STATE ENGINEER'S
TWENTIETH ANNUAL REPORT ON DAM SAFETY
TO THE
COLORADO GENERAL ASSEMBLY

FY 03-04

Prepared by

COLORADO DIVISION OF WATER RESOURCES
OFFICE OF THE STATE ENGINEER

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STATE OF COLORADO
1876

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EXECUTIVE SUMMARY

The Colorado Division of Water Resources' Dam Safety Branch's objective is to prevent property damage and the loss of life, while protecting the loss of water supplies due to the failure of dams in Colorado. The Dam Safety Program includes the enforcement of a comprehensive set of regulations, policies, and procedures for the design, construction, and maintenance of dams; the safe operation of reservoirs; and emergency preparedness planning.

The Dam Safety Program is managed by the State Engineer in accordance with Title 37, Article 87 of C.R.S. and the Livestock Water Tank Act, Title 35, Article 49 of C.R.S. The program is implemented by the State Engineer through the Dam Safety Branch and the Division field offices. The Branch currently consists of a branch chief, dam safety engineers, and design review engineers. Currently, the program oversees a total of about 2,900 dams in Colorado with 1,879 dams of jurisdictional size. Of these, about 1,757 are non-federal dams. Of the non-federal dams, approximately 591, or about one-third of the total non-federal dams in Colorado, are classified as dams that, in the event of a failure, would be expected to cause loss of life and/or significant property damage to a significant portion of the state's population.

For FY 03-04, the Dam Safety Program achieved a great number of goals and objectives in the design review and inspection of dams for the determination of safe water storage levels. Although dam safety incidents were reported again this year, because of our program, these incidents resulted in reduced consequences with no loss of life or significant property damage. This is attributed to the increased awareness and responsibility of the dam owners for their dams - including emergency preparedness planning - and to the enforcement of the regulations, policies, and procedures by our office.

During FY 03-04, the State Engineer's Office approved plans for five new dams and thirty-four plans for alteration, modification, or enlargement. Twelve separate hydrology studies were also approved for determination of the inflow design flood for spillway design. The estimated cost of construction for the submitted plans was over $39 million.

During FY 03-04, a total of 621 dam safety inspections and 238 construction inspections were conducted for a total of 859 inspections. In addition, 163 follow-up inspections were performed. At the conclusion of the reporting period, there were 186 dams restricted from full storage due to various structural deficiencies such as significant leakage, cracking and sliding of embankments, and inadequate spillways. Total storage restricted was 137,559 acre-feet. The restrictions provide risk reduction for the public and environment until the problems are corrected. Although many dams were repaired and removed from the restricted list within the last year, a number of dams were also added to the list during the same time period. The change in the restriction from the same time last year resulted in a slight reduction in the number of dams on the restricted list and the volume of the restrictions decreased approximately 6,000 acre-feet. Approximately half of the dams on the Colorado Division of Water Resources restricted list have been on that list for ten years or longer.

The state has been able to acquire and maintain a solid group of experienced professionals, and has adequate statutes, regulations, policies, and procedures to implement and carry out the program.

The Dam Safety Branch continues to use risk-based tools to help evaluate and prioritize the jurisdictional dams in Colorado in order to more efficiently and effectively use program resources.

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1.0 INTRODUCTION

1.1 Program Mission

The mission of the Dam Safety Program is to prevent property damage and the loss of life, while protecting the loss of water supplies due to the failure of dams in Colorado through the effective and efficient use of available resources. The program includes the enforcement of a comprehensive set of regulations, policies, and procedures for the design, construction, inspection, and maintenance of dams; the safe operation of reservoirs; and emergency preparedness planning. In the event a dam is found to be unsafe, the risk of adverse consequences due to failure of the dam is reduced by restricting the storage in the reservoir to a safe level. The safe reservoir storage levels are determined by the results of engineering analyses, the review and approval of engineered plans for the construction and repair of dams, and regular safety evaluations of existing dams and reservoirs by licensed professional engineers.

The program is managed by the State Engineer in accordance with Title 37, Article 87 of C.R.S. and the Livestock Water Tank Act, Title 35, Article 49 of C.R.S. The "Rules and Regulations for Dam Safety and Dam Construction" and "Standard Specifications for Livestock Water Tanks and Erosion Control Dams" establish the procedures and requirements of the State Engineer in the implementation of these statutes.

1.2 Report Purpose

This report is submitted in compliance with Section 37-87-114.4 of C.R.S. concerning the dam safety activities of the State Engineer and the Colorado Division of Water Resources relating to Sections 37-87-105 to 37-87-114 of C.R.S.

2.0 PROGRAM OVERVIEW

2.1 Goals and Objectives

The Dam Safety Program, although responsible for the approximately 2,900 dams within the state, concentrates on "jurisdictional" dams and reservoirs as defined in Section 37-87-105 of C.R.S. Jurisdictional dams are dams that are greater than ten feet high as measured at the spillway, impound a reservoir with twenty acres or more in surface area, or 100 acre-feet or more in reservoir capacity at the high water line. Further, dams are classified as to estimated downstream consequences as a result of failure of the dam in the absence of flooding conditions as follows:

Classification	Description
1	Loss of human life is expected in the event of failure of the dam.
2	Significant damage is expected to occur, but no loss of human life is expected.
3	Loss of human life is not expected and damage to structures and public facilities is not expected.
4	No loss of human life is expected and damage will occur only to the dam owner's property.

Identified goals of the program are as follows:

1. In order to protect the public, the Dam Safety Branch shall determine the amount of water that is safe to impound in reservoirs of the state.

2. In order to protect the public from failure of dams, the Dam Safety Branch shall review and recommend approval of plans and specification for the construction, modification, and repairs of dams, in accordance with the Rules and Regulations for Dam Safety and Dam Construction, implemented on September 30, 1988.

3. To reduce the risk of dam failure and adverse consequences and to more efficiently and effectively use the available resources within the program, the Dam Safety Branch shall implement and utilize a risk-based approach to prioritize the jurisdictional dams within the program.

4. In order to improve the functions of the Branch and to meet the public information needs, the Dam Safety Branch shall maintain a data information system.

5. In order to improve the technical proficiency of the Branch, the Division of Water Resources shall provide training and professional development of the Branch personnel.

6. In order to improve the Dam Safety Program, to participate in the development of national policies on dam safety, and to take advantage of the continuing education and information available, the state shall be a full voting member of the Association of State Dam Safety Officials (ASDSO).

2.2 Organization

The Dam Safety Program is executed by the State Engineer through the Dam Safety Branch and the Division Engineers' offices. The Branch consists of a branch chief, dam safety engineers, and design review engineers. The dam safety engineers are responsible for the program in their geographic area. The dam safety review engineers and branch chief are located in Denver. A summary of the Branch organization and personnel is included in Appendix A.

Interagency coordination occurs as necessary. A Memorandum of Understanding has been executed with the Division of Wildlife (DOW) regarding the responsibilities of each agency in carrying out the safety inspection of DOW dams. The DOW is making safety inspections of their Class 3 (low hazard) dams.

The Colorado Water Conservation Board (CWCB) makes its construction fund available to assist owners with the repair of their dams. We closely coordinate the review and approval and final acceptance of these dams with the CWCB.

2.3 Roles and Responsibilities

The branch chief has program-wide responsibility for formulating the goals of the program, recommending policies for implementation of the regulations, preparing procedures for carrying out the policies, providing technical guidelines for conduct of the work, communication, training, and coordination. The branch chief directly supervises the Design Review and Construction Inspection Unit activities.

The dam safety engineers' principal duties are to:

1. respond to emergency situations;
2. conduct safety inspections of existing dams;
3. review the adequacy of spillways under the rules;
4. enforce the requirement for emergency planning;
5. assist dam owner in developing their Emergency Preparedness Plans (EPP);
6. provide design review and construction inspection of repairs and alternations when necessary; and
7. investigate complaints on the safety of dams.

Dam safety engineers also investigate the construction of dams in violation of Section 37-87-105 (1) and (4) of C.R.S. and conduct training on the inspection of dams for Division personnel, dam owners, interested agencies, engineers, and the public. In addition, they review and approve Livestock Watertank and Erosion Control Dam applications and do other related work as assigned.

The design review engineers' principal duties are to review the plans and specifications for the construction, alteration, modification, repair, and enlargement of reservoirs or dams in accordance with Section 37-87-105 of C.R.S. This involves a comprehensive engineering review of the plans and specifications to assure that a safe design has been developed and to inspect the construction of the dam. The engineers assist the Department of Health in the technical evaluation of tailing impoundments through a Memorandum of Understanding, participate in the state's joint review process with the Department of Natural Resources, provide technical assistance to the Division Engineers' offices on dam safety, and perform other related work as assigned.

2.4 Summary of Colorado Dams

Table 1 summarizes the distribution of dams by division, ownership, and hazard class in Colorado. Currently, the program oversees a total of about 2,900 dams within Colorado. Of these, 1,879 are considered jurisdictional dams, of which about 1,757 are non-federal dams. Of the non-federal dams, approximately 591, or about one-third of the total non-federal dams in Colorado, are classified as dams that, in the event of a failure, would be expected to cause loss of life and/or significant property damage.

3.0 PROGRAM ACCOMPLISHMENTS

3.1 General

The effectiveness of a program can be demonstrated by producing a positive result or accomplishment. For fiscal year 2003-2004, the Dam Safety Program achieved a great number of goals and objectives in the design review and inspection of dams. Although dam safety incidents were reported this year, because of our program, these incidents resulted in reduced consequences with no loss of life or significant property damage. This is attributed to the increased awareness of the dam owners to be responsible for their dams, including emergency preparedness planning, and to the enforcement of the regulations, policies, and procedures by our office.

No emergency incidents occurred during the reporting period. However, as is typical, a number of dams experienced serious problems during the period. Due to the drought conditions that affected the entire state and the subsequent wet spring, many reservoirs that had been dry or substantially lower than in past years resulted in the drying of their associated embankments. The relatively wet spring caused many of these reservoirs to fill quickly. This rapid filling of several reservoirs lead to excessive seepage through the dams that had experienced drying and cracking of the embankment materials. This led to a rather large number of safety concerns identified this year. However, due to the rapid response and quick thinking of our dam safety engineers, none of the concerns developed into emergencies incidents that could have lead to loss of life or property damage. Problems reported this year include:

- Nofstger Dam, Division 6, Class 3 - Construction for breach and outlet repair, nothing yet in writing.
- Ellgen #2 Dam, Division 6 - Severe wave erosion, blocked spillway causing toe erosion.
- Haunted Spring Dam, Division 6 - Piping at toe.
- Basset #2 Dam, Division 6 - Piping found near left toe.
- Sellars-Crowell Dam, Division 6 - Severe spillway channel erosion and backcutting.
- Shaffer Dam, Division 6 - Rodent hole through dam.
- Dunckley-Dubeau Dam, Division 6 - Long-term spillway channel erosion has reduced freeboard.
- Lower Cogdill Dam, Division 6 - D/S landslide on top of old landslide.
- Wyman Dam, Division 6 - Grout around outlet slip lining is leaking water with very little head.
- Palisade Cabin Dam, Division 5 - Cracked RCP outlet conduit and poorly compacted fill along conduit.
- Fisher Canyon Dam, Division 2, Class 1 - Excessive seepage and stability concern, reservoir lowered for investigations.
- Bennett Dam, Division 6, Class 3 - Piping along outlet conduit, voluntary restriction.
- Larson #1 Dam, Division 6, Class 3 - Piping along outlet conduit, voluntary restriction.

