

# **GUIDE TO CONSTRUCTION AND ADMINISTRATION OF DAMS IN COLORADO**



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

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## COLORADO'S SAFETY OF DAMS PROGRAM

This guide provides general information related to the requirements for construction and administration of dams in Colorado. *Owners are advised to seek professional help in constructing or repairing a dam.* Colorado laws governing dams and reservoirs were enacted for the protection of lives and property due to potential hazards associated with the storage of water in the reservoir behind a dam. The owner of the dam is responsible for the safe storage of water impounded in the reservoir.

There are specific construction and administration requirements depending on the category of a dam. The categories are as follows:

**Jurisdictional Size Dams**  
**Non-Jurisdictional Size Dams**  
**Livestock Water Tanks (LSWT)**  
**Erosion Control Dams (ECD)**  
**Exempt Structures**

Laws that are contained in the Colorado Revised Statutes (C.R.S.) establish specific requirements for each type of dam.

**Jurisdictional and Non-Jurisdictional Size Dams, Exempt Structures, and Erosion Control Dams** are governed by the following:

- Sections 37-87-101 thru 125 C.R.S. (1973) (Current Supp.)
- Rules and Regulations for Dam Safety and Dam Construction (September 30, 1988)

**Livestock Water Tanks** are regulated by:

- Sections 35-49-101 thru 116 C.R.S. (1973) (Current Supp.)

The owner of a dam and/or irrigation ditch has responsibilities, and the Division Engineer in charge of each Water Division has additional related authorities, under the following statutes:

- Section 37-84 Inclusive C.R.S. (1973) (Current Supp.)
- Section 37-92 Inclusive C.R.S. (1973) (Current Supp.)

During reservoir construction, any excavation that intercepts ground water may need a well permit. Please consult your local Water Division office for further information on well permitting requirements.

Typical requirements for constructing a dam include: obtaining a permit for a LSWT or ECD; approval of the State Engineer for construction or repair of a jurisdictional size dam; and certification of the construction. Additional requirements may include obtaining water rights and complying with laws governing administration of water rights. Contact your local Water Division office or District Water Court for additional water right information.

**Jurisdictional Size Dams** must be approved by the State Engineer before construction. These dams are structures having a statutory height greater than ten feet to the spillway crest, or creating a reservoir with more than 100 acre-feet of water, or covering more than 20 acres at the high waterline. The statutory height is measured vertically at the centerline of the dam's crest from the lowest point in the natural stream channel or ground surface to the crest of the spillway (see Figure 1). *If an outlet works is constructed below the natural ground surface, the vertical height shall be measured from the bottom of the outlet pipe at the centerline of the dam.*

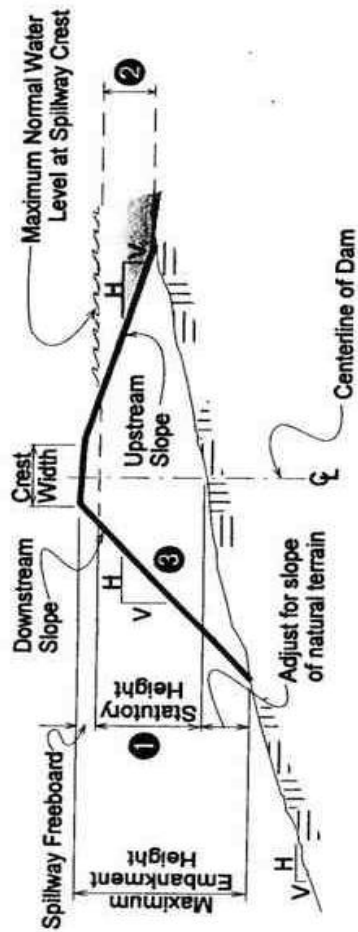
To construct a new jurisdictional size dam, or to repair, alter, or modify an existing jurisdictional size dam, the State Engineer must be provided a detailed set of plans and specifications for the construction. The documents must be prepared by a professional engineer, licensed in Colorado, who is familiar with current practices of dam design and construction in accordance with the Rules and Regulations for Dam Safety and Dam Construction, September 30, 1988. Design reports must also accompany the plans and specifications and include documentation and calculations to support the design.

