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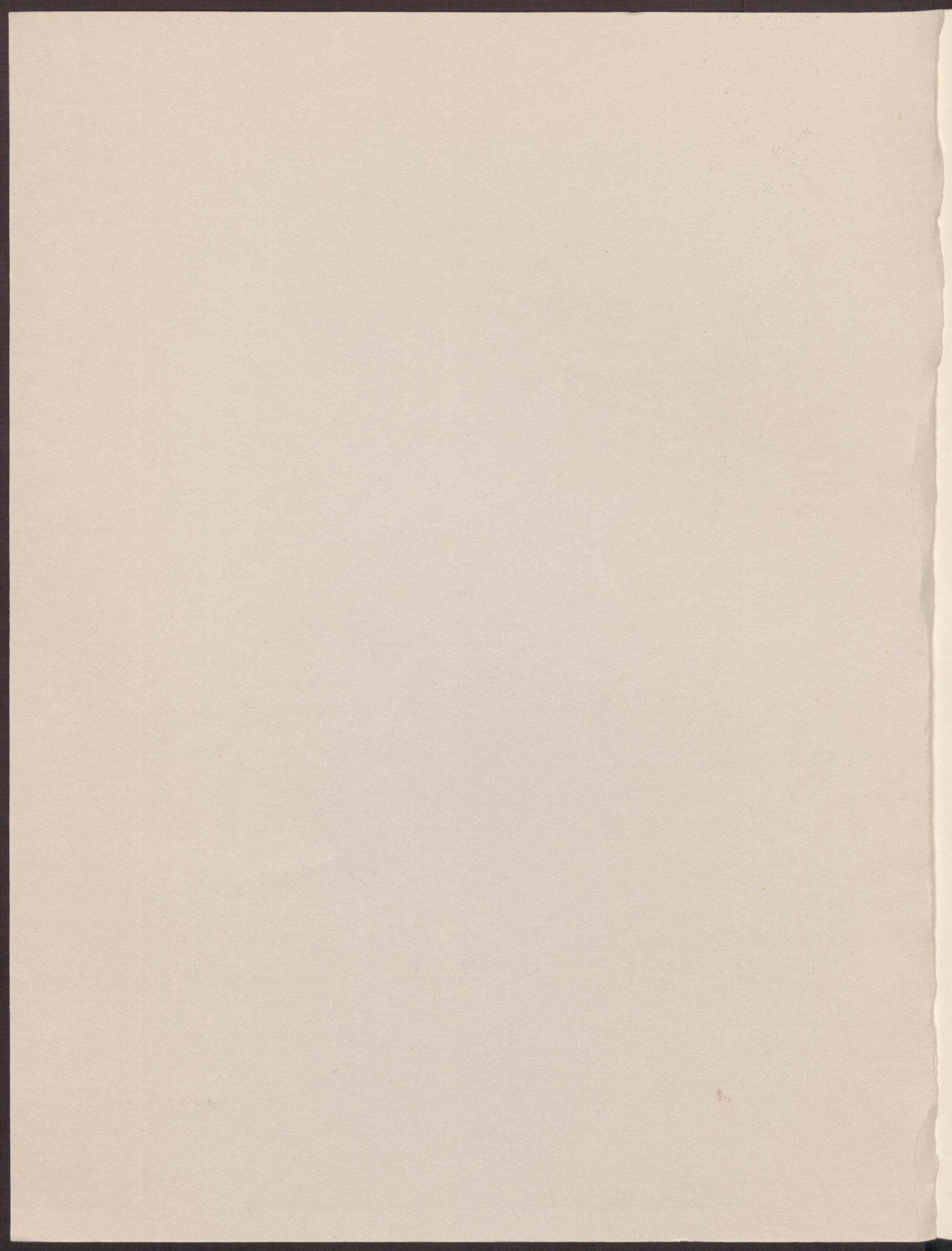
**STATE ENGINEER'S  
NINTH ANNUAL REPORT TO THE  
COLORADO GENERAL ASSEMBLY  
ON DAM SAFETY FOR  
F.Y. 91-92**

*November 1, 1992*

**OFFICE OF THE STATE ENGINEER  
DIVISION OF WATER RESOURCES**



Harold D. Simpson  
State Engineer



# STATE OF COLORADO

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

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Roy Romer  
Governor  
Ken Salazar  
Executive Director  
Hal D. Simpson  
State Engineer

December 1, 1992

The Honorable Roy Romer  
Governor, State of Colorado  
State Capitol Building  
Denver, CO 80203

Sincerely,  
The Honorable Ted Strickland  
President, Colorado State Senate  
State Capitol Building  
Denver, CO 80203

The Honorable Chuck Berry  
Speaker of the House  
Colorado House of Representatives  
State Capitol Building  
Denver, CO 80203

Gentlemen:

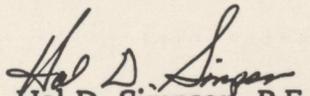
In accordance with Section 37-87-114.4, C.R.S. (1991), I am pleased to submit this report covering the activities of the State Engineer on dam safety in Colorado for Fiscal Year 1991-92.

Colorado's Dam Safety Program is rated among the best in the nation because of the continued support of the General Assembly. Dam safety is the number one priority of my office. We will strive to maintain this strong program for the safety of the citizens of Colorado. We plan to participate fully in the activities of the Association of State Dam Safety Officials in pursuit of this goal.

During the past year, we have increased our efforts to be prepared for emergencies at dams. House-Bill 92-1131 will enable the State Engineer to protect public safety by taking emergency actions at dams when there isn't time to issue orders to the owner of a dam that is in danger, or when the owner is not available. We have also begun several initiatives in the area of emergency planning, including the development of an updated guideline for dam owners for writing emergency preparedness plans for dams, sponsoring workshops to educate dam owners on the need for and value of emergency preparedness plans, and we have joined the Office of Emergency Management in the effort to assist local governments to be prepared for flooding due to dam failures.

Recognizing the limited availability of general funds, we are not requesting funding of new programs as we have in past annual reports. We are focusing on new management techniques and training programs using existing resources as ways to achieve our goals and protecting public safety.

Sincerely,

  
Hal D. Simpson, P.E.  
State Engineer

HDS\AEP\clf:artran92

cc: The Honorable Jeffrey Wells, Senate Majority Leader  
The Honorable Larry Trujillo, Sr., Senate Minority Leader  
The Honorable Scott McInnis, House Majority Leader  
The Honorable Ruth Wright, House Minority Leader  
The Honorable Tilman Bishop, Chairman, Senate Agriculture Committee  
The Honorable Dan Williams, Chairman, House Agriculture Committee  
The Honorable Tony Grampsas, Chairman, Joint Budget Committee  
Joint Budget Committee Members  
Ken Salazar, Director, Department of Natural Resources

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This report is submitted in compliance with Section 37-87-114.4, C.R.S. (1992 Supp.) 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, C.R.S. (1992 Supp.)

#### Organization

Implementation of the Dam Safety Program is achieved by the State Engineer through the Dam Safety Branch. A major reorganization of the Branch occurred during the period. The State Engineer has been decentralizing the program by moving members of the division to the field division offices for the past several years, especially within the Dam Safety Branch. Transfer of the Dam Safety Engineers to Division 1 in Greeley has completed the plan to place supervision of the inspection program under the Division Engineers. As a result of this change, three supervising positions were eliminated from the Branch, with the positions reallocated to Senior Professional Engineers. In addition, the Chief of the Branch position was reallocated from a Principal Water Resource Engineer to a Supervising Professional Engineer.

One Senior Engineer was transferred to Division 1, Greeley, another to Division 2, Pueblo (Part time dam safety), and one assigned to the Design Review and Construction Inspection Unit (reallocation of Supervising Professional Engineer). In addition, a Senior Professional Engineer was eliminated from the Branch (Design Review) and reassigned to the Hydrography Branch. The supervisor of the Branch has program wide responsibilities, and also supervises the Design Review and Construction Inspection Unit. (See Appendix A for tables and charts of the personnel and organization of the Branch.)