At the conclusion of the reporting period, there were 186 dams restricted from full storage due to various structural deficiencies such as significant leakage, cracking and sliding of embankments,

and inadequate spillways. Total storage restricted was 137,559 acre-feet. The restrictions provide risk reduction for the public and environment until the problems are corrected. The owners are responsible for following the restricted operating levels and the restrictions are enforced by the Division Engineers. A list of restricted reservoirs at the end of the reporting period is included in Appendix B. Although many dams were repaired and removed from the restricted list within the last year, a number of dams were also added to the list during the same time period. The change in the restriction from the same time last year resulted in a slight decrease in the number of dams on the restricted list and the volume of the restrictions decreased approximately 6,000 acre-feet.

In the event that conditions of any dam or reservoir are so unsafe as to not permit the time to issue or enforce a restriction, or a dam is threatened by a large flood, the State Engineer may immediately employ remedial measures to protect the public safety. An emergency dam repair cash fund is provided under the CWCB construction fund per Section 37-87-122.5.

With the passage of the National Dam Safety Program Act (NDSP), PL 104-303 and its subsequent funding, Colorado has applied for and received assistance grants each year since 1998. An additional grant was approved for 2003. These funds are being used to provide advanced training to the Dam Safety Branch personnel in the field of dam safety and risk analysis. Additional training is provided under the technical seminar provisions of the Act. The grant funds are also used to acquire emergency communication equipment, upgrade computers, and purchase engineering computer software programs and other equipment. Future grants may be available each year under the Act, subject to appropriations.

3.2 Approval of Plans and Specifications

During FY 03-04, the State Engineer's Office approved plans for five new dams and 34 plans for alteration, modification, or enlargement. Twelve separate hydrology studies were also approved for determination of the inflow design flood for spillway design. The estimated cost of construction for the approved plans was $39,932,281 and $51,664.70 was collected for the examination and filing of the submitted plans.

Thirty-four sets of plans and specifications for construction and twelve hydrology studies were approved by the State Engineer during FY 03-04, as listed in Appendix C. In order to expedite the approval of repair plans for dams, the dam safety engineers located in the division offices review plans and specifications and perform the construction inspections on selected projects. In addition, four third-party reviews of the plans and specifications were performed in FY 03-04. This enables the owners to repair or construct their dams sooner by shortening the review time. The State Engineer provides review and approval of plans and specifications performed by third parties.

Upon completion of construction, the owner's design engineer submits copies of the "AS-CONSTRUCTED" plans showing any changes made during construction. These plans are reviewed by the engineer who monitored the construction for completeness before being accepted for filing. The superseded plans are disposed and the "AS-CONSTRUCTED" plans serve as the public record as required by the statutes.

Section 37-87-114.5 of C.R.S. exempts certain structures from the State Engineer's approval. These are structures not designed or operated for the purposes of storing water, and include: mill tailing impoundments permitted under Article 32 or Article 33 of title 34 of C.R.S. (Minerals or Coal Mines), uranium mill tailing and liquid impoundment structures permitted under Article 11 of Title 25 of C.R.S., siltation structures permitted under Article 33 of Title 34 of C.R.S. (Coal Mines), and structures that only store water below the natural surface of the ground.

Owners of small dams that do not fall under the jurisdiction of the State Engineer are required to submit a Notice of Intent to Construct a Nonjurisdictional Water Impoundment Structure to the State Engineer prior to beginning construction under Section 37-87-125 of C.R.S.

3.3 Safety Inspections and Construction Observations

The statutes specify that a dam safety inspection must include the review of previous inspection reports and drawings, site inspection of the dam, spillways, outlet facilities, seepage control and measurement system, and permanent monument or monitoring installations. The dam safety inspection dam includes an evaluation of the adequacy of the spillway to pass the appropriate inflow design flood based on the size and hazard classification of the dam, an evaluation of the hazard classification and an assessment of the adequacy of the Emergency Preparedness Plan. The internal inspection of the outlet works and an evaluation of instrumentation has also been added to the workload as required by the regulations. The hydrologic evaluation of spillways on dams located above elevation 7,500 feet has been postponed, pending the completion of a study of extreme precipitation by the State Engineer and the CWCB as discussed in Section 4.1 of this report.

The findings of the dam safety inspection are documented in a report that rates the conditions observed of the several components of the dam and reservoir. The overall conditions are rated as satisfactory, conditionally satisfactory, or unsatisfactory (unsafe) for full storage and a recommendation is made for the safe storage level by the dam safety engineer. The report also identifies the several repair and maintenance items that the owner should take care of and any engineering and monitoring requirements that are deemed necessary to assure the safety of the dam. A copy of the Engineers Inspection Report is included in Appendix D.

Procedures have been implemented to begin reporting incidents and the findings of dam safety inspections where orders have been issued to make modifications for safety reasons. Incidents are reported to the Center for the Performance of Dams at Stanford University, in Palo Alto, California. This is a national program that has been developed by the Association of State Dam Safety Officials and the Federal Emergency Management Agency for the accumulation of data for the improvement of design and safety evaluations of dams nationwide.

Orders to repair or maintain the dam usually require the re-inspection of the dam in order to verify that the work has been done in an acceptable manner. Re-inspections also occur to assure follow-up of the State Engineer's orders or as requested by the owner. If the dam safety inspection finds that the overall conditions are unsafe, an order is written by the State Engineer restricting the storage of the reservoir to a safe level. Restriction letters are accompanied by

orders to rehabilitate the dam to make it safe for full storage or to breach the dam. In the event the owner fails to comply with an order to make the dam safe, a breach order is issued to remove the hazard created by the dam and reservoir. If the findings are conditionally satisfactory, full storage is recommended contingent on appropriate monitoring being provided by the owner.

Construction inspections are important to assure that the approved plans are being followed and to assure changed conditions during construction does not jeopardize the safety of the design. The site visits are preceded by a review of the file and history of performance, coordination with the owner, division staff, and other interested parties so they may take part in the inspection.

The dam safety engineers collectively conduct about 800 to 900 dam safety and construction inspections each year. Jurisdictional dams identified for inspection in accordance with the policies of the State Engineer are assigned to the dam safety engineers in each division. The number of inspections to be performed is related to the number of dams in each division and their hazard class. Included in these numbers is the annual inspection of all Class 1, one-half of the Class 2, and about one-sixth of the Class 3 dams. Subsequent follow-up and problem solving meetings with dam owners result in additional inspections each year.

In order to track potential problems that could develop at Class 3 dams, the dam safety engineers assign dams to be observed by the division's water commissioners and they file an observation report. The report is reviewed and then furnished to the owner for their information and to implement any recommendations for repair and maintenance. A copy of the Water Commissioner Dam Observation Report form is included in Appendix E.

During FY 03-04, a total of approximately 621 safety inspections and approximately 238 construction inspections were conducted for a total of 859 inspections. In addition, approximately 163 follow-up inspections were made. The safety inspections included 262 Class 1 (High hazard), 154 Class 2 (Significant hazard), 130 Class 3 (Low hazard), 1 Class 4 (No hazard), and 1 (other) dams and 73 interim inspections. The combined safety inspections and construction inspections in FY 03-04 resulted in an overall increase in the workload performed by the dam safety staff. This additional workload was incorporated into the overall schedules of the staff. No additional staff was added as a result of the increased workload.

For inspections of federally-owned and FERC-regulated dams that the State Engineer's Office does not participate in, the reports prepared by the federal agencies are received and reviewed.

3.4 Staff Training

A critical element in the Dam Safety Program is the continued training of our personnel to maintain a high level of technical competency, to keep up with changing technology, to develop additional management and communication skills, and to keep abreast of changes in the development of dam safety programs across the country. The following training opportunities were achieved this fiscal year:

1. ASDSO Annual Conference, Dam Safety 2003, Minneapolis, MN (attended by two dam safety engineers);

2. FEMA Spillway Workshop, Denver (attended by one dam safety engineer);

3. Association of Engineering Geologists, Dams Symposium, Vail (attended by one dam safety engineer);

4. ASDSO Regional Technical Seminar on Seepage and Piping, Boulder (attended by eleven dam safety engineers);

5. U.S. Bureau of Reclamation, Safety Evaluation of Existing Dams Seminar, Denver (attended by one dam safety engineer);

6. FEMA HEC-RAS training seminar, Emmitsburg, MD (attended by one dam safety engineer);

7. FEMA Spillway Hydrologic Deficiencies Workshop, Emmitsburg, MD (attended by one dam safety engineer);

8. U.S. Society on Dams Potential Failure Modes Workshop, St. Louis, MO (attended by one dam safety engineer);

3.5 Emergency Preparedness Plans

Emergency preparedness for incidents at dams that jeopardize the public safety, including the failure of dams, has become an integral part of dam safety programs across the nation. All the federal dam owning/regulating agencies and most states require that plans be formulated in order to detect incidents at dams, give adequate warning, and maintain preparedness for the eventual failure or misoperation of dams. Colorado has been actively involved in this area since 1981, ultimately requiring that Emergency Preparedness Plans (EPP) be prepared for High and Significant Hazard dams as part of the regulations for dam safety adopted in September 1988. Although all high hazard dams have such a plan, much work is still needed to update, maintain, and exercise the plans annually. Approximately 126 EPP's were reviewed during the fiscal year.

Approximately 98 percent of the significant hazard dams have plans on file. The owners of significant hazard dams that do not have a plan have been notified of the requirement to prepare them. The dam safety engineers continue to assist dam owners in the preparation of their EPP's. In some cases, we have prepared the plans for the owners. This will continue to be enforced during the following year of inspections. We also participate in a variety of emergency exercises in coordination with federal, state, and local emergency managers.

3.6 Security Issues

Awareness of security issues surrounding the nation's infrastructure has increased following the events of September 11, 2001. Dams are an integral part of the nation's, and this state's, critical infrastructure. Through training and correspondence with others practicing in dam safety, personnel from the Dam Safety Branch have gained an understanding of the need to have

security assessments performed for critical dams in the state. The division's personnel have emphasized to owners of dams the importance of performing these security assessments for their structures. As a minimum, these assessments should include a thorough evaluation of the potential threats, consequences, vulnerability, and responses associated with their structures. The performance of security assessments and continued security updates by owners of dams will continue to be emphasized by the Dam Safety Branch.

3.7 Dam Safety Management System

The dams database (DAMS) has been updated and upgraded this fiscal year. While the main database is kept on a computer server in Denver, the dam safety engineers can access and update the data for their divisions through modem connections. The Dam Safety Branch's capability to maintain the database and analyze dams was enhanced by the receipt of computer hardware and software for the Denver office and the division offices under the auspices of the National Dam Safety Program Assistance grants. This system is used to update the National Inventory of Dams (NATDAM or NID) periodically when requested by the US Army Corps of Engineers.