An application form and a filing fee must accompany the submittal. The application form is available from the Office of the State Engineer in Denver, from any of the Water Division offices, or from the DWR website. The filing fee is based on the estimated cost of engineering and construction. The required fee is calculated at a rate of \$3 per \$1,000 of the estimated cost or fraction thereof, but not less than \$100 nor more than \$3,000.

The owner must have approval before construction begins. The State Engineer is responsible for reviewing and approving the plans and specifications in a timely manner.

A state dam safety engineer will make inspections during construction to check the progress of work and to ensure compliance with the approved plans. A final inspection must be performed and construction certified by the owner's engineer before water may be stored.

Figure 1: Dam Cross Section at Maximum Embankment Height



**NOTES**

- 1 Statutory Height is measured at centerline of the dam according to 37-87-105 C.R.S.
- 2 Height of Livestock Water Tanks and Erosion Control Dams is measured at the upstream toe of the dam.
- 3 Slopes are expressed as a ratio of the horizontal (H) distance to the vertical distance (V). Typically, the Downstream Slope is 2:1 and the Upstream Slope is 3:1.

**Non-Jurisdictional Size Dams** are smaller in size than jurisdictional size dams. Plans and specifications are not required for construction, however, filing of a Notice of Intent to Construct a Non-Jurisdictional Water Impoundment Structure is required. The form may be obtained from the Office of the State Engineer in Denver, from any Water Division office, or from the DWR website, and must be filed 10 days prior to construction. No fee is required to file the Notice of Intent form. The Division Engineer may require an outlet pipe with a regulating gate to be installed in the bottom of the dam to prevent injury to existing water rights. Because any dam, regardless of size, has the potential to cause damage downstream if it should fail, the owner is advised to consult a person familiar with dam construction to ensure the dam is constructed properly. The Notice of Intent form shall be submitted to the Division Engineer of the Water Division in which the dam is to be located as listed on pages 6 and 7.

**Livestock Water Tanks (LSWT)** require a permit from the State Engineer. These dams must be constructed on normally dry watercourses, are constructed to capture runoff water on rangeland to provide water for livestock, and may not be used for irrigation. A normally dry watercourse or stream is considered dry 80% of the time. The vertical height of the dam cannot exceed fifteen feet from the bottom of the channel to the bottom of the spillway. The height is measured at the toe of the upstream slope where the dam contacts the ground surface. The spillway must have a minimum freeboard of four feet to the dam crest (see Figure1). Impoundment volume of the reservoir cannot exceed ten acre-feet at the emergency spillway level. The dam and spillway must comply with standard specifications. An engineered design may be used as an alternative.

The LSWT does not require water rights for its use. A number is assigned a LSWT when the application is approved. The priority of the tanks is in accordance with the tank having the lowest number having priority in relation to the numbers assigned to each LSWT on a given stream system. An outlet pipe with a regulating gate is required unless specifically waived by the Division Engineer during review of the application. Standard specifications and application forms are available from the Office of the State Engineer in Denver, from any Water Division office, or from the DWR website. The application, along with a \$15 fee, must be submitted to the local Water Division office listed on pages 6 and 7. Construction may begin upon approval of the application by the Division Engineer. The U.S. Natural Resources Conservation Service may assist owners in preparing an application, or owners may wish to hire a Licensed Professional Engineer experienced in dam design for assistance.

**Erosion Control Dams (ECD)** also require a permit from the Office of the State Engineer. These dams must be constructed on normally dry watercourses and are only for the purpose of controlling soil erosion caused by floods. The vertical height of the dam cannot exceed fifteen feet from the bottom of the channel to the bottom of the spillway. The height is measured at the toe of the upstream slope where the dam contacts the ground surface. The spillway must have a minimum freeboard of four feet to the dam crest (see Figure 1). Impoundment volume of the reservoir cannot exceed ten acre-feet at the emergency spillway level. An ECD with more than two acre-feet capacity must have an ungated outlet conduit large enough to pass stored water in excess of two acre-feet within a 36-hour period, but not less than 12-inch diameter. The vertical location of the outlet must be at or below the two acre-feet storage volume level. A water right is not required for an ECD but a number is assigned, similar to a LSWT. Since an ECD is not intended to store water, a priority is not assigned.

