STATE ENGINEER'S SECOND ANNUAL REPORT TO THE GENERAL ASSEMBLY ON DAM SAFETY FOR F. Y. 84-85

November 1, 1985

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October 31, 1985

The Honorable Richard D. Lamm
Governor, State of Colorado
State Capitol Building
Denver, Colorado

The Honorable Ted Strickland
President of the Senate
Colorado State Senate
Denver, Colorado

The Honorable Bev Bledsoe
Speaker of the House
Colorado House of Representatives
Denver, Colorado

Gentlemen:

Pursuant to Section 37-87-114.4, C.R.S. 1973 (1984 Supp.), I am pleased to transmit the enclosed report describing the activities of the State Engineer with respect to dam safety in Colorado for fiscal year 1984-85.

Colorado's dam safety program continues to grow stronger as a result of increased resources made available by the General Assembly and as a result of increased awareness by the dam owners of their responsibilities.

Areas where efforts need to be focused are the improvement of our liability laws for our inspecting engineers, continued education of the dam owner and public, and development of an effective data base management system for dams and reservoirs.

If you have any questions, please feel free to call upon me at any time.

Sincerely,

Jeris A. Danielson
State Engineer

JAD/pka

Enclosure (a/s)

cc: Senate Majority Leader Dan Noble
Senate Minority Leader Ray Peterson
House Majority Leader Ron Strahle
House Minority Leader David Skaggs
Senator Tilman Bishop, Chairman
Senate Ag Committee
Representative Walt Younglund, Chairman
House Ag Committee
Senator Cliff Dodge, Chairman
Joint Budget Committee
Representative Bob Leon Kirscht, Vice-Chairman
Joint Budget Committee
Senator James Beatty, Joint Budget Committee
Senator John Beno, Joint Budget Committee
Representative Elwood Gillis, Joint Budget Committee
Representative Joann Groff, Joint Budget Committee
Representative Wilma Webb, Joint Budget Committee

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STATE ENGINEER'S SECOND ANNUAL REPORT TO THE GENERAL ASSEMBLY ON DAM SAFETY FOR FY 84-85

INTRODUCTION

Statutory Provisions

Colorado's Dam Safety Program is administered by the State Engineer in accordance with Title 37, Article 87, of C.R.S. 1973 (amended 1984), and the Livestock Water Tank Act, Title 35, Article 49 of C.R.S. 1973, as amended. Rules and Regulations for filing plans and specifications for the construction of reservoir dams, and standard specifications for Livestock Water Tanks and Erosion Control Dams, establish the procedures and requirements of the State Engineer for administration of these statutes.

This report is submitted in compliance with Section 37-87-114.4, C.R.S. (1984) concerning the activities of the State Engineer and the Division of Water Resources relating to Sections 37-87-105 to 37-87-114, C.R.S. 1973 (1983)(amended 1984).

Organization

Implementation of the dam safety program is done by the State Engineer through the Dam Safety Branch.

The branch is organized into three units, two being field engineering units (FEU), and the other, a design review and construction inspection unit (DRCIU). Each unit is led by a Supervising Water Resource Engineer. (See Appendix A for tables and charts of the personnel and organization of the branch.)

The Field Engineering Units' principal duties are to conduct Safety Evaluations of Existing Dams (SEED)1/, design review and construction inspection of repairs 2/, and investigation of complaints on the safety of dams 3/. They investigate the construction of dams in violation of Section 37-87-105(1) and (4), C.R.S. (1983)(amended 1984), assist the Department of Health in the inspection of tailing dams, and conduct training on the inspection of dams for division personnel, dam owners, interested agencies, engineers, and the public. They also do other related work as assigned.

1/ Per Section 37-87-107, C.R.S. (1973)(amended 1984)
2/ Per Section 37-87-105(4), C.R.S. (1983)(amended 1984)
3/ Per Section 37-87-109, C.R.S. (1973)

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. (1983)(amended 1984) (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 work. It processes the Livestock Water Tank and Erosion Control Dam applications per Section 36-49-101 et al., C.R.S. (1973), and Section 37-87-122, C.R.S. (1973). The Unit assists the Department of Health in the technical evaluation of tailing impoundments through a "Memorandum of Understanding," and participates in the State's "Joint Review Process" with the Department of Natural Resources. They also do other related work as assigned.

Goals and Objectives of the Program

The primary goal of the State Engineer with respect to dam safety is to provide maximum public safety against dam failures within the resources of his office. Towards this goal, the resources are directed at the safety inspection of each high and moderate hazard non-federal dam and reservoir on an annual basis, and the safety inspection of each low hazard non-federal dam and reservoir on a five year basis. The program concentrates on "jurisdictional" dams and reservoirs as defined in Section 37-87-105 C.R.S. (1973)(amended 1984) which are greater than 10 feet high at the spillway, or greater than 20 acres in surface area at the high water line, or greater than 100 acre-feet in capacity at the high water line.

Safety inspections are made of U.S. Bureau of Reclamation and U.S. Corps of Engineers dams on a cooperative basis, their safety inspections being carried out in accordance with the "Federal Guidelines on Dam Safety." Arrangements are made with other federal agencies for the safety inspection of their dams by the Bureau of Reclamation, the Corps of Engineers, their own forces, consulting engineers, or by the State Engineer. When other than State Engineer personnel conduct the safety inspections, the agencies submit the findings/recommendations, and follow-up to the State Engineer in order to assure the safety of these dams.

A related objective is the inspection of 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, but an important element of the dam safety program, is the goal to have each owner of high hazard dams prepare an Emergency Preparedness Plan to combat any incident which would jeopardize 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.

The following Table 1 shows the ownership of jurisdictional dams in Colorado by owner; and Table 2 shows the distribution of dams in the state by Irrigation/Division and hazard rating.

TABLE 1

JURISDICTIONAL[1/] DAM OWNERSHIP STATUS
IN COLORADO

TYPE OF OWNER / HAZARD RATING	FEDERAL	STATE	OTHER GOV'T.	PRIVATE	TOTAL
HIGH (Class I)	36	11	76	129	252
MODERATE (Class II)	13	22	76	227	338
LOW (Class III)	55	43	140	1,109	1,347 [2/]
TOTAL	104	76	292	1,465	1,937

1/ Greater than ten feet high to spillway, or 20 acres in surface area at the high water line, or 100 acre-feet in capacity at the high water line.

2/ This total became reduced by legislation in 1979 due to the change in definition of the height of a dam from the crest to the bottom of the spillway (SB 342). The status was not changed until 1985, when the dams data base enabled the amount to be determined.

TABLE 2

DISTRIBUTION OF DAMS BY IRRIGATION DIVISION/HAZARD

DIV.	NON-FEDERAL				FEDERAL				TOTAL			
	H	M	L		H	M	L		H	M	L	
1	113	142	485		13	7	17		126	149	502	
2	32	50	237		5	3	12		37	53	249	
3	9	13	50		1	0	5		10	13	55	
4	19	39	189		7	0	7		26	39	196	
5	24	41	148		7	2	9		31	43	157	
6	10	21	132		0	1	4		10	22	136	
7	9	19	51		3	0	1		12	19	52	
				TOTAL				TOTAL				TOTAL
	216	325	1,292	1,833	36	13	55	104	252	338	1,347	1,937

H = High Hazard = 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.

M = Moderate Hazard = 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.

L = Low Hazard = 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.

APPROVAL OF PLANS AND SPECIFICATIONS FOR CONSTRUCTION OF DAMS AND RESERVOIRS

During FY 84-85, the State Engineer received plans for one new dam, and 30 plans for alteration, modification, repair, or enlargement. Eight change orders to previously approved plans were also reviewed and seven approved within the time frame. Eighty-six separate reviews of the submitted plans were done, about 40 percent of them being subsequent reviews of the same plans. Six separate hydrology studies were also received for determination of the inflow design flood for spillway designs. Estimated cost of construction for the submitted plans was $7,511,896. Two thousand one hundred and sixty-five dollars and eighty-five cents ($2,165.85) was collected for the examination and filing of the submitted plans.

Twenty-one sets of plans and specifications were approved by the State Engineer for construction during FY 84-85. Twelve of them were for high hazard dams, four for moderate hazard, and five for low hazard dams. (See Appendix B for lists of dams which were approved by Irrigation Division/District, and use.)

Fifteen special studies associated with dams were also performed, five being for review of subdivision water supply plans; the subdivisions potentially affecting the hazard ratings of upstream dams. If it appears that the development will affect the rating, the governing body is advised and a recommendation made that the developer mitigate the increased hazard.

Upon completion of construction, the owners engineer submits copies of the "AS-BUILT" plans, showing the changes made during construction. These plans are reviewed by the engineer who monitored the construction for completeness before accepting for filing. The superceded plans are disposed of and the "AS-BUILT" plans serve as the public record as provided by the statutes.

Section 37-87-114.5, C.R.S. (1984) 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 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 store water only below the natural surface of the ground.

In order to prevent administrative problems arising from 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. (1984) requires that a notice of intent to construct an impoundment must be submitted to the State Engineer prior to beginning construction. The State Engineer has developed a form for submitting the notice, which is directed to the Division Engineer of the Division the impoundment is located in for processing. The notification also serves to address any dam safety issues which are evident.

SAFETY INSPECTIONS AND CONSTRUCTION OBSERVATION

Scheduling

Jurisdictional dams identified for inspection in accordance with the objectives of the State Engineer are assigned to the field engineers on a geographic and hazard related basis. The field engineers schedule the inspection of approximately 90 separate dams each "inspection year," which begins about April 1 and ends about November 1. Subsequent follow-up and problem solving results in about 110 inspections that are planned on each year as a standard. Within the planned schedules are the inclusion of all the high and moderate hazard dams, and approximately one-fifth of the low ones. Inspection of Federal dams are integrated with these schedules. In addition, the State Engineer has executed a memorandum of understanding 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. The two field engineering units, therefore, collectively plan to conduct at least 990 safety inspections on an "inspection year" basis which is equivalent to a fiscal year in the amount planned.