3.8 Publications/Internet

As a service to dam owners, the Dam Safety Branch makes available, at no cost, a brochure on the construction and operation of dams in Colorado. It contains general information on requirements for approval of plans, water rights, financing, liability, insurance, Emergency Preparedness Plans, statutes, publications, and Division Engineer and Water Court addresses. A "Dam Safety Manual" is also available at a reasonable cost that instructs dam owners on the safety inspections of their dams. Guidelines for preparing EPP's and a Project Review Guide for submitting plans for approval are provided at no cost.

In addition, the Regulations, Project Review Guide, application forms, sample plans, Livestock and Erosion Control Dam Permits, Notice to Construct a Nonjurisdictional Impoundment Structure, and other policy documents are available on the Dam Safety Web page at http://water.state.co.us/damsafety/dams.asp.

3.9 Risk-Based Approach

Colorado has relied on an inspection/standards based program for over 20 years to assure the safety of dams in the state. While inspection activities are necessary and provide a basis for dam inventories, evaluation of hazard classifications, and site conditions at dams, a significant amount of serious incidents and even failures of dams in Colorado are still occurring. After attending an ASDSO workshop in 1999 on risk assessment, dam safety engineers decided to explore ways to include risk assessment in the Dam Safety Program as a tool for identifying potential failure modes at existing dam and to focus resources at the dams having the greatest risk of failure and significant consequences.

A pilot project was implemented to train staff and evaluate Failure Modes and Consequence Evaluations (FMCE). Simultaneously, an evaluation began of the U. S. Bureau of Reclamation's

Risk Based Profiling System (RBPS). It is an indexing method for ranking dams in accordance with weighted failure modes and consequences. RBPS could be used to create a list of dams to do a more detailed FMCE.

A subset of risk analysis, FMCE, is simplified by qualitatively, rather than quantitatively, estimating the likelihood of adverse consequences from loads on dams (static, hydrologic, and seismic). It includes a comprehensive review of the engineering data, operation, performance history, and record of design construction, as well as information related to the consequences of failure and planned emergency procedures, by a team of experts in dam safety. The teams use an "expert elicitation" process to develop an understanding of the most significant failure modes, consequences, and any risk reductions that can be implemented with respect to a dam. One session was conducted in 2000 and four have been conducted in 2001. The sessions have proven to be very successful and the process shows promise for further implementation in the program. Future sessions will be planned after the implementation and screening provided by the results of the RBPS.

A review of the RBPS was performed on a number of dams to evaluate the effectiveness of the procedure. In fact, several of the dam safety engineers have ranked many of the dams in their geographic area using this tool. The RBPS results provide a relative ranking of dams that should receive more attention, and in some cases, less attention, in the program. As discussed in Section 4.2 below, based on initial reviews, an agreement was executed with the Bureau of Reclamation for adapting this system for the state. An Intergovernmental Agreement with the Bureau of Reclamation was issued to revise their RBPS based on program needs.

3.10 IPA

For most of the fiscal year, the Dam Safety Branch Chief position was served through an innovative agreement with the U.S. Bureau of Reclamation by Doug Boyer, a highly respected and experienced engineer. Through some unique resources and abilities, the Deputy State Engineer was able to investigate, request, and obtain approval for an Intergovernmental Personnel Act (IPA) agreement with the Department of the Interior, Bureau of Reclamation, for an individual to provide technical leadership necessary to serve as the Branch Chief. The Bureau of Reclamation funded 100 percent of the employee's salary and benefits through this program. In February 2004, the individual serving as the branch chief returned to the Bureau of Reclamation. However, this individual continued part-time in fulfilling the branch chief role through special projects beyond the end of this reporting period.

4.0 SPECIAL STUDIES

4.1 Extreme Precipitation Study

The State Engineer and the Colorado Water Conservation Board (CWCB) continued the process during the period to study extreme precipitation in the mountainous areas of Colorado. A volunteer committee of meteorologists, hydrologists, engineers, federal and state agencies, and private entities assisted in the preparation of the technical portions of the request for proposal.

The Department of Atmospheric Science at CSU was selected to develop a new method of estimating extreme precipitation and to develop concepts of how extreme precipitation varies with elevation in Colorado. One of the objectives of the study was to provide a more accurate portrayal of the maximum estimated precipitation in the mountainous areas. It is believed that a more accurate estimate of the maximum estimated precipitation in the mountainous area could save millions of dollars in the construction of spillways for dams.

A technical review group is assisting the Dam Safety Branch in reviewing the progress of the research. The members of the group are Mr. Jimy Dudhia, National Center for Atmospheric Research; Mr. Louis Schreiner and Mr. David Mathews, U.S. Bureau of Reclamation; and Mr. Stephen Spann, consultant.

The draft final report was submitted by CSU on July 29, 2002 and the technical review group met in February 2003 to discuss the conclusions and recommendations of the report. The conclusions of the study were disappointing to the state and the technical review group. The research group was not able to provide a tool or methodology that could estimate extreme precipitation within the mountainous regions of the state. The recommendations of the study indicated that additional research, data collection, and analyses were required in order to develop a better model to more accurately estimate extreme precipitation events within Colorado.

During this fiscal year scoping meetings were held with Division personnel as well as private consultants and federal government officials. The purpose of these meetings was to discuss technological limitations and potential alternatives to address the ongoing extreme precipitation concerns. Based on these meetings and evaluations performed by dam safety branch personnel, a methodology has been drafted to quantitatively reduce the estimates of extreme precipitation based on established hydrologic procedures. This draft methodology will be evaluated by branch personnel early next fiscal year with the hope that the methodology will be adopted for use by early 2005.

4.2 Risk Based Profiling System

The Dam Safety Branch continued their efforts in using risk-based tools to help evaluate and rank the jurisdictional dams in Colorado in order to more efficiently and effectively use program resources. One tool that has shown promise is the Risk Based Profiling System (RBPS) as developed by the Bureau of Reclamation. The Bureau of Reclamation has been using this tool for a number of years for similar purposes with much success. Based on understanding of the system and initial reviews, an agreement was executed with the Bureau of Reclamation for adapting this system for the state. An Intergovernmental Agreement with the Bureau of Reclamation was issued to revise their RBPS based on program needs. It is the Branch's goal that, by the end of the next fiscal year, a modified RBPS is in place that is fully functional and effective at focusing resources where they are most needed.

5.0 COORDINATION WITH NATIONAL DAM SAFETY PROGRAMS

5.1 Association of State Dam Safety Officials

All of the dam safety engineers in the Dam Safety Branch are members of the Association of State Dam Safety Officials (ASDSO) and actively participate in its programs, presenting papers and serving on task groups and committees. The purpose of ASDSO is to provide a forum for the exchange of ideas and experiences on dam safety issues, foster interstate cooperation, provide information and assistance to dam safety programs, provide representation of state interests before Congress and federal agencies for dam safety, and to improve the efficiency and effectiveness of state dam safety programs. Mr. Jack Byers, Deputy State Engineer, is the state's representative to the ASDSO.

5.2 Federal Dam Safety Programs

5.2.1 General - Routine inspections of federal dams by dam safety engineers have been curtailed in accordance with a legislative audit recommendation. The Branch, however, will participate in the evaluation of the safety of some federal dams for special issues and performance problem evaluations, in accordance with the procedure for obtaining approval to participate in these inspections. Less than about 20 hours were spent this fiscal year participating in these safety inspections at a cost of less than $900.

5.2.2 Memoranda of Understanding - Memorandums of Understanding (MOU) have been executed with the U.S. Bureau of Reclamation, the U.S. Bureau of Land Management, and the Air Force Academy (AFA) relating to dam safety activities in Colorado. They provide for the exchange of safety related information of dams under each agency's jurisdiction. A MOU is also being updated with the U.S. Forest Service, Rocky Mountain Region, to provide coordination of mutual responsibilities for dam safety and their Travel Management Plan for the National Forests. This is necessary to provide access to private dams located within the forests. MOU's are being pursued with the other federal agencies such as the U.S. Army Corps of Engineers and the Federal Energy Regulatory Commission to assure that the dams under their jurisdiction are being maintained in a safe condition and to coordinate activities and exchange of information and data.

5.2.3 Federal Energy Regulatory Commission - The Branch makes safety inspections of dams that are also regulated by the Federal Energy Regulatory Commission (FERC). In accordance with an agreement with them, they furnish copies of their reports for Branch records. The Branch has curtailed participation in FERC regulated dams in accordance with the audit, but in accordance with the procedures for approval, spent about eight hours on inspections to evaluate specific performance or maintenance issues, at a cost of less than about $400.

6.0 FISCAL RESPONSIBILITY

6.1 Use of Appropriated Funds

Dam safety personal service expenditures for the fiscal year 2003-04 were approximately $1,000,000.

6.2 Receipt of Funds Generated by Filing Fees

Fees collected by the State Engineer and deposited in the General Fund for dam safety amounted to $51,664.70 for filing plans and specifications during the period.

7.0 ENFORCEMENT ORDERS AND PROCEEDINGS

No enforcement orders on dam safety were issued during the period.

8.0 LEGISLATION

No legislation affecting dam safety was enacted during the period.

9.0 SUMMARY OF FY 04-05 PROGRAM GOALS

In addition to yearly program goals of inspections and design reviews, the following are additional program goals for FY 04-05:

1. Fully implement the modified Risk Based Profiling System.
2. Review and update current policy documents.
3. Update and publish revised rules and regulations.
4. Hire a permanent dam safety branch chief.
5. Update the long range dam safety plan.
6. Continue to provide professional training of branch personnel.
7. Improve coordination and communication of personnel within the program and Division Offices.
8. Continue to perform dam owner training by conducting one-day workshops at various locations throughout the state.

Dam Safety Engineer's
Quarterly Activity Report

Dam Safety Engineer: ALL **FY:** 03-04
Division: ALL **Quarter:** ALL

Activity	Dam Hazard Classification					
	Class 1	Class 2	Class 3	Class 4	Other	Total
Inspections/Site Visits						
Dam Safety	262	154	130	1	1	548
Interim Dam Safety	2	69	2	0	0	73
Construction	115	48	73	2	0	238
Follow-up	45	54	56	3	5	163
Outlet Works	11	10	3	0	0	24
Federal Dams (non-FERC)	2	5	10	0	0	17
FERC Dams	3	0	0	0	0	3
Other	7	1	11	0	2	21
Reviews						
Hydrologic Studies	15	4	9	0	0	28
Geotech Analyses/Studies	3	0	2	0	0	5
Design (new/enlarge)	4	0	5	1	0	10
Design (repair/modification)	18	13	11	0	0	42
NJ Dam Applications	62	1	89	33	6	191
Outlet Inspection Reports	4	2	2	0	0	8
Federal Reports	2	1	1	0	0	4
FERC Reports	0	0	0	0	0	0
Monitoring Reports	80	3	7	0	0	90
Monitoring Data Evaluations	72	9	2	0	0	83
EPP's (new and updated)	84	37	5	0	0	126
Construction Change Orders	12	2	7	1	0	22
Final Construction Acceptance	14	17	12	1	0	44
Other	26	6	15	0	7	54
Hazard Classification Evaluation	2	2	21	0	2	27

DISTRIBUTION OF DAMS BY IRRIGATION DIVISION/CLASS

HAZARD RATING	DIVISION	NONFEDERAL	FEDERAL	TOTAL
Class 1	1	141	14	155
Class 2	1	122	8	130
Class 3	1	431	12	443
Class 4	1	37	8	45
Class 1	2	41	6	47
Class 2	2	49	3	52
Class 3	2	98	11	109
Class 4	2	101	4	105
Class 1	3	11	1	12
Class 2	3	15	0	15
Class 3	3	27	5	32
Class 4	3	19	0	19
Class 1	4	31	10	41
Class 2	4	37	0	37
Class 3	4	147	6	153
Class 4	4	5	3	8
Class 1	5	37	7	44
Class 2	5	45	0	45
Class 3	5	109	8	117
Class 4	5	19	0	19
Class 1	6	13	0	13
Class 2	6	13	1	14
Class 3	6	107	9	116
Class 4	6	12	0	12
Class 1	7	16	4	20
Class 2	7	20	1	21
Class 3	7	48	1	49
Class 4	7	6	0	6
TOTALS		**1757**	**122**	**1879**

Class 1 - Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.

