



**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



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## 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.<sup>1</sup>
- 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.<sup>2</sup> The Commission has fully or substantially implemented 5 of 11 key recommendations. However, the Commission still needs

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<sup>1</sup> 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.

<sup>2</sup> *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.<sup>3</sup> 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.

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<sup>3</sup> 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*

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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 report<sup>4</sup>, 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.

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<sup>4</sup> *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 <sup>a</sup> |                        |                        |                        |                                     |
|---|------------------------|------------------------|------------------------|-------------------------------------|
| 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 <sup>b</sup>                                  | 253                    | 178                    | 64                     | 321                                 |
| Low   | 408                    | 248                    | 66                     | 5,149                               |
| <b>Totals</b>   | <b>1,210</b>           | <b>616</b>             | <b>206</b>             | <b>5,527</b>                        |

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

<sup>b</sup> 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<br>(Includes Natural Resource<br>Conservation Service) | 87               | 8                | 127              | 113              | 83               |
| Obtained by Owner  | 11               | 17               | 48               | 22               | 37               |
| <b>Total Inspections</b>   | <b>143</b>       | <b>76</b>        | <b>255</b>       | <b>241</b>       | <b>237</b>       |

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 <sup>a</sup> |
| Model State Dam Safety Program  | High-hazard Dams—Annually<br>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  |
| <sup>a</sup> 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                |
| <b>Total Inspections</b>                                     | <b>143</b>       | <b>76</b>        | <b>255</b>       | <b>241</b>       | <b>237</b>       |

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.<sup>5</sup>

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)                                   |
| <b>Totals</b>   | <b>1,689</b>   | <b>431 (26 percent)</b>     | <b>454 (27 percent)</b>         | <b>804 (48 percent)</b> | <b>1,258 (75 percent)</b>                          |

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.<sup>6</sup> Hydraulic studies can be costly—estimates range from \$20,000 to \$50,000 for large

<sup>5</sup> 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.

<sup>6</sup> 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***

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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.<sup>7</sup> (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

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<sup>7</sup> 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*

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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-feet<sup>8</sup> 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.<sup>9</sup> 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."<sup>10</sup> 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

<sup>8</sup> 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.

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

<sup>10</sup> 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***

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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**

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#### **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 Quality, presented at the Association of State Dam Safety Officials 2007 annual conference, September 9-13, 2007.

Procedures and tests conducted included the following:

- Selecting and testing a judgmental sample of inspections performed by Commission staff and contracted consultants for compliance with Texas Administrative Code and Commission informal policies and procedures.
- Selecting a judgmental sample of new dam construction projects and repair and modification projects to existing dams submitted by dam owners to the Commission and testing the plan approval process for compliance with the Texas Administrative Code.
- Selecting and testing a judgmental sample of emergency action plans for compliance with best practices as recommended by the Association of State Dam Safety Officials.
- Interviewing Commission staff and management and selected dam owners.
- Analyzing information in the Commission's dam inventory database.
- Reviewing the Commission's dam safety program's operational activities, including the methodology used for prioritizing and scheduling inspections.

- 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<br>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<br>Texas Administrative Code, Title 13, Section 299.11 |   |  |
|---|---|--|
| Category  | Maximum Reservoir Storage Capacity <sup>a</sup>               | 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                  |

<sup>a</sup> 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<br>Texas Administrative Code, Title 13, Section 299.14 |                     |                                       |
|--|---------------------|---------------------------------------|
| Hazard Classification  | Size Classification | Minimum Flood Hydrograph <sup>a</sup> |
| 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<br>Texas Administrative Code, Title 13, Section 299.14   |                     |                                       |
|--|---------------------|---------------------------------------|
| Hazard Classification  | Size Classification | Minimum Flood Hydrograph <sup>a</sup> |
| High   | Small               | All of probable maximum flood         |
|  | Intermediate        | All of probable maximum flood         |
|  | Large               | All of probable maximum flood         |
| <sup>a</sup> 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 Dams<sup>11</sup>*

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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.