COLORADO STATE ENGINEER'S NINTH ANNUAL REPORT

TO THE  
GENERAL ASSEMBLY

ON

DAM SAFETY

FOR

FISCAL YEAR 1991-1992

INTRODUCTION

Statutory Provisions

Colorado's Dam Safety Program is implemented and managed by the State Engineer in accordance with Title 37, Article 87, of C.R.S. (1992 Supp.), and the Livestock Water Tank Act, Title 35, Article 49, of C.R.S. (1992 Supp.), as amended. 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.

This report is submitted in compliance with Section 37-87-114.4, C.R.S. (1992 Supp.) 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, C.R.S. (1992 Supp.)

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The Dam Safety Engineer's principal duties are to conduct safety inspections of existing dams, design review and construction inspection of repairs and alterations, and investigation of complaints on the safety of dams. They investigate the construction of dams in violation of Section 37-87-105(1) and (4), C.R.S. (1992 Supp.), and conduct training on the inspection of dams for division personnel, dam owners, interested agencies, engineers, and the public. The responsibility to process and approve Livestock Water Tank and Erosion Control Dam applications was transferred to the Division Engineers and the Dam Safety Engineers in February, 1991. They also do other related work as assigned.

The Design Review and Construction Inspection Unit's 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, C.R.S. (1992 Supp.). 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 Unit assists the Department of Health in the technical evaluation of tailing impoundments through a Memorandum of Understanding, participates in the state's Joint Review Process with the Department of Natural Resources, and performs other related work as assigned.

#### Goals and Objectives of the Program

The mission of the program is to prevent loss of life and property damage as a result of the failure of dams within the resources available to this office. The program concentrates on "jurisdictional" dams and reservoirs as defined in Section 37-87-105, C.R.S. (1992 Supp.), which are greater than ten feet high at the spillway, or twenty acres in surface area at the high water line, or 100 acre-feet in capacity at the high water line. Because of their non-hazardous situation, Class IV dams are not inspected regularly, but observed for changes in hazard class periodically. Particular focus is placed on inspecting Class I and II dams annually, and Class III dams are inspected every five years.

Safety inspections are made of U.S. Bureau of Reclamation and U.S. Army Corps of Engineers' dams on a cooperative basis with their safety inspections being done in accordance with the "Federal Guidelines for Dam Safety." Arrangements are made with other Federal agencies for the safety inspection of their dams by the U.S. Bureau of Reclamation, the Corps of Engineers, their own people, consulting engineers, or by the State Engineer. When other than State Engineer personnel conduct the safety inspections, the agency submits the findings/recommendations and follow-up to the State Engineer in order to assure the safety of these dams. A Memorandum of Understanding has been formulated with the U.S. Bureau of Reclamation relating to dam safety activities in Colorado. It provides for the exchange of safety related information of dams under each agency's jurisdiction. An MOU has also been executed with the U.S. Forest Service, Rocky Mountain Region, to provide inspections by the State Engineer of their dams.

A related objective is the inspection during construction for compliance with approved plans, and to assure that plans are adequate for the site conditions. Inspections are made of the foundation, outlet works, spillways, and final construction as a minimum. Interim inspections are made as necessary.

An adjunct to the inspection objectives is the goal to have each owner of Class I and Class II hazard dams prepare an Emergency Preparedness Plan to combat any incident which jeopardizes the safety of the dams, and to give warning to appropriate emergency preparedness agencies/officials so they may mobilize their plans for mitigating the consequences of dam-break flooding. An inundation map is required for Class I dams. See EMERGENCY PREPAREDNESS PLANS on page 10 for more discussion.

The Dam Safety Branch annually identifies specific goals for the Dam Safety Program. For 1992, the following goals were adopted:

1. To make annual safety inspections of Class I and Class II dams, and to inspect Class III dams every five years.
2. To make quality reviews of the plans and specifications for the construction of dams within the statutory 180-day limit.
3. To inspect the construction of a dam as often as necessary to assure that the work is being performed in accordance with the approved plans and specifications, and to assure that changed conditions will not jeopardize the approved design.
4. To implement the requirements of the regulations (adopted September 1988) in a timely manner. The hazard classification must be ascertained before implementation of the standards in the regulations, or other requirements: For example, Hydrologic standards, outlet inspections, instrumentation, Emergency Preparedness Plans, owner inspections and maintenance plans.
5. To maintain a database of the dam safety program (DAMS), including the update of the National Inventory of Dams (NATDAM).
6. To develop state-of-the-art computer capabilities for engineering analysis of dams, and the Dam Safety Program.
7. To provide training as necessary, and encourage teamwork.

In order to achieve the goals, each of the division engineer offices prepare workplans (objectives) which are reviewed by the program supervisor, and used for monitoring progress of the program.

Each of the goals for 1992 were either accomplished in whole or in part. Goal 1 to make annual safety inspections of Class I and Class II dams was accomplished. See page 10 for more details on the number of inspections done.

Goal 2 was also accomplished with the Design Review Unit completing the review of plans and specifications in an average time of 56 days. See page 7 for more details on the number of plans reviewed and approved.

The construction inspection of dams was accomplished under Goal 3 in a better manner than the past, with critical inspections being made in a timely manner on all projects because of the high priority assigned to this important task.

A long term program for implementing the regulations was begun in 1991 in accordance with Goal 4. For example, a five-year plan was implemented for evaluating the adequacy of existing dams beginning in 1992. This plan was postponed one year however, to prepare an updated hydrologic procedure. A ten-year program was begun on 1989 to accomplish the internal inspection of outlet works, and to require that existing dams be instrumented in accordance with the regulations by 1995. The requirement for Emergency Preparedness Plans for dams has been only partially successful to date. See page 11 for more information on initiatives being implemented to accomplish this goal.

Per Goal 5 the maintenance of the DAMS database has been very successful. See page 12 for more information about this and the NATDAM project.

Finally, in accordance with Goals 6 and 7, training has been an on-going activity at all levels within the Dam Safety Branch. The engineers have taken technical courses at Universities, supervising and developmental courses by the Department of Personnel, and attended Technical Seminars offered by the Association of State Dam Safety Officials. Total Quality Management is being implemented division wide by the State Engineer.

#### Tables of Jurisdictional Dams

The following Table 1 shows the ownership of jurisdictional dams in Colorado by type of owner, and Table 2 shows the distribution of dams in the state by water division and hazard rating.

<sup>1</sup>Greater than ten feet high to spillway, or twenty acres in surface area at the high water line, or 100 acre-feet in capacity at the high water line.

<sup>2</sup>Includes one Class I non-jurisdictional dam.

<sup>3</sup>Includes nine Class II non-jurisdictional dams.

TABLE 1

JURISDICTIONAL<sup>1</sup> DAM OWNERSHIP STATUS  
IN COLORADO

HAZARD RATING	TYPE OF OWNER				TOTAL
	FEDERAL	STATE	OTHER GOVT.	PRIVATE	
Class I	48	12	74	135	269 <sup>2</sup>
Class II	14	20	79	209	322 <sup>3</sup>
Class III	63	30	118	885	1096
Class IV	<u>15</u>	<u>1</u>	<u>4</u>	<u>117</u>	<u>137</u>
TOTAL	140	63	275	1346	1824

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

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

TOTALS

1684

140

1824

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

Class II - 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.

<sup>1</sup>Greater than ten feet high to spillway, or twenty acres in surface area at the high water line, or 100 acre-feet in capacity at the high water line.

<sup>2</sup>Includes one Class I non-jurisdictional dam.

<sup>3</sup>Includes nine Class II non-jurisdictional dams.