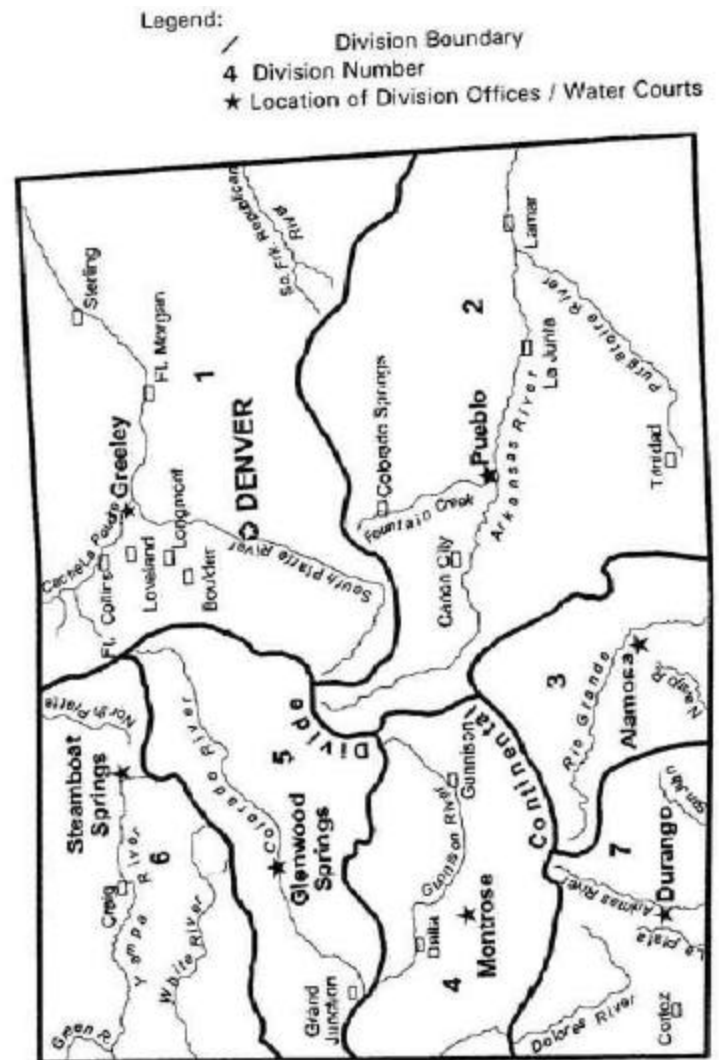
Standard specifications and application forms are available from any Water Division office or the DWR website. The application, along with a \$15 fee, must be submitted to the Water Division office. Construction may begin upon approval of the application by the Division Engineer. The U.S. Natural Resources Conservation Service may assist owners in preparing an application, or owners may wish to hire a Licensed Professional Engineer for assistance.

**Exempt structures** are defined by statute. These structures are all other types of dams constructed for purposes other than storage of water. Statutes pertaining to other state agencies govern exempt structures. For example, the Division of Minerals and Geology, Mined Land Reclamation Board regulates mine-tailing dams. The following list of structures contains those normally exempt from regulation by the Office of the State Engineer:

- Mill Tailings Impoundments
- Coal Mine Siltation Structures
- Liquid Mill or Mine Tailing Structures
- Highway or Road Fills
- Railroad Embankments
- Refuse Embankments

**Other permits** may be required for the construction of any dam, such as local building permits, 404 permits from the U. S. Army Corps of Engineers, and air quality permits from the Colorado Department of Public Health and Environment.

Figure 2: Map of Colorado Water Division Boundaries And Major Drainage Systems



**HEADQUARTERS** for the Office of the State Engineer, Division of Water Resources is:

**1313 Sherman Street, Room 818  
 Denver, CO 80203  
 (303) 866-3581 Fax (303) 866-3589  
<http://www.water.state.co.us>**

Each **WATER DIVISION OFFICE** is assigned a resident Dam Safety Engineer. Questions relating to dams may be directed to the Water Division office in your area. Listed below are the addresses for the seven Water Divisions. The map on the preceding page shows the Water Division boundaries.