In addition, engineering personnel in the Division Engineers offices are assigned low hazard dams for safety inspection to supplement the dam safety branch's schedules. This assures that at least one-fifth of the low hazard dams receive an inspection on a five-year schedule. The safety inspections are coordinated and supervised by the chiefs of the field engineering units to assure continuity.

Scope

A safety inspection involves more than just a visit to the dam. The site visit is preceded by a review of the file and history of performance, and 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 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 on the safe storage level. The report also enumerates the several repair and maintenance items which the owner must attend to, and specifies the several engineering and monitoring requirements necessary to assure the safety of the dam. (A copy of the "ENGINEERS INSPECTION REPORT" is in Appendix C.)

An invoice for the cost of the inspection is also prepared in accordance with the provisions of the statutes, the payment being due within 30 days of receipt 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 level. If the findings are conditionally satisfactory, full storage is recommended contingent upon appropriate monitoring provisions being provided by the owner.

Restriction orders are accompanied by orders to rehabilitate the dam to make it safe for full storage, or to breach the dam.

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 a workmanlike manner. Re-inspections normally occur to assure follow-up on the State Engineer's orders, or by request from the owner.

In the event the owner fails to comply with an order to make a dam safe, a breach order will be issued to remove the hazard created by the dam and reservoir. This subject will be covered in more detail later in this report under RESULTS OF SAFETY INSPECTIONS, AND ENFORCEMENT PROCEEDINGS, where the attorney general is requested to commence proceedings against owners refusing to obey the written orders of the State Engineer.

Number of Inspections

During FY 84-85, a total of 985 safety inspections were conducted (and 92 construction inspections), for a total of 1,077. This included 216 safety inspections of high hazard dams, 305 safety inspections of moderate hazard dams, and 464 safety inspections of low hazard dams (including federal dams). The objective of inspecting all high and moderate hazard dams on an annual basis is an "inspection year" objective versus a fiscal year one. This objective was reached for "inspection year" 1984, and is expected for 1985.

Results of Safety Inspections

The 985 safety inspections resulted in the issuance of 97 restriction orders due to unsafe conditions during FY 84-85. Twenty-six former restrictions were removed, and 33 revised.

As of June 30, 1985, there were a total of 256 restriction orders in effect. The following tables show the cause for restrictions by category and hazard rating in Table 3, and by category and Irrigation Division in Table 4.

TABLE 3

CAUSE FOR RESTRICTIONS BY CATEGORY/HAZARD 1/

HAZARD	CATEGORY A	B	C	D	TOTAL
HIGH	20	5	11	5	41
MODERATE	22	33	9	6	70
LOW	54	61	13	17	145
TOTAL	96	99	33	28	256 2/

TABLE 4

CAUSE FOR RESTRICTIONS BY CATEGORY/IRRIGATION DIVISION 1/

DIVISION	CATEGORY A	B	C	D	TOTAL	NO. OF NON-FEDERAL DAMS
1	35	44	15	12	106	740
2	22	7	3	5	37	319
3	1	6	1	9	8	72
4	14	16	5	5	40	247
5	14	16	7	4	41	213
6	5	4	0	1	10	163
7	5	6	2	1	14	79
TOTAL	96	99	33	28	256 2/	1,833

A - Inadequate Spillway/Freeboard
B - Structural Problem (Deteriorated appurtenances, cracking, erosion, scarps, sinkholes, deteriorated riprap, etc.
C - Leakage/Piping Conditions
D - Stability (Slides, saturated slopes)

1/ In effect as of June 30, 1985
2/ All non-Federal dams

The approximate amount of storage lost due to restrictions was 234,163 acre-feet. A list of the storage restrictions by name, former water district, amount of restriction, date, reason, hazard rating, and approximate storage lost is contained in Appendix D.

The greatest problems causing the unsafe conditions according to the tables are inadequate spillway capacity-insufficient freeboard (Freeboard is the vertical distance between the bottom of the spillway and the crest of the dam.), and structural deficiencies. As a single category, inadequate spillway capacity is the most frequent deficiency; it being judged by hydrologic standards related to a dam's "hazard" to the floodplain. The State Engineer's hydrologic requirements for spillway flood capacity range from the 100-year flood to the Probable Maximum Flood (PMF); any spillway capacity less than the PMF requiring demonstration that the overtopping failure of the dam will be insignificant on the floodplain.

The increase in the amount of restrictions, especially of low hazard dams, is partially due to the increased number of inspections performed by the increased staff. The several problems and deficiencies at low hazard dams being identified and remedial measures being taken.

With inadequate spillways identified as the most frequent deficiency concerning the safety of dams in Colorado, the majority of orders issued by the State Engineer to dam owners is the need to repair and enlarge spillways. For "inspection year" 1985, all dams are being evaluated for hydrologic adequacy in accordance with the following policy: All dams must pass a 100-year flood with one foot of residual freeboard. For high and moderate hazard dams that cannot do this, the dam is restricted to a level that can handle the 100-year event, and an order issued to upgrade the spillway (to the PMF, if needed). For low hazard dams that cannot pass the 50-year flood, the dam is restricted to handle the 50-year event, and an order issued to upgrade the spillway (to at least the 100-year event). If a low hazard dam will pass the 50-year event but not the 100-year event, an order is issued to upgrade the spillway to the 100-year event. In each case, the owner has the alternative to partially or fully breach the dam. These policies will be applied until the revised rules and regulations are promulgated, upon which the hydrolgic requirements will be enforced.

In cases where the restriction orders cannot be enforced during flooding due to inadequate outlet capacity, and the owner has not complied with the orders to rehabilitate the dam; orders are issued to partially breach the dam by cutting the spillway down to the restricted level. The work must be done under the supervision of a registered professional engineer, and the spillway must be able to pass the 100-year flood.

In the event the owner does not comply with any of the above orders, another order is issued to completely breach the dam. The breach must be of sufficient width to pass abnormal flood flows without surcharging the reservoir basin, and must pass the 100-year event at less than five feet of depth.

Following is a list of the dams which were ordered to be rehabilitated or breached during FY 84-85

NAME	COUNTY	DIVISION	DISTRICT
Cantrill	Douglas	1	8
Lambert	Douglas	1	8
Quick	Douglas	1	8
Hughes	Garfield	5	38
Cole	Grand	5	51
Haiku	Douglas	1	8

The following dams were ordered to be breached in FY 84-85.

NAME	COUNTY	DIVISION	DISTRICT
Shelton	Larimer	1	4
Oberon #1	Jefferson	1	7
Rowes	Mesa	5	72

The following dams were breached during FY 84-85

NAME	COUNTY	DIV./DIST.	DESCRIPTION
Allis	Douglas	1/8	to 14.5' below crest
Big Tooth	El Paso	2/10	to 15.0' below crest
Mill Lake	Huerfano	2/16	to 9.0' below crest
Unsafe Dam	Jefferson	1/80	TOTAL BREACH

Status of National Dam Safety Program

The National Dam Safety Program was authorized by P.L. 92-367 which directed the Secretary of the Army, acting through the Corps of Engineers to, among other things, carry out a national program of inspection of non-federal dams, and to inventory all dams in the United States greater than 25 feet high and greater than 50 acre-feet.

The Corps of Engineers (COE), Omaha District, conducted their evaluations of the high hazard dams in Colorado from 1977 through 1981. As a result of their evaluations, 35 dams were found to be "unsafe" due to serious hydrologically inadequate spillways. That is, they could not pass more than 50 percent of a Probable Maximum Flood. Some of these same structures had structural problems as well. None of these conditions were rated as emergency in nature. Since the completion of the National Dam Safety Program (1981), the Corps of Engineers has requested, and we have furnished them, with an update of the status of the "unsafe" dams.

As of August 30, 1985, the unsafe status of all but 12 of the dams have been resolved, six of them have been temporarily mitigated by restriction in use until the problems are fixed. All except one are presently working on solutions to resolve the unsafe conditions. (A copy of the status report is in Appendix E.)

USE OF APPROPRIATED FUNDS

The Legislature, for FY 84-85, budgeted by separate line item $739,170 for Dam Safety personal services. Twenty-eight thousand nine hundred and thirty-nine dollars ($28,939) was allocated for operating costs, and $15,000 for travel and subsistence from the Division of Water Resources appropriation.

Dam Safety personal services expenditures for the fiscal year were $729,270. Total operating expenditures were $34,836 and $18,745 for travel and subsistence.

No capital expenditures were made during the fiscal year.

RECEIPTS GENERATED FOR COSTS OF INSPECTION AND FILING OF PLANS

Fees collected by the State Engineer for dam safety were $48,471.36 for safety inspections and construction observation, and $2,165.85 for filing plans and specifications. Invoices totalling $58,698.80 were issued for safety inspections during the period, requiring the state to resort to collection procedures for payment.

RULES AND REGULATIONS

No regulations were promulgated during the fiscal year. Existing rules and regulations were promulgated in 1967 and are in force. With the passage of HB-1052 (1984), preparation of revised regulations is nearly complete. Pending completion of staff review and approval of the draft regulations by the State Engineer, the basis and purpose of the rules will be prepared for the public hearings in accordance with Section 24-4-103, C.R.S. 1973.

ENFORCEMENT ORDERS AND PROCEEDINGS

During the fiscal year, the State Engineer was involved in three enforcement proceedings under Section 37-87-114 (1973)(amended 1984). Following is a brief description of each case.

1. Hidden Lake/aka/Mayham Reservoir, Adams County

Hidden Lake is located in the vicinity of 65th Avenue and Lowell Boulevard in Adams County. It is an eight-foot high, 492 acre-foot, low hazard structure.

