritized for Inspections

With more than 7,600 dams in its inventory, it is particularly important that the Commission identify the highest-risk dams and ensure they are inspected on a timely basis. The Commission currently lacks a formal or documented risk-assessment process to prioritize its inspections. A 2003 peer review report by the Association of State Dam Safety Officials recommended that the Commission develop a procedure for identifying, prioritizing, and scheduling inspections.

The Commission has not inspected 16 high- or significant-hazard state-regulated dams that are listed as being in poor condition in more than 10 years. In addition, the Commission has not inspected 24 other high- or significant-hazard dams that are listed as being in poor condition in more than five years.

The Commission should develop a strategy to update the downstream hazard classifications of low-hazard dams and prioritize requests for inspections of low-hazard dams. The Commission has never inspected 4,314 of 5,871 (73 percent) state-regulated, low-hazard dams. As a result, it lacks recent information about the downstream conditions of these dams. However, development may have occurred downstream of some of these dams that would warrant an upgrade of the dam's hazard classification from low-hazard to significant- or high-hazard. For example, low-hazard dams in high population growth areas are more likely to warrant an upgrade. The Commission could use geographic information system (GIS) software to make an initial determination of whether a low-hazard downstream hazard classification should be changed to a higher classification in lieu of performing a full safety inspection of the dam.

Each year, the Commission receives requests from dam owners and complaints from the public that result in inspections of low-hazard dams. In fiscal year 2007, there were 54 inspections of low-hazard dams (see Table 4). Of those 54 inspections, 43 were conducted by Commission staff. These 43 inspections represent 37 percent of the 177 inspections performed by Commission staff in fiscal year 2007.

Table 4

Number of Dam Inspections Performed by Hazard Classification Fiscal years 2003 through 2007					
Hazard Classification of Dam	Fiscal Year 2003	Fiscal Year 2004	Fiscal Year 2005	Fiscal Year 2006	Fiscal Year 2007
High Hazard	69	32	187	134	127
Significant Hazard	37	15	39	46	56
Low Hazard	36	29	29	60	54
No Hazard Classification	1	0	0	1	0
Total Inspections	143	76	255	241	237

Source: Commission's Dam Inventory Database.

Commission staff believe responding to these requests and complaints is important because, although the dams are classified as low-hazard, downstream development may have occurred and created a new risk. Commission inspectors said they attempt to schedule these inspections as part of a trip that includes inspections of high- and significant-hazard dams in the same geographic area. However, there are no written criteria that must be satisfied prior to the initiation of an inspection of low-hazard dams. Without written criteria, the Commission lacks assurance that an inspection of a low-hazard dam is warranted.

Recommendations

The Commission should:

- Develop formal risk-assessment criteria to ensure it identifies the highest-risk dams and prioritizes its inspections. These criteria should include, but not be limited to:
 - ♦ Date of the most recent inspection of a dam.
 - ♦ Downstream hazard classification of a dam.
 - ♦ Condition information on a dam, or lack thereof.
 - ♦ Hydraulic adequacy information on a dam, or lack thereof.
 - ♦ Maximum storage capacity of a dam's impoundment.
 - ♦ Progress by a dam owner in implementing recommendations from prior inspection reports.

- ♦ Location of a dam in a high-growth area.
- ♦ Purpose of the dam's impoundment.
- ♦ Security risks posed by a dam.
- Develop a strategy for updating the downstream hazard classification of low-hazard dams. This strategy should include:
 - ♦ Developing and using criteria to prioritize re-evaluations of low-hazard dams' downstream hazard classifications.
 - ♦ Considering the use of geographic information system (GIS) software to assist in an evaluation of changes in downstream conditions.
- Develop criteria for screening and prioritizing requests for inspections of low-hazard dams.

Management's Response

TCEQ Management accepts these recommendations and has developed formal risk-assessment criteria to ensure it identifies the highest risk dams and prioritizes its inspections using, in part, the criteria identified by the SAO.

Additionally, TCEQ Management will develop a strategy for updating the downstream hazard classification of low-hazard dams as time and resources allow. This strategy will include consideration of the elements identified by the SAO.

The Field Operations Support Division is responsible for implementing these recommendations with a target date of July 31, 2010, however, the ability to complete implementation of the recommendations contained herein is contingent upon legislative support for additional FTEs and funding needed to modify the dam safety program as proposed.

The Commission Should Obtain Additional Information on the Hydraulic Adequacy of High- and Significant-Hazard Dams

Hydraulic Adequacy Criteria and Probable Maximum Flood Event

Hydraulic adequacy is the measure of a dam's ability to pass through a particular storm without being overtopped or suffering damage or failure. The Texas Administrative Code contains criteria that must be met for a dam to be considered hydraulically adequate. The criteria vary depending on a dam's size and downstream hazard classification. For example, a large, high-hazard dam must be able to withstand 100 percent of a probable maximum flood event. However, a small, low-hazard dam must be able to withstand 25 percent of a probable maximum flood event.

A probable maximum flood event is the flood magnitude expected to occur during the most critical combination of possible weather and water conditions for a given watershed. The likelihood of a probable maximum flood event occurring is very low. For example, some estimates set the frequency of a probable maximum flood event as once in 10,000 years.

The Commission lacks adequate information about the hydraulic adequacy of 48 percent of the 1,689 high- and significant-hazard state-regulated dams in Texas. An analysis of the hydraulic adequacy of a dam determines the structure's ability to withstand a "probable maximum flood event." State requirements for hydraulic adequacy vary depending on the size and downstream hazard classification of a dam (see text box). A dam is considered to be hydraulically adequate if it meets the criteria listed in Texas Administrative Code, Title 30, Section 299.14 (see Appendix 3 for more information about hydraulic adequacy criteria). The risk posed by a dam that does not meet the State's standards for hydraulic adequacy should be considered in light of the low likelihood of a probable maximum flood. However, information about hydraulic adequacy is critical in assisting the Commission's dam safety program in fulfilling its mission.

The Commission lacked information about the hydraulic adequacy of 193 high-hazard and 611 significant-hazard dams, according to auditors' analysis of the Commission's dam inventory database (see Table 5). The Commission lacked information about the hydraulic adequacy of 119 (40 percent) of the 300 largest state-regulated dams.⁵

Table 5

Hydraulic Status of High- and Significant-hazard State-regulated Dams					
Hazard Classification	Number of Dams	Hydraulically Adequate Dams	Hydraulically Not Adequate Dams	Status Unknown	Hydraulically Not Adequate Dams and Status Unknown
High	872	305 (35 percent)	374 (43 percent)	193 (22 percent)	567 (65 percent)
Significant	817	126 (15 percent)	80 (10 percent)	611 (75 percent)	691 (85 percent)
Totals	1,689	431 (26 percent)	454 (27 percent)	804 (48 percent)	1,258 (75 percent)

Source: Auditors' analysis of Commission data.

The Texas Administrative Code does not require dam owners to conduct or submit hydraulic studies of existing dams, although it does make clear that responsibility for a dam ultimately rests with the dam owner.⁶ Hydraulic studies can be costly—estimates range from \$20,000 to \$50,000 for large

⁵ Size is based on the maximum reservoir capacity of a dam. As a point of reference, Longhorn Dam on Ladybird Lake (formerly Town Lake) in Austin is the 299th largest state-regulated dam in Texas.

⁶ There are requirements for owners with plans to build new dams or to repair and modify existing dams to conduct hydraulic studies and submit them to the Commission.

dams and from \$5,000 to \$10,000 for small dams. Auditors sent informal questionnaires to dam safety programs in 16 states and received 10 responses. All 10 respondents said hydraulic adequacy is a critical measure of dam safety. Seven of these 10 respondents also stated that they have either completed hydraulic studies or have obtained a substantially complete list of hydraulic adequacy status of all their high- and significant-hazard dams.

Additionally, the information about hydraulic adequacy in the Commission's dam inventory database is not complete and accurate. Auditor testing identified the following:

- Two of 29 (7 percent) projects contained information in hard copy files indicating that a hydraulic study had been done, but the database did not contain this information.
- Three of 29 (10 percent) projects contained information in hard copy files indicating that the dams were hydraulically inadequate, but the dams were listed as hydraulically adequate in the database.

Recommendations

The Commission should develop a strategy, including a time line, for obtaining and maintaining accurate information about the hydraulic adequacy of the dams it regulates. This should include:

- Identifying all high- and significant-hazard dams that lack hydraulic information in its database.
- Contacting owners of high- and significant-hazard dams for which the Commission does not have hydraulic studies to determine whether the studies exist.
- Revising administrative rules to require owners of all high- and significant-hazard dams to submit hydraulic studies to the Commission and amending its rules to require dam owners without existing hydraulic studies to obtain them.
- Ensuring that its database is consistently and accurately updated, including:
 - ♦ Reconciling the dam inventory database to the Commission's hard copy files to ensure the database contains complete and accurate information on hydraulic adequacy.
 - ♦ Recording the receipt and classification of all submitted hydraulic studies on a timely basis.
 - ♦ Identifying the resources necessary to maintain this information.

Management's Response

TCEQ Management accepts these recommendations. We have initiated efforts to update dam safety data including the development of a modern database. This effort includes consideration of the elements identified by the SAO.

We believe a statutory requirement for owners of all high- and significant-hazard dams to obtain and submit hydraulic studies to the Commission would be needed to implement this recommendation.

The Field Operations Support Division is responsible for implementing these recommendations with a target date of August 31, 2008 for completion of the data system; May 31, 2010 for development of the legislative recommendation for statutorily requiring hydraulic studies during the 2012 and 2013 biennium. However, the ability to complete implementation of the recommendations contained herein is contingent upon legislative support for language, additional FTEs and funding needed to modify the dam safety program statutory language as proposed.

The Commission Should Ensure That Dam Owners Comply with Administrative Rules and Mitigate the Risk Associated with Deficient Dams

The Commission does not ensure that dam owners take corrective action to address deficiencies identified during an inspection. In nearly half of the inspection files tested by auditors, dam owners did not submit requested corrective action plans. Also, the Commission did not adequately follow up with dam owners to ensure that the identified deficiencies had been corrected, and it rarely took enforcement action against noncompliant dam owners.

Dam owners, which include both public (38 percent) and private (62 percent) owners, are responsible for the cost of repairs. In 2003, the Association of State Dam Safety Officials estimated that it would cost dam owners more than \$711 million to rehabilitate the non-federally owned, high-hazard dams in Texas. Federal and state funding to assist dam owners in making these repairs is very limited.

Chapter 4-A

The Commission Should Follow Up on Deficiencies Identified in Inspection Reports

Following an inspection of a dam by Commission staff or contractors, the Commission provides dam owners a report that summarizes the results, including the general condition of the dam and descriptions of all deficiencies identified.

However, the Commission does not ensure that dam owners take the corrective actions needed to address the identified deficiencies. Twenty-two of 31 (71 percent) inspection files tested from fiscal years 2005 and 2006 lacked documentation showing that dam owners had made necessary repairs.

The Commission's current process for following up on identified deficiencies is not effective. Under the Commission's informal process, inspectors ask dam owners to submit a corrective action plan by a specified date. Of 46 files tested in which dam owners were asked to submit a corrective action plan, 22 (48 percent) did not comply with the request. It should be noted, however, that dam owners are not required to submit a corrective action plan under the Commission's current administrative rules (see Chapter 5).

After the initial request for dam owners to submit a corrective action plan, the Commission may also send follow-up letters to owners of dams with more serious identified deficiencies. However, 8 of 16 (50 percent) inspection files tested for high-hazard dams inspected during fiscal years 2005 and 2006 lacked correspondence indicating that the Commission had subsequently sought or received information about the status of needed corrective actions.

Additionally, the Commission does not use an automated system to track the status of identified deficiencies.

The Commission does conduct some follow-up inspections; however, it does not have a process to ensure the dams that are most in need of follow-up inspections are the ones receiving the follow-up inspections. A peer review conducted by the Association of State Dam Safety Officials in 2003 recommended that the Commission “develop a procedure and tracking method to ensure that dam deficiencies identified during inspections have follow-up inspections.” Given the Commission’s inability to meet its performance target for inspection frequency, requiring the Commission to perform follow-up inspections on each dam with identified deficiencies may not be realistic. However, at a minimum, the Commission’s policies and procedures should require dam owners to submit documentation demonstrating that corrective action has been taken.

The Commission’s effort to follow up on deficiencies identified by inspectors is also hindered by weaknesses in its administrative rules (see Chapter 5).