Class 2 - Significant damage to improved property is expected in the event of failure of the dam while the reservoir is at the high water line, but no loss of life is expected.

Class 3 - Loss of human life is not expected, and damage to improved property is expected to be small in the event of failure of the dam while the reservoir is at the high water line.

Class 4 - Loss of human life is not expected, and damage will only occur to the dam owner's property in the event of failure of the dam while the reservoir is at the high water line.

APPENDIX A

DAM SAFETY BRANCH ORGANIZATION AND PERSONNEL

DAM SAFETY BRANCH PERSONNEL

NAME	TITLE	RESPONSIBILITY
Denver Office		
Douglas Boyer[1]		Chief, Dam Safety Branch
Mark Haynes	Professional Engineer II	Design Review/Construction Inspect.
Division Offices		
Michael Cola	Professional Engineer II	Dam Safety Engineer, Division 1
James Dubler	Professional Engineer II	Dam Safety Engineer, Division 1
Gregory Hammer	Professional Engineer II	Dam Safety Engineer, Division 1
Michael Graber	Professional Engineer II	Dam Safety Engineer, Division 2
William McCormick	Professional Engineer II	Dam Safety Engineer, Division 2
Dennis Miller	Professional Engineer II	Dam Safety Engineer, Division 3/7
James Norfleet	Professional Engineer II	Dam Safety Engineer, Division 4
Garrett Jackson	Professional Engineer II	Dam Safety Engineer, Division 4/5
John G. Blair	Professional Engineer II	Dam Safety Engineer, Division 5
John R. Blair	Professional Engineer II	Dam Safety Engineer, Division 6

Notes:

[1] Through IPA with U.S. Bureau of Reclamation

APPENDIX B

RESERVOIR RESTRICTION LIST

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 1

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
010104	3	ADAMS & BUNKER #3	6.0 CREST	INADEQUATE FREEBOARD, SEEPAGE	0	5/22/1975	C	150
010115	2	BIJOU #2 DAM #1	GH 16 but not > GH 15 for > 30 days	scarping, seepage, no spillway	16	6/1/1993	C	2400
010132	3	J.B. COOKE	3 ft below top of headwall	provide minimum freeboard		5/6/1998	R	0
010138	3	DOVER	10.0 FT. CREST	POOR CONDITION		6/27/1996	I	60
010210	1	EMPIRE (OUTLET EMBANKMENT)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
010419	3	D.A. LORD #4	2.0 SPILLWAY	INADEQUATE SPILLWAY	0	9/19/1980	C	400
010505	2	PROSPECT	GH 35.5.	maintenance & monitoring issues	35.5	4/15/1981	R	588
010506	1	RIVERSIDE	GH 33.55 FT.	no spillway; 33.55 is max decree	33.5	5/9/1984	I	0
010612	3	NO NAME 1-1 #1	10 FT. CREST	SCOUR OF D/S SLOPE DUE TO FAILURE OF OUTLET		11/2/2000	I	100
010709	3	JOLLY JOHN	NO STORAGE	SCOUR HOLE FROM OUTLET	0	10/27/2000	I	297
010716	3	HOWARDS LAKE	3.0 FT. SPILLWAY	EROSION OF DAM AND CREST		6/3/1998	I	50
010723	2	BIJOU #2 DAM #2	GH 16 but not > GH 15 for > 30 days	scarping, seepage, no spillway	16	6/1/1993	C	2400
010724	2	BIJOU #2 DAM #3	GH 16 but not > GH 15 for > 30 days	scarping, seepage, no spillway	16	6/1/1993	C	2400
010725	2	BIJOU #2 DAM #4	GH 16 but not > GH 15 for > 30 days	scarping, seepage, no spillway	16	6/1/1993	C	2400
010726	1	EMPIRE (NW EMBANKMENT)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
010727	1	EMPIRE (McINTYRE DIKE)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
010728	1	EMPIRE (EAST EMBANKMENT)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
010729	3	EMPIRE (FREEBOARD DIKE)	GH 29.0	lack of emergency spillway	29	3/7/1985	R	2779
020109	3	BRIGHT VIEW #1	7.0 CREST	INOP. OUTLET, INADEQUATE FREEBOARD	0	9/30/1985	I	17
020113	3	CARLIN	5.0 CREST	NO SPILLWAY	0	7/29/1986	C	0
020115	3	LOWER CHURCH LAKE	3.0 FT CREST	INADEQUATE SPILLWAY		6/22/1999	I	0
020119	3	COLE	NO STORAGE	POOR CONDITION	0	6/30/1994	I	95
020123	N	EAST LAKE #1	NO STORAGE	INADEQUATE SPILLWAY, POOR CONDITION	0	3/19/1992	I	125
020237	3	MARSHALL	5 ft. below dam crest	Obstructed spillway, etc.		10/21/2002	I	10
020314	3	NORTH STAR	5.0 BELOW DAM CREST	SINKHOLE ON DOWNSTREAM SLOPE		2/11/2003	R	
020322	2	SIGNAL #1	5.0 CREST	CONCENTRATD SPG AREAS&QUESTNBLE COND OF OUTLET	0	6/21/1993	R	60
020327	2	RANKIN RESERVOIR	NO STORAGE	POOR CONDITION	0	7/12/1995	I	44
020333	3	THOMPSON	5.0 CREST	INADEQUATE FREEBOARD, GENERALLY POOR CONDITION	0	10/7/1987	R	30
020411	2	NISSEN #2	1.75 SPILLWAY	LACK OF FREEBOARD		9/11/1995	I	50
020606	3	MOWER	3 Feet below Lowest Point of Dam Crest	Inadequate Spillway and Freeboard		5/22/2002	I	8
020615	3	HAVANA STREET DAM	NO STORAGE	NO SPILLWAY	0	6/17/1987	C	0
030107	1	BLACK HOLLOW	4.2 FT. SPILLWAY	INADEQUATE SPILLWAY	31	10/22/1997	I	999
030108	3	BOX ELDER #2	3.0 FT. SPILLWAY	EXCESSIVE SEEPAGE	6.5	8/8/1989	I	49
030122	2	CURTIS LAKE	GH 10 FT.	CREST, SLOPE, EXT. SEEP. AREA BELOW D/S TOE	10	7/2/1985	I	397

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 1

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
030128	3	DRY CREEK	GH 11.5 FT.	OUTLET DETERIORATION,SEEPAGE, INAD SW	11.5	1/17/1996	R	150
030138	2	GRAY #3	NO STORAGE	SINKHOLE OVER OUTLET	0	5/27/1997	I	100
030214	3	LAW, JOHN	3.0 CREST	INADEQUATE SPILLWAY AND FREEBOARD	11	6/22/1987	C	45
030220	3	MATTINGLY	2.0 FT. SPILLWAY	EROSION/3-5 FT. SCARP ON U/S FACE		10/23/1997	I	99
030225	3	MOUNTAIN SUPPLY # 1	10 FT. CREST	POOR CONDITION	5	11/5/1997	I	500
030226	3	MOUNTAIN SUPPLY # 2	10 FT. CREST	POOR CONDITION	5	11/5/1997	I	300
030227	3	MOUNTAIN SUPPLY # 6	3.0 CREST	NO SPILLWAY		10/19/2000	C	120
030229	3	MOUNTAIN SUPPLY # 8	NO STORAGE	POOR CONDITION	0	10/3/1978	I	643
030236	2	NORTH POUDRE # 1	7.0 CREST	SEEP. @ HIGHER STGE. LEVELS/COND. OF UP SLOPE	9	10/17/1988	R	365
030301	2	NORTH POUDRE # 4	GH 17 FT.	POOR U/S FACE, GENERAL CONDITION	17	4/17/1984	R	562
030512	3	RIST CANYON	3.0 CREST	SEEPAGE, INADEQUATE SPILLWAY	0	4/19/1983	I	33
040101	3	ARROWHEAD	zero storage	sinkhole; inoperable outlet	0	1/14/2003	I	230
040123	2	FAIRPORT	6.0 SPILLWAY	POOR CONDITION	6	6/22/1987	R	363
040211	2	RYAN GULCH	GH 27.6	INADEQUATE SPILLWAY, LEAKAGE	27.6	2/12/1997	R	40
040213	2	SOUTH SIDE	8.0 CREST	DAM UNSAFE FOR ORIG. STOR. AMT.	8	7/7/1978	I	105
040237	3	WESTERDOLL LAKE	8.5 CREST	POOR CONDITION		3/30/1992	I	9
045234	3	IDE AND STARBIRD #1	3.0 CREST	POOR MN, ERODED U/S FACE, QUES. SPILLWAY	0	7/3/1985	I	0
050101	2	AKERS & TARR	7.0 CREST OCT. 1 - APRIL 1	SLIDE ON D/S SLOPE, SPGE. IN AREA OF ABAND OTL	0	3/23/1989	R	34
050132	3	HIGHLAND	3.0 BELOW TOP OF CONCRETE WALL AT OUTLET	NO SPILLWAY	0	11/26/1990	R	0
050206	3	KNOTH	NO STORAGE	NEVER COMPLETED DAM	0	12/24/1985	I	204
050212	3	LITTLE GEM	10.0 CREST	EROSION ON U/S SLOPE & CRST,TREES ON U/S SLOPE	0	10/11/1985	I	60
050301	3	STEELE BROTHERS #1	4.0 SPILLWAY	SAT. EMBKMT.;INOP. O'S.;INAD. FBD.;SPWY.REPAIR	0	12/1/1987	I	34
050302	3	STEELE BROTHERS #2	3.0 SPILLWAY	TOTAL REHABILITATION REQUIRED	0	11/23/1987	I	14
050304	3	SWEDE	5.0 CREST	EMBANKMENT SEEPAGE & INADEQUATE FREEBOARD	0	11/14/1986	I	75
050308	2	UNION	GH 28.0	spillway design based on GH=28.0	28	12/6/1977	C	0
060122	4	GREEN LAKE NO. 1	3.0 CREST	SEEPAGE, NO SPILLWAY	0	10/12/1984	I	30
060124	4	GREEN LAKE NO. 3	3.0 CREST	LEAKS, INADEQUATE SPILLWAY FREEBOARD	0	10/8/1984	I	60
060202	3	MCKAY LAKE - EAST DAM	GH 11 FT.	INAD. FREEBOARD, SEEPAGE	11	9/11/1995	I	90
060204	3	MESA	NO STORAGE	POOR COND		6/28/2000	I	100
060212	3	SECTION 19	4.0 CREST	NO SPILLWAY	0	7/24/1984	I	10
060306	3	VARSITY POND	1 FT. SPILLWAY	SEEPAGE/SPILLWAY		8/31/1999	I	1
060314	3	HODGSON-HARRIS	6.0 CREST	POOR CONDITION		11/14/1995	I	60
070111	1	IDAHO SPRINGS	8.0 CREST	SEEPAGE, SETTLEMENT & REPAIRS REQD. ON SPWY.	22	2/27/2002	R	19
070126	2	DEWEY NO. 1	3.0 CREST(NW)	POOR CONDITION	0	11/19/1990	I	15
070201	1	KALCEVIC	11.0 CREST	ERODED UPSTREAM SLOPE	0	2/10/1983	I	43
070202	3	KELLY	3.0 CREST	NO SPILLWAY,	0	12/5/1986	I	0