This is a continuation of a case reported on in the 1984 report. Since that time, the suit in the Water Court, Water Division 1 (Case No. 83CW109), on the ownership of the reservoir was decided. During an inspection of the dam on October 10, 1984, it was discovered that some unknown party or parties, had nailed a piece of plywood over the breached concrete wall. The reservoir, however, was below the restricted elevation due to outflow through the outlet works. The State Engineer subsequently had the breach widened from 34 inches to 14 feet wide using the money deposited with the Court and transferred to the State Engineer. A balance of $2,318 remained after the widening and was returned to the Court. On March 5, 1985, the Water Court issued a Memorandum of Decision on Case No. 83CW109 (and related cases) that the Mayham Reservoir Corporation had title to the reservoir. The State Engineer subsequently ordered the owner (Mayham Reservoir Corporation) to rehabilitate the dam or completely breach it. The Corporation's attorney responded that the State Engineer and the Corporation were still subject to the jurisdiction of the Court and could not comply. (A hearing has been set for October 7, 1985 in the Water Court to determine further proceedings in the case.)

2. Hughes Reservoir Dam/aka/Aspen Lake, Garfield County

Hughes Reservoir Dam is located on Three Mile Creek about four miles above its confluence with the Roaring Fork River, which is located about two miles south of Glenwood Springs in Garfield in County. It is a 26 foot high, 572 acre-foot, high hazard structure.

Hughes Reservoir Dam had been restricted to zero storage since October 1, 1975, due to poor conditions and an inadequate spillway. The reservoir has been a problem several times due to abnormal snowmelt run-off, the reservoir filling and nearly overtopping the dam. On July 24, 1984, the State Engineer ordered the owner to enlarge the spillway in order to handle future flooding. The order had a suspense date of September 30, 1984. On October 3, 1984, the State Engineer ordered that the dam be breached due to non-action, with a completion date of October 31, 1984. The owner's engineer submitted a breach plan to the State Engineer, which was approved on October 19, 1984, but the owner failed to complete the breach by the due date (October 31, 1984), claiming that weather conditions prevented it. On December 6, 1984, the State Engineer requested the Attorney General to initiate legal proceedings to have the breach

order enforced prior to April 1, 1985. The Attorney General entered a stipulation in Ninth Judicial District Court in Glenwood Springs, that the owner must monitor access to the dam and breach it as soon as he could; otherwise, the dam must be breached no later than August 1, 1985. In addition, the owner must keep the spillway clear of any debris, and sandbag low spots on the dam's crest. During peak run-off periods, the owner shall monitor the dam daily, and provide 24-hour monitoring if a storm develops. Judge Thomas Ossola upheld the stipulation on April 5, 1985. (The dam was breached in accordance with the plans on July 31, 1985.)

3. Charles Frost Dam, Park County

The Charles Frost dams are located in the Roland Valley Subdivision, adjacent to U.S. 285, about five miles east of Bailey in Park County.

The Frost dams are three of several "non-jurisdictional" dams less than 10 feet high, which the Board of County Commissioners of Park County requested assistance because of a drainage problem in 1983. The State Engineer subsequently investigated the problem dams which resulted in an order to the several dam owners to construct appropriate spillways and outlets in 1984. After a reasonable time period, the owners who did not upgrade their dams were ordered to remove their dams within 30 days. All of the owners proceeded to fix their dams, except Mr. Charles Frost.

The Attorney General, upon the complaint of the State Engineer, filed a complaint on February 26, 1985 for preliminary and permanent injunction regarding the order to remove the dam dated May 21, 1984. A hearing was held in Judge Behrman's Water Court in Greeley on June 4, 1985 where the defendant agreed to construct spillways in accordance with plans approved by the State Engineer, and to provide pumping facilities at the dams in order to comply with any administrative requirements for passing "calls" on the water in storage. The work was required to be completed by August 30, 1985 in accordance with the order.

DAM FAILURES

Sage Creek Dam, Routt County

One failure of a "jurisdictional" dam occurred during the fiscal year. The Sage Creek dam was located on Sage Creek about eight miles south of Hayden in Routt County. It was a 41 foot high, 800 acre-foot, moderate hazard structure.

Sage Creek dam failed between 5 A.M. and 6 A.M. on May 4, 1985. The entire reservoir volume emptied through the breach that occurred at the spillway on the right side of the dam. The final breach was about 450 feet wide and 35 to 40 feet deep. The resulting flood peak of about 5,800 cfs caused severe damage to the county road adjacent to Sage Creek for a distance of 2.25 miles from the dam, and flooding of farmland between four and five miles downstream of the dam.

Investigation of the failure by the State Engineer determined that the probable cause of failure was due to erosion of the spillway channel caused by snowmelt run-off and a severe thunderstorm the night before. The increased flows caused erosion of the sandy alluvium, cutting back to the reservoir and breaching of the dam. Evidence of backcutting at the downstream end of the spillway was in evidence prior to the failure. The owner was directed by the State Engineer the year before to fix the spillway to prevent backcutting.

EMERGENCY PREPAREDNESS PLANS

During the National Dam Safety Program's inspection and phase I findings/ recommendations on high hazard dams, the preparation and maintenance of plans to combat incidents at dams, and to give warning to the floodplain area downstream, became a common recommendation of the reviewing professional engineers. At the conclusion of the National Dam Safety Program in 1981, the State Engineer requested that all owners of high hazard dams prepare emergency preparedness plans, and provided a guideline for them to follow.

As of June 30, 1985, a total of 147 plans have been filed with the State Engineer, out of the 252 Federal and non-Federal high hazard dams on file. Of the 147, thirty-one are for Federal dams; primarily of the Bureau of Reclamation.

During FY 85-86, the State Engineer will return comments on the plans to the owners for updating and to re-request the balance of the high hazard dam owners to prepare plans and file them with the State Engineer. The owners will also be requested to coordinate with the Division of Disaster Emergency Services and local disaster coordinators.

DAM SAFETY DATA BASE MANAGEMENT SYSTEM

The Legislature funded to the Department of Natural Resources for FY 1984-1985 the amount of $244,200 for the first year's development of a Dam Safety Data Base Management System.

The first year's program involved primarily the acquisition of hardware to add to the Department's WANG VS computer, workstations and printer for the Division of Water Resources, and sufficient software development to allow the transfer of the existing data base from Colorado State University's computer to the Department's computer.

This work was satisfactorily accomplished and the system is usable with an interim data base management system on the WANG VS computer. Considerable data was entered into the data base during this fiscal year by temporary help and the system is an improvement over the previous system at CSU.

The acquisition of FOCUS data base management software in FY 1985-86 should hopefully allow the system to be completed as envisioned into a very useful data base management system. This system will allow this office to store up-to-date data in the system so that management decisions can be made on a much more timely basis. If the FOCUS software does not perform as expected then the system will not be as useful as planned.

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. Although one failure did occur during the fiscal year, the cause of the failure was recognized by the State Engineer as a potential problem, and the owner's inaction was probably instrumental in the failure. In another instance, the failure of Fuchs Reservoir Dam in Rio Grande County was prevented as a direct result of the dam safety program and the actions of the State Engineer.

The reservoir at Fuchs Dam had been restricted by the State Engineer due to a poor structural condition of the spillway. During the 1985 spring run-off, the spillway flows were threatening to backcut the spillway (similar to Sage Creek) and breach the dam. The State Engineer ordered the owner to take measures to prevent the failure, which he did by constructing a coffer dam upstream of the spillway and controlling the flow with a culvert. This prevented further backcutting and failure.

Another example of the effectiveness of the dam safety program is shown in the tables of causes for restriciton, and the restriction list in the appendix. The identification of the unsafe conditions at the several dams and reservoirs and the subsequent restrictions to safe storage levels, prevented inevitable failures of these structures and the costly consequences thereof. The combination of the State Engineer's safety inspections, restrictions to safe storage, follow-up, Emergency Preparedness Plans, and program to make the dam owners more knowledgeable about the safe operation and maintenance of their dams through the State Engineer's "Dam Safety Manual," makes Colorado's Dam Safety Program one of the most effective in the United States. The modern day incidence of dam failures in Colorado is well below the national average of two damaging failures per year (in accordance with the insurance industries statistics.)

LEGISLATION

Two pieces of legislation were passed during the fiscal year; one was Senate Bill 3, which amended Section 37-87-114(2) on penalties, and the other was HB-1377, which amended Section 37-87-104 on liability. Senate Bill 3 added the "operator" of a dam to the statutory language concerning proceedings which the Attorney General is authorized to do upon complaint by the State Engineer that an owner or an operator has not obyed his directives. HB-1377 makes the owner of a reservoir financially responsible to pay for any damages caused by failure of their dams. The amount of liability can be limited by a valid liability insurance policy of not less than one million dollars; or as an alternative to insurance, a good and sufficient bond or escrow of acceptable securities or letter of credit for not less than one million dollars. Copies of the bills are in Appendices F and G.

RECOMMENDED LEGISLATION

Section 37-87-102 - Definitions - Natural Streams.

Recommend amending (3) to read "probable future flows of water" to "probable future flow of 100-year floods" because the methodology prescribed in the statute are not reliable for predicting flows beyond the 100-year flood.

Section 37-87-105 - Approval of Plans for Reservoir.

Recommend adding that plans and specifications must be prepared by a Registered Professional Engineer in Colorado, in accordance with Section 12-25-101, et al., and that apparent violations of the rules of professional conduct will be reported to the state board of registration for professional engineers.

Section 37-87-106 Cost of Inspections and Observations

Due to the variation in expenses charged for inspections while traveling throughout the state from the Denver area, an apparent inequity exists between the cost of them for each dam. (Expenses charged include salary of the inspecting engineer per hour starting at the beginning of a field trip, mileage, subsistence, and extra-ordinary expenses such as telephone calls, etc.). The cost of an inspection on the Western Slope, for instance, would be greater than in the Denver metro area. Several dam owners have expressed their unhappiness with this disparity. Consideration should be made to making the cost of the inspection and observation more equitable among the dam owners statewide.

Section 37-87-114.5 - Exemptions

(d) Need to clarify that structures used solely for sediment control which do not permanently store water are exempt. Multi-purpose structures which store water are not exempt.

Diversion dams for irrigation canals need to be specifically exempt because they have never been regulated (but could be) and have not caused any damage due to failure in the history of Colorado.