Recommendations

The Commission, in conjunction with recommendations regarding administrative rule revisions in Chapter 5, should:

- Establish written policies and procedures that provide guidance regarding:
 - ♦ The circumstances under which the Commission should request a corrective action plan from dam owners.
 - ♦ The format and timeframes for dam owners to submit and implement a corrective action plan.
 - ♦ Follow-up activities that Commission staff should perform based on the seriousness of the deficiencies identified.
 - ♦ Required documentation that dam owners must submit demonstrating the corrective action(s) taken.
- Utilize an automated process to monitor corrective action plans submitted by dam owners, ensure that important recommendations made in inspection reports are implemented, and ensure that rule violations are appropriately resolved.

Management’s Response

TCEQ Management accepts these recommendations and will, in conjunction with the recommendations regarding administrative rule revisions in Chapter

5, establish written policies and procedures that provide guidance regarding the requirements to submit plans of action including the elements identified by the SAO.

Additionally, once completed, we will use the CCEDS module for dam safety inspections to monitor and track plans of action due dates submitted by dam owners and to ensure that requirements made in inspection reports are implemented and that rule violations are appropriately addressed.

The Field Operations Support Division is responsible for implementing these recommendations with a target date of December 10, 2008 for adoption of the rules contingent upon the Commissioners adoption of the proposed final rule; August 31, 2010 for completion of the CCEDS module, however, the ability to complete implementation of the recommendations contained herein is contingent upon legislative support for the funding needed to develop the CCEDS module.

Chapter 4-B

The Commission Should Strengthen Its Enforcement Function to Ensure Dam Owners Make Needed Repairs

The Commission has the authority to enforce Commission rules and ensure that dam owners make needed repairs to existing dams. The Commission can issue enforcement orders and emergency orders, refer matters to the Office of the Attorney General for injunctive relief, or seek civil penalties in district court. However, the Commission has made limited use of its enforcement function. In the past four years, the Commission issued only one notice of violation and has not assessed any penalties against noncompliant dam owners.

An effective enforcement function is a key element in ensuring the safety of dams. Under the *Model State Dam Safety Program* developed by the Association of State Dam Safety Officials, a regulatory agency should be able to enforce its dam safety statutes and corresponding regulations quickly, uniformly, and fairly to ensure that all dams function safely. With 140 high- and significant- hazard dams in Texas listed as being in poor condition, and 454 high- and significant-hazard dams listed as being hydraulically inadequate, it is important that the Commission have a strong enforcement function so that deficiencies will not persist after they have been identified.

The Commission provided auditors three reasons for its lack of enforcement activity:

- **The Commission lacks statutory authority to assess administrative penalties.** Texas Administrative Code, Title 30, Section 299.2(a), states that a dam owner who willfully fails or refuses to take appropriate action after the

Commission finds that a dam poses an unacceptable level of danger to the public is liable for a penalty of not more than \$1,000 a day for each day the violation occurs. However, Commission management stated they do not have statutory authority under the Texas Water Code to assess administrative penalties; therefore, no penalties have been pursued.

Although the Commission does not pursue administrative penalties, civil penalties are authorized by statute. Texas Water Code, Section 12.052(c), authorizes a civil penalty of not more than \$5,000 for each day a dam owner willfully fails to comply with any rule or commission order. This section requires the State to recover the penalty through a suit brought in district court. However, as of January 2008, the Commission had not pursued civil penalties against dam owners under this section.

- **Weaknesses in administrative rules hinder enforcement efforts.** Weaknesses in the Commission's administrative rules have contributed to its lack of enforcement action. For example, the Commission's current rules do not define a dam "owner" or make clear which parties are responsible for violations of applicable statutes and regulations. Leases, easements, and other types of agreements can shift responsibility for maintaining a dam. For example, dams that were built with financial assistance from the Natural Resource Conservation Service (NRCS) have one or more local sponsors that may have assumed responsibility for the operation and maintenance of the dams (see Appendix 4 for more information on NRCS-assisted project dams). The Commission indicated that some of these types of agreements create uncertainty regarding which parties are responsible for meeting the requirements in the rules. However, the Commission also regulates many dams that are unaffected by these arrangements and that have readily identifiable owners who are responsible for addressing any issues associated with their dams. (Chapter 5 of this audit report identifies a number of weaknesses in the Commission's current administrative rules that should be addressed to strengthen its enforcement function.)
- **The Commission lacks an enforcement policy for its dam safety program.** The Commission's dam safety program lacks an enforcement policy. Commission management stated that enforcement criteria used for other Commission programs are not well-suited to its dam safety program. An internal written enforcement policy is important to ensure that the Commission can support its case in a civil or administrative proceeding and that it applies consistent enforcement among dam owners.

Recommendations

The Commission should:

- Develop and adhere to an enforcement policy for its dam safety program.
- Consider seeking statutory authority to assess administrative penalties against dam owners that violate statute or administrative rules.

Management's Response

TCEQ Management accepts the recommendations and will seek statutory authority to assess administrative penalties against dam owners that violate statutory or administrative rules.

If statutory authority is obtained we will develop and adhere to an enforcement policy.

The Field Operations Support Division and Enforcement Division are responsible for implementing these recommendations with a target date of December 31, 2008 for developing a legislative recommendation that seeks statutory authority to assess administrative penalties; June 30, 2010 for developing and implementing a penalty policy and penalty schedule. Completion of these recommendations is contingent upon legislative adoption of the statutory changes needed to enable the TCEQ to assess administrative penalties for violations of the dam safety rules.

Chapter 4-C

While the Commission's Plan Review Process Is Adequate, It Should Ensure That Dam Owners Fully Comply with Administrative Requirements Governing Construction and Modification of Dams

In fiscal year 2007, the Commission reports that it approved 46 dam construction plans and completed 21 inspection reports from construction inspections. The Commission's plan reviews appear to be thorough and cover the critical areas of design, including hydraulic adequacy information. The Commission has assigned primary responsibility for reviewing all plans submitted by dam owners to one professional engineer. This individual also makes periodic inspections during the construction process.

Although its review process covers critical areas of design, the Commission has not enforced its administrative requirements for the construction and modification of state-regulated dams. Auditors' review of new dam construction and modification projects submitted to the Commission between January 2005 and October 2007 identified the following:

- 15 of 27 (56 percent) files of projects completed as of December 2007 lacked evidence that a certificate of completion was signed and sealed by a professional engineer. Texas Administrative Code, Title 30, Section 299.30, requires that, upon the completion of a dam project, dam owners must provide the Commission a written certificate signed and sealed by an engineer certifying that the construction or repairs were performed in substantial compliance with the approved plans and specifications.
- 15 of 29 (52 percent) files for projects that were in process or completed as of December 2007 lacked evidence that owners had notified the Commission within 10 days of starting construction. Texas Administrative Code, Title 30, Section 299.25, requires dam owners to notify the Commission within 10 days of beginning construction to give the Commission an opportunity to make a site visit early in the process.
- 14 of 29 (48 percent) files for projects that were in process or completed as of December 2007 lacked evidence that owners had provided the Commission monthly progress reports during construction. Texas Administrative Code, Title 30, Section 299.25, requires owners' engineers to submit monthly progress reports and photographs during construction to provide assurance to Commission staff that construction is proceeding according to the approved plans.

Recommendations

The Commission should:

- Develop and adhere to an enforcement policy for its dam safety program.
- Consider seeking statutory authority to assess administrative penalties against dam owners that violate statute or administrative rules, including those governing the construction and modification of dams.

Management's Response

TCEQ Management accepts the recommendations and will seek statutory authority to assess administrative penalties against dam owners that violate statutory or administrative rules

If statutory authority is obtained we will develop and adhere to an enforcement policy.

The Field Operations Support Division and the Enforcement Division are responsible for implementing these recommendations with a target date of December 31, 2008 for developing a legislative recommendation that seeks statutory authority to assess administrative penalties; June 30, 2010 for

developing and implementing a penalty policy and penalty schedule. Completion of these recommendations is contingent upon legislative adoption of the statutory changes needed to enable the TCEQ to assess administrative penalties for violations of the dam safety rules.

Chapter 4-D

State and Federal Funding Available to Assist Dam Owners in Making Repairs Is Very Limited

In 2003, the Association of State Dam Safety Officials estimated that it would cost more than \$711 million to make needed repairs to the non-federally owned, high-hazard dams in Texas. However, available federal and state funding to assist dam owners in paying for these repairs is very limited.

Federal legislation to provide some funding to help public dam owners make needed repairs is pending in the U.S. Congress. House of Representatives Bill 3224, the National Dam Rehabilitation and Repair Act of 2007, was passed by the U.S. House of Representatives on October 29, 2007, and would provide \$200 million over five years to repair publicly-owned dams. Similar legislation, Senate Bill 2238, has been introduced in the U.S. Senate.

Some funding for dam upgrades has been available through the Watershed Rehabilitation Program for Aging Dams at the Natural Resource Conservation Service. This funding is available only to dams originally built with the assistance of the Natural Resource Conservation Service. Of the 7,603 state-regulated dams in Texas, 1,999 dams are eligible for this assistance. Funding for dams in Texas through this program averaged \$2.5 million each year from federal fiscal years 2002 through 2006; \$1.7 million was allocated to dams in Texas in federal fiscal year 2007. (See Appendix 4 for more information on Natural Resource Conservation Service-assisted dams.)

Texas does not have a state program specifically designed to assist dam owners to pay for needed repairs. Some dam repair projects have received financial assistance from the Water Development Board in the past; however, none has been funded in recent years. The 80th Legislature did direct the Water Development Board to give funding priority to a \$10 million loan to Bexar-Medina-Atascosa Water Control and Improvement District No. 1 for structural improvements to Lake Medina Dam.⁷ (See Appendix 10 for the Commission's summary of the Lake Medina Dam.) However, according to the Commission's summary, as of April 2008, the District had not submitted an application to the Water Development Board for a loan to make these repairs. Certain dam repair projects may be eligible for assistance from the Texas Community Development Program Disaster Relief/Urgent Need Fund at the Office Rural and Community Affairs. The City of Bryson was awarded a \$230,000 grant from this fund for dam repairs in 2005. To qualify for this

⁷ General Appropriations Act (80th Legislature, Regular Session) Section 19.108, page IX-99.

funding, however, the repairs must be required because of an infrastructure failure that was not foreseeable and must not be needed because of a lack of maintenance.

As of 2006, 17 states had financial assistance programs for dam repairs or removals. Among the assistance these programs provide are low interest loans, competitive grants, and cost-sharing arrangements. Some of these 17 states restrict eligibility to only publicly owned dams. (See Appendix 9 for more information.)

The source of funds for these state programs varies and includes bond proceeds and inspection fees. Twenty-five of 49 (51 percent) states reported to the Association of State Dam Safety Officials in 2006 that they had established fees for inspections of dams, application or permit reviews, or annual registrations. Texas has not established any fee structures for the Commission's dam safety program. Additionally, 16 of 49 (33 percent) states reported that they had the authority to require dam owners to provide proof of financial responsibility.

Recommendations

The Commission should:

- Work with the Water Development Board to develop alternative strategies for funding dam rehabilitation projects for legislative consideration.
- Develop and apply a methodology to estimate the costs associated with rehabilitating high- and significant-hazard dams with identified deficiencies.

Management's Response

TCEQ Management accepts the actions recommended by the SAO. We will coordinate with the Water Development Board to:

- *Develop alternative strategies for funding dam rehabilitation projects for legislative consideration, and*
- *Utilize the ASDSO methodology to estimate the costs associated with rehabilitating high- and significant-hazard dams with identified deficiencies upon its completion, assuming that ASDSO completes the methodology in a timely manner.*

The Field Operations Support Division is responsible for implementing these recommendations with a target date of August 31, 2009 for the development of alternative dam rehabilitation strategies; June 30, 2010 to begin utilization of the ASDSO methodology to estimate dam rehabilitation costs. However, the

ability to complete implementation of the recommendations contained herein is contingent upon legislative support for additional FTEs and funding needed to develop the alternative dam rehabilitation strategies.

The Commission Should Revise Its Administrative Rules Governing Dam Safety

Texas Administrative Code provisions that govern dam safety have not been revised since 1986 and do not adequately address key dam safety practices established by federal guidelines and best practices. This hinders critical aspects of the Commission's dam safety program, including inspections, enforcement, and emergency response.

The Commission began the process to revise the Texas Administrative Code provisions governing dam safety in December 2007 and expects to publish proposed rule changes in July 2008. The Commission should ensure that a number of key areas within the Texas Administrative Code are revised.

Current rules do not require dam owners to develop emergency action plans for high- or significant-hazard dams. An emergency action plan is a formal document that identifies potential emergency conditions that could occur at a dam and specifies actions to be followed in an emergency to minimize loss of life and property. The *Model State Dam Safety Program* (Model Program) developed by the Association of State Dam Safety Officials encourages states to require owners of high- and significant-hazard dams to prepare, update, and periodically test emergency action plans. Federal guidelines also encourage owners of federally-regulated dams to develop emergency actions plans.