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 1

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
075311	1	SMITH	1.0 SPILLWAY	SEEPAGE	0	1/26/2000	R	100
080101	3	ALLIS	15.0 CREST	SLOUGHING, SEEPAGE	0	8/25/1992	R	50
080105	3	BAIRD #1	7.0 CREST	SEVERE BEAVER ACTIVITY, PLUGGED OUTLET	0	1/8/1990	I	25
080110	4	CANTRILL	NO STORAGE	NO SPILLWAY, INOPERABLE OUTLET	0	10/22/1987	I	37
080306	3	WAKEMAN	NO STORAGE	SPILLWAY EROSION		10/17/1994	I	110
080321	4	QUICK	NO STORAGE	NO SPILLWAY, INOPERABLE OUTLET	0	10/22/1987	I	64
080327	1	SKEEL	2.0 FT. SPILLWAY	POOR CONDITION		4/2/1997	R	10
080422	3	RAINBOW FALLS #5	9.0 CREST	INADEQUATE SPILLWAY	0	9/11/1985	I	25
080424	3	GERLITS	NO STORAGE	DAM PARTIALLY BREACHED DUE TO OVERTOPPING.	0	11/13/1984	I	10
090102	2	BEERS SISTERS LAKE	5' BELOW DAM CREST	INADEQUATE SPILLWAY		1/8/1999	I	15
090115	2	HARRIMAN	GH 19 FT.	EXCESSIVE SEEPAGE	19	11/12/1992	R	300
090138	4	HAYSTACK #1	NO STORAGE	SPILLWAY UNDERMINED	0	5/8/1987	I	3
090204	1	WILLOW SPRINGS #1	1.0 SPILLWAY	EROSION OF US FACE	13.5	9/14/2000	R	10
230102	1	ANTERO	GH 18 FT.	STAB. BERM CONST. & NEW INSTR. MONITORING	18	2/4/1986	R	5100
230104	3	BAYOU SALADO	One-Foot Below Spillway Crest	Unsatisfactory & Unsafe Condition of Spillway		8/29/2002	I	26
230208	1	TARRYALL	ZERO STORAGE	UNSTABLE DURING OVERTOPPING		8/21/2002	I	1963
230308	3	MOUNTAIN	4.0 CREST	INSUFFICIENT FREEBOARD, SEEPAGE AT TOE	0	11/6/1985	I	3
230310	3	STOCKING POND	NO STORAGE	INADEQUATE SPILLWAY	0	6/13/1988	I	10
230311	3	SUN	5.0 CREST	SEEPAGE-RESTRICT O 8' BELOW CREST	0	12/31/1984	R	6
230312	3	WIND	5.5 CREST	SATURATED D/S SLOPE	0	9/20/1985	C	3
480101	3	JOHNSON	4.0 CREST(3.0 CREST IRR. SEASON)	EROS. ON U/S FACE, IMPROPER FB., SEEP/D/S TOE	0	7/18/1994	C	68
640104	1	JULESBURG #4	GH 24 FT. FOR 90 DAYS, THEN GH 23 FT.	CONDITION OF OUTLET, EXCESSIVE SEEPAGE	24	5/2/1995	R	6964
640108	1	PREWITT	GH 26.5 FT.	NO SPWY & EXCESSIVE SEEPAGE	26.5	8/23/1990	I	2531
650121	3	DUCK	4.0 SPILLWAY	NARROW CREST, STEEP SLOPES	0	3/23/1987	I	15
650123	3	HANSHAW	5.0 CREST	seepage, slide, overall poor	0	7/7/1987	I	12

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 1 48997 AF TOTAL NUMBER OF DAMS AFFECTED: 95 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 2

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
100123	3	A. MC CRAY	5.0 FT SPILLWAY	INSTABILITY		4/13/1998	I	10
100131	3	GARDEN OF THE GODS GOLF COURSE	3.0 CREST	NO SPILLWAY	0	5/31/1988	I	0
100205	3	KEETON LAKE	10.O FT. SPILLWAY	EROSION OF SPILLWAY, LEAKAGE, PIPING	0	8/8/1997	I	10
100215	N	MODERN WOODMEN OF AMER. #2	NO STORAGE	INADEQUATE SPILLWAY, POOR REPAIR	0	8/12/1983	R	85
100235	2	PROSPECT LAKE	3.5 CREST	NO SPWY., OTLT OPERABILITY QUESTIONABLE	0	5/31/1988	I	0
100309	3	VALLEY NO. 1	15.0 CREST	INOPERABLE OUTLET & BLOCKED SPILLWAY	0	12/27/1984	I	50
100402	2	VALLEY NO. 2	NO STORAGE	INOPERABLE OUTLET, OBSTRUCTED SPILLWAY	0	9/21/2000	C	185
110106	3	EVANS GULCH	3.0 CREST	INSUFFICIENT FREEBOARD	0	2/2/1985	R	2
120136	3	PARK CENTER L & W #2	8.8 CREST	SLIDE ON DOWNSTREAM SLOPE	0	1/4/1989	R	11
120202	3	PARK CENTER L & W #10	GH 7 FT.	EXTENSIVE CRACKING ON THE CREST	7	10/2/1974	I	48
150116	3	OCCHIATO #1	10 FEET CREST	SLIDE		9/16/1999	I	3
160108	1	CUCHARAS #5	GH 100 FT.	POOR OVERALL CON. EMBKMT. HISTY. MVMNT.	100	7/21/1988	R	33000
160135	4	CLARK #1	8.0 CREST	ERODED UPSTREAM SLOPE	0	2/16/1994	R	80
170118	3	CUDAHY #1	5.0 FT. BELOW DAM CREST	INADEQUATE FREEBOARD AND INOPERABLE OUTLET		7/15/1985	I	900
170217	3	SWINK #1	5.0 CREST	IN DISREPAIR, ABANDONED	0	4/24/1986	I	500
170218	3	SWINK #2	5.0 CREST	IN DISREPAIR, ABANDONED	0	4/24/1986	I	600
170219	3	SWINK #5	5.0 CREST	IN DISREPAIR, ABANDONED	0	4/24/1986	I	750
170220	3	SWINK #6	5.0 CREST	IN DISREPAIR, ABANDONED	0	4/24/1986	I	650
170222	3	TIMPAS #3	10.0 CREST	IN DISREPAIR, ABANDONED	0	4/21/1986	I	500
180206	2	APISHAPA	22.0 CREST	SPILLWAY, OUTLET SILTED IN	0	2/18/1994	I	260
180207	3	SEVEN LAKES	7.0 CREST	DILAPIDATED CONDITION OF DAM	0	5/6/1987	I	1200
190114	3	MODEL	3.0 FT SPILLWAY	POOR COND		6/28/2000	I	1000
670236	1	TWO BUTTES	GH 20 FT.	HYDRAULICALLY INADEQUATE SPILWAY	20	1/24/1983	I	31465

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 2 71309 AF TOTAL NUMBER OF DAMS AFFECTED: 23 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 3

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
200105	3	BRISTOL HEAD #1	ZERO STORAGE	INOPERABLE OUTLET/POOR GENERAL CONDITION	0	8/6/2002	I	121
200110	1	CONTINENTAL	GH 64.5	LEAKAGE	64.5	8/1/1995	R	7679
210102	1	TERRACE	7.0 SPILLWAY	DETERIORATED SPILLWAY	117	7/18/1984	I	2000

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 3 9800 AF TOTAL NUMBER OF DAMS AFFECTED: 3 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 4

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
400103	3	ARCH SLOUGH	DAM WAS ABANDONED,BUT CAN STILL HOLD WATER	POOR CONDITION	0	12/12/1985	I	66
400108	1	BARREN	zero storage	outlet deficiencies	0	12/11/2003	I	759
400112	2	BIG BATTLEMENT	GH 8 FT.	SINKHOLES ON EMBANKMENT	8	9/24/1991	R	750
400212	3	CYPHER #1	4.0 BELOW EMERGENCY SPILLWAY CREST	REPAIRS NOT COMPLETED		1/14/2003	R	8
400306	2	GRANBY #12	GH 17 FT.	D/S FACE SLIDE DUE TO SEEPAGE	17	10/15/1987	R	0
400318	1	HOTEL LAKE	NO STORAGE	WEAKENED CONDITIONS!	0	1/14/2002	I	549
400330	3	KNOX	FULL STORAGE FROM 4/1 TO 8/15 IF MONITORED	EXCESSIVE SEEPAGE AT TOE AND ON EMBANKMENT	17	1/8/1988	R	0
400405	3	LONE STAR #1	30.0 CREST	CRACKS ON CREST, UNAPPROVED PLANS, POOR CONSTR	0	7/31/1996	R	0
400411	3	MILITARY PARK		PIPING	10	9/7/2000	I	150
400413	2	MONUMENT	10.0 SPILLWAY, FILL/MONITORING PLAN IN PLACE	CRACKS ON DAM AND LEFT ABUTMENT SLIDE	33.5	4/29/1993	I	175
400419	3	OASIS	3 FEET BELOW NORMAL WATER SURFACE	UNCONTROLLED SEEPAGE		9/30/2003	I	40
400434	3	PITCAIRNE #1	5.5 FT. SPILLWAY	BEAVER DENS ON US FACE		8/2/2000	I	50
400522	3	TODD	10.0 CREST	6' ELEVATION DIFF ALONG CREST WITH NO SPLLWAY	0	10/19/1984	I	112
400524	3	TRIO	8.0 SPILLWAY	SLIDE ON DOWNSTREAM SLOPE	14	1/11/1989	I	75
400601	3	HARRY WHITE #2	5.0 CREST	POOR OUTLET VALVE,LACK OF FREEBOARD,MAINTENANC	0	8/9/1991	I	30
400619	3	LONE STAR #2	10.0 CREST	CONSTRUCTION WITHOUT APPROVED PLANS & SPECS	0	6/2/1988	C	0
400705	3	WEBSTER #1	NO STORAGE	POORLY CONSTRUCTED	0	5/6/1987	C	15
400707	3	WEBSTER #3	NO STORAGE	POORLY CONSTRUCTED	0	5/6/1987	C	15
410201	3	COFFEY RESERVOIR	NO STORAGE	GENERAL POOR CONDITION,CONST. WO/APP. PLANS	0	7/21/1988	C	90
410202	3	MOCK #1	9.0 CREST(AFTER 60 DAYS FULL)	BUILT WITHOUT APPROVED PLANS & SEEPAGE	0	4/26/1989	R	0
420116	2	FRUITA #1	20 FT. CREST	SLIDE ON DOWNSTREAM SLOPE		8/12/1998	I	100
420119	3	G.H. AND S. #2	NO STORAGE	NARROW CREST, STEEP SLOPES, POOR OUTLET	0	8/26/1992	R	29
420120	2	GRAND MESA #1	8 FT. SPILLWAY	OUTLET WORKS FAILURE	12	12/21/2000	I	300
420123	3	GRAND MESA #9	3.4 FT SPILLWAY	OUTLET WORKS PROBLEMS	8	12/21/2000	I	100
420135	3	REEDER	8.0 CREST	SEEP. ON D/S SURFACE,NUMEROUS LARGE TREES	0	8/26/1985	R	96
590113	2	MERIDIAN LAKE PARK #1	2.0 SPILLWAY (PRIN SPWY LOWERED)	SEVERE EROSION OF THE EMERGENCY SPILLWAY	0	6/4/1987	I	10
600105	3	BLUE LAKE #1	5.0 FEET SPILLWAY	POOR CONDITION		11/21/2001	I	100
600118	3	PAXTON	2.5 SPILLWAY	SEEPAGE	0	8/8/1988	R	100
600126	3	CUSHMAN	6.0 CREST	OUTLET-INOP. SPWY-INAD. EMB. SEEPS	0	7/29/1975	I	36
600127	1	PRIEST	3.0 CREST	INSUFFICIENT FREEBOARD	0	9/16/1985	I	25