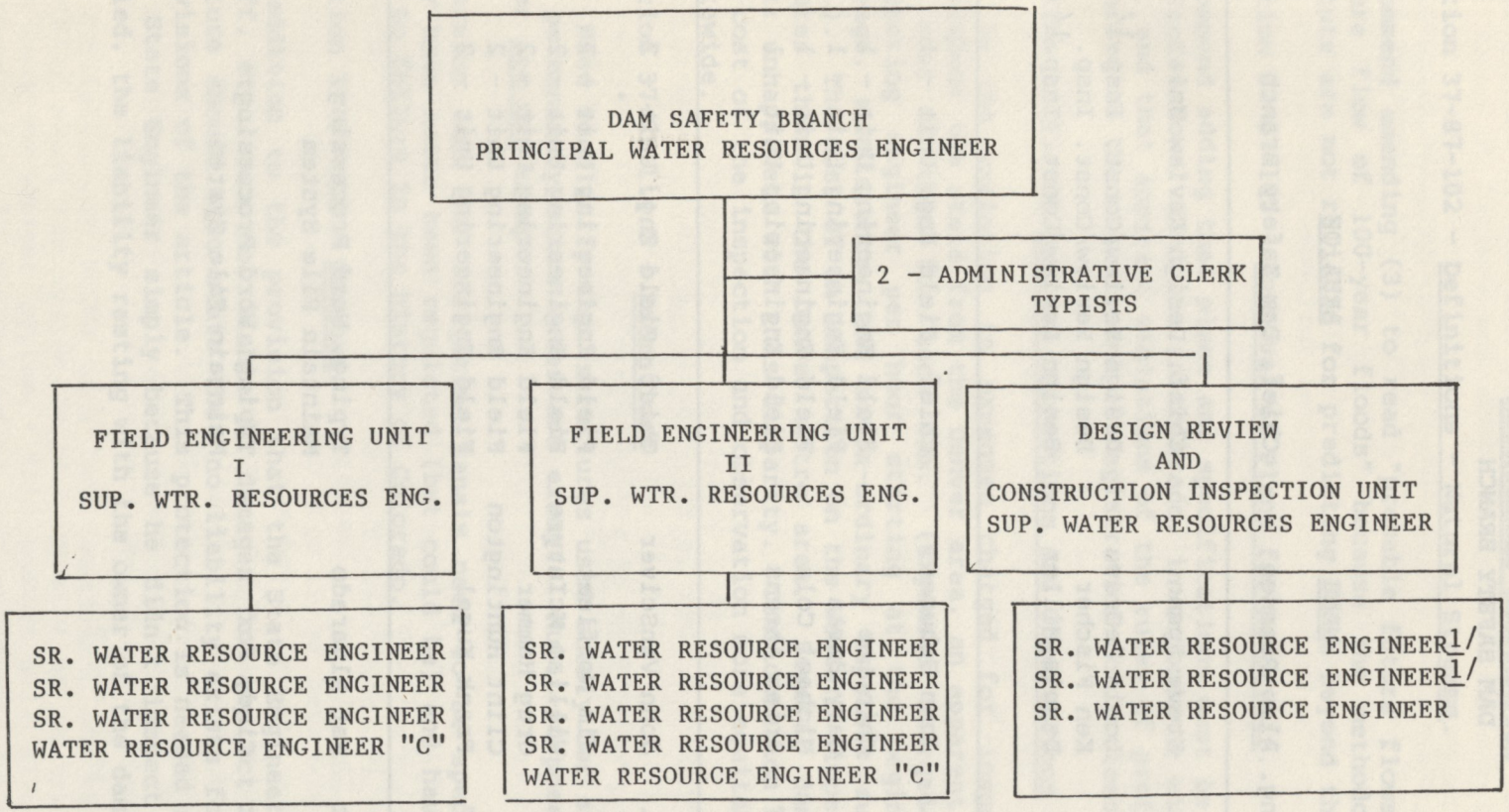
Section 37-87-115 - Damages.

In addition to the provision that the State Engineer nor any member of his staff, etc., are not liable in damages for any act done by him . . ., the statute should also state that no liability exists for not acting within the provisions of the article. This protection is needed so plaintiffs cannot sue the State Engineer simply because he didn't inspect a dam, which may have failed, the liability resting with the owner of the dam.

APPENDIX A
PERSONNEL
DAM SAFETY BRANCH

TITLE	NAME	AREA OF
Principal Water Resource Eng.	Alan Pearson	Chief, Dam Safety Branch
Superv. Water Resource Eng.	Steve Spann	Chief, Design Review Unit
Senior Water Resource Eng.	Louis DeGrave	Design Review/Const. Insp.1/
Senior Water Resource Eng.	Ken Fischer	Design Review/Const. Insp.
Senior Water Resource Eng.	Dennis Miller	Design Review/Const. Insp.1/
Superv. Water Resource Eng.	John Schurer	Chief, Field Eng. Unit - 1
Senior Water Resource Eng.	Chin Lee	Field Engineering Unit - 1
Senior Water Resource Eng.	Gary Barta	Field Engineering Unit - 1
Senior Water Resource Eng.	Michael Cola	Field Engineering Unit - 1
Water Resource Engineer "C"	Brian Ahrens	Field Engineering Unit - 1
Superv. Water Resource Eng.	John VanSciver	Chief, Field Eng. Unit - 2
Senior Water Resource Eng.	Jim Norfleet	Field Engineering Unit - 2
Senior Water Resource Eng.	William McIntyre	Field Engineering Unit - 2
Senior Water Resource Eng.	Greg Hammer	Field Engineering Unit - 2
Senior Water Resource Eng.	Clint Huntington	Field Engineering Unit - 2
Water Resource Engineer "C"	Frank Kugel	Field Engineering Unit - 2
Administrative Clerk Typist	Pat Alvarado	Typing, Word Processing, Maintain File System
Administrative Clerk Typist	Cindy Fox	Typing, Word Processing, Maintain File System

1/ Field Engineer position being used for Design Review and Construction Inspection.



1/ Field Engineer position being used for Design Review & Construction Inspection

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Administrative Clerk Typist	Cindy Fox	Typing, Word Processing, Maintain File System

1/ Field Engineer position being used for Design Review and Construction Inspection.

APPENDIX B

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

NAME	DIV./ DIST.	"C" No.[1/]	USE	DATE
De France	1/4	C-1636	Irrigation	9/84
Windsor-Kern	1/3	C-1637	Mun./Rec.	10/84
Granite Dam	7/3	C-1638	Dom./Rec.	10/84
Goose Lake Dam	1/6	C-1639	Municipal	11/84
Harper Lake	1/6	C-1642	Municipal	3/85
Wolf Mtn. Dam	6/57	C-1643	Irr./Dom.	5/85

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

NAME	DIV./ DIST.	"C" No.[2/]	USE	DATE
Douglas Reservoir	1/3	C-1034A	Irr./Wild.	7/84
Summit	7/34	C-344A	Irr.	8/84
Comanche	1/3	C-250C	Mun./Irr.	9/84
Patrick	1/8	C-1266A	Irr./Rec.	9/84
Barr Lake	1/2	C-1214F	Irr./Rec./Wild.	9/84
Adobe Creek	2/17	C-1270A	Irr.	10/84
Timnath #2	1/3	C-1447B	Irr./Rec.	11/84
Rampart	2/10	C-1225A	Mun.	1/85
Chambers Reservoir	1/3	C-173B	Irr.	2/85
Dillon Dam	5/36	C-930A	Ind./Dom./Irr./Rec.	3/85
Empire Reservoir	1/1	C-465B	Irr./Rec.	3/85
Sherwood-Nelson	1/3	C-1555A	Irr.	3/85
Horseshoe #2	1/4	C-807C	Irr./Rec.	4/85
Rampart	2/10	C-1225B	Mun./Rec.	4/85
Dillon Dam	5/36	C-930B	Ind./Dom./Irr./Rec.	6/85

1/ Filing system for approved plans (C-1643). Assigned to new dams, and existing dams without previously approved plans, which are being altered, enlarged, or repaired.

2/ Filing system for approved plans (C-930B). Letters denote revisions to previously approved plans.

APPENDIX C

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 NOT OPERATED DURING INSPECTION
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

185a-85

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) ENG.

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

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

THIS IS THE MINIMUM ACTION YOU SHOULD TAKE. ADDITIONAL ACTION MAY BE NECESSARY PER YOUR ENGINEER'S ADVICE.

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:

☐ (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/OWNER'S REPRESENTATIVE DATE: ___/___/___

DC-185a-85

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
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

GOOD	ACCEPTABLE	POOR
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

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. 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

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 public safety.

CLASSIFICATION OF DAMS

CLASS I	CLASS II	CLASS III
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.

DAM SAFETY BRANCH
CURRENT RESTRICTIONS

JUNE 30, 1985

DIVISION ONE

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Adams & Bunker #3	1	6' below crest	5/22/75	Inadequate freeboard, high seepage	L	150
Akers & Tarr	5	7' below crest	2/17/83	Sloughing on downstream slope	M	95
Allis	8	14.5' below crest	6/27/84	Excessive seepage and slide on embankment	M	24
Angel Lake	3	8' below crest	2/21/78	Poor condition	L	309
Antero	23	G.H. 16 ft.	1/19/76	Excessive leakage	H	70,564
Badding/Croke 12 West	7	11' below embankment crest	12/30/83	Lack of maintenance and repair; no service spillway; no investigation of seepage situation, no EPP	H	751
Beaver Brook #3A	7	G.H. 41 ft.	12/8/83	Saturated surface of downstream slope 12' below crest	H	45
Beaver Park	5	5' below spillway	11/8/84	Inadequate spillway	H	570
Bergen #1	9	G.H. 19 ft.	7/11/83	Questionable condition of east embankment	M	90
						120,163.1 A.F.
					TOTAL	234,163.1 A.F.

* Restrictions imposed this month.
** Restrictions removed this month (date).
\+ Revised existing restrictions
Note: The dates shown are the dates the restrictions were first imposed.