However, according to the Commission's records, few dams in Texas have emergency action plans in place—710 of 872 (81 percent) high-hazard dams and 720 of 817 (88 percent) significant-hazard dams lack an emergency action plan. Of the high- and significant-hazard dams that lack emergency action plans, the Commission lists 113 as being in "poor" condition, and it lacks condition information for 347 of these dams. An emergency action plan decreases the risk that a dam failure will result in harmful consequences for people and properties located downstream.

Current rules do not require dam owners to prepare and follow maintenance and operating plans. The Model Program recommends that states require dam owners to have detailed maintenance and operating plans and that these plans be approved by a state regulatory agency.

The Commission's *Guidelines for Operation and Maintenance of Dams in Texas* also states that "[a] good maintenance program will protect a dam against deterioration and prolong its life. A poorly maintained dam will deteriorate, and may fail."

Current rules defining a dam may be unnecessarily broad. As a result, the Commission's jurisdiction includes 7,603 state-regulated dams, which is the largest number of regulated dams among any state in the nation. The definition of a dam in Texas Administrative Code, Title 30, Chapter 299,

excludes only structures that are six feet tall or shorter from state regulation. However, the Model Program, as well as the National Dam Safety Program

How Other States Define a Dam

States' definitions of a dam are based on several factors. These include:

- Storage capacity of the impoundment.
- Dam height.
- Downstream hazard classification.
- Surface area of the impoundment.
- Drainage area.
- Public versus private ownership.

Twenty-four states define a dam based on a combination of the dam's height and the impoundment's storage capacity, similar to the definition recommended by the Model Program.

Some states specifically exclude certain types of impoundments. For example, Tennessee, Virginia, and West Virginia exclude farm ponds from the definition of a dam.

Act, recommends excluding two additional sets of dams from state regulation: (1) those that impound less than 50 acre-feet⁸ at maximum storage capacity if they are less than 25 feet in height, and (2) those that impound less than 15 acre-feet at maximum storage capacity, regardless of dam height, as long as they are not classified as high-hazard. Adopting a definition that excludes these two sets from state regulation would eliminate about 354 dams from the Commission's current inventory of regulated dams. Additionally, there may be other definitions that would reduce the size of the Commission's inventory while maintaining public safety.

Current rules do not define who is considered a dam owner or make clear which parties are responsible for violations of applicable statutes and regulations. Current Texas Administrative Code provisions refer only to "owners" and do not make reference to other parties who may be in control of a dam or responsible for its upkeep.⁹ The Commission may want to consider whether these other parties should be held responsible for violations of certain administrative

regulations. Rules governing some other programs operated by the Commission take this approach. For example, the Petroleum Storage Tank remediation program defines "operator" as "[a]ny person in day-to-day control of, and having responsibility for, the daily operation of the underground storage tank system or the aboveground storage tank system, as applicable."¹⁰ These operators are responsible for violations.

Current rules do not provide any alternative safety requirements to dam owners for existing dams that do not meet required hydraulic standards. Many Texas dams do not comply with the hydraulic criteria found in Texas Administrative Code, Title 30, Section 299.14. Of the 1,689 high- and significant-hazard dams regulated by the Commission, 454 (27 percent) are listed as being hydraulically inadequate. However, the Texas Administrative Code does not offer any alternatives, short of potentially costly modifications, for dam owners to use to bring dams with inadequate hydraulics into compliance. The Texas House Committee on Natural Resources recommended in its interim report to the 76th Legislature that dam owners be provided with alternative safety requirements, such as development of emergency warning systems, for existing dams that cannot be reasonably upgraded to fully meet hydraulic adequacy standards. The Model Program also recommends that states

⁸ One-acre foot of maximum water storage is the volume of water that would be required to cover one acre of land (43,560 square feet) to a depth of 1 foot. This is equal to 325,851 gallons.

⁹ Texas Administrative Code, Title 30, Sections 299.2(a), 299.51, and 299.61.

¹⁰ Texas Administrative Code, Title 30, Section 334.2(70).

consider reduced design criteria for some dams, provided it can be demonstrated that such criteria still protects against loss of life and property.

Current rules are unclear about which proposed dams must receive Commission approval of construction plans. Texas Administrative Code, Title 30, Section 299.22, states:

Construction of a dam or the enlargement, repair, or alteration of an existing dam requiring *commission authorization* shall not be commenced prior to the executive director's written approval of final construction plans and specifications. {emphasis added}

Although the rules do not define which existing dams require commission authorization, the Commission has interpreted this to mean that dam construction projects must obtain Commission approval only if they are part of a project that requires a new or amended water permit. The Texas Administrative Code should be clarified to specify which proposed projects require Commission authorization to ensure that all dams that warrant oversight are included. For example, under Texas Water Code, Section 11.142, certain dams with normal storage of no more than 200 acre-feet of water are exempt from the requirement to obtain a water rights permit. Although some of these dams may have high- or significant-hazard classifications, they could be constructed without Commission approval. Also, because water permit application or construction plan approval is not required, the Commission may be unaware of the existence of some of these dams; and consequently, it is not inspecting them.

Current rules do not require dam owners to submit inspection reports completed by private contractors or government entities. Inspections performed by other government entities or private contractors can provide valuable information to assist the Commission in setting its inspection schedule by raising or lowering the risk associated with these dams and alerting the Commission to any serious safety concerns. Some dam owners provide copies of these reports to the Commission; however, they are not required to do so. Commission employees say they believe there are times when these reports are not submitted.

Current rules do not require dam owners to submit corrective action plans or document any corrective actions they have taken to address identified dam deficiencies. Weaknesses in administrative rules hinder the Commission's efforts to ensure that identified deficiencies are corrected. Under the Commission's current informal process, inspectors ask dam owners to submit a corrective action plan by a specified date; however, the Texas Administrative Code does not require dam owners to comply with this request. Of 46 files tested in which dam owners were asked to submit a corrective action plan to the Commission, 22 (48 percent) did not do so.

The Texas Administrative Code also does not require dam owners to submit documentation of any corrective actions they have taken to address identified deficiencies. The Model Program recommends that administrative rules require dam owners to provide copies of records supporting actions they take to correct conditions identified in inspection reports.

Current rules do not require the Commission to be notified when a dam changes ownership. The Model Program recommends that states require current dam owners to notify the regulating agency in writing about any proposed changes in ownership. However, dam owners in Texas are not currently required to file any notification when there is a change in dam ownership. As a result, the Commission currently spends significant time trying to identify the correct owners of a dam it plans to inspect.

Current rules do not define some key terms relating to the regulation of dams. Texas Administrative Code, Title 30, Section 299.1, contains many useful definitions. However, there are some key terms that are not defined. These include “repairs,” “alteration,” “modification,” “emergency action plan,” “emergency repairs,” and “critical infrastructure dam.” Additionally, current rules do not define what constitutes a structurally “deficient” or “unsafe” dam, a clear definition of which could serve as a trigger for enforcement action.

Recommendations

The Commission should update its administrative rules to address best practices. Specifically, the Commission should consider revising its rules to:

- Require dam owners to prepare, submit, and follow maintenance and operating plans.
- Redefine the term “dam” to reduce the number of low-risk dams in the Commission’s inventory.
- Provide alternative safety requirements, such as developing emergency warning systems, to owners of existing dams that do not meet the required hydraulic standards.
- Require owners of all high- and significant-hazard dams to develop emergency action plans.
- Define who is considered a dam owner and identify which parties are responsible for violations of regulations and laws.
- Clarify which proposed dams must submit construction plans to the Commission for approval prior to the commencement of construction.
- Require dam owners to submit inspection reports completed by other government entities, private contractors, and dam owners’ own inspectors.

- Create a framework for the Commission to monitor and verify corrective action taken by dam owners. This could include requiring dam owners to (1) submit corrective action plans in a format prescribed by the Commission and by deadlines set by the Commission and (2) submit documentation of any corrective actions taken so the Commission can verify that identified deficiencies have been addressed.
- Require dam owners to notify the Commission in writing of any ownership changes.
- Clearly define key terms relating to dam safety requirements.

Management's Response

TCEQ Management accepts the recommendations. A rule package has been prepared and is expected to be presented to the TCEQ Commissioners for consideration for publication in the near future with final adoption scheduled prior to the 81st Legislative Session contingent upon Commission adoption of the proposed final rules. This rule package includes the majority of the areas recommended by the SAO recommendations. The remaining areas will be considered in a subsequent rule package.

The Field Operations Support Division is responsible for implementing these recommendations with a target date of December 10, 2008 for final rule adoption contingent upon Commission approval.

The Commission Should Improve Its Collection and Maintenance of Dam Inspection Data

The Commission uses two databases to collect and maintain dam inspection information. Its dam inventory database contains information about each of the more than 7,600 dams the Commission regulates, including the dam's size, location, condition, downstream hazard classification, hydraulic adequacy, owner, and other information. Its DamTracker database contains information about program staff activity, including safety inspections and construction plan reviews.

With minor exceptions, auditor testing of 60 dam inspection files concluded that the DamTracker database was substantially complete and accurate. However, the Commission did not consistently update the information in its dam inventory database. The Commission lacks formal written procedures about the collection, documentation, and entry of data to guide staff, all of whom have full access to the databases.

The Commission maintains a list of dam failures with dates and causes of failures, but there is no information regarding loss of life or economic loss resulting from the failure. In addition, the Commission does not retain supporting documentation for the performance measure results it reports to the Legislative Budget Board.

Although the Commission has some controls over the dam inventory database, it needs to take additional measures to ensure the accuracy and reliability of the data. The Commission plans to develop new databases to replace the existing ones. As it develops these new systems, the Commission should ensure that they comply with state data development requirements.

Chapter 6-A

The Commission Should Develop Formal, Written Policies and Procedures to Guide Data Entry, Collection of Data, and Documentation of Performance Measure Reporting

Information entered into the Commission's dam inventory database can be inconsistent and does not always match what is in the Commission's hard copy files. Specifically:

- Five of 29 (17 percent) dam construction or modification project files in the dam inventory database reviewed by auditors did not contain information about the dam's hydraulic adequacy, even though the project's hard copy file contained this information.
- Users entered 17 different descriptions for dam conditions. There should be only three standard conditions: good, fair, and poor. But the Commission database contained numerous variations, including "fair to

good,” “good to fair,” “poor to fair,” “moderate,” and “good to excellent” that varied depending on who was entering the data. The Commission’s standard inspection report form includes the categories of “good”, “fair”, and “poor” in assessing the general condition of the dam.

The Commission lacks formal, written operating procedures, including clear standards for what should be entered as the dam’s condition, to ensure that staff enter data in a consistent manner. Additionally, all staff members have full access to the dam inventory database and are responsible for entering (and overwriting) data. This increases the risk that the database will contain inaccurate, incomplete, and inconsistent information. Although the Commission recently developed informal policies, these should be formally adopted and communicated to staff.

The Commission also does not maintain complete information on dam failures that occur in Texas. Commission records indicate that 98 dam failures have occurred since 1970 (see Appendix 5 for additional information on dam failures). While the Commission maintains basic information about the cause of the dam failures and the failure date, it does not retain information about any resulting loss of life and/or property damage. This data could be useful to the Commission as an additional factor in evaluating the risk posed by the existing dams it regulates.

In addition, the Commission’s dam safety program does not calculate the results for its non-key performance measure—Percent of High- and Significant-hazard Dams Inspected within Established Time Frames—according to the definition agreed upon by the Legislative Budget Board and the Commission. The measure’s definition states that in-house plan reviews and emergency action plan reviews should be counted in addition to dam inspections; however, the Commission includes only dam inspections in its measure calculations. The Commission’s current methodology is more accurate because including activities such as review of construction plans and emergency action plans would misrepresent the percentage of dams that the Commission inspected. In addition, the measure’s definition states that the source of the data should be the DamTracker database, whereas the Commission uses the data in its dam inventory database to calculate the measure.

The Commission also does not retain supporting documentation for the data it uses to calculate the measure. Inspection dates are overwritten whenever a new inspection date is entered. The total number of dams is also overwritten whenever the Commission’s inventory fluctuates. This prevents any historical tracking data from being retained. The *Guide to Performance Measure Management* (State Auditor’s Office Report No. 06-329, August 2006) states that adequate documentation of primary data related to performance measures should be retained.

Recommendations

The Commission should:

- Ensure that it develops formal written data entry, data collection, and data documentation guidelines for its databases.
- Clearly define all data fields, such as condition of dam.
- Communicate the guidelines to its staff to improve consistency in data entry.
- Ensure that information in its dam inventory database completely and accurately reflects the information contained in the Commission's hard copy files.
- Ensure that it maintains complete information on dam failures, including information regarding any loss of life and economic loss resulting from the failure.
- Ensure that supporting documentation is retained for the calculation of the Percent of High- and Significant-hazard Dams Inspected within Established Time Frames performance measure.
- Meet with the Legislative Budget Board to review the definition for Percent of High- and Significant-hazard Dams Inspected within Established Time Frames to determine which activities conducted by Commission staff should be counted as inspections for reporting measure results.