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 4

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
620122	3	FISH CREEK #1	zero storage	stability, seepage, outlet control	0	9/11/2003	I	85
630103	3	BURG	ZERO STORAGE	DAMAGED OUTLET CONTROLS		9/30/2003	I	91

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 4 3956 AF TOTAL NUMBER OF DAMS AFFECTED: 32 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 5

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
370116	3	G G LOWER	4.0 CREST	INADEQ FRBD., STABILITY OF DOWNSTREAM SLOPE	0	12/14/1992	R	7
370205	3	FORIER #3	NO STORAGE	ILLEGAL DAM /INADEQUATE SPILLWAY	0	11/9/1995	I	3
380212	2	FLANNERY	1.0 FT SPILLWAY	SPILLWAY EROSION		9/17/2001	I	20
380217	2	CHRISTINE LAKE	3.5 FT CREST	NO SPILLWAY		5/4/2001	I	10
500113	2	MATHESON	FULL STOR IN SPRING. DRAIN TO GH 30 BY 9/1	MONITORING DEVISE INSTALLED	30	10/30/2002	R	0
500126	3	MILK CREEK	15.0 CREST (AUG 1 THRU MAY 1)	EXCESSIVE LEAKAGE	0	5/10/1991	R	56
510114	2	LITTLE KING RANCH	10.0 SPILLWAY	EXCESSIVE SEEPAGE	41	3/7/1978	C	439
510124	2	SCHOLL	SEASONAL GH 18 IN SPRING GH 10 BY JULY 1			3/30/2004	R	212
510129	N	ROCK CREEK	NO STORAGE	DAM BREACHED BY OWNER BUT WANTS TO REPAIR	0	6/28/1989	C	66
530119	3	KELLY	5.0 CREST	SPILLWAY EROSION	0	9/20/1985	C	54
530125	3	NEWTON GULCH	20.0 CREST, GAGE 17	EXCESSIVE SEEPAGE THROUGH ABUTMENTS	17	7/3/1975	I	465
530129	3	STERNER	RELAX 5/1-8/15, 3.0 SPILLWAY	UNCONTROLLED LEAKAGE		8/2/1995	R	71
720117	3	CARPENTER	NO STORAGE	PIPING HOLE		8/23/1994	I	39
720126	3	CURRIER #2	5.0 SPILLWAY	SLIDE ON HILL ABOVE SPILLWAY, BACKCUTTING		5/24/1995	I	79
720136	3	HAWXHURST	9 feet below crest/6 feet below spillway	Hole in dam		9/9/2003	I	120
720237	1	Y T RANCH	6' BELOW DAM CREST LOW POINT	SLOUGHING OF UPSTREAM SLOPE AND SEEPAGE		5/28/2003	I	21
720304	3	LONG SLOUGH	Zero Storage	Piping along outlet works conduit		9/9/2003	I	219

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 5 1881 AF TOTAL NUMBER OF DAMS AFFECTED: 17 DAMS

STATE OF COLORADO --- DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 6

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
430205	3	BAXTER	5.0 FT. SPILLWAY	SEEPAGE, EROSION OF U/S FACE		11/13/1997	I	30
430212	3	WILSON #3	3.0 SPILLWAY	INOPERABLE OUTLET, INAD SPWY	3	9/30/1989	I	10
440106	3	BISKUP	5.0 SPILLWAY	DILAPIDATED CONDITION	0	8/19/1987	C	55
440120	3	DRESCHER	8.0 SPILLWAY	SEEPAGE & INSTABILITY	8	8/1/1988	R	159
440124	3	ELLGEN #2	Full Storage	New outlet pipe. Recommend restriction lifted.		2/16/1999	R	
440213	3	FLATTOP	5.0 FT CREST MAIN DAM	BREACHED, BEAVER DAMS, FREEBOARD		8/2/1999	I	50
560105	3	HAUNTED SPRING	Zero Storage	Uncontrolled seepage/piping		9/9/2003	I	8
560107	3	BASSET #2	5-FEET BELOW SPILWAY CREST	ILLEGAL DAM, POOR CONDITION		10/21/2002	R	25
570114	3	LAKE EMRICH	15.0 CREST	SLIDES ON DOWNSTREAM SLOPE	0	8/30/1988	C	330
580303	N	LOWER SPRING CREEK	Dam Breached.	Approval of breach construction.	0	12/16/2003	R	0

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 6 667 AF TOTAL NUMBER OF DAMS AFFECTED: 10 DAMS

STATE OF COLORADO — DAM SAFETY BRANCH
LISTING OF DAMS UNDER STORAGE RESTRICTION ORDERS

FOR DIVISION: 7

DAMID	Haz. Class	Dam Name	Restricted Reservoir Level	Reason for Restriction	Gage Ht.	Action Date	Act. Type	Volume
340106	3	HURST	NO STORAGE	OUTLET FAILURE	0	3/29/1999	I	35
340117	3	SELLERS AND MCCLANE	4 FT BELOW DAM CREST	SEEPAGE, MUSKRAT DAMAGE		5/29/2003	I	12
340119	3	J. O. SPENCER	NO STORAGE	INOPERABLE OUTLET	0	5/8/2000	I	16
340203	1	SUMMIT - MAIN DAM	NOT TO EXCEED 1.1' BELOW SPILL FOR > 3 WEEKS	EXCESSIVE SEEPAGE	23.6	6/3/1998	R	400
340205	1	SUMMIT - SOUTH DAM	NOT TO EXCEED 1.1' BELOW SPILL FOR > 3 WEEKS	EXCESSIVE SEEPAGE	23.6	6/3/1998	R	400
780111	2	PINON LAKE	3 FEET SPILLWAY	POOR CONDITION OF OUTLET		7/27/2001	I	86

VOLUME OF STORAGE WATER LOST DUE TO RESTRICTION FOR DIVISION 7 949 AF

TOTAL NUMBER OF DAMS AFFECTED: 6 DAMS

APPENDIX C

APPROVED PLANS AND SPECIFICATIONS LIST

APPROVED PLANS AND SPECIFICATIONS FOR NEW DAMS AND ALTERATIONS, ENLARGEMENTS, OR REPAIRS OF EXISTING DAMS

NAME	DAMID	C-NO	CONST TYPE	APPROVAL	USE
SIENA	020646	C-1840	NEW	7/15/2003	DOMESTIC
CASTLEWOOD RANCH POND B	080447	C-1845	NEW	7/15/2003	FLOOD CONTROL
BONITA	400122	C-1831	REPAIR	8/1/2003	IRRIGATION
BATTLEMENT #1	450102	LTR	MODIFICATION	8/1/2003	FISH AND WILDLIFE
TRIO	400524	C-0701A	REPAIR	8/1/2003	IRRIGATION
SEELEY LAKE	030318	C-1816	MODIFICATION	8/27/2003	IRRIGATION
WESTERN HILLSIDE RESERVOI	370206	C-1758A	REPAIR	9/11/2003	OTHER
TOWN CENTER	780109	C-1379A	MODIFICATION	9/12/2003	RECREATION
GROSS	060211	C-0569C	MODIFICATION	9/15/2003	DOMESTIC
IVANHOE	380115	C-1323A	REPAIR	9/15/2003	IRRIGATION
BARREN	400108	C-1849	REPAIR	10/8/2003	IRRIGATION
KISER SLOUGH	400329	C-0549B	REPAIR	10/8/2003	IRRIGATION
WAUCONDA	080307	C-1273F	MODIFICATION	10/15/2003	RECREATION
CEDAR MESA	400135	C-1419D	MODIFICATION	10/15/2003	IRRIGATION
UPPER TULE LAKE	095221	C-1662A	MODIFICATION	10/15/2003	RECREATION
TIGERS	020644	C-1818	NEW	10/24/2003	DOMESTIC
SPRING RUN #2	100106	C-0441D	MODIFICATION	10/24/2003	IRRIGATION
MONUMENT LAKE	190115	C-0202B	REPAIR	11/6/2003	DOMESTIC
GLEN EYRE #3	100132	C-0217B	REPAIR	11/12/2003	DOMESTIC
LEFT HAND VALLEY	050210	C-0635C	REPAIR	12/31/2003	IRRIGATION
TERRACE	210102	C-0875F	REPAIR	1/8/2004	IRRIGATION
NORTH LAKE	190116	C-1063B	REPAIR	1/19/2004	DOMESTIC
CORTEZ - NON-ROSTER	32___A	LTR	BREACH	3/1/2004	
LAKE HENRY	170203	C-0555D	MODIFICATION	3/2/2004	IRRIGATION
ST. CHARLES MESA #2	150115	C-1523B	MODIFICATION	3/2/2004	DOMESTIC
TIGERS	020644	C-1818A	MODIFICATION	3/10/2004	DOMESTIC
MUSGRAVE	510121	C-1855	REPAIR	3/16/2004	IRRIGATION
FOOTHILLS	050124	C-0066C	REPAIR	3/24/2004	IRRIGATION
ANNEX #8	030103	C-1821A	MODIFICATION	3/24/2004	IRRIGATION
WINDSOR #8	030337	C-1596B	MODIFICATION	3/24/2004	IRRIGATION
HIGHLAND #1	050133	C-1858	REPAIR	3/24/2004	IRRIGATION
ARROWHEAD	040101	C-1003A	REPAIR	3/29/2004	IRRIGATION
BIG CREEK #3	720104	C-1860	REPAIR	3/29/2004	IRRIGATION
KARVAL	170201	C-0931D	MODIFICATION	4/20/2004	RECREATION
SOUTH TANI RESERVOIR	02___F	C-1841	NEW	4/21/2004	
NOTTINGHAM	370119	C-1610A	MODIFICATION	5/5/2004	IRRIGATION
MAPLE GROVE	070219	C-0757F	MODIFICATION	5/17/2004	DOMESTIC
FISHER CANON	100121	C-0228B	REPAIR	5/17/2004	DOMESTIC
LONGMONT WTP FOREBAY EMB	050328	C-1854	NEW	5/24/2004	DOMESTIC
WOMAN CREEK	020633	C-1747A	MODIFICATION	6/7/2004	FLOOD CONTROL