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<sup>11</sup> 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

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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

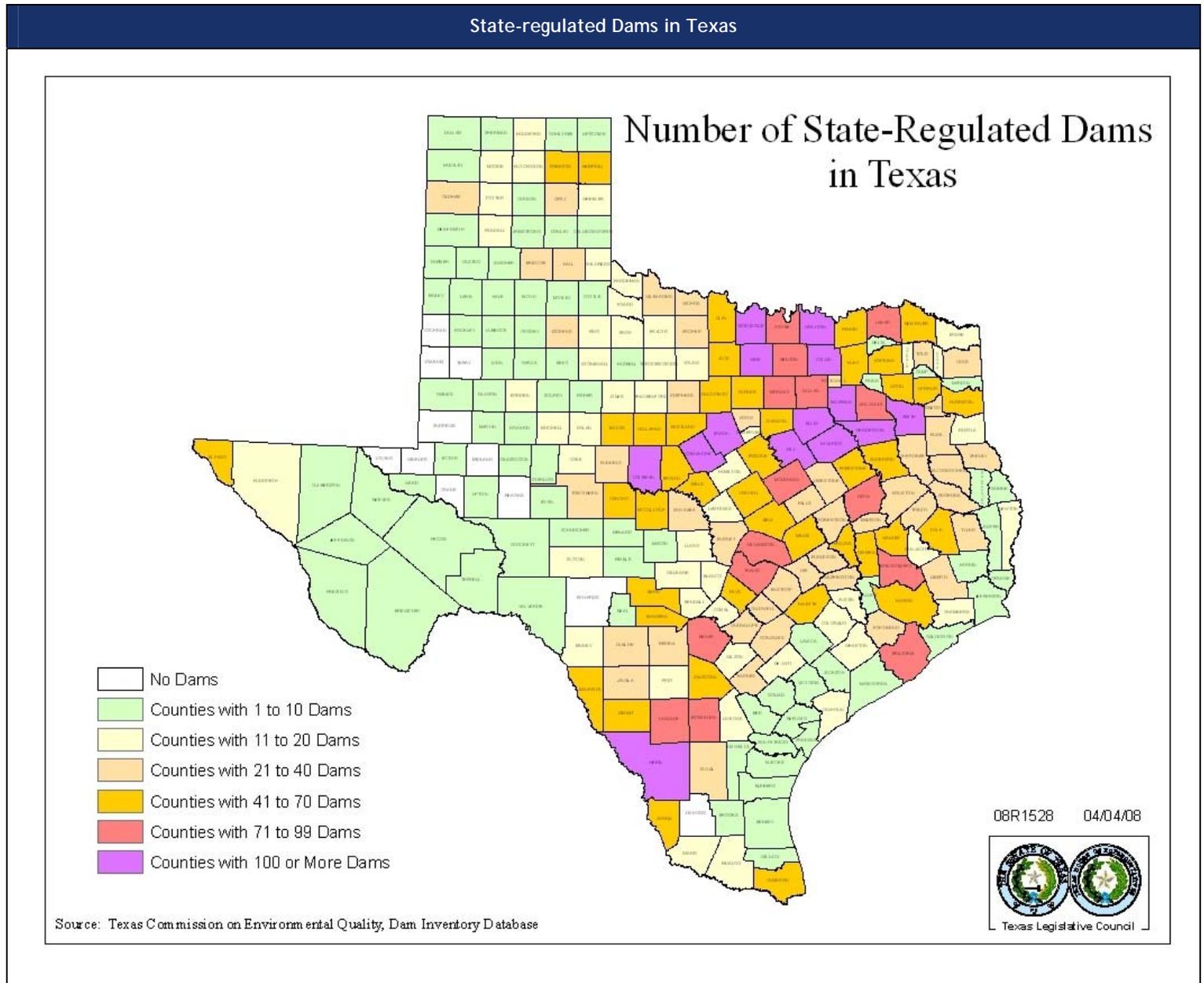
| Dam Failures in Texas<br>1970 to January 2008 |              |                     |
|---|--------------|---------------------|
| Hazard Classification                         | Dam Failures | Percent of Failures |
| High  | 13           | 13%                 |
| Significant                       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

Source: Commission on Environmental Quality.