Management's Response

TCEQ Management accepts these recommendations and will:

- *Develop formal written data entry, data collection, and data documentation guidelines for its databases.*
- *Clearly define all data fields, such as condition of dam.*
- *Communicate the guidelines to staff to improve consistency in data entry.*
- *Ensure that information in the dam inventory database completely and accurately reflects the information contained in the Commission's hard copy files, as inspections occur, from completion of the data system forward.*
- *Ensure that we maintain complete information on dam failures, including information regarding any loss of life and economic loss resulting from*

the failure as information related to such is made available. This will be maintained in a separate data system to ensure confidentiality of information.

- *Ensure that supporting documentation is retained for the calculation of the Percent of High- and Significant-hazard Dams Inspected within established Time Frames performance measure.*
- *Work with the Legislative Budget Board has been completed to review the definition for Percent of High- and Significant-hazard Dams Inspected within established Time Frames to determine which activities conducted by Commission staff should be counted as inspections for reporting measure results.*

As applicable, the Field Operations Support Division is responsible for implementing these recommendations with a target date of August 31, 2008, for development of the data system.

Chapter 6-B

The Commission Should Ensure Data Reliability by Strengthening Its Access Controls and Performing Data Reconciliations

The Commission's DamTracker database contains information on all inspections that the Commission performed during the most recent three years, as well as other information about other activities, including plan reviews for new construction, dam modifications, and repairs. Some of the information in this database, as well as the Commission's dam inventory database, is sensitive (such as hazard classifications) and warrants special measures to protect it.

The Commission has some effective general controls over these databases. Specifically:

- Edit checks validate the dam safety data that Commission staff enters.
- A secure method is available for off-site connection to the network, even though it is generally not used by inspectors because they usually wait until they return to headquarters to access the databases.
- Controls are in place to prevent unauthorized access to the network and to the electronic folders in the databases that contain dam safety data.
- Physical controls over the server room appear to be strong. These include measures to prevent unauthorized access to the server room and physical controls to detect fire and water in the server room.

- Data on the servers is backed up nightly and stored off site, and there are some controls in place for data recovery during a disaster.

However, the Commission has inadequate database application controls to ensure the reliability of the data. Auditors identified the following weaknesses:

- The Commission lacks a consistent or formal method for reconciliation of the data. Data should be reconciled regularly to ensure completeness.
- The databases do not restrict users to a list of predefined, standard options for some key data fields, such as a dam's condition. Allowing a user to only enter "good," "fair," or "poor" in this field, for example, would help ensure consistency of the data.
- All employees use the same password to access the databases, and the password has not been changed since the database was implemented in the 1980s, according to the Commission. This creates a potentially serious security risk.
- The two databases are technologically outdated and the original vendor no longer supports these databases.
- The databases lack an automated method to log out inactive personal computers from the network. An automatic logout would help prevent access by unauthorized users.
- Many of the data fields in the dam inventory database contain partial or no information. Some fields are not used by staff or management. Also, the Commission cannot identify the source or meaning of some information previously entered in these fields.
- The current version of the Commission's disaster recovery plan provides details about the recovery of only the most critical business processes and has not been tested. Secondary business processes are not addressed.

According to Commission management, both databases will soon be converted to a new database system. If this occurs, the Commission should ensure that the weaknesses identified in this chapter are addressed by the new system.

Recommendations

The Commission should ensure, either through the implementation of a new system or modifications to its existing one, that:

- Its automated systems and disaster recovery plan are compliant with the requirements in Title 1, Texas Administrative Code, Chapter 202.

- It utilizes the Texas Project Delivery Framework from the Department of Information Resources as a guide for system development and maintenance, where applicable.
- Its dam safety program coordinates all planned new database work with the Commission's Information Resources Department in the development, security, and maintenance of the system.
- It ensures that any planned new database design functions are compatible with the U.S. Army Corps of Engineers' systems to ensure continued sharing of data.
- Any new databases developed track and store the history of data entered and who entered the data.
- All data fields in any new system, or in the current system, are identified, defined, and used in a consistent manner.

Management's Response

TCEQ Management accepts the recommendations.

TCEQ Information Resources Division will:

- *Work with the TCEQ Information Security Officer to assure our disaster recovery plan is compliant with the requirements in Texas Administrative Code, Title 1, Chapter 202.*
- *Assure that the new database is compliant with the requirements in Texas Administrative Code, Title 1, Chapter 202.*
- *Utilize the Texas Project Delivery Framework from the Department of Information Resources as a guide for system development and maintenance, where applicable.*

As applicable, the Information Resources Division is responsible for implementing these recommendations with a target date of December 31, 2008.

The Field Operations Support Division and Information Resources Division will ensure:

- *all planned new database work is coordinated with the Commission's Information Resources Division in the development, security, and maintenance of the system.*
- *the new database design functions are compatible with the U.S. Army Corps of Engineers' systems to ensure continued sharing of data.*

- *the requirements of the new database developed will include provisions for tracking and storing the history of data entered and who entered the data.*
- *all data fields in any new system are identified, defined, and used in a consistent manner.*

As applicable, the Field Operations Support Division and the Information Resources Division are responsible for implementing these recommendations with a target date of August 31, 2008 for development of the data system.

Appendices

Appendix 1

Objectives, Scope, and Methodology

Objectives

The objectives of this audit were to:

- Determine whether the Commission on Environmental Quality (Commission) has established and adheres to policies, procedures, and administrative rules that govern the safe construction, maintenance, repair, and removal of dams in Texas.
- Evaluate the Commission's progress toward addressing recommendations in the *Peer Review of the Dam Safety Program of the Texas Commission on Environmental Quality* conducted by the Association of State Dam Safety Officials and released on January 27, 2003.

Scope

The scope of this audit covered the operations of the Commission's dam safety program, including inspections and plan review files for fiscal years 2005 through 2007 and information in two dam safety program databases. Auditors also reviewed information relating to the Commission's progress toward implementing the recommendations made in the January 2003 peer review report by the Association of State Dam Safety Officials. This audit specifically excluded levees.

Methodology

The audit methodology included interviewing staff and management of the dam safety program, observing staff inspectors on dam inspections, performing data analysis on the Commission's dam inventory and DamTracker databases, testing selected inspection and plan review and approval files for compliance with rules and regulations, researching information on dams in the United States and Texas, and contacting associations in the dam safety and management industry.

Information collected and reviewed included the following:

- Relevant state and federal legislation and proposed legislation relating to dams.
- Information from the Association of State Dam Safety Officials regarding the operation, management, and statistics from other states' dam safety programs.

- Human resource information about the dam safety program staff and their qualifications.
- Inspection reports and correspondence between the Commission and dam owners and/or their representatives.
- Plan review and approval files and all associated correspondence.
- Contracts with consultants and documents related to procurement of these contracts.
- All information contained in the two databases the Commission uses to manage the dam safety program.
- Emergency action plans submitted to the Commission by dam owners.
- Information relating to the Commission's progress toward implementing the recommendations in *Peer Review of the Dam Safety Program of the Texas Commission on Environmental Quality*.
- *Challenges Facing Sponsors of NRCS-assisted Dams in Texas*, Laura B. Gibson and Warren D. Samuelson at the Commission on Environmental

- Reviewing dam safety program staff qualifications and training.
- Accompanying staff and a contracted consultant on multiple dam inspections.
- Reviewing the Commission's progress toward implementation of the recommendations in the Association of State Dam Safety Officials' January 2003 peer review report.
- Conducting a limited survey of dam safety program management in 16 other states.
- Reviewing general and application controls of the information technology systems used by the Commission's dam safety program staff.

Criteria used included the following:

- Texas Water Code, Chapters 11 and 12.
- Texas Administrative Code, Chapter 299.
- *State of Texas Contract Management Guide*, as it relates to consultant services procurement.
- Commission policies and procedures.
- Applicable federal law and regulations.
- Best practices, including those recommended by (1) the Association of State Dam Safety Officials' in its *Model State Dam Safety Program* and its 2003 peer review report of the Commission's dam safety program, (2) the Federal Emergency Management Agency in *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*, and (3) the U.S. Army Corps of Engineers.
- Department of Information Resources guidelines.
- Texas Administrative Code, Chapter 202.

Project Information

Audit fieldwork was conducted from November 2007 through February 2008. We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The following members of the State Auditor's staff performed the audit:

- Lucien Hughes (Project Manager)
- Michael Stiernberg, MBA, JD (Assistant Project Manager)
- LaTonya Dansby
- Lynn Magee, MBA
- Marlen Kraemer, MBA, CISA (Information Services Audit Team)
- Rachelle Wood (Information Services Audit Team)
- Worth Ferguson, CPA (Quality Control Reviewer)
- John Young, MPAff (Audit Manager)

Additionally, the State Auditor's Office thanks the following organizations for their assistance:

- The Texas Legislative Council for the preparation of the map in Appendix 6.
- The Association of State Dam Safety Officials for providing statistical information on dam safety programs in other states and for accommodating auditors' requests for additional information.

Status of Implementation of Peer Review Recommendations

The Commission on Environmental Quality (Commission) has fully or substantially implemented 5 of 11 key recommendations in the 2003 report *Peer Review of the Dam Safety Program of the Texas Commission on Environmental Quality* by the Association of State Dam Safety Officials. The Commission requested the peer review.

In the report, the Association of State Dam Safety Officials concluded that “the Texas Dam Safety Program is seriously deficient in meeting the statutory and regulatory requirements of the state’s dam safety laws.” To correct the identified deficiencies, the peer review team made a number of recommendations, five of which the Commission has fully or substantially implemented (see Table 6). For example, the Commission updated its *Guidelines for Operation and Maintenance of Dams* manual and provided six educational workshops for dam owners in 2007.

However, the Commission has not implemented three of the recommendations because they refer to the Commission’s administrative rules regarding dam safety, which the Commission is in the process of revising (see Chapter 5). The Commission has partially implemented three other recommendations. While the Commission has assigned an administrative assistant to the dam safety program, this assistant provides minimal support. Also, the Commission lacks a formal or documented risk assessment process for dam inspections and a system for ensuring that follow-up inspections are conducted on deficient dams (see Chapters 2 and 4).

Table 6

Status of Key Recommendations in 2003 Peer Review Report by Association of State Dam Safety Officials				
Recommendation	Implementation Status			
	Fully Implemented	Substantially Implemented	Partially Implemented	Not Implemented
Chapter 299 regulations of the Commission’s regulations need to be updated to conform with currently established dam safety practices as outlined in the Association of State Dam Safety Officials’ Model Dam Safety Program (1998).				X
Regulations should include provisions for enforcement of the dam safety regulations.				X
The Commission should adopt the guidance and recommendations on dam safety as presented in the “Executive Director’s Task Force on Dam Safety: Final Report” published in June 1998.				X
Update and republish the <i>Texas Dam Safety Program Guidelines for Operation and Maintenance of Dams</i> for owners and distribute them during inspections and training.	X			
The dam safety program’s job classifications should include the requirements for an engineering degree relevant to dam design and			X	

**Status of Key Recommendations in 2003 Peer Review Report by
Association of State Dam Safety Officials**

Recommendation	Implementation Status			
	Fully Implemented	Substantially Implemented	Partially Implemented	Not Implemented
construction with the goal of the individual obtaining a professional license.				
A compensation plan needs to be developed that is commensurate with the desired qualifications in order to attract experienced people to the dam safety program.	X			
Increase the administrative support in Austin to update and maintain the dam inventory.			X	
Develop a procedure for identifying, prioritizing, and scheduling the required annual inspections			X	
Develop a procedure and tracking method to ensure the dam deficiencies that are identified during inspections have follow-up inspections.			X	
Provide additional funding for training opportunities in dam safety, including workshops and conferences that are available. Approve the use of Association of State Dam Safety Officials training grant money for this training.		X		
Conduct public workshops for dam owners, emergency agencies, and the general public.	X			

Size Classification and Hydraulic Adequacy Classification Criteria in the Texas Administrative Code

Size Classification

Texas Administrative Code, Title 30, Section 299.11, requires all dams to be classified in one of three size classifications: small, intermediate, and large. The appropriate size classification is the largest category determined by the criteria listed in Table 7 for either maximum reservoir storage capacity or dam height.