APPROVAL OF PLANS AND SPECIFICATIONS FOR CONSTRUCTION

TABLE 2

DISTRIBUTION OF DAMS BY IRRIGATION DIVISION/CLASS

HAZARD RATING	DIVISION	NONFEDERAL	FEDERAL	TOTAL
Class I	1	117	13	130
Class II	1	129	10	139
Class III	1	436	12	448
Class IV	1	24	9	33
<hr/>				
Class I	2	33	6	39
Class II	2	53	3	56
Class III	2	148	12	160
Class IV	2	69	4	73
<hr/>				
Class I	3	9	1	10
Class II	3	14	0	14
Class III	3	31	4	35
Class IV	3	10	0	10
<hr/>				
Class I	4	23	9	32
Class II	4	38	0	38
Class III	4	156	9	165
Class IV	4	1	2	3
<hr/>				
Class I	5	17	15	32
Class II	5	41	1	42
Class III	5	115	16	131
Class IV	5	10	0	10
<hr/>				
Class I	6	12	0	12
Class II	6	12	0	12
Class III	6	107	9	116
Class IV	6	5	0	5
<hr/>				
Class I	7	10	4	14
Class II	7	21	0	21
Class III	7	40	1	41
Class IV	7	3	0	3
<hr/>				
<b>TOTALS</b>		<b>1684</b>	<b>140</b>	<b>1824</b>

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

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

APPROVAL OF PLANS AND SPECIFICATIONS FOR CONSTRUCTION  
OF DAMS AND RESERVOIRS

During FY 91-92, the State Engineer received plans for eight new dams and fifteen plans for alteration, modification, repair, or enlargement. Seven separate hydrology studies were also approved for determination of the inflow design flood for spillway design or hazard classifications. The estimated cost of construction for the submitted plans is \$6,256,337.00. Fourteen thousand eight hundred fifty four dollars and twenty six cents (\$14,854.26) was collected for the examination and filing of the submitted plans.

Eighteen sets of plans and specifications were approved by the State Engineer for construction during FY 91-92. (See Appendix B for lists of dams which were approved.) In order to expedite the approval of repair plans for dams, the Dam Safety Engineers may review them and perform the construction inspections. This enables the owners to repair their dams sooner by shortening the review time. Four hydrology studies and one special study associated with Sanchez dam flood runoff during the emergency were also performed.

Upon completion of construction, the owner's 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 of and the "AS-CONSTRUCTED" plans serve as the public record as required by the statutes.

Section 37-87-114.5., C.R.S., (1991 Supp.) exempts certain structures from the State Engineer's approval. They are, structures not designed or operated for the purpose of storing water, mill tailing impoundments permitted under Article 32 or Article 33 of Title 34, C.R.S. (Minerals or Coal Mines), uranium mill tailing and liquid impoundment structures permitted under Article 11 of Title 25, C.R.S., siltation structures permitted under Article 33 of Title 34, C.R.S. (Coal Mines), and structures which only store water below the natural surface of the ground.

In order to prevent administrative problems as a result of the construction of small dams which do not fall under the jurisdiction of the State Engineer's review and approval, Section 37-87-125, C.R.S. (1991 Supp.) requires that a Notice of Intent to Construct a Nonjurisdictional Water Impoundment Structure must be submitted to the State Engineer prior to beginning construction.

## SAFETY INSPECTIONS AND CONSTRUCTION OBSERVATIONS

### Scheduling

Jurisdictional dams identified for inspection in accordance with the objectives of the State Engineer are assigned to the Dam Safety Engineers in each division. The engineers are required to each schedule the inspection of approximately 70 to 125 separate dams each "inspection season," which begins around April 1st, and ends approximately November 1st, depending upon the weather. Subsequent follow-up and problem solving results in additional inspections each year. A reasonable workload is approximately 85 dams each. A revision of the frequency of inspections of dams needs to be considered in order to reduce the inspection workload to this amount in order to accomplish the other goals and objectives of the program, especially implementation of the regulations in a timely manner (Goal 4). Within the planned schedules are the inclusion of all the Class I and Class II hazard dams, and approximately one-fifth of the Class III hazard dams. Inspection of federal dams are integrated with these schedules. The Dam Safety Engineers therefore, collectively conduct about 900 to 1000 safety inspections on an inspection year basis.

The State Engineer has executed a Memorandum of Understanding (MOU) with the Regional Forester, Rocky Mountain Region, USDA Forest Service, concerning the statutory obligations each has in regard to the administration and safety of dams on National Forest lands in Colorado. The Memorandum of Understanding provides for the exchange of information, assuring access to dams (e.g. wilderness areas), scheduling of the inspection of Forest Service dams, and the joint review for approval of plans and specifications. An MOU has also been executed with the Bureau of Reclamation (Upper Colorado Region and the Great Plains Region). This MOU provides for the exchange of information at an annual meeting, or when requested, the observation of construction at Bureau dams, the notification of emergency conditions at mutually affected dams, and the access to technical information when requested. An MOU is being pursued with the Bureau of Land Management.

In order to track potential problems which could develop at Class III dams, the Division's Water Commissioners are assigned these dams to observe by the Resident Dam Safety Engineer, and they fill out a report. The report is reviewed by the Dam Safety Engineer, and a copy is furnished to the owner for their information and to implement any recommendations for maintenance and repair. A copy of the WATER COMMISSIONER DAM OBSERVATION REPORT is in Appendix D.

## Scope

A safety inspection involves more than a trip to the dam. The site visit is 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 statute specifies that a safety inspection 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 safety inspection must also include an evaluation of the adequacy of the spillway to pass the appropriate sized flood for the dam's size and hazard class, to make an evaluation of the dam's hazard classification and whether it has changed, and to assess the adequacy of the Emergency Preparedness Plan for the dam. The internal inspection of the outlet works and evaluation of instrumentation has also been added to the workload as required by the regulations. The hydrologic evaluation of spillways was postponed due to the publication of the Third Edition, Design of Small Dams, U.S. Bureau of Reclamation, and the revision of the hydrologic procedures. The State Engineer had been using the Second Edition as the procedure for evaluating spillways. New procedures are being developed in accordance with the Third Edition and the HEC1 program for calculating flood hydrographs.

In order to economically evaluate the condition of outlet works too small to enter, Mr. James Norfleet, Resident Dam Safety Engineer for Division 4, has designed and built a prototype sled and 35mm camera system for photographing the interiors of small outlet pipes. Two working models of the sled have been manufactured, and are being used to inspect outlets. Although this system has limitations, it is less expensive than using a TV camera system and the photos are easy to file. The TV system, however, is much more versatile by being able to view the entire outlet while being advanced through the conduit. A video tape can also be made to have a permanent record.

The findings of the inspection are documented on a report form which 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 which the owner should take care of, and any engineering and monitoring requirements necessary to assure the safety of the dam. A copy of the ENGINEERS INSPECTION REPORT is in Appendix D.

Orders to repair or maintain the dam usually require the reinspection of the dam in order to verify that the work has been done in a workmanlike manner. Re-inspections also occur to assure follow-up of the State Engineer's orders, or as requested by the owner. If the safety inspection finds that the overall conditions are unsafe, an order is written by the State Engineer restricting the storage in the reservoir to a safe storage level. If the findings are conditionally satisfactory, full storage is recommended contingent upon appropriate

monitoring being provided by the owner. 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.

On January 1, 1991, the State Engineer placed the supervision of the Resident Dam Safety Engineers under the Division Engineers in their respective divisions. The Division Engineers are responsible for implementation of the Dam Safety Program, exclusive of design review, including enforcement of reservoir level restrictions and performance evaluation of the engineers. The Dam Safety Branch is responsible for development of a comprehensive statewide Dam Safety Program to include training of all dam safety personnel, monitoring of the Program in the field, and reporting to the State Engineer any shortfalls or discrepancies observed in the field that cannot be resolved.

#### Number of Inspections

During FY 91-92, a total of 818 safety inspections and 110 construction inspections were conducted for a total of 928. In addition, 184 follow-up inspections were made. This included 221 safety inspections of Class I hazard dams, 299 safety inspections of Class II hazard dams, 282 safety inspections of Class III hazard dams, and 16 inspections of Class IV dams (includes Federal dams). Construction inspections were significant compared to the past due to reorganization and more emphasis placed on these inspections. Construction inspections are important because we must assure that the approved plans are being followed and to assure changed conditions during construction don't jeopardize the safety of the design. The objective of inspecting all Class I and Class II hazard dams on an annual basis and Class III dams on a five year basis is an inspection year objective versus a fiscal year objective. This objective was attained for 1991 and 1992 with the assistance of the Dam Safety Branch supervisors, including the Chief of the Branch, and engineers in some of the divisions, and subsequently as a result of the reorganization.