APPENDIX D

ENGINEERS INSPECTION REPORT FORM

ENGINEERS INSPECTION REPORT

OFFICE OF THE STATE ENGINEER-DIVISION OF WATER RESOURCES - DAM SAFETY BRANCH
1313 Sherman Street, Room 818, Denver, CO 80203, (303) 866-3581

DAM NAME _____ W. DIV. _____ W. DIST. _____ DATE OF INSPECTION ___/___/___

DAM ID _____ FILE NO. C- _____ FOREST I.D. _____ DATE OF LAST INSPECTION ___/___/___

OWNER NAME _____ OWNER PHONE _____

ADDRESS _____ ZIP CODE _____

CONTACT NAME _____ CONTACT PHONE _____

CLASS _____ CAPACITY _____ AF SURFACE AREA _____ AC. HEIGHT _____ FT. CREST LENGTH _____ FT CREST WIDTH _____ FT

CURRENT RESTRICTION ☐ (NO) ☐ (YES) LEVEL _____ EPP ON FILE ☐ (NO) ☐ (YES) SPWY WIDTH _____ FT. FBD. _____ FT. Z _____

INSPECTION PARTY REPRESENTING _____ _____ _____

DIRECTIONS: MARK AN **X** FOR CONDITIONS FOUND **AND** UNDERLINE WORDS THAT APPLY. GIVE LOCATION AND EXTENT WITH NUMBER REFERENCE I.E. (25) ALL ALONG SLOPE, OR SHOW IT ON SKETCH.

FIELD CONDITIONS OBSERVED

WATER LEVEL - BELOW DAM CREST _____ FT., BELOW SPILLWAY _____ FT., GAGE ROD _____

GROUND MOISTURE CONDITION: DRY _____ WET _____ SNOWCOVER _____ OTHER _____

Conditions Observed

UPSTREAM SLOPE

PROBLEMS NOTED: ☐ (0) NONE ☐ (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED ☐ (2) WAVE EROSION-WITH SCARPS
☐ (3) CRACKS-WITH DISPLACEMENT ☐ (4) SINKHOLE ☐ (5) APPEARS TOO STEEP ☐ (6) DEPRESSIONS OR BULGES ☐ (7) SLIDES
☐ (8) CONCRETE FACING-HOLES, CRACKS, DISPLACED, UNDERMINED ☐ (9) OTHER _____
Comments: _____

GOOD | ACCEPTABLE | POOR — UPSTREAM SLOPE

CREST

PROBLEMS NOTED: ☐ (10) NONE ☐ (11) RUTS OR PUDDLES ☐ (12) EROSION ☐ (13) CRACKS - WITH DISPLACEMENT ☐ (14) SINKHOLES
☐ (15) NOT WIDE ENOUGH ☐ (16) LOW AREA ☐ (17) MISALIGNMENT ☐ (18) INADEQUATE SURFACE DRAINAGE
☐ (19) OTHER _____
Comments: _____

GOOD | ACCEPTABLE | POOR — CREST

DOWNSTREAM SLOPE

PROBLEMS NOTED: ☐ (20) NONE ☐ (21) LIVESTOCK DAMAGE ☐ (22) EROSION OR GULLIES ☐ (23) CRACKS - WITH DISPLACEMENT ☐ (24) SINKHOLE
☐ (25) APPEARS TOO STEEP ☐ (26) DEPRESSION OR BULGES ☐ (27) SLIDE ☐ (28) SOFT AREAS ☐ (29) OTHER _____
Comments: _____

GOOD | ACCEPTABLE | POOR — DOWNSTREAM SLOPE

SEEPAGE

PROBLEMS NOTED: ☐ (30) NONE ☐ (31) SATURATED EMBANKMENT AREA ☐ (32) SEEPAGE EXITS ON EMBANKMENT
☐ (33) SEEPAGE EXITS AT POINT SOURCE ☐ (34) SEEPAGE AREA AT TOE ☐ (35) FLOW ADJACENT TO OUTLET ☐ (36) SEEPAGE INCREASED/MUDDY
DRAIN OUTFALLS SEEN ___No ___Yes ☐ (37) FLOW INCREASED/MUDDY ☐ (38) DRAIN DRY/OBSTRUCTED
☐ (39) OTHER _____ Show location of drains on sketch and indicate amount and quality of discharge.
Comments: _____

GOOD | ACCEPTABLE | POOR — SEEPAGE

OUTLET

PROBLEMS NOTED: ☐ (40) NONE ☐ (41) NO OUTLET FOUND ☐ (42) POOR OPERATING ACCESS ☐ (43) INOPERABLE
☐ (44)UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED (45) OUTLET OPERATED DURING INSPECTION ☐ YES ☐ NO
INTERIOR INSPECTED ☐ (120) NO ☐ (121) YES ☐ (46) CONDUIT DETERIORATED OR COLLAPSED ☐ (47) JOINTS DISPLACED ☐ (48) VALVE LEAKAGE
☐ (49) OTHER _____
Comments: _____

GOOD | ACCEPTABLE | POOR — OUTLET

SPILLWAY

PROBLEMS NOTED: ☐ (50) NONE ☐ (51) NO EMERGENCY SPILLWAY FOUND ☐ (52) EROSION-WITH BACKCUTTING ☐ (53) CRACK - WITH DISPLACEMENT
☐ (54) APPEARS TO BE STRUCTURALLY INADEQUATE ☐ (55) APPEARS TOO SMALL ☐ (56) INADEQUATE FREEBOARD ☐ (57) FLOW OBSTRUCTED
☐ (58) CONCRETE DETERIORATED/UNDERMINED ☐ (59) OTHER _____
Comments: _____

GOOD | ACCEPTABLE | POOR — SPILLWAY

See Guidelines on Back of this Sheet

DAM NAME: _____ DAM I.D.: _____ DATE ___/___/___

MONITORING

EXISTING INSTRUMENTATION FOUND ☐ (110) NONE ☐ (111) GAGE ROD ☐ (112) PIEZOMETERS ☐ (113) SEEPAGE WEIRS/FLUMES

☐ (114) SURVEY MONUMENTS ☐ (115) OTHER _____

MONITORING OF INSTRUMENTATION: ☐ (116) NO ☐ (117) YES PERIODIC INSPECTIONS BY: ☐ (118) OWNER ☐ (119) ENGINEER

Comments: _____

GOOD ACCEPTABLE POOR — MONITORING

MAINTENANCE AND REPAIR

PROBLEMS NOTED: ☐ (60) NONE ☐ (61) ACCESS ROAD NEEDS MAINTENANCE ☐ (62) CATTLE DAMAGE

☐ (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE ☐ (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE

☐ (65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE ☐ (66) DETERIORATED CONCRETE-FACING, OUTLET, SPILLWAY

☐ (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE ☐ (68) OTHER _____

Comments: _____

GOOD ACCEPTABLE POOR — MAINTENANCE AND REPAIRS

OVERALL CONDITIONS

REMARKS: _____

Based on this Safety Inspection and recent file review, the overall condition is determined to be:

☐ 71 SATISFACTORY ☐ 72 CONDITIONALLY SATISFACTORY ☐ 73 UNSATISFACTORY

OVERALL CONDITIONS

The State Engineer, by providing this dam safety inspection report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of this dam rests with the reservoir owner or operator, who should take every step necessary to prevent damages caused by leakage or overflow of waters from the reservoir or floods resulting from a failure of the dam.

ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

MAINTENANCE - MINOR REPAIR - MONITORING

☐ (80) PROVIDE ADDITIONAL RIPRAP: _____

☐ (81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE: _____

☐ (82) CLEAR TREES AND/OR BRUSH FROM: _____

☐ (83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES: _____

☐ (84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE: _____

☐ (85) PROVIDE SURFACE DRAINAGE FOR: _____

☐ (86) MONITOR: _____

☐ (87) DEVELOP AND SUBMIT AN EMERGENCY PREPAREDNESS PLAN. _____

☐ (88) OTHER. _____

☐ (89) OTHER. _____

ENGINEERING - EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO: (Plans & Specification must be approved by State Engineer prior to construction.)

☐ (90) PREPARE PLANS AND SPECIFICATIONS FOR THE REHABILITATION OF THE DAM: _____

☐ (91) PREPARE AS-BUILT DRAWINGS OF: _____

☐ (92) PERFORM A GEOTECHNICAL INVESTIGATION TO EVALUATE THE STABILITY OF THE DAM: _____

☐ (93) PERFORM A HYDROLOGIC STUDY TO DETERMINE REQUIRED SPILLWAY SIZE: _____

☐ (94) PREPARE PLANS AND SPECIFICATIONS FOR AN ADEQUATE SPILLWAY: _____

☐ (95) SET UP A MONITORING SYSTEM INCLUDING WORK SHEETS, REDUCED DATA AND GRAPHED RESULTS: _____

☐ (96) PERFORM AN INTERNAL INSPECTION OF THE OUTLET: _____

☐ (97) OTHER: _____

☐ (98) OTHER. _____

☐ (99) OTHER: _____

SAFE STORAGE LEVEL RECOMMENDED AS A RESULT OF THIS INSPECTION

☐ (101) FULL STORAGE

☐ (102) CONDITIONAL FULL STORAGE

☐ (103) RECOMMENDED RESTRICTION → RESTRICTED LEVEL OFFICIAL ORDER TO FOLLOW

- _____ FT. BELOW DAMS CREST
- _____ FT. BELOW SPILLWAY CREST
- _____ FT. GAGE HEIGHT
- _____ NO STORAGE-MAINTAIN OUTLET FULLY OPEN
- _____ _____

REASON FOR RESTRICTION: _____

ACTIONS REQUIRED FOR CONDITIONAL FULL STORAGE OR CONTINUED STORAGE AT THE RESTRICTED LEVEL: _____

Engineer's Signature _____ INSPECTED BY

Owner's Signature _____ OWNER/OWNERS REPRESENTATIVE

DATE: ___/___/___

GUIDELINES FOR DETERMINING CONDITIONS

CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, OUTLET, SPILLWAY

GOOD	ACCEPTABLE	POOR
In general, this part of the structure has a near new appearance, and conditions observed in this area do not appear to threaten the safety of the dam.	Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.	Conditions observed in this area appear to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO SEEPAGE

GOOD	ACCEPTABLE	POOR
No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.	Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in seepage. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.	Seepage conditions observed appear to threaten the safety of the dam. Examples: 1) Designed drain or seepage flows have increased without increase in reservoir level. 2) Drain or seepage flows contain sediment, i.e., muddy water or particles in jar samples. 3) Widespread seepage, concentrated seepage or ponding appears to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO MONITORING

GOOD	ACCEPTABLE	POOR
Instrumentation and monitoring described under acceptable are being exceeded, as described under comments in the report.	Instrumentation is provided in accordance with the rules. Special instrumentation and monitoring deemed necessary is provided. The owner monitors the dam and records data in accordance with the rules, and submits the data annually or more frequently if required.	Required instrumentation and monitoring are not provided, or required periodic readings are not being made, or unexplained changes in readings are not reacted to by the owner.

CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

GOOD	ACCEPTABLE	POOR
Owner has a plan for annual maintenance. Dam consistently receives effective on-going maintenance and repair.	Dam receives maintenance in accordance with a plan, but some maintenance items need to be addressed. No major repairs are required.	No annual maintenance plan in effect. Dam does not appear to receive adequate maintenance. One or more items needing maintenance or repair have begun to threaten the safety of the dam. Lack of maintenance prevents thorough inspection.

OVERALL CONDITIONS

SATISFACTORY	CONDITIONALLY SATISFACTORY	UNSATISFACTORY
The safety inspection indicates no conditions that appear to threaten the safety of the dam, and the dam is expected to perform satisfactorily under all design loading conditions.	The safety inspection indicates symptoms of structural distress (excessive seepage, evidence of major displacements, etc.) which, if conditions worsen, could lead to the failure of the dam. Essential monitoring, inspection and maintenance must be performed as a requirement for continued full storage in the reservoir or storage at a reduced level. There are no requirements if maintained at the restricted level.	The safety inspection indicates definite signs of hydrologic inadequacy or structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.), which could lead to the failure of the dam if operated at full storage.

SAFE STORAGE LEVEL

FULL STORAGE	CONDITIONAL FULL STORAGE	RESTRICTION
Dam may be used to full capacity with no conditions attached.	Dam may be used to full storage if certain monitoring, maintenance, or operational conditions are met.	Dam may not be used to full capacity, but must be operated at some reduced level in the interest of pulic safety.

CLASSIFICATION OF DAMS

Class 1 - Loss of human life is expected in the event of failure of the dam.	Class 2 - Significant damage is expected in the event of failure of the dam, but no loss of human life is expected. Class 4 - No loss of human life is expected and damage will occur only to the dam owner's property.	Class 3 - A small amount of damage is expected. Loss of human life and significant damage are not expected.

APPENDIX E

WATER COMMISSIONER DAM OBSERVATION REPORT FORM

WATER COMMISSIONER • DAM OBSERVATION REPORT • OFFICE OF THE STATE ENGINEER

DIVISION OF WATER RESOURCES • DAM SAFETY BRANCH — 1313 SHERMAN STREET, ROOM 818, DENVER, CO 80203, (303) 866-3581

FIELD CONDITIONS OBSERVED

WATER LEVEL: BELOW DAM CREST _____ FT., BELOW SPILLWAY _____ FT., GAGE ROD READING _____

GROUND MOISTURE CONDITION: DRY _____ WET _____ SNOWCOVER _____ OTHER _____

DIRECTIONS: MARK AN X FOR CONDITIONS FOUND AND UNDERLINE WORDS THAT APPLY.

UPSTREAM SLOPE

PROBLEMS NOTED: ☐ (0) NONE ☐ (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED ☐ (2) WAVE EROSION-WITH SCARPS
☐ (3) CRACKSWITH DISPLACEMENT ☐ (4) SINKHOLE (5) APPEARS TO STEEP ☐ (6)DEPRESSIONS OR BULGES (7) SLIDES
☐ (8) CONCRETE FACING-HOLES, CRACKS, DISPLACED, UNDERMINED ☐ (9) OTHER _____

CREST

PROBLEMS NOTED: ☐ (10) NONE ☐ (11) RUTS OR PUDDLES ☐ (12) EROSION ☐ (13) CRACKS - WITH DISPLACEMENT ☐ (14) SINKHOLES
☐ (15) NOT WIDE ENOUGH ☐ (16) LOW AREA ☐ (17) MISALIGNMENT ☐ (18) IMPROPER SURFACE DRAINAGE
☐ (19) OTHER _____

DOWNSTREAM SLOPE

PROBLEMS NOTED: ☐ (20) NONE ☐ (21) LIVESTOCK DAMAGE ☐ (22) EROSION OR GULLIES ☐ (23) CRACKS - WITH DISPLACEMENT
☐ (24) SINKHOLE ☐ (25) APPEARS TOO STEEP ☐ (26) DEPRESSION OR BULGES ☐ (27) SLIDE ☐ (28) SOFT AREAS
☐ (29) OTHER _____

SEEPAGE

PROBLEMS NOTED: ☐ (30) NONE ☐ (31) SATURATED EMBANKMENT AREA ☐ (32) SEEPAGE EXITS ON EMBANKMENT
☐ (33) SEEPAGE EXITS AT POINT SOURCE ☐ (34) SEEPAGE AREA AT TOE ☐ (35) FLOW ADJACENT TO OUTLET ☐ (36) SEEPAGE INCREASED/MUDDY
DRAIN OUTFALL SEEN ___ No ___ Yes ☐ (37) FLOW INCREASED/MUDDY (38) DRAIN DRY/OBSTRUCTED
☐ (39) OTHER _____

OUTLET

PROBLEMS NOTED: ☐ (40) NONE ☐ (41) NO OUTLET FOUND ☐ (42) POOR OPERATING ACCESS ☐ (43) INOPERABLE
☐ (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED (45) OUTLET OPERATED DURING INSPECTION? ☐ YES ☐ NO
INTERIOR INSPECTED ☐ (120) NO ☐ (121) YES ☐ (46) CONDUIT DETERIORATED OR COLLAPSED ☐ (47) JOINTS DISPLACED
☐ (48) VALVE LEAKAGE ☐ (49) OTHER _____

SPILLWAY

PROBLEMS NOTED: ☐ (50) NONE ☐ (51) NO EMERGENCY SPILLWAY FOUND ☐ (52) EROSION-WITH BACKCUTTING
☐ (53) CRACK - WITH DISPLACEMENT ☐ (54) APPEARS TO BE STRUCTURALLY INADEQUATE ☐ (55) APPEARS TOO SMALL
☐ (56) INADEQUATE FREEBOARD
☐ (57) FLOW OBSTRUCTED ☐ (58) CONCRETE DETERIORATED/UNDERMINED ☐ (59) OTHER _____

MAINTENANCE

PROBLEMS NOTED: ☐ (60) NONE ☐ (61) ACCESS ROAD NEEDS MAINTENANCE ☐ (62) CATTLE DAMAGE
☐ (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE ☐ (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE
☐ (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE ☐ (68) OTHER _____

See Guidelines on Back of this Sheet

Conditions Observed	GOOD	ACCEPTABLE	POOR
UPSTREAM SLOPE			
CREST			
DOWNSTREAM SLOPE			
SEEPAGE			
OUTLET			
SPILLWAY			
MAINTENANCE			

DIRECTIONS: ENTER PROBLEM NUMBER ( ) THEN LOCATION DIMENSIONS, DEGREE,

LOCATION OF PROBLEMS & COMMENTS _____

MAINTENANCE – MINOR REPAIR – MONITORING – ACTION REQUIRED OF OWNER TO IMPROVE THE SAFETY OF THE DAM.

☐ (80) PROVIDE ADDITIONAL RIPRAP _____
☐ (81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE _____
☐ (82) CLEAR TREES AND/OR BRUSH FROM _____
☐ (83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES _____
☐ (84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE _____
☐ (85) PROVIDE SURFACE DRAINAGE FOR _____
☐ (86) MONITOR _____
☐ (88) OTHER _____
☐ (89) OTHER _____

DAM REQUIRES INSPECTION BY A FIELD ENGINEER

STATE OF COLORADO

OFFICE OF THE STATE ENGINEER
Division of Water Resources
Department of Natural Resources

1313 Sherman Street, Room 818
Denver, Colorado 80203
Phone (303) 866-3581
FAX (303) 866-3589

www.water.state.co.us

February 15, 2005

Bill Owens
Governor

Russell George
Executive Director

Hal D. Simpson, P.E.
State Engineer

The Honorable Bill Owens
Governor, State of Colorado
State Capitol Building
Denver, CO 80203

The Honorable Joan Fitz-Gerald
President, Colorado State Senate
State Capitol Building
Denver, CO 80203

The Honorable Andrew Romanoff
Speaker of the House
Colorado House of Representatives
State Capitol Building
Denver, CO 80203

Dear Governor, President and Speaker:

In accordance with Section 37-87-114.4, C.R.S. (2003 Supp.), I am please to submit this report covering the activities of the State Engineer on dam safety in Colorado for Fiscal Year 2003-2004.

Colorado's Dam Safety Program strives to provide the citizens of Colorado with responsible protection from failures of dams. We continue to improve our program by taking advantage of the research and training provisions of The National Dam Safety Program Act of 1996, as well as the assistance offered by matching grants to the states.

The Dam Safety Program achieved a great number of goals and objectives this past fiscal year in the design review and inspection of dams for the determination of safe water storage levels. Although we experienced a number of incidents at dams this year, including sinkholes due to piping failures, serious seepage, cracking, and slope stability failures, because of our program, these incidents resulted in reduced consequences with no loss of life or significant property damage. The owners responded with emergency actions to prevent the failures of the dams. Our dam safety personnel also responded in a timely manner to assure appropriate actions were being followed to protect the public safety.

We continue to implement the use of risk-based techniques to help evaluate and prioritize the jurisdictional dams in Colorado in order to more efficiently and effectively use the program resources.

We will continue to work at accomplishing our goals and protecting the public safety in the most efficient matter possible. We appreciate the support that you provide us in this important public safety activity.

Sincerely,

Hal D. Simpson, P.E.
State Engineer

Attachment

cc: Ken Gordon, Senate Majority Leader
Mark Hillman, Senate Minority Leader
Alice Madden, House Majority Leader
Joe Stengel, House Minority Leader
Jim Isgar, Chair, Senate Agriculture, Natural Resources and Energy Committee (7)
Kathleen Curry, Chair, House Agriculture, Livestock, and Natural Resources Committee (13)
Abel Tapia, Chair, Joint Budget Committee (6)
David Beaujon, State Capitol
Hal Simpson, State Engineer
Russell George, Executive Director, Department of Natural Resources
Rod Kuharich, Director, CWCB
Frank McNulty, Executive Director's Office
Dawn Taylor-Owens, Executive Director's Office
Tim Pollard, Executive Director's Office