Table 7

Size Classification Criteria Texas Administrative Code, Title 13, Section 299.11		
Category	Maximum Reservoir Storage Capacity ^a	Dam Height
Small	Less than 1,000 acre-feet	Less than 40 feet
Intermediate	Equal to or greater than 1,000 and less than 50,000 acre-feet	Equal to or greater than 40 feet and less than 100
Large	Equal to or greater than 50,000 acre-feet	Equal to or greater than 100 feet

^a One-acre foot of maximum water storage is the volume of water that would be required to cover one acre of land (43,560 square feet) to a depth of 1 foot. This is equal to 325,851 gallons.

Hydraulic Adequacy Classification

Texas Administrative Code, Title 13, Section 299.13, requires the downstream hazard posed by a dam to be classified in one of three classifications: low, significant, and high. A dam must meet the criteria listed in Table 8 for its size and hazard classification to be considered hydraulically adequate.

Table 8

Hydraulic Adequacy Criteria Texas Administrative Code, Title 13, Section 299.14		
Hazard Classification	Size Classification	Minimum Flood Hydrograph ^a
Low	Small	¼ of probable maximum flood
	Intermediate	¼ to ½ of probable maximum flood
	Large	All of probable maximum flood
Significant	Small	¼ to ½ of probable maximum flood
	Intermediate	½ to all of probable maximum flood
	Large	All of probable maximum flood

Hydraulic Adequacy Criteria Texas Administrative Code, Title 13, Section 299.14		
Hazard Classification	Size Classification	Minimum Flood Hydrograph ^a
High	Small	All of probable maximum flood
	Intermediate	All of probable maximum flood
	Large	All of probable maximum flood
^a Flood hydrograph is the minimum required flood that the dam is required to safely pass. Where a range is given, the minimum flood hydrograph will be determined by straight line interpolation within the given range. Interpolation shall be based on either hydraulic height or impoundment size, whichever is greater.		

Proposed low-hazard dams that are exempt under Texas Water Code, Section 11.142, also are exempt from the minimum hydraulic adequacy criteria in Table 12. Specifically, the Texas Administrative Code, Section 299.14, states:

Any other proposed structure may be exempt from the minimum criteria if properly prepared dam breach analyses show that existing downstream improvements or known or planned future improvements will not be adversely affected. A properly prepared breach analysis should include at least three events: the normal storage capacity nonflood event, the barely overtopping event, and the probable maximum flood event. Data on additional flood magnitudes may be provided as necessary to document other conditions or conclusions. Downstream flooding differentials of 1-foot or less between breach and nonbreach simulations are not considered to be adverse.

Natural Resource Conservation Service Dams¹¹

The U.S. Department of Agriculture Natural Resource Conservation Service (NRCS), through authorizations received under the Flood Control Act of 1944 and the Watershed Protection and Flood Prevention Act of 1954, has assisted in the construction of 11,000 dams in 47 states since 1948. Of the 7,603 dams in the Commission on Environmental Quality's (Commission) dam safety program inventory, 1,999 are NRCS-assisted dams.

Local sponsors originally secured the land rights and easements needed for the construction of the NRCS-assisted dams and also may have assumed responsibility for the operation and maintenance of the dams. These local sponsors may include soil and water conservation districts, counties, cities, water districts, or other entities. An NRCS-assisted dam may also have more than one sponsor.

According to NRCS, most of the NRCS-assisted dams were designed for a 50-year lifespan and some of the dams in Texas have already exceeded that period. Additionally, many of these dams are located in areas that have experienced significant population increases, such as central Texas along the I-35 corridor. As a result, the downstream hazard classification of some of these NRCS-assisted dams may warrant an upgrade. Reclassifying a dam from low- to significant- or high-hazard may cause the dam to be noncompliant with the Texas Administrative Code requirements for hydraulic adequacy.

The federal Watershed Rehabilitation Program for Aging Dams has provided some funding for repairs and upgrades to NRCS-assisted dams. Funding for NRCS-assisted dams in Texas through this program averaged \$2.5 million each year from fiscal years 2002 through 2006. Also, the program allocated \$1.7 million to NRCS-assisted dams in Texas in fiscal year 2007. However, as of December 2007, NRCS estimated that the total cost for making needed upgrades to 107 high-hazard NRCS-assisted dams in Texas was \$205 million.

¹¹ The information in this appendix is unaudited and was provided by the Commission on Environmental Quality and the Natural Resource Conservation Service.

Dam Failures in Texas

There have been 98 dam failures in Texas since 1970, according to the Commission on Environmental Quality. Examples of these dam failures include breaches, spillway failures, overtoppings, and collapses. Of the 98 failures, 42 percent were at high- or significant-hazard dams (see Table 9 below). In some cases, the same dam had multiple failures. For example, one dam owned by a public utility has suffered four failures since 1970 and three dams owned by one business suffered a total of eight failures.

Table 9

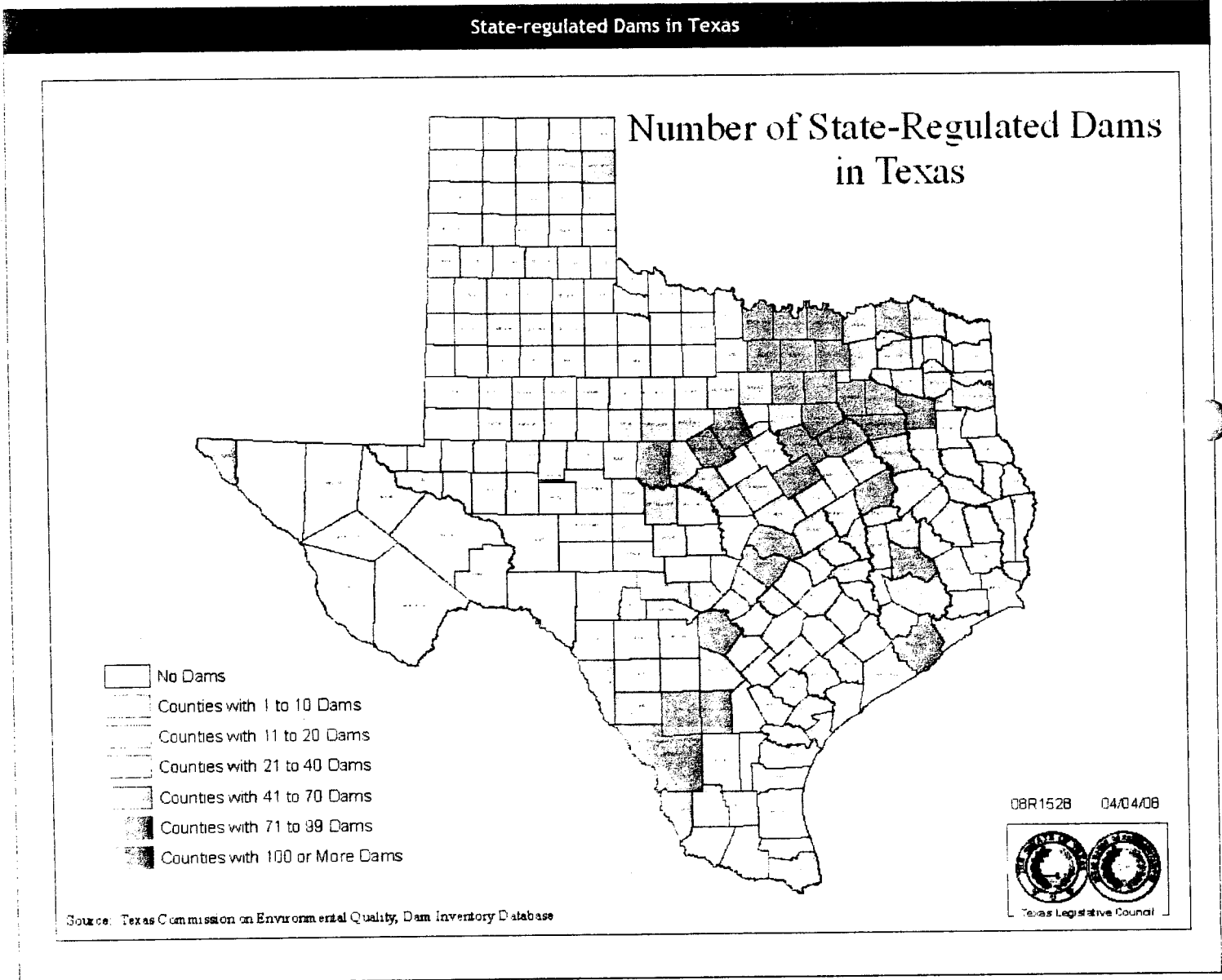
Dam Failures in Texas 1970 to January 2008		
Hazard Classification	Dam Failures	Percent of Failures
High	13	13%
Significant	28	29%
Low	55	56%
No Hazard Classification	1	1%
Removed from Inventory	1	1%
Total	98	100%

Source: Commission on Environmental Quality.

Statistics Regarding State-regulated Dams in Texas

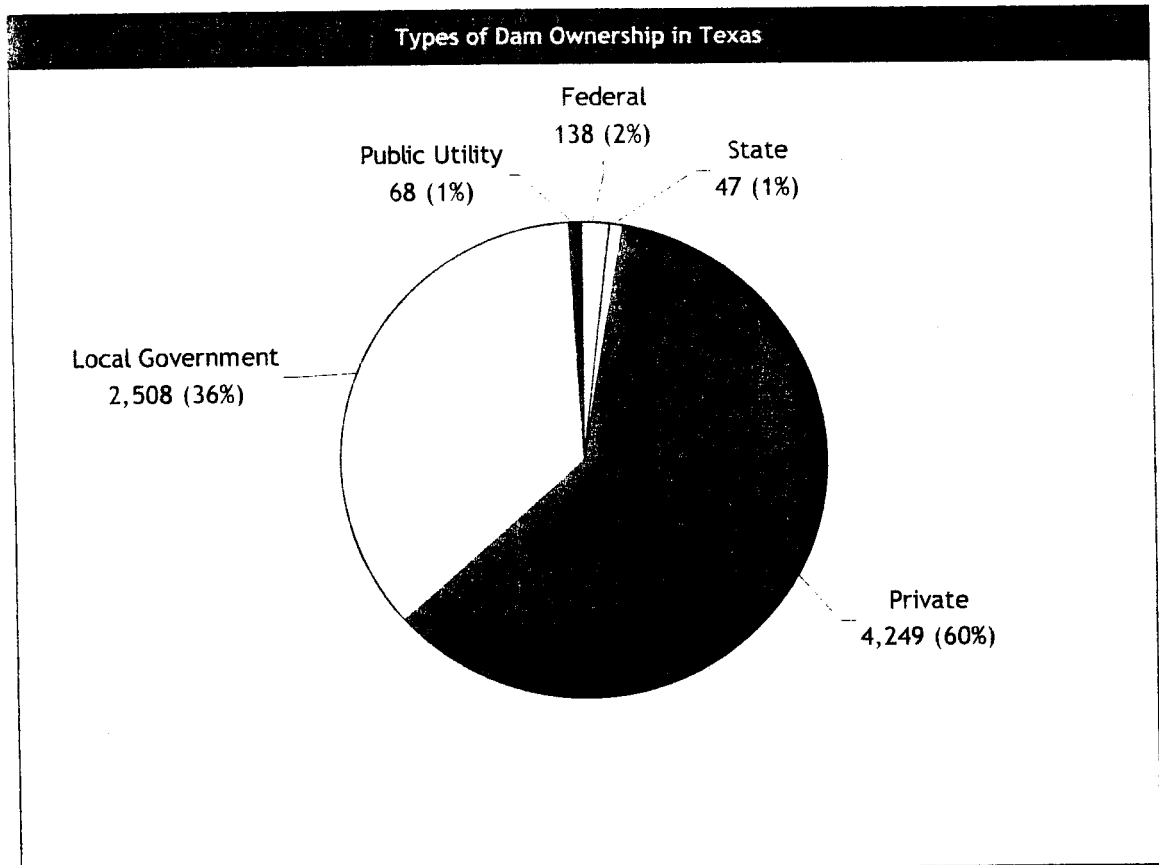
According to the Commission of Environmental Quality's (Commission) dam inventory database, there are 7,603 state-regulated dams in Texas. Most Texas counties have at least one dam. Figure 1 identifies the number of dams within a stated range in each county.

Figure 1



In 2006, the Commission reported to the Association of State Dam Safety Officials that it had 7,010 dams in its inventory that fit the National Inventory of Dams criteria.¹² Of these dams, 60 percent were privately owned and 36 were owned by local governments (see Figure 2).