#### USE OF APPROPRIATED FUNDS

Dam safety personal service expenditures for the FY 91-92 were \$875,251.00. Total operating and travel expenditures were approximately \$29,400.00.

Whenever possible, the members of the Dam Safety Branch are provided training. Several members of the Branch have attended conferences and meetings of the Association of State Dam Safety Officials, participated in university courses on hydrology, the state's Supervisory Certificate Program, and computer related courses. Funds for these, however, must be gleaned from the operating budget because there is no cost center for training. The funds saved by decentralization have been used to provide this training.

## RECEIPTS GENERATED FOR COSTS OF FILING PLANS

Fees collected by the State Engineer and deposited in the General Fund for dam safety amounted to \$14,854.26 for filing plans and specifications during the period. House Bill 90-1130, approved April 12, 1990, amended the fees charged by the State Engineer effective July 1, 1990. The fee for safety inspections was repealed, and the fees for filing plans were increased to three dollars for each one thousand dollars of estimated costs of engineering and construction, with a minimum fee of one hundred dollars, and a maximum fee of three thousand dollars.

## PROGRAM FUNDING

Rapid changes occur in the field of dam safety engineering and related disciplines. New designs for dams (and rehabilitation of dams) are utilizing new materials whose behavior and properties are unknown to the staff. Many conferences are held throughout the country with the objective of sharing knowledge and experience in the field of dam safety. It is proposed to establish training plans to send our engineers to these training courses to maintain a knowledge of state-of-the-art dam safety. The estimated first year's cost for the program is about \$5,000.

Another funding area is the acquisition of computer programs that have been developed by companies, such as the generic models of DAMBRK, BREACH, STABL, HEC1, and HEC2, to make them more "user-friendly," and improving the efficiency of the users to apply them to engineering problems. The estimated cost for these programs is about \$13,000.

The SLED and 35mm camera have been useful for evaluating the condition of small outlets. Presently only two complete SLEDS have been developed for use in Division 1 (4 engineers) and Division 4. In order to more effectively conduct the internal inspection of outlet works, each Dam Safety Engineer should have a SLED and water-resistant 35mm camera for use during safety inspections. The estimated cost for four additional SLEDS is \$6,600 (Sled - \$500 ea., 300 ft. push-pipe - \$900 ea., and weather-resistant 35mm camera - \$250 ea.).

## ENFORCEMENT ORDERS AND PROCEEDINGS

There were no enforcement proceedings under Section 37-87-114, C.R.S. (1992 Supp.) during the fiscal year.

## EMERGENCY PREPAREDNESS PLANS

Emergency preparedness for incidents at dams that jeopardize the public safety, including the failure of dams, has become an important part of dam safety programs. All the federal dam owning/regulating agencies, and most states require that plans be formulated 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 EPPs be prepared for Class I and Class II dams as part of the regulations for dam safety adopted in September 1988. In spite of these efforts, at the end of the period of this report, June 30, 1992, emergency plans have not been prepared for all the Class I dams of record. Only about 75% of the required plans have been prepared statewide. Also, a Legislative audit of the division, dated March 1991, found that the State Engineer's guideline for emergency plans was deficient compared to the national standard. In order to remedy these deficiencies, several initiatives were started during the period. Some of these were:

1. The Colorado Natural Hazards Mitigation Council created a subcommittee on Dam Safety and Warning, chaired by the Supervisor of the Dam Safety Branch.
2. An updated guideline for preparing a dam safety emergency preparedness plan was drafted, following a nationally recognized guideline.
3. Increased efforts were made to encourage/assist dam owners to complete their EPPs. Emergency preparedness was part of a Public Awareness Workshop organized by Division 4, and held in Grand Junction for dam owners.
4. Alan Pearson participated in the Colorado Natural Hazards Mitigation Council's 1992 Spring Workshops. The presentations were on the purpose of Emergency Preparedness Plans, and how to develop and implement an emergency preparedness plan.
5. Workshops are planned for September 1992 to educate dam owners and emergency managers about the need and value of emergency preparedness for dam incidents/failures.

## DAM SAFETY DATABASE MANAGEMENT SYSTEM

During FY 91-92, the dams database (DAMS) was permanently transferred to a personal computer (PC) using dBASE IV as the data management program. While the main database is kept on the PC in Denver, the several dam safety engineers maintain the data for their divisions on division PCs. The main database in Denver is updated from the several divisions on a periodic basis.

In accordance with a Memorandum of Agreement with the Association of State Dam Safety Officials (ASDSO) the State Engineer completed the National Inventory of Dams project during the period. The inventory (NATDAM) is produced from the Branch's DAMS database, which also serves the information management needs of the division, and provides data and reports for the public.

### EFFECTIVENESS OF PROGRAM

As expressed by the goals and objectives of the State Engineer, the program's effectiveness can be measured by the prevention of dam failures. No significant failures occurred during the period, or since the Sage Creek Dam failure in Routt County, in 1985. The enforcement of the State Engineer's orders is also instrumental in assuring the effectiveness of the program. The combination of the State Engineer's safety inspections, restrictions, Emergency Preparedness Plans, and programs to make dam owners more knowledgeable about the safe operation and maintenance of their dams, makes Colorado's Dam Safety Program one of the most effective in the United States.

The decentralization of the dam inspection program to the Division Engineer's offices throughout the state has been very beneficial. One benefit is the more efficient cost of conducting inspections by reducing travel expenses. Another benefit is the accessibility of the Dam Safety Engineers to the dam owners and consulting engineers to assist them with working on problems with their dams, and to obtain records.

The response to two notable incidents at dams during the period is also indicative of the effectiveness of the program. One was a sinkhole on the upstream face and muddy leakage at Sanchez dam near San Luis; and the other was an apparent leakage problem at Big Beaver dam (Lake Avery) near Meeker. In both cases serious consequences were prevented, first by the actions of the owners to respond, and second by the State Engineer's actions to lower the reservoirs, and require close monitoring. The Emergency Preparedness Plans were implemented in both cases.

The Sanchez incident is a good example of the effectiveness of the cooperative efforts of the State Engineer's Office (SEO) and the Colorado Water Conservation Board (CWCB). The SEO contacted the CWCB requesting their help in providing financial assistance to the owner from their Construction Fund to make the needed repairs to the leaking dam. Because of the unique diversion of the runoff waters of Culebra Creek in Sanchez reservoir, the dam provided flood protection to the communities of San Luis and San Acacio. The CWCB promptly provided the funding to repair the dam so it could store additional water safely. The dam safety problem, and the potential flooding problem, were both alleviated through the cooperation of the U.S. Army Corps of Engineers, National Weather Service, and Soil Conservation Service; the State Engineer's Office, Water Conservation Board, and Office of Emergency Management; the Costilla County Commissioners, Emergency Management, and Sheriffs Office; and the Sanchez Ditch and Reservoir Company

As a service to dam owners, the Dam Safety Branch has and makes available at no charge, a brochure on the construction and operation of dams in Colorado (June, 1989). 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 inspection of their dams.