APPENDIX D

Division One (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Bergen #2	9	10' below crest	4/30/84	Cracks in crest; inadequate spillway	H	209
Bijou #2	1	G.H. 15 ft.	5/16/83	Erosion on upstream slope	M	470
Bluebird	5	No storage	11/21/74	Poor condition	M	966
Bootleg	1	No storage	5/19/83	Poor condition	M	3,613
Boulder	6	6' below spillway Elev. 5177' MSL	4/9/79	Inadequate spillway	H	3,792
Box Elder #3	3	5' below outlet	10/10/84	No emergency spillway	L	150
Carmody	9	3' below crest	4/30/84	No spillway	M	0
Chambers	3	No storage above gage 45' more than 30 days	11/22/78	Excessive seepage over gage 45	H	0
Clarks Lake	3	G.H. 5 ft.	4/23/84	Poor condition	M	338
Comanche	3	G.H. 30 ft.	1/21/83	Excessive seepage	H	340
Conqueror	7	28' below crest	6/23/82	Inadequate construction, no spillway	L	1.5
Cooke	1	5' below crest	3/20/74	Deteriorated conditions	L	75
Croke #12 East	7	G.H. 13 ft.	5/21/84	Leakage from outlet pipe, sinkholes & depressions above outlet pipe	M	44

Division One (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Crystal	5	5' below crest at outlet	4/17/85	Excessive seepage, erosion of upstream slope, no spillway, brush and trees and slough areas on downstream slope	M	50
D. A. Lord #4	1	7' below crest	2/10/76	Inadequate spillway - seepage	L	450
Davis	80	4.0' below crest	9/13/84	Non-existent emergency spillway	L	10
Derby	2	14.5' below crest	2/5/85	Inadequate Spillway	M	400
Dixon Canyon	3	6' below crest	4/13/84	Erosion of u/s slope, sliding of d/s slope, lack of maintenance	M	195
Dry Creek	3	6' below crest	3/27/84	Outlet deterioration, u/s face erosion, seepage, d/s slope cracking	L	125
Eaton Law	3	6' below crest	6/4/84	Questionable condition of outlet	M	200
Elder	3	8.5' below crest	10/20/81	Inadequate spillway	H	264
Empire	1	No storage above G.H. 29.0 ft. more than 60 days	7/9/84	Excess seepage and sloughing of toe support berm on east dike	H	6,000
Fairport	4	6' below crest	7/16/73	Poor condition	L	0
Florissant	23	No storage	5/21/73	Spillway failed	L	20
Francis Smart	6	1' below spillway	12/12/84	Incompleted dam construction	L	40
Geist/aka/B-22	3	5' below crest	1/27/84	Erosion, seepage, inadequate spillway, no acceptable outlet	L	57.5

Division One (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Gerlits	8	No storage	11/13/84	Dam partially breached due to overtopping	L	10
Gray #3	3	2' below spillway	3/11/83	Severe erosion U/S slope	M	200
Green Lake #1	6	13.5' below crest	10/12/84	Seepage, no spillway	L	30
Green Lake #2	6	6' below crest	10/8/84	Warping of upstream steel face	M	72
Green Lake #3	6	3' below crest	10/8/84	Leaks, inadequate spwy. freeboard	L	60
Harris Park Est.#1	80	G.H. 0 ft.	4/13/84	Inadequate spillway	M	207
Highland	5	4' below crest	3/7/77	Inadequate freeboard	L	90
Highland #1	5	G.H. 10 ft.	6/8/84	Erosion of u/s face has reduced dam x-section, inadequate frbd.	M	220
Hourglass	3	9.5' below crest	10/27/75	Excessive seepage	H	260
Hyatt	7	8' below crest	5/8/84	Seepage d/s of toe and continual pressure on outlet pipe	M	360
Idaho Springs	7	9' below crest	7/9/84	Freeboard, leakage, depression spot	M	59
Ish #3	4	G.H. 34 ft.	6/11/84	Concentrated seep w/slide, extensive seepage	M	730
Julesburg	64	G.H. 23.5 ft.	5/9/84	Wet saturated area on downstream slope of Dam #2	H	9,000

Division One (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Kalcevic	7	11' below crest	2/10/83	Sloughing on upstream slope	H	69
*Lake Loveland	4	8.0' below crest	6/27/85	Deteriorated outlet, no spillway	L	1,000
Lambert	8	8' below crest	7/10/84	Completely rehabilitate the dam	L	50
Leyden	7	8' below crest	5/29/74	Inadequate spillway, unstable embankment	M	207
+Lilly Lake	4	3.5' below spillway	9/7/82	Inadequate freeboard, excessive seepage	M	14
Little Hohnholtz (Hohnholtz #2)	48	7' below crest	10/10/84	Questionable outlet, seepage	L	200
Loup Lake	3	1' below spillway	7/26/84	Wave erosion on upstream face	M	100
Lower Chinns	7	7' below crest	11/13/84	Excessive seepage in vicinity of outlet	L	14
*Lower Long Lake	7	5.0' below crest	6/21/85	Poor condition of upstream face and crest, no spillway	M	52
Magnusun #1	23	5' below principal spillway	8/23/83	Poor condition	L	20
Mammoth Creek	6	3' below spillway	9/14/84	Slip on slope; previous restriction never rescinded	L	60
Metzger	2	No storage	10/24/83	Eroded spillway	L	31
Mitchell #1	3	3' below crest	4/25/83	Insufficient freeboard	L	32

Division One (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Mountain Supply #8	3	No storage	10/3/78	Poor condition	L	643
Munger No. 2	2	12' below crest	9/11/84	Poor condition, no spillway, no outlet, trees	L	100
North Poudre #1	3	7' below crest	5/2/84	Poor u/s slope, decaying tree stumps, deteriorated riprap	M	106
North Poudre #2	3	G.H. 18 ft.	5/15/84	Concentrated seep, questions concerning abandoned outlet	H	985
North Poudre #4	3	G.H. 17 ft.	4/25/84	Poor u/s face, general condition	M	265
North Poudre #5	3	5.5' below spillway	12/12/78	Seepage instability	H	2,375
North Poudre #6	3	G.H. 9 ft.	1/21/83	Inadequate spillway, outlet, riprap	H	4,567
North Poudre #15	3	G.H. 40 ft.	10/3/78	Instability, seepage, poor riprap	H	1,283
North Poudre #17	3	15' below crest after repaired	7/15/83	Poor condition, outlet	M	600
Ohio Lake	2	5' below crest	5/14/84	Erosion on u/s slope, rodent activity, lack of maintenance	M	0
Owl Creek	1	No storage	5/27/83	Failure of outlet	M	1,750
Panhandle	3	Level of Morning Glory spillway	3/14/84	Lack of monitoring and maintenance	H	192
Parkcreek #2	3	8' below crest	10/3/84	Generally poor condition, seepage	M	10

Division One (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Patrick Lake	8	4' below crest	12/9/82	Inadequate spillway	H	300
Pear	5	No storage	11/21/74	Poor condition	L	420
Peterson	3	12.6' below principal spillway	8/16/82	Excessive uplift at toe	H	246
Polly Deane	9	6.5' below crest	4/30/84	Erosion of upstream slope, poor general condition	M	57
Prince #1	6	5.5' below crest	5/27/77	Poor condition, eroded embankment	L	63
Prospect	1	1.5' below spillway	4/15/80	Post-failure monitor	M	600
Richards	2	6' below crest	12/22/83	Erosion, narrow crest, seepage, plugged outlet, etc.	L	140
Rist Canyon	3	3' below crest	4/19/83	Poor condition	L	30
Rist George	4	5' below crest	6/6/84	No spillway	M	90
Riverside	1	G.H. 33.55 ft.	5/9/84	Prevent overfilling of reservoir	H	0
Rockwell Dam	4	8' below crest	6/8/72	Poor riprap, no access to outlet control	L	62
Rosalie #1	80	No storage	11/9/84	Overtopping, slide on d/s slope	L	5
Rosalie #3,#4,#6	80	5' below crest	11/19/84	Slides and no emergency spillway	L	2
Rush Creek #1	65	7' below crest	5/10/84	Failure of principal spillway and eroded upstream slope	L	20

Division One (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Rush Creek #2	65	9' below crest	5/10/84	Eroded upstream slope; slough on downstream slope	L	15
Ryan Gulch	4	8' below crest	2/15/78	Inadequate spillway and leakage	M	217
Sandbeach	5	No storage	2/7/83	Poor condition	M	297
Section 19 Res.	6	4' below crest	7/24/84	No spillway	M	10
Shaffer/aka Tinker Shaffer	8	No storage	6/4/84	Outlet unsafe, sinkholes above outlet	L	90
Signal #1	2	10' below crest	5/25/84	Concentrated seepage areas and questionable condition of outlet	L	100
Southside	4	8' below crest	7/7/78	Inadequate spillway	M	144
Storm	2	5' below crest	11/7/84	Inadequate cross-section, low areas on crest, service spwy. blocked	L	10
Stouffer #1	2	4' below crest	9/18/84	Poor cross-section	L	20
Stouffer #2	2	6' below crest	9/18/84	Poor cross-section, outlet seepage and mining	L	25
Sun Lake	23	5' below crest	6/20/83	Provide adequate freeboard	L	1
Todd (B-10)	2	7' below crest	5/22/84	No upstream slope, boggy area	L	4.5
Tony White	8	10' below crest	5/18/84	Dam breached through spillway	L	112
Tucker Lake	7	6' below crest	6/12/78	Inadequate spillway	H	70

Division One (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
*Wadley #1	2	8.0 below crest	6/13/85	Poor condition of dam	L	50
*Wadley #2	2	7.0 below crest	6/17/85	Poor condition of dam	L	140
Wind Lake	23	3' below crest	10/25/84	Crack on d/s shoulder of crest, and inadequate freeboard	L	2
Windsor Lake	3	5' below crest	2/17/78	Inadequate spillway	H	0
Woodland Park	8	20' below crest	4/21/83	Poor condition/inadequate spillway	H	40
Worster	3	5' below spillway	7/26/84	Inadequate emergency spillway	M	531

DIVISION TWO

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Beeman	16	10' below crest	11/16/84	No spillway, outlet inoperable, slide above outlet discharge	L	105
Big Tooth	10	15' below crest G.H. 55'	4/28/83	Inadequate spillway	H	250
Calahan	10	8' below crest	12/6/84	Saturated downstream slope	L	180
Cripple Creek #3	12	6' below crest	6/8/83	Inadequate spillway	L	112
Cucharas #5	16	15' below spillway	6/6/84	Spillway inadequate and questionable stability	H	6,500
Dye	17	5' below crest	5/8/85	Poor upstream slope/no spillway	M	300
Evans Gulch	11	3' below crest	9/14/84	Insufficient freeboard	L	2
Evans Gulch #2	11	2' below spillway	9/14/84	Insufficient freeboard	M	39
Hardesty	17	15' below crest	6/27/84	Collapse of outlet, uneveness of crest, rodent damage	M	1,956
Holita	16	3' below crest	6/2/77	Inadequate freeboard, slip on D/S slope	L	189
Horse Creek	17	G.H. 23 Until July 15, 1985	1/18/85	Temporary, Pending Repairs	H	540
J.M. Reservoir	16	4' below crest	11/13/84	Insufficient freeboard	L	100
Lake Chipita	10	5' below crest	3/11/83	Provide adequate freeboard	L	5
*Lake Henry	17	6.5' below crest	6/7/85	Leakage in annular space of outlet	M	500
						69,453 A.F.