Figure 2

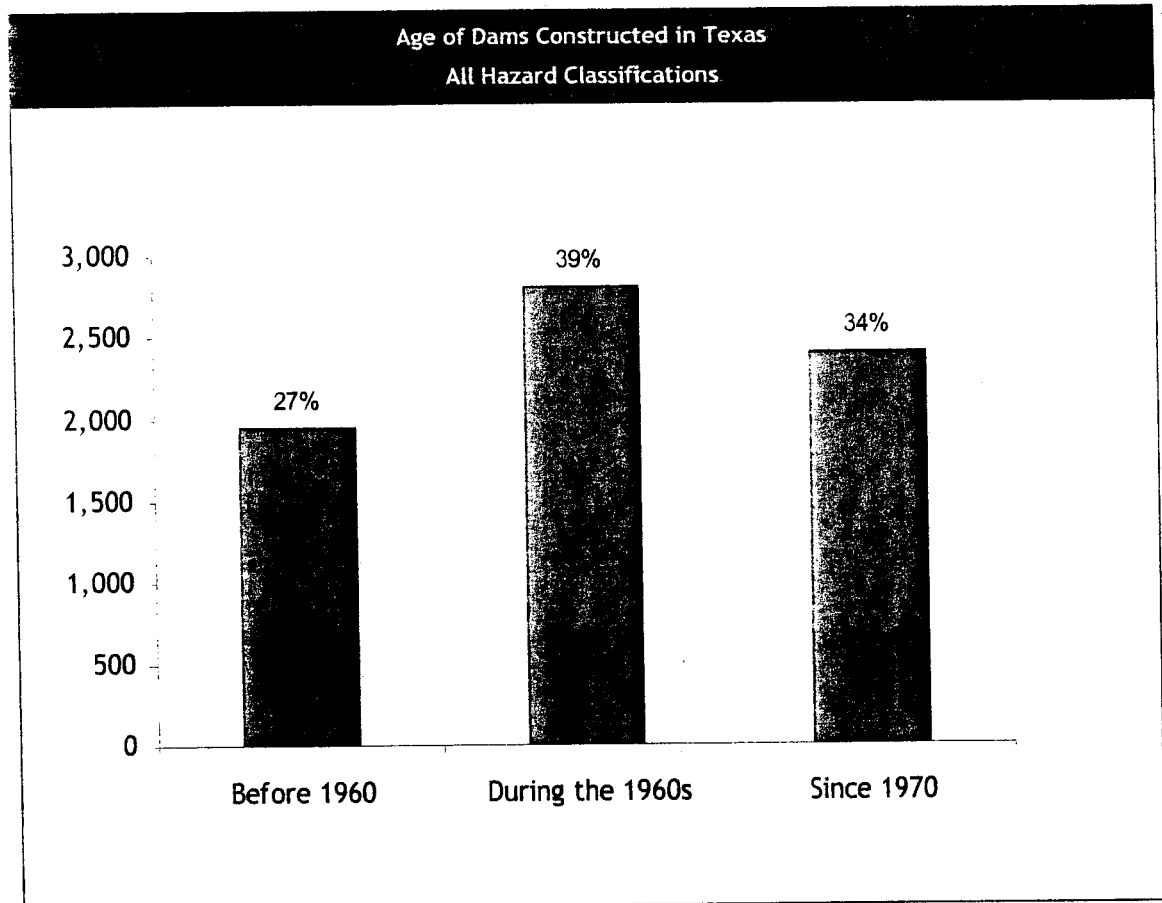


Source: Information reported to Association of State Dam Safety Officials by the Commission.

¹² A dam is included in the National Inventory of Dams if it meets the following criteria: it is high- or significant-hazard; it is low-hazard, is taller than 25 feet, and has more than 15 acre feet of storage; or it is low-hazard, taller than 6 feet, and has more than 50 acre feet of storage.

The Commission's dam inventory database contains information about the year of construction completion for 7,161 dams. As Figure 3 shows, 27 percent were built before 1960, 39 percent were built during the 1960s, and 34 percent were built since 1970.

Figure 3



Source: Commission dam inventory database.

As of January 2008, the Commission's dam safety program had 7,603 state-regulated dams in its inventory. Of these, 90 were considered to be large dams, which are defined by Texas Administrative Code, Title 30, Section 299.12 as having either (1) a maximum storage capacity equal to or greater than 50,000 acre-feet¹³ or (2) a height equal to or greater than 100 feet.¹⁴ For example, Medina Lake Dam in Medina County has a height of 164 feet; as a result, it is considered to be a large dam. The tallest state-regulated dam in

¹³ One-acre foot of maximum water storage is the volume of water that would be required to cover one acre of land (43,560 square feet) to a depth of 1 foot. This is equal to 325,851 gallons.

¹⁴ There are 331 dams in the Commission's dam inventory database that lack information about maximum storage capacity, and 68 dams that lack information about dam height.

Texas is the Mansfield Dam at 277 feet. However, height does not directly correlate to maximum storage capacity. While there are only four state-regulated dams in Texas that have a height greater than Medina Lake Dam, there are 27 dams that have a larger maximum storage capacity.

Table 10 lists the 10 largest state-regulated dams in Texas by maximum storage capacity.

Table 10

Ten Largest State-regulated Dams in Texas By Maximum Storage Capacity			
Dam Name	County	Impoundment Name	Maximum Storage Capacity in Acres feet
Toledo Bend Dam	Newton	Toledo Bend Reservoir	5,097,500
Mansfield Dam	Travis	Lake Travis	3,223,000
Livingston Dam	San Jacinto	Livingston Reservoir	2,045,000
Richland Creek Dam	Freestone	Richland Creek Reservoir	1,743,000
Iron Bridge Dam	Rains	Lake Tawakoni	1,660,023
Morris Sheppard Dam	Palo Pinto	Possum Kingdom Lake	1,365,000
Lake Fork Dam	Wood	Lake Fork Reservoir	1,269,599
Simon Freese Dam	Coleman	O. H. Ivie Reservoir	1,235,813
Buchanan Dam	Burnet	Lake Buchanan	1,180,000
Joe B. Hogsett Dam	Henderson	Cedar Creek Reservoir	1,085,000

Source: Commission's dam inventory database.

The Commission regulates 1,948 intermediate-sized dams. As defined by the Texas Administrative Code, intermediate dams have either (1) a maximum storage capacity equal to or greater than 1,000 acre-feet and less than 50,000 acre-feet or (2) a height equal to or greater than 40 feet and less than 100 feet.¹⁵ For example, Longhorn Dam, which impounds Ladybird Lake (formerly Town Lake), is an intermediate-sized dam. There are 298 dams in the Commission's inventory that impound more water than Longhorn Dam.

The Commission also regulates 5,234 small dams. As defined by the Texas Administrative Code, small dams have either (1) a maximum storage capacity of less than 1,000 acre-feet or (2) a height of less than 40 feet.

¹⁵ According to the Texas Administrative Code, Title 30, Section 299.12, the appropriate size (large, intermediate, or small) is the largest category determined for either storage or height.

Federally Regulated Dams in Texas

Federal agencies regulate 40 dams in Texas. These 40 dams include some of the largest dams in the state. Table 11 provides an alphabetical list of the federally regulated dams in Texas.

Table 11

Federally Regulated Dams in Texas			
Dam	County	Impoundment	Owner
Addicks Dam	Harris	Addicks Reservoir	U.S. Army Corps of Engineers
American Diversion Dam	El Paso	American Reservoir	International Boundary and Water Commission
Anzalduas Channel Dam	Hidalgo	(On Rio Grande River)	International Boundary and Water Commission
Aquilla Dam	Hill	Aquilla Lake	U.S. Army Corps of Engineers
Bardwell Dam	Ellis	Bardwell Lake	U.S. Army Corps of Engineers
Barker Dam	Harris	Barker Reservoir	U.S. Army Corps of Engineers
Benbrook Dam	Tarrant	Benbrook Lake	U.S. Army Corps of Engineers
Belton Dam	Bell	Belton Lake	U.S. Army Corps of Engineers
Canyon Dam	Comal	Canyon Lake	U.S. Army Corps of Engineers
Choke Canyon Dam	Live Oak	Choke Canyon Reservoir	U.S. Department of the Interior
Cooper Dam	Hopkins	Jim Chapman Lake	U.S. Army Corps of Engineers
Denison Dam	Grayson	Lake Texoma	U.S. Army Corps of Engineers
Ferrells Bridge Dam	Marion	Lake O The Pines	U.S. Army Corps of Engineers
Granger Dam	Williamson	Granger Lake	U.S. Army Corps of Engineers
Grapevine Dam	Tarrant	Lake Grapevine	U.S. Army Corps of Engineers
Hords Creek Dam	Coleman	Hords Creek Lake	U.S. Army Corps of Engineers
International Amistad Dam	Val Verde	Amistad Reservoir	International Boundary and Water Commission
International Dam	El Paso	International Reservoir	International Boundary and Water Commission
International Falcon Lake Dam	Starr	International Falcon Reservoir	International Boundary and Water Commission
Joe Pool Lake Dam	Dallas	Joe Pool Lake	U.S. Army Corps of Engineers
Lake Georgetown Dam	Williamson	Lake Georgetown	U.S. Army Corps of Engineers
Lavon Dam	Collin	Lavon Reservoir	U.S. Army Corps of Engineers
Lewisville Dam	Denton	Lake Lewisville	U.S. Army Corps of Engineers
Navarro Mills Dam	Navarro	Navarro Mills Lake	U.S. Army Corps of Engineers
O.C. Fisher Dam	Tom Green	O.C. Fisher Lake	U.S. Army Corps of Engineers
Pat Mayse Dam	Lamar	Pat Mayse Lake	U.S. Army Corps of Engineers
Proctor Dam	Comanche	Proctor Lake	U.S. Army Corps of Engineers
Ray Roberts Lake Dam	Denton	Ray Roberts Lake	U.S. Army Corps of Engineers
Retamal Channel Dam	Hidalgo	(On Rio Grande River)	International Boundary and Water Commission
Riverside Diversion Dam	El Paso	Riverside Reservoir	U.S. Department of the Interior
Sam Rayburn Dam	Jasper	Sam Rayburn Reservoir	U.S. Army Corps of Engineers
Sanford Dam	Hutchinson	Lake Meredith	U.S. Department of the Interior

Federally Regulated Dams in Texas

Dam	County	Impoundment	Owner
Somerville Dam	Burleson	Somerville Lake	U.S. Army Corps of Engineers
Stillhouse Hollow Dam	Bell	Stillhouse Hollow Reservoir	U.S. Army Corps of Engineers
Town Bluff Dam	Tyler	B.A. Steinhagen Lake	U.S. Army Corps of Engineers
Truscott Brine Lake Dam	Knox	Truscott Brine Lake	U.S. Army Corps of Engineers
Twin Buttes Dam	Tom Green	Twin Buttes Reservoir	U.S. Department of the Interior
Waco Dam	McLennan	Waco Lake	U.S. Army Corps of Engineers
Whitney Dam	Bosque	Lake Whitney	U.S. Army Corps of Engineers
Wright Patman Dam	Bowie	Wright Patman Lake	U.S. Army Corps of Engineers

Source: Commission on Environmental Quality dam inventory database.

Dam Safety Program Funding in Texas and Other States

As Table 12 shows, Texas ranks 28th among 47 states for state funding provided to the regulatory agency charged with ensuring dam safety, even though Texas has the largest inventory of state-regulated dams.¹⁶ State funding information was not available for Florida, Maine, and Massachusetts.

Table 12

Size and Funding of Dam Safety Programs in Texas and Other States ^a							
Fiscal Year 2006 Data							
State	State Funding Provided	Full-time Equivalents Employees (FTEs)	All States Regulated Dams	High Hazard Dams	Significant Hazard Dams	Low Hazard Dams	Regulated Dams per FTE
California	\$9,190,000	58.00	1,273	341	720	212	21.9
Pennsylvania	\$2,211,046	24.50	3,177	789	268	2,120	129.7
Colorado	\$1,692,300	14.00	1,928	345	332	1,251	137.7
Kentucky	\$1,550,420	14.00	1,060	177	209	674	75.7
Ohio	\$1,483,944	13.50	1,698	442	564	692	125.8
New Jersey	\$1,254,000	20.00	1,715	213	354	1,148	85.8
Virginia	\$1,247,124	5.00	1,604	146	304	1,154	320.8
New York	\$1,006,732	10.75	5,060	386	762	3,912	470.7
North Carolina	\$ 973,886	16.00	4,502	1,025	650	2,827	281.4
Washington	\$ 938,952	7.80	950	145	192	613	121.8
Georgia	\$ 727,009	11.00	3,874	450	0	3,424	352.2
New Hampshire	\$ 717,282	8.00	840	90	193	557	105.0
Arizona	\$ 711,028	7.30	251	94	41	116	34.4
Utah	\$ 666,200	6.00	667	189	200	278	111.2
Kansas	\$ 557,104	10.08	6,031	194	252	5,585	598.3
Wisconsin	\$ 537,500	6.25	3,749	211	188	3,350	599.8
Connecticut	\$ 490,000	6.50	1,187	226	462	499	182.6
New Mexico	\$ 484,411	6.00	396	177	88	131	66.0
Maryland	\$ 482,668	5.75	382	68	87	227	66.4
Louisiana	\$ 480,316	8.00	540	28	69	443	67.5
Delaware	\$ 470,000	0.75	37	9	27	1	49.3
West Virginia	\$ 465,773	6.00	341	245	78	18	56.8
Puerto Rico	\$ 440,000	6.00	35	35	0	0	5.8

¹⁶ States self-reported this information to the Association of State Dam Safety Officials. Specific information about what was included in the budget figures for each state was not made available to the State Auditor's Office. Texas's budget figure is the amount appropriated by the Legislature for the Commission's dam safety program and includes staff salaries but not consultant expenditures. Other states may include more than just salaries. Additionally, funding sources may differ. For example, California's dam safety program, the largest dollar amount of all states, is totally fee-funded.