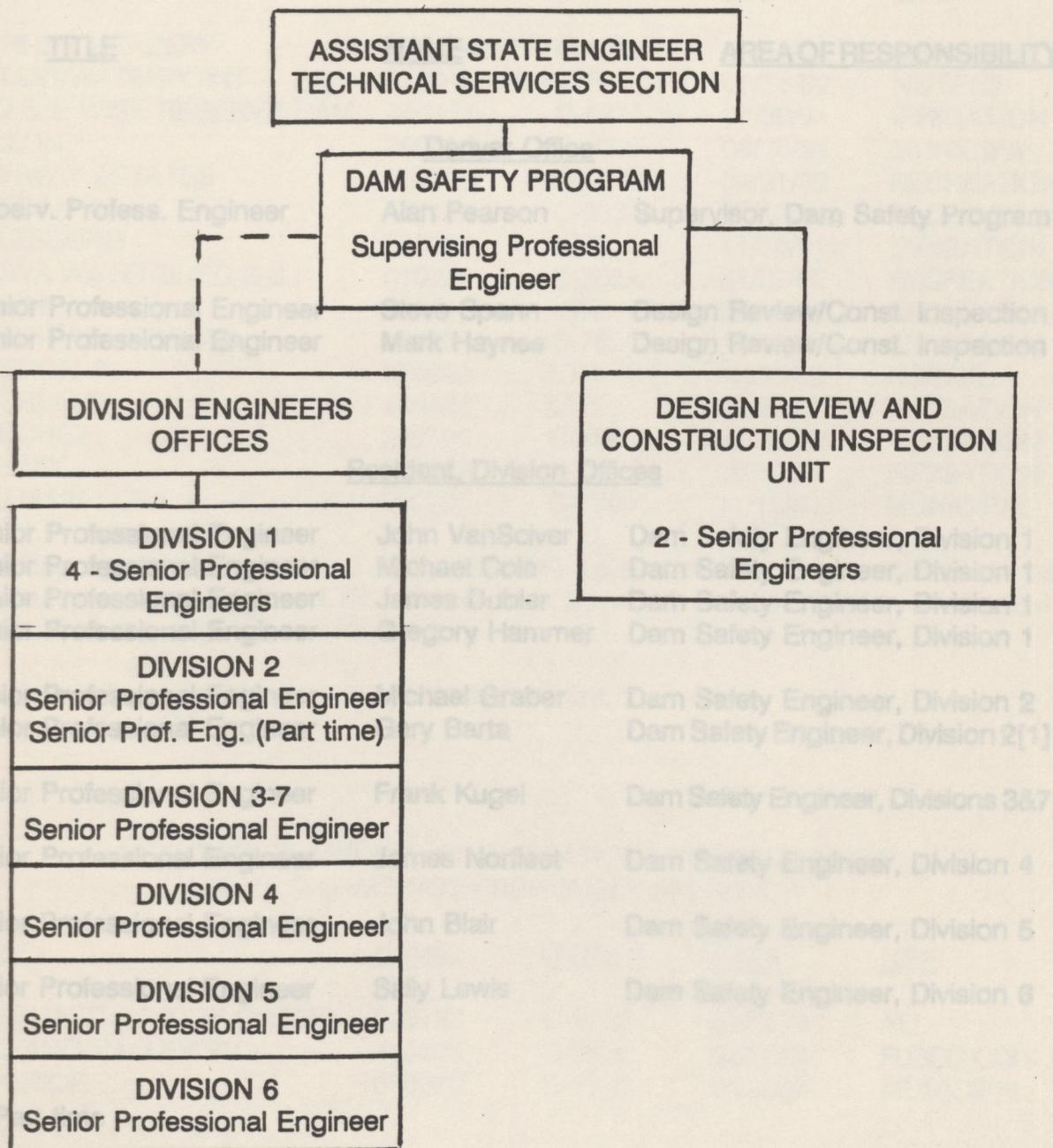
All of the engineers in the Dam Safety Branch are members of the Association of State Dam Safety Officials (ASDSO) and actively participate in its programs. The purpose of ASDSO is to provide a forum for the exchange of ideas and experiences on dam safety issues, foster interstate cooperation, provide information and assistance to dam safety programs, provide representation of state interests before Congress and Federal agencies for dam safety, and to improve efficiency and effectiveness of state dam safety programs. The State Engineer nominated the City of Colorado Springs to receive ASDSO's special recognition at their Annual Meeting in San Diego, California in September, 1991. The City received an award for their maintenance program for their dams, their electronic remote monitoring system, and for their cooperation with the state's Dam Safety Program. The Supervisor of the Branch is participating on an ASDSO workgroup for developing a manual on the performance of dams. The manual will be used by states and others to submit data to a library which will be maintained by Stanford University. Mr. Gregory Hammer, a Dam Safety Engineer, serves on the Subcommittee for Geosynthetics. Several of the Engineers have made presentations at the conferences.

#### LEGISLATION

House Bill 92-1131, by Representatives Eisenach, Acquafresca, DeHerrera, Dyer, Entz, Fish, Redder, Swenson, Theibut, and D. Williams, also Senators Norton, McCormick, Roberts, and Wattenberg, was signed into law by Governor Romer on June 3, 1992. The Bill amended legislation pertaining to Livestock Water Tanks and Erosion Control Dams; and created new legislation concerning authority for emergency actions at dams by the State Engineer. There also is created an Emergency Dam Repair Cash Account as part of the Water Conservation Board's Construction Fund. This legislation was recommended by the State Engineer and reported in the last report (FY 90-91). See Appendix E for a copy of the Act.

**APPENDIX A**

**DAM SAFETY BRANCH  
CHART**



**APPENDIX A**

APPROVED PLANS AND PERSONNEL FOR ALTERATIONS  
ENLARGEMENTS DAM SAFETY BRANCH (EXISTING DAMS)

<u>NAME</u>	<u>DAMID</u>	<u>C-NO(1)</u>	<u>DATE</u>	<u>USE</u>
<u>TITLE</u>	<u>NAME</u>	<u>C-169C</u>	<u>AREA OF RESPONSIBILITY</u>	
BARNADOW	020612	LTR	03/16/92	NOTE(2)
BELLIC/WATERPOINT	440117	C-427A	07/30/91	IRRIGATION
D'D & E WISE RESERVR DAM	300133	C-1079B	08/28/91	MUNICIPAL
DILLON	030133	C-933	04/21/92	RECREATION
FAIRWAY ESTATES	640104	LTR	11/18/91	IRRIGATION
Superv. Profess. Engineer	Alan Pearson			Supervisor, Dam Safety Program
JULESBURG	010231	C-708A	01/22/92	RECREATION
KIOWA WATERSHED B-9	Senior Professional Engineer	Steve Spann	LTR	Design Review/Const. Inspection
Senior Professional Engineer	Mark Haynes	C-752		Design Review/Const. Inspection
OBERON #	070220	LTR	02/25/92	NOTE(2)
OVERLAND	400422	LTR	08/05/91	IRRIGATION
SANCHEZ	240108	C-13A	05/22/92	IRRIGATION
SUMMIT	Resident, Division Offices		08/30/91	IRRIGATION
WILLIAMS FORK	610127	C-798B	11/13/91	MUNICIPAL
Senior Professional Engineer	John VanSciver			Dam Safety Engineer, Division 1
Senior Professional Engineer	Michael Cola			Dam Safety Engineer, Division 1
Senior Professional Engineer	James Dubler			Dam Safety Engineer, Division 1
Senior Professional Engineer	Gregory Hammer			Dam Safety Engineer, Division 1
Senior Professional Engineer	Michael Graber			Dam Safety Engineer, Division 2
Senior Professional Engineer	Gary Barta			Dam Safety Engineer, Division 2[1]
Senior Professional Engineer	Frank Kugel			Dam Safety Engineer, Divisions 3&7
Senior Professional Engineer	James Norfleet			Dam Safety Engineer, Division 4
Senior Professional Engineer	John Blair			Dam Safety Engineer, Division 5
Senior Professional Engineer	Sally Lewis			Dam Safety Engineer, Division 6
RITSCHARD (MUDDY CREEK)	500133	C-1725	02/28/92	ALL
SHAVANO VALLEY SV-1	410203	C-1726	05/20/92	FLOOD CONT.
SUPERIOR	050310	C-1724	09/20/91	MUNICIPAL

[1] Part time

[1] Filing system for approved plans (C-1724). Assigned to new dams, and existing dams without previously approved plans, that are being altered, enlarged, or repaired.

**APPENDIX B**

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

<u>NAME</u>	<u>DAMID</u>	<u>C-NO(1)</u>	<u>DATE</u>	<u>USE</u>
BARNES MEADOW	030104	C-169C	03/19/92	MUNICIPAL
BELLIO/WATERPOINT	020612	LTR	03/16/92	NOTE(2)
D D & E WISE RESERVR DAM	440117	C-427A	07/30/91	IRRIGATION
DILLON	360104	C-930E	08/28/91	MUNICIPAL
FAIRWAY ESTATES	030133	C-1079B	04/21/92	RECREATION
JORDAN #1	120126	C-933A	11/13/91	FLOOD/REC
JULESBURG	640104	LTR	11/18/91	IRRIGATION
KIOWA WATERSHED B-9	010231	C-708A	01/22/92	RECREATION
NO #4	090213	LTR	02/12/92	RECREATION
NORTH POUUDRE # 3	030238	C-752C	10/22/91	IRRIGATION
OBERON #1	070220	LTR	02/25/92	NOTE(2)
OVERLAND	400422	LTR	08/05/91	IRRIGATION
SANCHEZ	240106	C-19A	05/22/92	IRRIGATION
SUMMIT	340203	C-344C	08/30/91	IRRIGATION
WILLIAMS FORK	510127	C-799B	11/13/91	MUNICIPAL

[1] Filing system for approved plans (C-799B) Letter denotes revisions/additions to previously approved plans. LTR indicates letter approval and work is of such a scope that filing of drawings are not required.