## Statistics Regarding State-regulated Dams in Texas

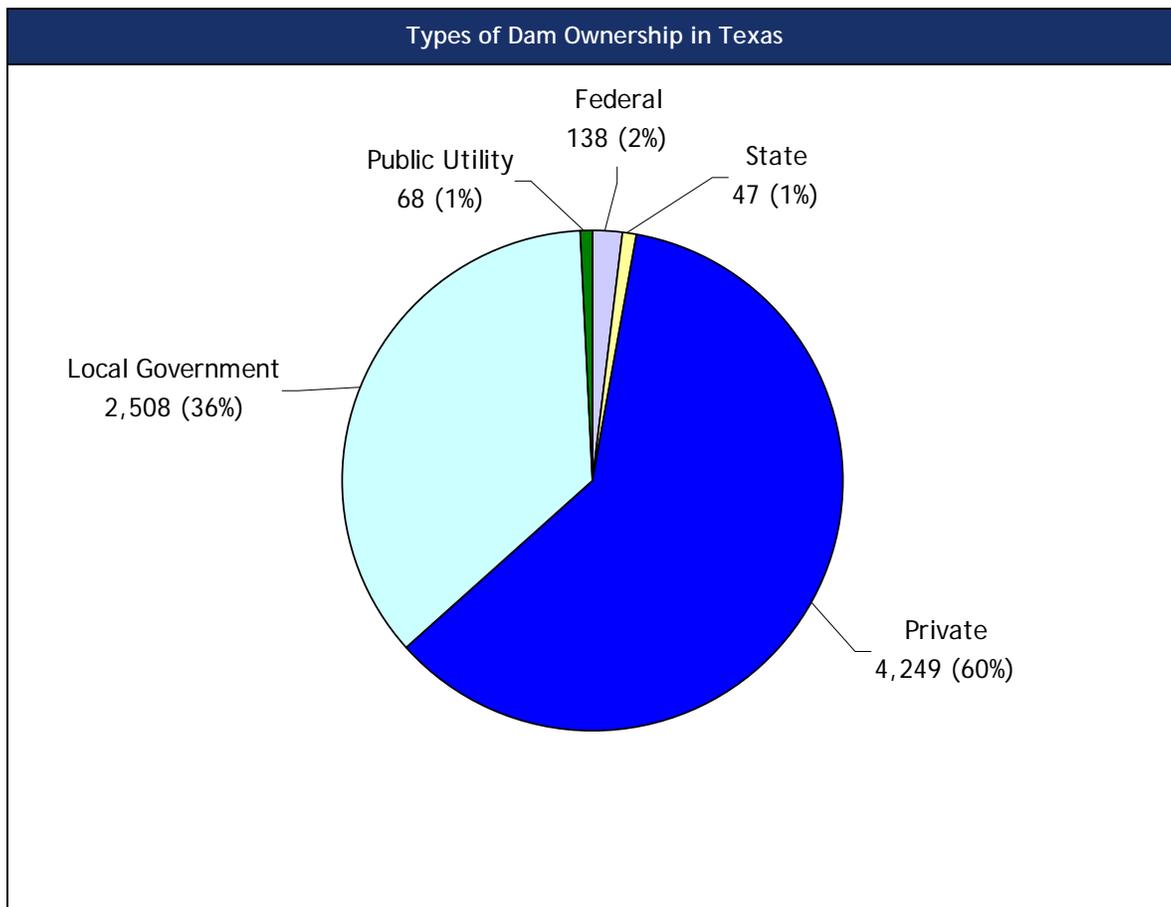
According to the Commission of Environmental Quality’s (Commission) dam inventory database, there are 7,603 state-regulated dams in Texas. Most Texas counties have at least one dam. Figure 1 identifies the number of dams within a stated range in each county.