Size and Funding of Dam Safety Programs in Texas and Other States ^a

Fiscal Year 2006 Data

State	State Funding Provided	Full-time Equivalent Employment (FTEs)	All State Regulated Dams	High Hazard Dams	Significant Hazard Dams	Low Hazard Dams	Regulated Dams per FTE
Indiana	\$ 425,000	5.00	993	241	250	502	198.6
Montana	\$ 399,937	4.20	2,884	102	132	2,650	686.7
Oklahoma	\$ 395,336	3.00	4,460	187	82	4,191	1,486.7
Tennessee	\$ 352,822	8.00	656	149	209	298	82.0
Texas	\$ 350,000	7.00	7,202	837	773	5,592	1,028.9
Nebraska	\$ 326,145	5.80	2,288	121	210	1,957	394.5
Illinois	\$ 306,000	4.80	1,485	187	299	999	309.4
Minnesota	\$ 305,000	3.40	1,151	23	125	1,003	338.5
Vermont	\$ 300,000	2.20	568	57	137	374	258.2
Arkansas	\$ 282,018	3.30	403	102	92	209	122.1
Missouri	\$ 261,779	5.00	653	455	132	66	130.6
Michigan	\$ 255,400	3.10	1,034	84	138	812	333.5
Idaho	\$ 249,294	7.50	569	107	149	313	75.9
Hawaii	\$ 246,638	1.75	136	95	21	20	77.7
North Dakota	\$ 220,000	4.50	1,150	29	94	1,027	255.6
Oregon	\$ 212,400	2.26	1,204	122	181	901	532.7
Nevada	\$ 197,304	2.00	672	157	131	384	336.0
Wyoming	\$ 160,365	4.98	1,445	79	116	1,250	290.2
South Dakota	\$ 150,000	1.50	2,349	47	144	2,158	1,566.0
Rhode Island	\$ 113,976	1.20	671	17	41	613	559.2
Alaska	\$ 100,500	1.00	81	17	32	32	81.0
Mississippi	\$ 62,079	4.30	3,698	258	94	3,346	860.0
Iowa	\$ 57,000	1.75	3,325	83	193	3,049	1,900.0
South Carolina	\$ 0	2.50	2,317	153	481	1,683	926.8
Alabama	\$ 0	0.00	0	0	0	0	0
Florida	Not Available	77.00	805	72	321	412	Not Available

^a Information about dam safety programs in Maine and Massachusetts was not available.

^b The number of state-regulated dams in Texas in this table differs from the total number cited in this report because the Commission's inventory of dams has increased since 2006. Additionally, there were 43 dams in the Commission's current inventory with no hazard classification listed.

Source: This information was provided to the State Auditor's Office by Association of State Dam Safety Officials.

Other States' Grant or Loan Programs, Fee Assessments, and Responsibility for Performing Inspections

State Grant/Loan Programs

As of calendar year 2006, 17 states had grant and/or loan funds available to dam owners for the repair, abandonment, or removal of a dam. Two of five of Texas' neighboring states—Colorado and New Mexico—have grant and/or loan funds available for their dam safety programs. The remaining 15 states with grant and/or loan funds are: Arizona, Kansas, Maryland, Minnesota, Montana, New Jersey, New York, North Dakota, Ohio, Pennsylvania, Utah, Vermont, Virginia, West Virginia, and Wisconsin.

The source of funds used for the grants and/or loans varies by state and sometimes within a state. For instance, Arizona's Dam Repair Fund consists of state appropriations and monies collected from application and inspection fees. In North Dakota, the purpose of the dam determines a political subdivision's share of repair or rehabilitation costs with the State of North Dakota providing the balance. Ohio has two low-interest loan programs for dam safety programs. One of these programs, the Dam Safety Linked Deposit Loan Program, offers loans to private dam owners through private banks.

Who is eligible to participate in the grant and/or loan programs also varies from state to state. Most state programs restrict the eligibility for the grant/loan programs to only dams that are publicly owned (Minnesota, Montana, and Pennsylvania); some states restrict it further by specifying that the dam owner must be a municipality (New York) or a political subdivision (New Mexico and North Dakota). However, some states allow their grant/loan programs to help private dam owners (Maryland, New Jersey, and Ohio). In some cases (Montana and New York), grant funds are competitively awarded.

The amounts allocated for dam safety projects also vary. At least one state, North Dakota, requires that the dam owner match at least a portion of project costs. Virginia and Kansas have authorized grant and/or loan programs, but they are still working on the details. West Virginia created a revolving loan fund for deficient dams but had not funded the program as of April 2008.

Fees Assessed for Permits and Inspections

Twenty-five of 48 states reported to the Association of State Dam Safety Officials in 2006 that they had an established fee structure for applicant and permit reviews and/or for inspections of dams.

Responsibility for Performing Inspections

Twelve states have some variation of regulations that require dam owners to provide inspections. For example, Indiana and Montana require owners of all high-hazard dams to provide inspections to the state's dam safety program; Oklahoma requires owners of high- and significant-hazard dams to provide inspections to the state; Missouri requires all private dam owners to provide inspections to the state. Delaware, New Jersey, and Mississippi require all dam owners to provide inspections to the state.

Table 13 lists the grant and/or loan programs, assessed fees, and assignment of responsibility for performing inspections for each state listed in the Association of State Dam Safety Officials' publications. This information was compiled by the State Auditor's Office from information provided by the Association of State Dam Safety Officials.

Table 13

State Dam Safety Grant /Loan Programs; Fee Assessments; Inspection Responsibility			
State	Grant/Loan Program Provided ^a	Assess Fees for Permits/Inspections? ^b	Responsibility for Performing Inspections ^c
Alabama	Does not provide grants or loans.	Did not have a dam safety program as of 2006.	Did not have a dam safety program as of 2006.
Alaska	Does not provide grants or loans.	Yes	Consultants hired by the dam, dam owner, or dam operator.
Arizona	Dam Repair Fund consisting of monies appropriated by the legislature and monies collected from application and inspection fees. Owners of unsafe dams are eligible for grants or loans. Provides loan terms up to 20 years.	Yes	State personnel.
Arkansas	Does not provide grants or loans.	Yes	State personnel.
California	Does not provide grants or loans.	Yes	State personnel.
Colorado	Reported it had a state loan or grant program, but state officials provided no details.	Yes	State personnel.
Connecticut	Does not provide grants or loans.	Yes	Combination of dam owners' consultants and state personnel. Nine dams are inspected by consultants, but state officials did not specify whether the consultants were hired by the state or the dam owners.
Delaware	Does not provide grants or loans.	No	Dam owner.
Florida	Does not provide grants or loans.	No	State personnel and dam owners.
Georgia	Does not provide grants or loans.	No	State personnel.
Hawaii	Does not provide for grants or loans.	Yes	Consultants hired by the state and state personnel.
Idaho	Does not provide grants or loans.	Yes	State personnel.
Illinois	Does not provide grants or loans.	No	State personnel and dam owners.
Indiana	Does not provide grants or loans.	No	Dam owners for high-hazard dams.
Iowa	Does not provide grants or loans.	No	State personnel.

State Dam Safety Grant /Loan Programs; Fee Assessments; Inspection Responsibility

State	Grant/Loan Program Provided	Assess Fees for Permits/Inspections	Responsibility for Performing Inspections
Kansas	State Conservation Commission fund to rehabilitate watershed dams. Fund was active after July 1, 2006.	Yes	State personnel.
Kentucky	Does not provide grants or loans.	No	State personnel.
Louisiana	Does not provide grants or loans.	No	State personnel.
Maryland	Maryland Department of Natural Resources has limited funds to assist dam owners to remove dams that are no longer needed or that block passage of fish and eels.	No	State personnel.
Michigan	Does not provide grants or loans.	Yes	State personnel inspect state-owned dams. Inspections of all private dams are the responsibility of the owner. Dams owned by local governments are inspected by state personnel or consultant.
Minnesota	Provides assistance to publicly owned dams only.	Yes	State personnel.
Mississippi	Does not provide grants or loans.	No	Dam owners.
Missouri	Does not provide grants or loans.	No	Due to budget constraints, the state recently required dam owners to perform inspections.
Montana	Publicly owned dams can receive up to \$100,000 in grants and low interest loans. Grants are competitively awarded for all infrastructure projects (including wastewater, drinking water, and other projects).	Yes	Dam owners are responsible for inspections of high-hazard, non-state owned dams. High-hazard, state owned dams are inspected by state personnel. All other dams are inspected by state personnel or ordered on an "as needed" basis.
Nebraska	Does not provide grants or loans.	Yes	State personnel.
Nevada	Does not provide grants or loans.	No	Consultants hired by the state and state personnel.
New Hampshire	Does not provide grants or loans.	Yes	State personnel.
New Jersey	Operates a low interest dam rehabilitation loan program. A municipality must co-sign a loan for private dam owners. This is a revolving loan plan with loan terms of up to 20 years.	No	Dam owners.
New Mexico	Provides grant/loan funds to dam owners who are political subdivision of the state. Funds are not permanent. Each year additional capital improvement funds must be requested.	Yes	State personnel.
New York	Has a competitive reimbursement grant program for municipal dam owners.	No	State personnel.
North Carolina	Does not provide grants or loans.	No	State personnel.
North Dakota	Has a cost -share program for political subdivisions of the state; this is not a grant program. The state will contribute a certain percentage of the repair or rehabilitation costs. The cost share percentage is based on the purpose of the dam; a flood control project is eligible for 50 percent cost sharing, while a recreation project is eligible for 33.3 percent cost sharing. Currently, there is no cost sharing policy for the abandonment or removal of dams.	Yes	State personnel.

State Dam Safety Grant /Loan Programs; Fee Assessments; Inspection Responsibility

State	Grant/Loan/Program Details	Assess Fees for Permits/Inspections?	Responsibility for Permits/Inspection?
Ohio	The Ohio Water Development Authority has two low-interest loan programs for the repair or removal of existing dams. The Dam Safety Loan Program offers loans to local governments and the Dam Safety Linked Deposit Program offers low-interest loans to private dam owners. To be eligible for these programs, the dam owner must have plans for the repair or removal of the dam approved by the Division of Water and they must qualify based on their ability to repay the loan. The Linked Deposit Program is offered through private banks. Loan terms are 5 to 20 years.	Yes	State personnel.
Oklahoma	Does not provide grants or loans.	Yes	Dam owners for high- and significant-hazard dams. State personnel for low-hazard dams.
Oregon	Does not provide grants or loans.	No	State personnel.
Pennsylvania	Operates a low interest loan program (Pennvest) for publicly owned water supplies, waste water systems, and dams. The state also initiated a Growing Greener II program, which can be used for dam repair or removal. There are no specific dedicated amounts for dam-related work.	Yes	Combination of consultants hired by owners and state personnel.
Rhode Island	Does not provide grants or loans.	No	State personnel.
South Carolina	Does not provide grants or loans.	No	State personnel.
South Dakota	Does not provide grants or loans.	Yes	State personnel.
Tennessee	Does not provide grants or loans.	Yes	State personnel.
Texas	Does not provide grants or loans.	No	Consultants hired by the state and state personnel. Also uses some inspections conducted by consultants hired by dam owners.
Utah	Has a loan/grant program funded by a legislative appropriation for existing high-hazard dams not meeting state standards. Generally, the grants will cover 80 to 95 percent of costs with the dam owners able to take a loan for the remainder of costs. The terms of the loans depends upon an owner's circumstance and ability to repay.	No	State personnel.
Vermont	Provides loans or grants for the rehabilitation or removal of dams. Details will be established in regulations, which were not developed as of 2006.	No	Majority of dams are inspected by state personnel; others are conducted by consultants hired by the state or the dam owner.
Virginia	Operates a Dam Safety and Flood Prevention Protection Assistance Fund. The program has not been used; however, procedures were set to be in place by fall 2007 to allow some high-hazard dam owners to obtain low interest loans.	No	Dam owners for initial certification and re-certifications.
Washington	Does not provide grants or loans.	Yes	State personnel.
West Virginia	The 2007 Legislature created a revolving loan fund for deficient dams. Deficient dams are (1) a noncoal-related dam that exhibits one or more design, maintenance, or operational problems that may adversely affect the performance of the dam and that may cause loss of life or property or (2) a noncoal-related dam	Yes	Consultants hired by the state and state personnel.