[2] Dam is being modified to non-jurisdictional size.

**APPROVED PLANS AND SPECIFICATIONS FOR NEW DAMS  
OR OLD DAMS NOT PREVIOUSLY APPROVED**

<u>NAME</u>	<u>DAMID</u>	<u>C-NO(1)</u>	<u>DATE</u>	<u>USE</u>
RITSCHARD (MUDDY CREEK)	500133	C-1725	02/28/92	ALL
SHAVANO VALLEY SV-1	410203	C-1726	05/20/92	FLOOD CONT.
SUPERIOR	060310	C-1724	09/20/91	MUNICIPAL

[1] Filing system for approved plans (C-1724). Assigned to new dams, and existing dams without previously approved plans, that are being altered, enlarged, or repaired.



**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 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.

**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 3 - A small amount of damage is expected. Loss of human life and significant damage are not expected.
	Class 4 - No loss of human life is expected and damage will occur only to the dam owner's property.	

# 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 \_\_\_\_\_

**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: \_\_\_\_\_

**UPSTREAM SLOPE**  
 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: \_\_\_\_\_

**CREST**  
 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: \_\_\_\_\_

**DOWNSTREAM SLOPE**  
 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: \_\_\_\_\_

**SEEPAGE**  
 PROBLEMS NOTED:  (40) NONE  (41) NO OUTLET FOUND  (42) POOR OPERATING ACCESS  (43) INOPERABLE  
 (44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED  (45) OUTLET NOT OPERATED DURING INSPECTION  
 INTERIOR INSPECTED  (120) NO  (121) YES  (46) CONDUIT DETERIORATED OR COLLAPSED  (47) JOINTS DISPLACED  (48) VALVE LEAKAGE  
 (49) OTHER \_\_\_\_\_  
 Comments: \_\_\_\_\_

**OUTLET**  
 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: \_\_\_\_\_

**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: \_\_\_\_\_

See Guidelines on Back of this Sheet

Conditions Observed		
GOOD	ACCEPTABLE	POOR
<b>UPSTREAM SLOPE</b>		
GOOD	ACCEPTABLE	POOR
<b>CREST</b>		
GOOD	ACCEPTABLE	POOR
<b>DOWNSTREAM SLOPE</b>		
GOOD	ACCEPTABLE	POOR
<b>SEEPAGE</b>		
GOOD	ACCEPTABLE	POOR
<b>OUTLET</b>		
GOOD	ACCEPTABLE	POOR
<b>SPILLWAY</b>		

**GUIDELINES FOR DETERMINING CONDITIONS**

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

<b>GOOD</b>	<b>ACCEPTABLE</b>	<b>POOR</b>
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**

<b>GOOD</b>	<b>ACCEPTABLE</b>	<b>POOR</b>
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**

<b>GOOD</b>	<b>ACCEPTABLE</b>	<b>POOR</b>
Monitoring includes movement surveys and leakage measurements for all dams, and piezometer readings for Class I dams. Instrumentation is in reliable, working condition. A plan for monitoring the instrumentation and analyzing results by the owner's engineer is in effect. Periodic inspections by owner's engineer.	Monitoring includes movement surveys and leakage measurements for Class I & II dams; leakage measurements for Class III dams. Instrumentation is in serviceable condition. A plan for monitoring instrumentation is in effect by owner. Periodic inspections by owner or representative. OR, NO MONITORING REQUIRED.	All instrumentation and monitoring described under "ACCEPTABLE" here for each class of dam, 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**

<b>GOOD</b>	<b>ACCEPTABLE</b>	<b>POOR</b>
Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.	Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.	Dam does not appear to receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam.

**OVERALL CONDITIONS**

<b>SATISFACTORY</b>	<b>CONDITIONALLY SATISFACTORY</b>	<b>UNSATISFACTORY</b>
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. Most of the required monitoring is being performed.	The safety inspection indicates symptoms of possible structural distress (seepage, evidence of minor 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 or reduced storage in the reservoir.	The safety inspection indicates definite signs of structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.), which could lead to the failure of the dam if the reservoir is used to full capacity. The dam is judged unsafe for full storage of water.

**SAFE STORAGE LEVEL**

<b>FULL STORAGE</b>	<b>CONDITIONAL FULL STORAGE</b>	<b>RESTRICTION</b>
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 public safety.

**CLASSIFICATION OF DAMS**

<b>CLASS I</b>	<b>CLASS II</b>	<b>CLASS III</b>
Class I - Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.	Class II - 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 human life is expected.	Class III - 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 high water line.

**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
GOOD	ACCEPTABLE	POOR

**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
GOOD	ACCEPTABLE	POOR

**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

**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: \_\_\_\_\_

Inspector's Signature: \_\_\_\_\_

Owner's Signature: \_\_\_\_\_

DATE: \_\_\_\_/\_\_\_\_/\_\_\_\_

INSPECTED BY: \_\_\_\_\_

OWNER/OWNER'S REPRESENTATIVE: \_\_\_\_\_

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

# An Act

HOUSE BILL 92-1131.

BY REPRESENTATIVES Eisenach, Acquafresca, DeHerrera, Dyer, Entz, Fish, Redder, Swenson, Thiebaut, and D. Williams; also SENATORS Norton, McCormick, Roberts, and Wattenberg.

CONCERNING DAMS CONSTRUCTED WITH THE APPROVAL OF THE STATE ENGINEER, AND, IN CONNECTION THEREWITH, MAKING AN APPROPRIATION.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. 35-49-106, Colorado Revised Statutes, 1984 Repl. Vol., is amended to read:

35-49-106. Plans submitted to state engineer. Anyone proposing to construct a dam for the creation of a livestock water tank, as described in section 35-49-103, shall submit to the state engineer for his approval plans ~~and specifications therefor, together with a statement upon a form to be furnished by the state engineer~~ AN APPLICATION ON A FORM PROVIDED BY THE STATE ENGINEER showing the general location of such proposed dam with reference to section, township, and range, location and dimensions of spillway, and the number, location, and size of dams already constructed within the watersheds of the dry channel on which such dam is proposed to be built. Nothing contained in this section shall be construed to specify plans and specifications of such technical detail or nature as to require preparation by an engineer or construction of such stock water tanks under the supervision of an engineer; it being the intent and purpose of the provisions of this section that the state engineer shall be apprised by the ~~statement of the applicant and the accompanying plans and specifications~~ COMPLETED APPLICATION of pertinent information sufficient to enable him THE STATE ENGINEER to ascertain the general location of the water tank, its operation in relation to tanks already constructed, its relative priority rights, its effect on existing

Capital letters indicate new material added to existing statutes; dashes through words indicate deletions from existing statutes and such material not part of act.

appropriations of water, its capacity, its dam dimensions, the necessary and reasonable factors of safety, and its compliance with the provisions of this article.

SECTION 2. 35-49-107, Colorado Revised Statutes, 1984 Repl. Vol., are amended to read:

35-49-107. Construction requirements. (1) The state engineer shall examine such--plans--and--specifications EACH APPLICATION SUBMITTED and, if he THE STATE ENGINEER approves the same, shall return one copy of each of--such--plans, drawings,--and--specifications--with-his SUCH APPLICATION WITH THE approval OF THE STATE ENGINEER thereon to the person submitting the same and file the other in his COPY AT THE office OF THE STATE ENGINEER. If the state engineer disapproves such plans-and-specifications APPLICATION, or any part thereof, he--shall--return the same SHALL BE RETURNED TO THE APPLICANT for correction and revision. In cases where he THE STATE ENGINEER deems it necessary, before approval thereof, he THE STATE ENGINEER may inspect the proposed water tank site and make such independent investigation as he--deems necessary. Whether the state engineer approves such plans-and-specifications APPLICATION, or in--the-event-he disapproves them IT and returns the same for correction and revision, he THE STATE ENGINEER shall act within fifteen days after the statement, plans, and--specifications--are--submitted--to--him APPLICATION IS SUBMITTED. Until the approval by the state engineer of plans-and-specifications AN APPLICATION has been obtained, the construction of such dam is prohibited.