Division Two (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Martin Lake	16	5' below crest	2/18/83	Inadequate spillway, poor condition of outlet	H	412
Mill Lake	16	9' below crest	2/16/83	Inadequate spillway, poor condition	L	40
Model	19	No storage	7/20/84	Very poor condition	L	20,000
Modern Woodmen of America #2	10	No storage	8/12/83	Spillway obstructed	L	18
Monument	10	3' below spillway	4/23/85	Unsat. Spillway condition	M	150
*Mount Pisgah	12	5.2' below spillway	6/6/85	Inadequate spillway capacity	M	586
Neenoshe	67	5' below crest	1/17/83	No spillway	M	7,392
Orlando #2	16	G.H. 22.5 ft.	7/24/84	Cracks on downstream slope	L	750
Palmer Lake #1	10	3' below spillway	7/15/84	Inadequate spillway	L	12
Park Center #2	12	No storage		Slides on downstream slope	L	32
Park Center #10	12	6' below crest	1/5/74	Severe cracking	L	12
Queen	67	7.5' below crest	1/17/83	Deteriorated upstream slope	M	5,000
Sharps Orchard	16	7' below crest	5/1/72	Badly eroded upstream slope	L	20
Silver Spruce #7	12	7' below crest	11/19/84	Seepage and slide	L	6
Three Elk Dam	11	No storage	8/14/72	Inadequate spillway, leakage	L	26

Division Two (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Thurston	67	5' below crest	1/24/83	Inadequate freeboard	L	1,300
Two Buttes	67	35' below crest	1/24/83	Inadequate spillway	H	22,200
Valdez, Antonio	16	5' below crest	11/13/84	Inadequate freeboard,outlet damaged	L	450
Valley #1	10	15' below crest	12/27/84	Poor condition and blocked spillway	L	50
Valley #2	10	40' below crest	12/27/84	Inoperable outlet, poor condition	L	150
Victor #2	12	8' below crest	6/22/84	Extensive cracking along embankment	M	17
Wahatoya	16	5' below crest	5/12/75	Excess seepage, cracks	H	52
Walsenburg Water	16	5' below crest	5/12/75	Excess leakage, erosion	M	0

DIVISION THREE

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Cove Lake	22	No storage	5/8/74	Dam failed	L	6,380
Eastdale #1	24	Gage 18'	4/4/78	Excessive seepage	L	1,008
+Fuchs	20	4' below spillway	7/9/84	Erosion of emergency spillway	M	60
Hermit Lake #1	20	Level of service spillway	9/14/84	Sinkhole adjacent to outlet	L	182
Mountain Home	35	Gage 87.5'	9/16/82	Inadequate spillway	H	15,000
Salazar #1	24	7' below crest	12/30/83	Erosion on u/s slope, d/s valve, inadequate freeboard	M	34
Terrace	21	7' below spillway	7/18/84	Deteriorated spillway	H	2,000
Willow Creek	24	No storage	8/12/77	Poor condition	M	1,000
						25,664 A.F.

DIVISION FOUR

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Alta #1	60	5' below spillway	8/18/76	Inadequate spillway	L	20
Alta #3	60	8' below spillway	6/18/70	Unsatisfactory embankment	L	59
Beaver	40	10' below crest	6/26/78	Excessive abutment leakage	H	210
Big Battlement	40	5' below crest	9/27/84	Insufficient freeboard	L	134
Blanch Park	40	No storage	10/10/84	Piping of hole through embankment	L	36
Buckeye #1	61	4' below crest	3/3/83	No spillway	H	140
Carl Smith	40	5' below crest	3/27/80	Inadequate spillway stability	H	108
Casto	63	12' below crest	4/6/84	Rodent holes, abandoned outlet, thin crest	M	477
Coffey	41	10' below crest	12/4/78	Inadequate spillway	L	38
Cole #4	40	3' below crest	9/14/84	Lack of freeboard, crest width and muskrat diggings	L	5.6
Craig #1	63	5' below spillway	10/3/84	Beaver activity, thick willows in spillway	M	357
Cushman Lake	60	6' below crest	7/29/75	Dilapidated condition	L	6
Duvall #1	73	16' below crest	5/22/85	Poor condition, no outlet	L	15
Elephant	68	4' below crest	6/22/84	Poor condition	L	30
Fullmoon	68	5' below crest	10/22/79	Poor condition	L	20
						7,610.6 A.F.

Division Four (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
G.H.& S. #2	42	6' below crest	3/14/84	Narrow crest, steep slopes	L	29
Granby #11	40	6' below crest	4/2/84	Abutment sink holes	M	72
Granby #12	40	8' below crest	4/6/84	Slides on downstream slope	M	98
Grand Mesa No. 1	42	9' below crest	8/8/84	Extensive seepage, inadequate spillway, unacceptable outlet	L	230
Holy Terror	40	5' below crest	3/12/80	Inadequate spillway	L	32
Knox	40	Gage rod 13'	2/14/68	Slide - excess leakage	L	135
Leon Park	40	2' below spillway	9/14/84	Slip on upstream slope	L	36
Lone Cabin	40	3' below spillway	9/11/84	Slide on downstream slope	L	40
Lone Star #1	40	10' below crest of left spillway	4/12/85	Construction without plans	L	
Lone Star #3	40	4' below crest of spillway	4/12/85	Construction without plans and specs	L	
Meridian Park Lake	59	Outlet fully open	4/16/79	Construction not complete	L	105
Miramonte	60	5' below spillway	7/15/76	Extensive leakage	H	1,845
Mock #1	41	9' below crest	9/20/82	Poor condition	L	20
Monument	40	15' below crest	3/25/80	Inadequate spillway, leakage	M	501
Norwood Pond	60	5' below crest	1/5/83	Seepage high up on D/S slope	L	4

Division Four (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Oasis	40	3' below crest	11/9/84	Lack of freeboard, poor outlet	L	21
Overland	40	G.H. 35 feet	8/9/84	Cracking of embankment	H	2,000
Reeder	42	4' below crest	6/25/84	Insufficient freeboard	L	50
Spring Creek	59	5' below spillway	1/14/83	Inadequate spillway	H	400
*Squirrell Fish Pd.	62	4.0 'below crest	6/11/85	Steep slopes, narrow crest, no plans or outlet	L	25
St. George	40	7' below crest	10/19/84	Lack of freeeboard, muskrats, cattails, and seepage	L	145
Todd	40	10' below crest	10/19/84	6' elevation difference along crest with no spillway	L	112
Vela	40	G.H. 30 feet	9/14/84	Slip on downstream slope	L	32
Waterbug	40	5' below spillway	8/9/72	Poor condition	L	0
Womack #3	40	4' below crest	9/14/84	Inadequate cross-section	L	23

DIVISION FIVE

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Barton Porter	45	5' below crest	8/2/84	Severe erosion of upstream slope	L	10
Big Beaver	72	14' below spillway		Excessive leakage	L	100
Bull Basin #1	72	9' below crest	10/12/84	Unstable conditions	L	40
Coon Creek #1	72	5' below spillway	11/23/82	Poor condition	M	141
Coon Creek #2	72	3' below spillway	11/23/82	Poor condition	M	121
Coon Creek #3	72	5' below crest	10/15/84	Lack of freeboard	L	30
Coon Creek #4	72	No storage	1/27/84	Corroded outlet pipe	L	9
Crescent Lake #2	53	5' below crest	10/19/84	Sinkhole, outlet damage, inadequate freeboard	L	35
Currier #2	72	4' below spillway	8/2/84	Severe erosion in spillway channel and left side slope	L	70
Divide Creek	39	Reduce dam to 10'	4/18/83	Unapproved	L	10
Fruita Settling Basin #2	72	20' below crest	6/22/84	Poor condition	L	150
G. G. Lower	37	3' below crest	6/21/78	Inadequate freeboard	L	16
G. G. Upper	37	3' below crest	6/21/78	Inadequate freeboard	L	42
Hoagland #1	36	11' below crest	10/29/76	Excessive leakage, poor condition	L	99
Hopkins	38	8' below crest	8/3/84	Excessive seepage at downstream toe	M	54
						4,846 A.F.