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.<sup>12</sup> Of these dams, 60 percent were privately owned and 36 were owned by local governments (see Figure 2).

Figure 2

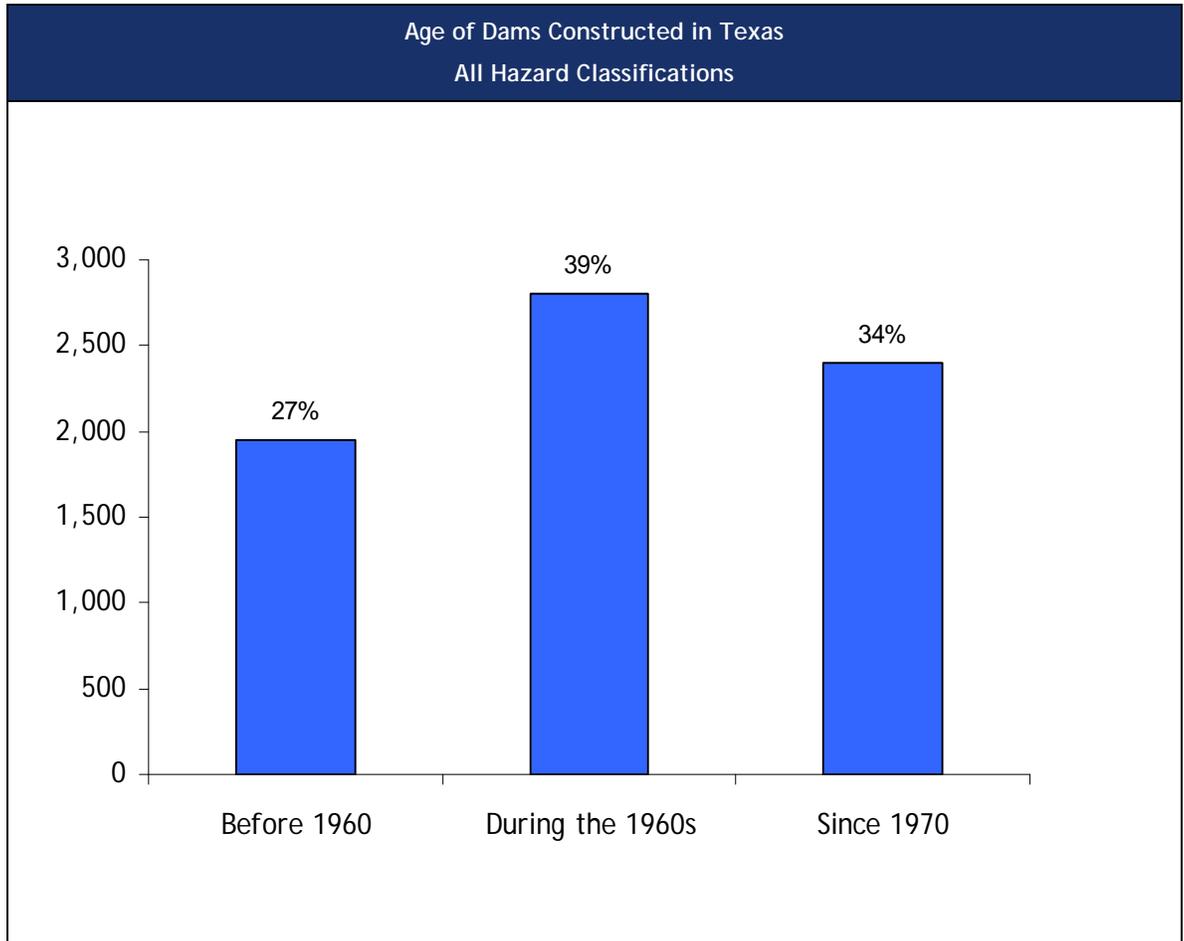


Source: Information reported to Association of State Dam Safety Officials by the Commission.