(2) The provisions of this section and sections 35-49-108 and SECTION 35-49-112 specifying approval by the state engineer and providing a fee therefor shall not apply to dams having a vertical height not exceeding five feet from the bottom of the channel to the bottom of the spillway and which impound not more than two acre feet of water.

(3) Anyone proposing to construct a dam for the creation of a livestock water tank, as described in section 35-49-103, shall comply with section 35-49-106. and every owner of an existing dam used to--impound--water--for--livestock--watering purposes--shall--comply--with--section--35-49-113--for--the--purpose of providing a record in the state engineer's--office--of--all such--structures--in--the--state--of--Colorado. Every owner of a proposed or-existing reservoir for stock watering purposes who desires to obtain a priority number for such structure shall comply fully with all pertinent provisions of this article.

SECTION 3. 35-49-108, Colorado Revised Statutes, 1984 Repl. Vol., is amended to read:

35-49-108. State engineer to inspect dam. When such a

dam is completed the state engineer shall be notified of such completion and, THEREAFTER, MAY ~~within fifteen days after receipt of such notice may~~ inspect said stock water tank. ~~Within ten days after receiving notice of completion or within ten days after inspection, if such inspection is made, he shall certify his approval or disapproval of the same. In case of disapproval he shall state wherein such~~ IF THE STATE ENGINEER FINDS THAT THE construction fails to conform with the ~~plans and specifications~~ APPLICATION approved by him or with the ~~provisions of this article.~~ THE STATE ENGINEER, it then becomes the duty of the owner of such dam to make such change and corrections therein as the state engineer has determined to be necessary to correct such failure, and when the same have been made, the state engineer shall PROVIDE in writing ~~certify his approval of such structure.~~ Approval shall be granted by the state engineer upon reasonable compliance with the ~~plans and~~ THE APPROVED APPLICATION AND STANDARD specifications. ~~approved by him, and no dam or~~ A stock water tank shall not be disapproved because of failure to observe technical engineering details in construction.

SECTION 4. 35-49-109, Colorado Revised Statutes, 1984 Repl. Vol., is amended to read:

35-49-109. Priority determined, how. The state engineer's certificate of approval of a livestock water tank on each normally dry stream and its tributaries shall be chronologically numbered in the order of the ~~completion thereof, and~~ APPROVAL AND IN CONCERT WITH ANY EROSION CONTROL DAMS APPROVED PURSUANT TO SECTION 37-87-122, C.R.S. Priority of right as between such tanks located on or within the watershed of each such dry stream shall be determined by such numbers seriatim, number one being first in such right. The ~~certificate of approval, specified in section 35-49-108, shall contain a certification of the priority of the use specified.~~

SECTION 5. 35-49-110, Colorado Revised Statutes, 1984 Repl. Vol., is amended to read:

35-49-110. Standard plans - publication. The state engineer shall prepare and keep in file ~~in his~~ AT THE office OF THE STATE ENGINEER standard plans, drawings, and specifications for livestock water tanks, which shall be subject to revision by the state engineer and shall in general be used as a guide by persons proposing to construct such tanks. Publication of these plans shall be subject to the approval and control of the executive director of the department of natural resources.

SECTION 6. 35-49-111, Colorado Revised Statutes, 1984 Repl. Vol., is amended to read:

35-49-111. When conduits not required. Where, in the judgment of the state engineer, such tanks upon such ANY stream and its tributaries do not require conduits for purposes of safety or the protection of prior stock water tank rights, it is lawful for the state engineer to approve plans, drawings, and specifications AN APPLICATION not calling for conduits. Nothing in this section shall abrogate the right of any owner of a vested water right or appropriation of water to require such conduits in any case where necessary to protect such senior right.

SECTION 7. 35-49-112, Colorado Revised Statutes, 1984 Repl. Vol., as amended, is amended to read:

35-49-112. Fees deposited in general fund. Each set of plans, drawings, and specifications EACH APPLICATION for a livestock water tank submitted to the state engineer under the provisions of this article shall be accompanied by a fee of fifteen dollars. This fee shall be deposited by the state engineer with the state treasurer who shall credit all such fees to the general fund of the state.

SECTION 8. 35-49-113, Colorado Revised Statutes, 1984 Repl. Vol., is repealed as follows:

35-49-113. Assignment of priority number. Every owner of existing reservoirs or dams used to impound any water whatsoever for stock watering purposes shall notify the state engineer in writing, on forms prepared by the state engineer, of the name of such dam or reservoir, the general location thereof with reference to section, township, and range, the capacity and height of the dam, and date of the completion thereof. All such stock watering reservoirs or dams constructed before April 17, 1941, and reported to the state engineer as provided in this section, shall be assigned a priority number according to the date of completion as shown by the notice, specified in this section, to the state engineer. In the event of doubt as to the date of completion or because of any controversy with respect thereto, the state engineer may in his discretion require further and satisfactory proof of such date of completion.

SECTION 9. 35-49-114, Colorado Revised Statutes, 1984 Repl. Vol., is repealed as follows:

35-49-114. Approval required for reservoir. No reservoir for stock watering purposes, having a capacity of more than ten acre-feet or having a dam more than fifteen feet in vertical height from the bottom of the channel to the bottom of the spillway, shall be constructed after April 17, 1941, in this state unless the plans and specifications for the same have first been approved by the state engineer and filed in

~~his office. The state engineer shall act as consulting engineer during the construction thereof and shall have authority to require the material to be used and the work of construction to be done to his satisfaction. No work shall be deemed complete under the provisions of this article until the state engineer furnishes to the owners of such structures a written statement of the work of construction and the full completion thereof, together with his acceptance of the same, which statement shall specify the dimensions of such dam and capacity of such reservoir.~~

SECTION 10. Article 60 of title 37, Colorado Revised Statutes, 1990 Repl. Vol., as amended, is amended BY THE ADDITION OF A NEW SECTION to read:

37-60-122.5. Emergency dam repair cash account. THERE IS HEREBY CREATED IN THE STATE TREASURY AS PART OF THE WATER CONSERVATION BOARD CONSTRUCTION FUND THE EMERGENCY DAM REPAIR CASH ACCOUNT. THE STATE TREASURER IS HEREBY AUTHORIZED AND DIRECTED TO TRANSFER MONEYS FROM THE WATER CONSERVATION BOARD CONSTRUCTION FUND TO THE EMERGENCY DAM REPAIR CASH ACCOUNT IN SUCH AMOUNTS AND AT SUCH TIMES AS DETERMINED BY THE WATER CONSERVATION BOARD. SUCH TRANSFERS SHALL NOT EXCEED FIFTY THOUSAND DOLLARS. THE MONEYS IN THE EMERGENCY DAM REPAIR CASH ACCOUNT ARE HEREBY CONTINUOUSLY APPROPRIATED TO THE WATER CONSERVATION BOARD FOR THE EMERGENCY REPAIR OF DAMS PURSUANT TO SECTION 37-87-108.5. ALL MONEYS COLLECTED BY THE STATE ENGINEER PURSUANT TO SECTION 37-87-108.5, SHALL BE TRANSMITTED TO THE STATE TREASURER WHO SHALL CREDIT SUCH MONEYS TO THE WATER CONSERVATION BOARD CONSTRUCTION FUND. ALL INTEREST DERIVED FROM THE INVESTMENT OF MONEYS IN THE EMERGENCY DAM REPAIR CASH ACCOUNT SHALL BE CREDITED TO THE WATER CONSERVATION BOARD CONSTRUCTION FUND. ANY BALANCE REMAINING IN THE EMERGENCY DAM REPAIR CASH ACCOUNT AT THE END OF ANY FISCAL YEAR SHALL REMAIN IN THE ACCOUNT.