Division Five (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Hughes	38	No storage	10/3/84	Order to breach dam	H	573
Huntington	51	10' below crest	11/27/84	Reconstruction without required plans and specifications	L	50
Kelly Dam	53	5' below crest	11/21/84	Inadequate freeboard	L	50
*Langholen	51	4.0' below spwy.	6/28/85	Inadequate spillway, deteriorated outlet	L	60
Little King Ranch	51	10' below crest	4/16/73	Excessive leakage	L	180
McElroy	50	10' below spillway	1/4/77	Inadequate spillway, poor condition	L	96
Mesa Creek No. 4	72	10' below crest	1/18/83	Excessive seepage and instability	M	324
Newton Gulch	53	20' below crest	7/3/75	Abutment piping failure	L	20
Noeker	37	5' below crest	10/10/84	Badger holes down into crest	L	65
Parsons	50	8' below crest	11/21/84	Slides near dam, "sagging" crest	L	30
Pinney	50	7' below crest	5/10/78	Inadequate outlet and spillway	L	30
*Ralston #1	38	3.0' below crest	7/2/85	Inadequate freeboard	L	20
Rapid Creek #1	72	3' below spillway	9/26/84	Extensive downstream seep area and need for embankment rehab.	M	375
Rapid Creek #2	72	5' below crest	3/14/84	Erosion, inadequate freeboard, outlet inoperable	M	147
Rifle Valley	39	5' below crest	2/14/77	No spillway, outlet, inoperable	M	49

Division Five (cont.)

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Rock Creek	51	15' below crest	1/22/79	Inadequate spillway, poor embankment	L	125
+Ruby Lee	72	4' below crest	6/22/84	Inadequate spillway, poor condition	L	150
Scholl	51	No storage	9/17/71	Excessive leakage	L	359
Schorn Fish Pond	72	No storage	9/14/82	Poor condition	L	7
Sterner	53	15' below crest	10/9/73	Partial failure	L	490
Sylvan	51	10' below crest 5' below crest for no more than 60 days	5/1/84	Lack of freeboard, small cross-section	M	260
Upper Craven	50	10' below crest	6/25/84	Poor condition	L	15
Vincent No. 1	72	No storage	9/22/84	Overall condition very poor	L	174
Vincent No. 2	72	No storage	9/22/84	Overall condition very poor	L	164
Welsh	37	8' below crest	5/17/78	Poor condition	L	36
Y-T Reservoir	72	12' below crest	11/21/84	Slope instability, extensive seepage, inadequate spillway	L	70

DIVISION SIX

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Burns	47	G.H. 10 ft.	8/23/83	Spillway dammed	L	16
Clayton	47	3' below lowest point in crest	1/18/85	Lack of freeboard - Low crest	L	25
Elk Lake	54	3' below crest	2/14/85		M	
*Gill	44	10.0 below crest	6/17/85	Seepage high on embankment	L	60
J.B. Dawson #1	57	9' below crest	9/27/84	Partial breach at spillway	L	49
*Nofstger-Zeigler	57	5.0' below crest	6/18/85	No spillway, poor condition	L	40
Pole Mountain	47	No storage	3/30/83	Slide, upstream slope	M	1,905
*Sage Creek	57	No storage	6/14/85	Dam breached at spillway	N	810
Skinny Fish	43	5' below crest	1/23/85	Sinkhole	M	60
*Wyman	44	5.0' below crest	6/28/85	Poor condition		40
Yoast	57	3' below crest	9/14/84	Spillway flow restricted	L	0
						3,005 A.F.

DIVISION SEVEN

NAME	DIST.	AMOUNT	DATE	REASON	HAZARD	APPROX. STG. LOST ACRE-FEET
Bauer #1	34	5' below spillway	7/27/84	Saturation high on embankment	M	144
Belmear	69	7' below crest	7/17/84	Backcutting of spillway, concentrated leakage, questionable outlet	M	168
Buck Pasture	69	13' below crest	5/17/85	Large slide on downstream slope	L	8
Charles Lemon	30	No storage	7/29/74	Poor condition	L	15
Coppinger #1	34	3' below crest	1/27/84	Inadequate freeboard, inoperable outlet, rodent activity	L	12
Coppinger #2	34	No storage	1/27/84	Adverse rodent activity caused hole through dam.	L	16
Durango #1	30	3' below crest	9/22/84	Insufficient freeboard, generally poor condition	L	40
Hurst	34	10' below crest	11/12/71	Inadequate spillway	L	30
J. O. Spencer	34	5' below spillway		Poor condition	L	13
Johnson	30	10' below spillway	12/30/83	Unfinished construction	M/H	163
Sellers & McClane	34	4' below crest	12/20/84	Berm & trees in spillway, rodent holes & erosion, brush in d/s toe	Low	14
Short	30	5' below crest	11/29/77	Inadequate spillway, erosion on upstream face	L	26
Sullenbeuger	78	No storage	10/10/84	Crack on upstream slope	M	1,491
Summit	34	3' below spillway	7/17/84	Adverse seepage, obscuring brush, low areas in crest	H	1,100
						3,240 A.F.

APPENDIX E

NATIONAL DAM SAFETY PROGRAM--COLORADO - UNSAFE DAM LIST - STATUS 8/30/85

LEGEND

STATUS

U = Unsafe
R = Removed from Unsafe List Due to Completion of Repairs Prior to 9/30/81
S = State Removed From Unsafe List Due to Completionof Repairs Since 9/30/81

DEFICIENCIES

SA = Stability Problems
SR = Structural Problems
SC = Spillway Capacity less than 50 percent Probable Maximum Flood (PMF)
SE = Seepage Problems
OP = Operational Problems

ID	NAME	COUNTY	STATUS	DEFICIENCIES
CO 00127	Chambers Lake	Larimer	R	SA, SC, SE
Remarks:				
CO 00130	Comanche	Larimer	U	SC, SE
Remarks:	Seepage has been reduced by restricting storage to gage 30. Owner's site-specific meterology report was rejected. Plans are approved to reline outlet in 1985. A comprehensive monitoring plan is being implemented.			
CO 00143	Milton Seaman	Larimer	R	SC
Remarks:				
CO 00148	Spring Creek	Gunnison	U	SE, SC
Remarks:	Restricted storage to five feet below spillway; 60 percent PMF passes without overtopping. Making weekly seepage readings. Owner has submitted plans for PMF spillway.			
CO 00259	Waneka	Boulder	S	SA, SR
Remarks:	The dam and spillway have been completely rehabilitated. Spillway designed for PMF.			
CO 00328	Evergreen	Jefferson	R	SC, SA
Remarks:				

NATIONAL DAM SAFETY PROGRAM--COLORADO - UNSAFE DAM LIST - STATUS 8/30/85

LEGEND

ID	NAME	COUNTY	STATUS	DEFICIENCIES
CO 00342	Tarryall	Park	R	SC

Remarks:

CO 00359	Eleven Mile Canyon	Park	S	SC

Remarks: Site-specific hydrology study for South Platte River above Cheesman Dam approved by State Engineer's office. Seventy-eight percent of this PMF routed before overtopping. Stability study indicates dam is stable with two foot overtopping by 100 percent PMF. Owner is looking at ways to prevent overtopping.

CO 00384	North Sterling	Logan	S	SC

Remarks: A spillway has been constructed to pass 50 percent of PMF. A study has been submitted to the Office of the State Engineer showing incremental effect if dam is overtopped. Owners consider insig. State Engineer requested warning system and emergency plan to assure no loss of life will occur.

CO 00408	South Catamount	Teller	U	SC

Remarks: Rehabilitation and hydrology study approved. Spillway will be enlarged for PMF. Design under way. Plans submitted for approval August 21, 1985.

CO 00410	Crystal Creek	El Paso	U	SC

Remarks: Plans have been submitted for construction of an auxiliary spillway to pass PMF. Major revisions made to plans. Plans will be resubmitted.

CO 00445	Big Tooth Reservoir	El Paso	S	SC, S

Remarks: Plans have been approved to reduce storage in dam and enlarge spillway so failure is insignificant. Storage transferred to enlarged Lake Moraine (CO901). Modification (and restriction removed) completed 6/85.

CO 00598	Monument	Delta	R	SA, SC

Remarks:

NATIONAL DAM SAFETY PROGRAM--COLORADO - UNSAFE DAM LIST - STATUS 8/30/85

LEGEND

ID	NAME	COUNTY	STATUS	DEFICIENCIES
CO 00629	Carl Smith	Delta	R	SA, SC

Remarks:

CO 00663	Goose Pasture	Summit	U	SC

Remarks: Engineer's report indicates failure by overtopping would cause significant incremental effect. State Engineer has requested that spillway be enlarged or dam breached by 1987. EPP is in effect.

CO 00681	Hughes	Garfield	S	SC

Remarks: New owner has hired engineers. They have submitted hydrology study to office of the State Engineer. They propose to construct a dam that would withstand overtopping (RCC) by PMF. State Engineer has restricted to zero storage and breach order was upheld by District Court in 1985.

CO 00759	Two Buttes	Baca	S	SC

Remarks: Dam has been restricted to gage 20. This provides capability to route 50 percent of PMF. Owner has funds to do engineering for rehabilitation of dam and spillway. Hydrology study submitted for review.

CO 00763	Beaver Park	Rio Grande	U	SC

Remarks: The owner has hired Harza Engineering to do design rehabilitation. Owner has budgeted for design and construction, and is analyzing options.

CO 00772	Humphreys Dam	Mineral	R	SC

Remarks:

CO 00792	Smith	Costilla	R	SC

Remarks:

CO 00805	Rio Grande	Hinsdale	S	SC, SA, SE

Remarks: Owner has rehabilitated dam by construction of stabilizing fill on D/S, installed drains, repaired outlet, spillway can pass 50 percent PMF. Approved by State Engineer.

NATIONAL DAM SAFETY PROGRAM--COLORADO - UNSAFE DAM LIST - STATUS 8/30/85

LEGEND

ID	NAME	COUNTY	STATUS	DEFICIENCIES
CO 00815	Terrace	Conejos	U	SC, (SR State)

Remarks: Pipeline has been constructed in tunnel to regulate discharge. Dam was raised two feet. Spillway design flood approved. Need to construct enlg. spillway (company has large debt.) Reservoir restricted to seven feet below spillway.

CO 00818	Mountain Home	Costilla	S	SC

Remarks: State Engineer restricted reservoir so it can route 50 percent PMF. Revised hydrology being pursued per NWS HMR-55.