<sup>12</sup> 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-feet<sup>13</sup> or (2) a height equal to or greater than 100 feet.<sup>14</sup> 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

<sup>13</sup> 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.

<sup>14</sup> 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<br>By Maximum Storage Capacity |             |                          |                                       |
|--|-------------|--------------------------|---------------------------------------|
| Dam Name   | County      | Impoundment Name         | Maximum Storage Capacity in Acre-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.<sup>15</sup> 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.

<sup>15</sup> 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.<sup>16</sup> 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 <sup>a</sup> |                        |                                       |                                       |                  |                         |                 |                        |
|--|------------------------|---------------------------------------|---------------------------------------|------------------|-------------------------|-----------------|------------------------|
| Fiscal Year 2006 Data  |                        |                                       |                                       |                  |                         |                 |                        |
| State  | State Funding Provided | Full-time Equivalent Employees (FTEs) | All State-Regulated Dams <sup>b</sup> | 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                    |

<sup>16</sup> 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 <sup>a</sup>**

**Fiscal Year 2006 Data**

| State          | State Funding Provided | Full-time Equivalent Employees (FTEs) | All State-Regulated Dams <sup>b</sup> | 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                   |
| <b>Texas</b>   | <b>\$ 350,000</b>      | <b>7.00</b>                           | <b>7,202</b>                          | <b>837</b>       | <b>773</b>              | <b>5,592</b>    | <b>1,028.9</b>         |
| 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          |

<sup>a</sup> Information about dam safety programs in Maine and Massachusetts was not available.

<sup>b</sup> 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***

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### **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 <sup>a</sup>  | Assess Fees for Permits, Inspections? <sup>b</sup> | Responsibility for Performing Inspections <sup>b</sup>   |
| 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 <sup>a</sup>  | Assess Fees for Permits, Inspections? <sup>b</sup> | Responsibility for Performing Inspections <sup>b</sup>   |
| 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 Provided <sup>a</sup>  | Assess Fees for Permits, Inspections? <sup>b</sup> | Responsibility for Performing Inspections <sup>b</sup>   |
| 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 <sup>a</sup>  | Assess Fees for Permits, Inspections? <sup>b</sup> | Responsibility for Performing Inspections <sup>b</sup> |
|   | 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.        |
| <p><sup>a</sup>This data is for the 2006 reporting year and was published in <i>2007 State Dam Safety Program Performance Information Summary</i> by the Association of State Dam Safety Officials and the National Dam Safety Review Board, August 2007. <b><u>This information has not been audited by the State Auditor's Office.</u></b> Additional information, primarily regarding loan term agreements, was provided by states responding to an informal survey conducted by the State Auditor's Office.</p> <p><sup>b</sup>This data is from <i>Requested Information Regarding State Regulatory Organization's Dam Safety Inspection Responsibility, Inspection Frequency, and Fee Information</i>, Association of State Dam Safety Officials, September 7, 2007. <b><u>This information has not been audited by the State Auditor's Office.</u></b></p> |   |  |  |

## Medina Dam Background Information Provided by the Commission

The Commission on Environmental Quality provided this information.

Buddy Garcia, *Chairman*  
Larry R. Soward, *Commissioner*  
Bryan W. Shaw, Ph.D., *Commissioner*  
Glenn Shankle, *Executive Director*



### TEXAS COMMISSION ON ENVIRONMENTAL QUALITY *Protecting Texas by Reducing and Preventing Pollution*

#### Medina Dam

In July of 2002, a flood event caused Medina Lake to rise to a level 1½ 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 ½ Probable Maximum Flood (PMF) (estimated 5.8 feet over the top of dam) and full PMF (10.8 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.

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 TCEQ 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 80<sup>th</sup> 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***

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| Recent SAO Work |  |               |
|-----------------|--|---------------|
| Number          | Product 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 |

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