SECTION 11. Article 87 of title 37, Colorado Revised Statutes, 1990 Repl. Vol., is amended BY THE ADDITION OF A NEW SECTION to read:

37-87-108.5. Emergency actions. (1) IF, IN THE OPINION OF THE STATE ENGINEER, CONDITIONS OF ANY DAM OR RESERVOIR ARE SO DANGEROUS TO THE HEALTH AND SAFETY OF LIFE OR PROPERTY AS NOT TO PERMIT TIME FOR ISSUANCE AND ENFORCEMENT OF AN ORDER RELATIVE TO CONSTRUCTION, MODIFICATION, MAINTENANCE, OR RESTRICTION OF STORAGE, OR THE DAM IS THREATENED BY ANY LARGE FLOOD, THE STATE ENGINEER MAY IMMEDIATELY EMPLOY REMEDIAL MEASURES NECESSARY TO PROTECT SUCH LIFE AND PROPERTY.

(2) (a) THE STATE ENGINEER SHALL MAINTAIN COMPLETE CONTROL OF ANY SUCH DAM OR RESERVOIR WHICH, PURSUANT TO SUBSECTION (1) OF THIS SECTION, HAS BEEN DETERMINED TO BE

DANGEROUS TO LIFE OR PROPERTY UNTIL SUCH DAM OR RESERVOIR IS DEEMED SAFE, OR UNTIL ANY EMERGENCY CONDITIONS WHICH PRECIPITATED THE STATE ENGINEER TAKING CONTROL OF ANY SUCH DAM OR RESERVOIR, PURSUANT TO SUBSECTION (1) OF THIS SECTION, HAVE ABATED. THE STATE ENGINEER IS HEREBY EMPOWERED TO DETERMINE THE PROPER TIME AT WHICH TO RELINQUISH CONTROL OF ANY SUCH DAM OR RESERVOIR.

(b) FOR PURPOSES OF THIS PARAGRAPH (b), MEASURES TAKEN BY THE STATE ENGINEER PURSUANT TO SUBSECTION (1) OF THIS SECTION SHALL BE DEEMED FINAL ACTION BY THE STATE ENGINEER FOR PURPOSES OF JUDICIAL REVIEW. THE OWNER OR OPERATOR OF ANY DAM UPON WHICH THE STATE ENGINEER HAS EMPLOYED REMEDIAL MEASURES PURSUANT TO SUBSECTION (1) OF THIS SECTION MAY SEEK JUDICIAL REVIEW OF THE PROPRIETY OF SUCH MEASURES BY FILING AN ACTION IN THE STATE DISTRICT COURT FOR THE DISTRICT IN WHICH SUCH DAM IS LOCATED.

(3) (a) ANY NECESSARY AND REASONABLE COSTS AND EXPENSES INCURRED BY THE STATE ENGINEER IN FULFILLING THE DUTIES MANDATED BY SUBSECTIONS (1) AND (2) OF THIS SECTION IN CONNECTION WITH A REMEDIAL OR EMERGENCY ACTION SHALL BE RECOVERABLE BY THE STATE ENGINEER FROM THE OWNER OF ANY SUCH DANGEROUS OR THREATENED DAM.

(b) ANY OWNER FAILING OR REFUSING, AFTER WRITTEN NOTICE HAS BEEN GIVEN, TO PAY THE REASONABLE COSTS AND EXPENSES INCURRED BY THE STATE ENGINEER PURSUANT TO PARAGRAPH (a) OF THIS SUBSECTION (3) SHALL BE, UPON COMPLAINT BY THE STATE ENGINEER TO THE ATTORNEY GENERAL, SUBJECT TO REASONABLE ATTORNEY FEES INCURRED IN THE RECOVERY OF SUCH COSTS AND EXPENSES.

(4) (a) ALL MONEYS COLLECTED BY THE STATE ENGINEER PURSUANT TO SUBSECTION (3) OF THIS SECTION SHALL BE CREDITED TO THE EMERGENCY DAM REPAIR CASH ACCOUNT CREATED IN SECTION 37-60-122.5, TO THE EXTENT NECESSARY TO REPLENISH THE ACCOUNT. MONEYS COLLECTED IN EXCESS OF SUCH AMOUNT SHALL BE CREDITED TO THE WATER CONSERVATION BOARD CONSTRUCTION FUND.

(b) THE GENERAL ASSEMBLY SHALL MAKE ANNUAL APPROPRIATIONS FROM THE EMERGENCY DAM REPAIR CASH ACCOUNT CREATED IN SECTION 37-60-122.5, FOR THE DIRECT AND INDIRECT COSTS INCURRED BY THE STATE ENGINEER IN THE PERFORMANCE OF THOSE DUTIES AUTHORIZED TO BE CARRIED OUT BY THE STATE ENGINEER IN THIS SECTION.

SECTION 12. 37-87-122 (2) and (4), Colorado Revised Statutes, 1990 Repl. Vol., are amended to read:

37-87-122. Erosion control dams. (2) Erosion control dams for reservoirs may be constructed on watercourses, the

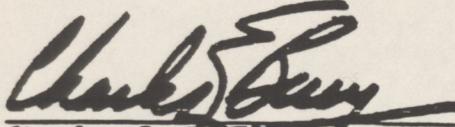
channels of which have been determined by the state engineer to be normally dry, having a vertical height not exceeding fifteen feet from the bottom of the channel to the bottom of the spillway, and having a capacity not exceeding ten acre-feet at the emergency spillway level, upon approval of an application for such erosion control dam by the state engineer, which application shall be accompanied by a fee of fifteen dollars. THE APPROVAL BY THE STATE ENGINEER OF AN EROSION CONTROL DAM SHALL BE CHRONOLOGICALLY NUMBERED IN ORDER OF APPROVAL AND IN CONCERT WITH ANY LIVESTOCK WATER TANKS APPROVED PURSUANT TO SECTION 35-49-109, C.R.S. When such reservoirs are to be constructed with such height exceeding fifteen feet and such capacity exceeding ten acre-feet, they shall be constructed in accordance with section 37-87-105.

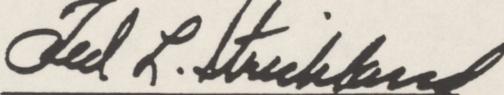
(4) The state engineer shall prepare and keep on file in his AT THE office OF THE STATE ENGINEER standard specifications for erosion control dams which shall be subject to revision by the state engineer and shall in general be used as a guide by persons proposing to construct such dams.

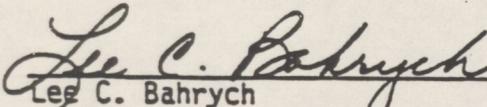
SECTION 13. Appropriation. In addition to any other appropriation, there is hereby appropriated, out of any moneys in the emergency dam repair cash account not otherwise appropriated, for the fiscal year beginning July 1, 1992, to the division of water resources under the department of natural resources, for allocation to the office of the state engineer, the sum of fifty thousand dollars (\$50,000) or so much thereof as may be necessary for the purposes set forth in section 37-85-108.5, Colorado Revised Statutes.

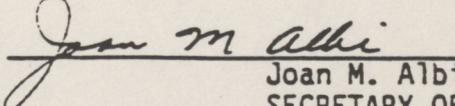
SECTION 14. Safety clause. The general assembly hereby

finds, determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

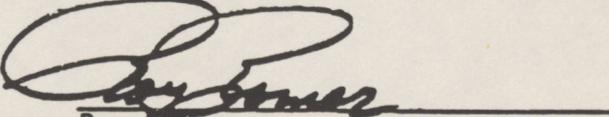
  
Charles E. Berry  
SPEAKER OF THE HOUSE  
OF REPRESENTATIVES

  
Ted L. Strickland  
PRESIDENT OF  
THE SENATE

  
Lee C. Bahrych  
CHIEF CLERK OF THE HOUSE  
OF REPRESENTATIVES

  
Joan M. Albi  
SECRETARY OF  
THE SENATE

APPROVED June 3, 1992 at 6:40 P.M.

  
Roy Romer  
GOVERNOR OF THE STATE OF COLORADO

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