State Dam Safety Grant /Loan Programs; Fee Assessments; Inspection Responsibility


State	Grant/Loan Program Provided	Assess Fees for Permits/Inspections ^a	Responsibility for Performing Inspections ^b
	that otherwise fails to meet dam safety requirements.		
Wisconsin	Reported it had a state loan or grant program, but state officials provided no details.	Yes	State personnel.
Wyoming	Does not provide grants or loans.	Yes	Consultants hired by state and state personnel.

^aThis data is for the 2006 reporting year and was published in *2007 State Dam Safety Program Performance Information Summary* by the Association of State Dam Safety Officials and the National Dam Safety Review Board, August 2007. **This information has not been audited by the State Auditor's Office.** Additional information, primarily regarding loan term agreements, was provided by states responding to an informal survey conducted by the State Auditor's Office.

^bThis data is from *Requested Information Regarding State Regulatory Organization's Dam Safety Inspection Responsibility, Inspection Frequency, and Fee Information*, Association of State Dam Safety Officials, September 7, 2007. **This information has not been audited by the State Auditor's Office.**

Medina Dam Background Information Provided by the Commission

The Commission on Environmental Quality provided this information.



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
Preserving Texas by Reducing and Preventing Pollution

Medina Dam

In July of 2002, a flood event caused Medina Lake to rise to a level 1.5 feet below the top of the dam. Evacuations were made downstream due to concern over the stability of the dam. The U.S. Army Corps of Engineers and Freese & Nichols, Inc., who were present during the flood event, expressed concerns over the stability of the dam during high lake levels and recommended that a stability analysis be undertaken. As a result, the TCEQ classified the dam as conditionally unsafe for an event leading to a lake level exceeding that of July 2002. A meeting was conducted by TCEQ with Bexar Medina Atascosa BMA Counties WCID #1 on July 18, 2002. During the meeting TCEQ required BMA to submit a report on the stability of the dam. In a response letter dated July 22, 2002, BMA indicated they were retaining URS Corporation to evaluate the structural and hydraulic capabilities of the dam to address TCEQ concerns.

The TCEQ formalized the issues discussed during the July 18, 2002 meeting in a letter dated October 22, 2002. Most notably, it requested that BMA take action to: (1) evaluate the structure for stability, (2) repair the outlet works, and (3) develop an emergency action plan (EAP). In response BMA initiated the following:

- An extensive evaluation of the dam was undertaken by URS Corporation, which, among other items included performing a two-dimensional stability analysis and a hydrologic and hydraulic analysis.
- On August 8, 2002, TCEQ approved the plans for the outlet works. BMA commenced construction started in March 2003. During repair of the valves, a problem developed with the valves, and the work has not been completed satisfactorily.
- The original EAP was received in September 2003. A revised EAP was submitted to TCEQ in January 2008, which contained the finalized breach inundation zone maps and changes to the evacuation procedures.

The final structural stability analysis report was completed on December 13, 2004. The report indicated the dam was structurally safe at the level previously considered conditionally unsafe (the 2002 flood), but the abutment sections did not satisfy criteria for the Probable Maximum Flood (PMF) (estimated 5.8 feet over the top of dam) and full PMF (6.5 feet over top of dam) loads. The results indicated that the abutment sections did not satisfy overturning criteria and were susceptible to erosion during overtopping.

Medina Dam
Page 2
May 2, 2008

BMA's engineer proposed two options in 2004 for addressing the stability issue: post-tension anchors and a reinforced concrete apron (costing \$2.68 million) and/or a downstream buttress behind the abutment sections made of roller compacted concrete (costing \$8.7 million). The initial modifications recommended by BMA's engineer included post-tension anchors and a reinforced concrete apron along the downstream toe of the abutment sections.

The Regional Flood Study was also completed in December 2004. The study refined the National Weather Service model for the Medina River. This model improved the accuracy and timing of real time predictions of peak lake levels and allowed predictions to be received by communities downstream 4 to 5 hours earlier than before.

By letter dated August 5, 2005, the FCIQ requested a written plan of action with time frames for completing the remaining work on the dam. In a letter dated September 12, 2005, BMA provided the requested plan of action with time frames.

A preliminary engineering report, completed in September 2006, provided a new cost for the anchors and concrete apron based on additional investigations. The 2006 estimate was \$10.4 million.

Since the September 2006 engineering report, the BMA has been attempting to raise funds necessary to complete the work proposed by URS Corporation. During the 80th Legislative Session in 2007, the BMA unsuccessfully sought a grant to fund the recommended modifications to the dam. In an attempt to further completion of the dam structural modifications, BMA has met with TWDB on several occasions in 2007 and 2008, but no application for funding has been submitted to date.

Recent State Auditor's Office Work

Recent SAO Work		
Number	Project Name	Release Date
06-029	An Audit Report on Selected Contracting Practices at the Commission on Environmental Quality	April 2006
04-016	An Audit Report on Permitting and Enforcement Functions at the Commission on Environmental Quality	December 2003

Copies of this report have been distributed to the following:

Legislative Audit Committee

The Honorable David Dewhurst, Lieutenant Governor, Joint Chair
The Honorable Tom Craddick, Speaker of the House, Joint Chair
The Honorable Steve Ogden, Senate Finance Committee
The Honorable Thomas "Tommy" Williams, Member, Texas Senate
The Honorable Warren Chisum, House Appropriations Committee
The Honorable Jim Keffer, House Ways and Means Committee

Office of the Governor

The Honorable Rick Perry, Governor

Commission on Environmental Quality

Members of the Commission on Environmental Quality

Mr. Buddy Garcia, Chairman

Dr. Bryan W. Shaw

Mr. Larry R. Soward

Mr. Glenn Shankle, Executive Director



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Appendix C

Size Classification

Category	Impoundment Storage (Ac-Ft)	Height (Ft.)
Small	Less than 1000	Less than 40
Intermediate	Equal to or greater than 1000 and less than 50,000	Equal to or greater than 40 and less than 100
Large	Equal to or greater than 50,000	Equal to or greater than 100

Appendix D

Hazard Potential Classification

Category	Loss of Human Life	Economic Loss
Low	None expected (No permanent structures for human habitation)	Minimal (Underdeveloped to occasional structures or agricultural improvements)
Significant	Possible, but not expected (A small number of inhabitable structures)	Appreciable (Notable agricultural, industrial or commercial development)
High	Expected (Urban development or large number of inhabitable structures)	Excessive (Extensive public, industrial, commercial or agricultural development)

Appendix E

Dam Owners

State	46
Federal	113
Local Governments	493
Water Districts	336
Soil and Water Conservation Districts	1,754
River Authorities	76
Public Utilities	73
Private	1,900
Individuals	2,432

Appendix

F



AGENDA
Senate Committee on Natural Resources
May 13, 2008, 10:00 a.m.
Erik Jonsson Public Library - First Floor Auditorium
Dallas, Texas

- I. Call to Order
- II. Overview - Texas Water Development Board
 - Carolyn Brittin, Deputy Executive Administrator, Water Planning and Information Resources
 - Bill Mullican, Deputy Executive Administrator, Water Science and Conservation
- III. Regional Water Supply and Conservation Panel
 - Jody Puckett, Water Utilities Director, Dallas Water Utilities
 - Jim Parks, General Manager, North Texas Municipal Water District
 - Jim Oliver, General Manager, Tarrant Regional Water District
- IV. Update on Region C Study Commission
 - Jim Parks, General Manager, North Texas Municipal Water District
 - Tom Duckert, Regional EHS Manager, International Paper
- V. Surface Water Salinity Panel
 - Herman Settemeyer, Interstate Compacts, Texas Commission on Environmental Quality, Water Supply Division
 - Matt Phillips, Government and Customer Relations Manager, Brazos River Authority
 - J.W. Thrasher, Commissioner, Pecos River Interstate Compact Commission
 - Allan Jones, Director, Texas Water Resources Institute
 - Alan Plummer, Chairman of the Board, Alan Plummer Associates, Inc.
 - Sonny Kretzschmar, Project Manager, HDR Engineering, Inc.
- VI. Dam Safety Audit Report
 - Michael Stierberg, Assistant Project Manager, State Auditor's Office
 - John Young, Audit Manager, State Auditor's Office
- VII. Dam Safety Overview
 - Warren Samuelson, Dam Safety Program Coordinator, Field Operations Division, Texas Commission on Environmental Quality
- VIII. Dam Safety Panel
 - Rex Isom, Executive Director, Texas State Soil and Water Conservation Board
 - John Foster, Statewide Programs Officer, Texas State Soil and Water Conservation Board
 - Mark Jordan, Manager, River Management Services, Lower Colorado River Authority
 - Louie Verreault, Dam Safety Engineer, Tarrant Regional Water District
 - Dean Robbins, Assistant General Manager, TWCA
- IX. Public Testimony
- X. Recess

Appendix G

SENATE COMMITTEE ON NATURAL RESOURCES

SENATOR KIP AVERITT, Chairman
SENATOR CRAIG ESTES
Vice Chairman
SENATOR GONZALO BARRIENTOS
SENATOR ROBERT DUNCAN
SENATOR TROY FRASER



SENATOR JUAN "CHUY" HINOJOSA
SENATOR MIKE JACKSON
SENATOR JON LINDSAY
SENATOR KEL SELIGER
SENATOR TODD STAPLES

October 8, 2008

Mr. Mark Vickery
Executive Director
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711

Dear Mr. Vickery:

Please allow this letter to serve as my request for the Texas Commission on Environmental Quality (TCEQ) to expend additional funds in order to increase the number of dams inspected prior to January 2009. The 81st Legislative Session is quickly approaching and it is necessary to expedite dam inspections in order fully understand the breadth of the issue at hand.

As you know, hurricane season is well underway and south Texas has experienced severe weather and flooding. It is imperative that the TCEQ begin to properly assess the aging dam infrastructure throughout the state so that every effort can be made to avoid catastrophic results that other states have experienced. Protecting Texans is our highest priority, and I respectfully request you give this expenditure serious and immediate consideration.

Thank you for your attention to this matter. Please do not hesitate to contact me if I may be of assistance to you.

Sincerely,

A handwritten signature in black ink, appearing to read "Kip Averitt", written over a horizontal line.

Kip Averitt

cc: The Honorable David Dewhurst

Buddy Garcia, *Chairman*
Larry R. Soward, *Commissioner*
Bryan W. Shaw, Ph.D., *Commissioner*
Mark R. Vickery, P.C., *Executive Director*



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

October 17, 2008

The Honorable Kip Averitt
Chair, Senate Natural Resources Committee
P.O. Box 12068
Austin, Texas 78711

Dear Chairman Averitt:

Thank you for your letter requesting the Texas Commission on Environmental Quality (TCEQ) expend additional funds in order to increase our inspections of dams in the state in this calendar year. Although the Legislature and the State Auditor have identified the need for additional resources for inspection of critical infrastructure and our Commissioners have approved an exceptional item request for the dam safety program in our 2010-2011 Legislative Appropriations Request, I agree that every effort must be made to focus on this important public safety issue as soon as possible. As a result, we have examined our current budget and will forego expenditures in other water resource programs at this time and reallocate resources to the dam safety program.

We currently budget \$200,000 of federal funds and \$200,000 of state funds to contracts for inspections of dams. An additional \$400,000 of state funds will be allocated to supplement these contracts. In addition, five FTEs have been moved from other program areas to begin work in the dam safety program to ensure that proper oversight of the expanded contracts is provided and that the increased number of inspection reports and other work products are properly reviewed. I estimate this reallocation of resources will enable us to produce an additional 100 inspections of dams that represent high or significant hazards prior to the Legislature's consideration of additional budget requests for the next biennium.

Also, the additional resources requested from the Legislature for 2010-2011 will enable us to ensure that dams are inspected on a reasonable schedule in the future and restore full support of other water resource program priorities.

Your recognition of this important program and support of our efforts to adequately implement it are always appreciated. If you have any questions, please do not hesitate to contact me at 512-239-3900.

Sincerely,

A handwritten signature in black ink, appearing to read "Mark R. Vickery", with a large, stylized flourish at the end.

Mark R. Vickery, P.C.
Executive Director

cc: Buddy Garcia, Chairman
Larry R. Soward, Commissioner
Bryan W. Shaw, Ph.D., Commissioner