CO 00837	North Poudre #2	Larimer	R	SC

Remarks:

CO 00838	North Poudre #3	Larimer	R	SC

Remarks:

CO 00854	Windsor Lake	Weld	U	SC

Remarks: State Engineer has approved plans to construct spillway which will provide adequate hydrologic safety (incremental failure would be insignificant). Construction pending. Reservoir is restricted to five feet below the crest of the dam.

CO 00901	Lake Moraine	El Paso	S	SC

Remarks: Plans for PMF spillway aproved by State Engineer. Construction of spillway completed 6/85.

CO 00976	Elkhead Creek	Moffat	S	SC

Remarks: Based on State Engineer's review of hydrologic parameters, the spillway can pass more than 50 percent of PMF. Spillway is still inadequate and plans are being made for enlargement.

CO 01015	Sheriff	Rio Blanco	U	SC

Remarks: Owner attempted to rebut Phase I hydrology unsuccessfully. State Engineer's office will proceed to take action to provide safe dam. No progress to date.

NATIONAL DAM SAFETY PROGRAM--COLORADO - UNSAFE DAM LIST - STATUS 8/30/85

LEGEND

ID	NAME	COUNTY	STATUS	DEFICIENCIES
CO 01055	Echo Canyon	Archuleta	R	SC
Remarks:				
CO 01066	Turner	La Plata	S	SC
Remarks:	Based on State Engineer's Review of hydrologic parameters, the spillway can pass more than 60 percent PMF. Spillway is still inadequate and State Engineer will take appropriate action to provide safe dam. Owner directed to submit plans for adequate spillway by July 1, 1986.			
CO 01143	Clear Creek	Chaffee	S	SC
Remarks:	Phase I review based unsafe rating on 100 percent PMF. Existing spillway can pass 50 percent PMF with recent enlargement of dam. PMF spillway was constructed in 1984.			
CO 01146	Cucharas #5	Huerfano	U	SC, SA
Remarks:	State Engineer has restricted dam to improve structural safety. Owner has repaired U/S concrete face, and has hired an engineer to do hydrologic and stability studies. Report due 12/1/85. Reservoir restricted to 15 feet below spillway.			
CO 01163	Douglas	Larimer	U	SC
Remarks:	Owner has hired an engineer to design spillway. State Engineer will restrict storage if no action completed in 1985.			
CO 01169	Halligan	Larimer	R	SC
Remarks:				
CO 01200	Beaver Park	Boulder	U	SA, SC
Remarks:	Owner has their engineer making safety evaluations, but no action on Phase I recommendations. State Engineer has restricted reservoir to five feet below spillway.			
CO 01347	Ramah Det.-Rec.	El Paso	S	SC
Remarks:	Owner has done incremental analysis on spillway. A warning plan has been devised to assure loss of life should not occur during flooding (dam is flood control-normally dry except for 500 acre-feet of recreation pool)			

TOTAL = 37

1985

An Act

SENATE BILL NO. 3.

BY SENATORS Peterson and Wells;
also REPRESENTATIVES Mielke, Kopel, Carpenter, Dambman, Entz, and Mutzebaugh.

CONCERNING JUDICIAL PROCEEDINGS COMMENCED AGAINST RESERVOIR OPERATORS TO SECURE COMPLIANCE WITH THE DIRECTIONS OF THE STATE ENGINEER.

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

SECTION 1. 37-87-114 (2), Colorado Revised Statutes, as amended, is amended to read:

37-87-114. Penalty - disposition of fines. (2) Upon the complaint of the state engineer, the attorney general is authorized to commence proceedings against any reservoir owner OR OPERATOR for refusing, after notice in writing has been given, to obey the directions of the state engineer as to the construction or safe operation of any reservoir to secure compliance with any such reasonable direction necessary for public safety in the district court of the county wherein any portion of such reservoir is located, pursuant to the Colorado rules of civil procedure; except that, if it appears to the court that the public safety is in jeopardy as the result of a failure to obey the directions of the state engineer, the court shall expedite the proceedings so that determinations may be made with respect to the directions of the state engineer commencing not later than twenty days from the service of the complaint on the owner or operator of a reservoir.

SECTION 2. Safety clause. The general assembly hereby

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

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

Ted L. Strickland
PRESIDENT OF
THE SENATE

Carl B. Bledsoe
SPEAKER OF THE HOUSE
OF REPRESENTATIVES

Marjorie L. Nielson
SECRETARY OF
THE SENATE

Lorraine F. Lombardi
CHIEF CLERK OF THE HOUSE
OF REPRESENTATIVES

APPROVED April 12, 1995 5:32 p.m.

Richard D. Lamm
GOVERNOR OF THE STATE OF COLORADO

1985

An Act

HOUSE BILL NO. 1377.

BY REPRESENTATIVES Swenson, Younglund, Paulson, Allison, Campbell, Carpenter, Entz, Fish, T. Hernandez, Mutzebaugh, and Pankey;
also SENATORS Bishop and Callihan.

CONCERNING THE LIABILITY OF RESERVOIR OWNERS.

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

SECTION 1. 37-87-104 (2), Colorado Revised Statutes, as amended, is amended to read:

37-87-104. Liability of owners for damages. (2) (a) ~~No employee, shareholder, officer, or member of a board of directors of an~~ THE owner of a reservoir shall be ~~liable~~ FINANCIALLY RESPONSIBLE TO PAY for ~~any~~ damage arising from leakage or overflow of the waters from such reservoir or for ~~any~~ damage arising from floods caused by breaking of the embankments of such reservoir if SUCH DAMAGE IS NOT COVERED BY a valid liability insurance policy ~~has been purchased by the owner of the reservoir and is~~ OR AN ALTERNATIVE TO SUCH AN INSURANCE POLICY AS PROVIDED FOR IN PARAGRAPH (b) OF THIS SUBSECTION (2) EITHER OF WHICH IS in effect at the time such damage occurs. Such insurance policy shall insure against such damages and provide coverage in an amount of not less than fifty thousand dollars for each claim and in an aggregate amount of not less than one million dollars for all claims which arise out of any one incident. The policy may provide that it does not apply to any act or omission of an employee, shareholder, officer, or member of a board of directors of an owner if such act or omission is dishonest, fraudulent, malicious, or criminal. The policy may also contain other reasonable provisions with respect to policy periods, territory, claims, conditions, and other matters common to such policies of insurance. The limitation of liability

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

pursuant to this subsection (2) shall not apply to any criminal, fraudulent, or malicious act by a member of the board of directors of the owner, an officer of the owner, a shareholder of the owner, or an employee of such owner, nor shall it apply to any ultra vires act of the owner or of a member of the board of directors, an officer, a shareholder, or an employee of such owner. ~~The provisions of this subsection (2) shall not be deemed to impose any liability upon a member of the board of directors, an officer, a shareholder, or an employee of the owner of a reservoir beyond that established by other principles or provisions of law.~~

(b) AS AN ALTERNATIVE TO THE LIABILITY INSURANCE POLICY PROVIDED IN PARAGRAPH (a) OF THIS SUBSECTION (2), THE OWNER OF A RESERVOIR MAY ALSO MAINTAIN ANY OF THE FOLLOWING OR A COMBINATION OF ONE OR MORE OF THE FOLLOWING. SUCH ALTERNATIVE SHALL PROVIDE FOR INDEMNIFICATION FOR DAMAGES TOTALING NOT LESS THAN ONE MILLION DOLLARS:

(I) A GOOD AND SUFFICIENT BOND DULY EXECUTED BY A QUALIFIED CORPORATE SURETY, APPROVED BY THE STATE INSURANCE COMMISSIONER, CONDITIONED UPON THE PAYMENT BY THE OWNER OF THE RESERVOIR OF ANY VALID AND FINAL JUDGMENT FOR DAMAGES IMPOSED PURSUANT TO SUBSECTION (1) OF THIS SECTION;

(II) A GOOD AND SUFFICIENT ESCROW OF ACCEPTABLE SECURITIES, AS DEFINED IN SECTION 24-91-102, C.R.S., OR AN ANNUAL IRREVOCABLE LETTER OR ANNUAL LETTERS OF CREDIT ISSUED BY ANY NATIONAL OR STATE BANK AND DEPOSITED WITH AN ESCROW AGENT PURSUANT TO AN ESCROW CONTRACT OR AGREEMENT. THE ESCROW AGENT SHALL PAY, FROM THE ESCROW ACCOUNT AMOUNTS NECESSARY TO DISCHARGE A VALID AND FINAL JUDGMENT FOR DAMAGES IMPOSED PURSUANT TO SUBSECTION (1) OF THIS SECTION. SUCH ESCROW CONTRACT OR AGREEMENT SHALL PROVIDE THAT IT CANNOT BE REVOKED OR AMENDED AFTER THE DAMAGE DESCRIBED IN SUBSECTION (1) OF THIS SECTION HAS OCCURRED AND ANY CLAIMS FOR SUCH DAMAGE HAVE BEEN DISCHARGED OR UNTIL APPLICABLE STATUTES OF LIMITATION PERTAINING THERETO HAVE EXPIRED.

(c) ANY OWNER WHO OBTAINS INSURANCE OR UTILIZES AN ALTERNATIVE AS PROVIDED IN PARAGRAPH (b) OF THIS SUBSECTION (2) SHALL FILE WITH THE OFFICE OF THE STATE ENGINEER A BRIEF DESCRIPTION OF THE POLICY OR OF THE ALTERNATIVE IN EFFECT AND SHALL THEREAFTER FILE AN AMENDED DESCRIPTION WHENEVER ANY SUBSTANTIAL CHANGE IS MADE.

SECTION 2. 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.

Cari B. Bledsoe
SPEAKER OF THE HOUSE
OF REPRESENTATIVES

Ted L. Strickland
PRESIDENT OF
THE SENATE

Lorraine F. Lombardi
CHIEF CLERK OF THE HOUSE
OF REPRESENTATIVES

Marjorie L. Nielson
SECRETARY OF
THE SENATE

APPROVED JUNE 6, 1995 11:20 AM

Richard D. Lamm
GOVERNOR OF THE STATE OF COLORADO