<u>Division</u>	<u>Office Address</u>
1	810 9th Street, Suite 200 Greeley, CO 80631 (970) 352-8712 Fax (970) 392-1816
2	310 East Abriendo, Suite B Pueblo, CO 81004 (719) 542-3368 Fax (719) 544-0800
3	301 Murphy Drive Alamosa, CO 81101 (719) 589-6683 Fax (719) 589-6685
4	1871 East Main St P.O. Box 456 Montrose, CO 81402 (970) 249-6622 Fax (970) 249-8728
5	50633 U. S. Hwy 6&24 (East side entrance) P.O. Box 396 Glenwood Springs, CO 81602 (970) 945-5665 Fax (970) 945-8741
6	505 Anglers Dr., Suite 101 P.O. Box 773450 Steamboat Springs, CO 80477 (970) 879-0272 Fax (970) 879-1070
7	701 Camino Del Rio, Suite 205 Durango, CO 81301 (970) 247-1845 Fax (970) 259-0944
Grand Junction Dam Safety Office	2754 Compass Drive #175 Grand Junction, CO 81506 (970) 245-8355

**Colorado's Safety of Dams Program** is carried out by the Office of the State Engineer, Dam Safety Branch. The requirements and responsibilities in relation to the safety of dams are set forth by the statutes and enforced by rules and regulations. The branch is responsible for review of the plans for the construction or repair of dams, including construction inspections, and for the safety inspections of existing dams. Each Water Division office is assigned a Dam Safety Engineer. The Denver office is staffed with a Design Review Engineer and the Chief Dam Safety Engineer. The original inspection files are maintained in the Water Division offices, and the plans and specifications files are maintained in the Denver office. Correspondence and recent inspection files may also be reviewed in the Denver office.

Applications for construction or repair of a dam are reviewed to ensure they are in compliance with the Rules and Regulations for Dam Safety and Dam Construction and with established design practices. By statute, the State Engineer must issue a written decision on the acceptability of any plans within 180 days from the date received. Once approved, the owner of the dam may proceed with construction. The work is inspected during construction to ensure compliance with the approved plans. A final inspection will also be performed before the dam will be approved for use.

All existing dams are inspected in accordance with the State Engineer's policy. To assist in establishing inspection priorities, dams are categorized according to the potential for loss of life and property damage in the event the dam should fail. Dams which pose a threat to life and property should the dam fail (High Hazard) are the highest priority. Dams where no loss of life is expected, but property damage would be significant (Significant Hazard) are the next highest priority. Smaller dams with less significant damage potential (Low Hazard) are the third highest priority. Dams that would only damage the owner's property (No Public Hazard) are generally only inspected if a complaint is filed.

Written reports of inspections provide information to owners about the overall condition of the dam, recommended maintenance or repairs, and the safe storage level. Dam Safety Engineers in the Water Division offices can also assist an owner and their engineer in preparing construction or repair plans. Success of the Dam Safety Program depends on public awareness of the potential hazards posed by dams, cooperation of the owners, and participation by the engineering community. For assistance, contact the respective Water Division office. For additional information, see Table 1 for a list of available publications and/or maps.

## LIABILITY AND INSURANCE

**Colorado law** states that no entity or owner of a reservoir (dam) shall be liable for damages resulting from failure of the structure unless caused by negligence. In addition, no stockholder, officer, or member of the board for a company owning a reservoir (dam), shall be liable for damages if the company has a valid insurance policy in effect at the time of the incident, with coverage for an aggregate amount of \$500,000 or an adequate substitute for insurance such as a bond (Section 37-87-104, C.R.S.).

Operating and maintaining a safe structure in accordance with the statutes and the Rules and Regulations for Dam Safety and Dam Construction is the first step in assuring protection against the exposure of liability. This work includes monitoring, periodic inspections by a qualified licensed professional engineer, and timely maintenance and repair.

**Emergency Action Plans (EAP)** contain prescribed actions for possible emergency situations that may occur at a dam. The principle objectives of an EAP are to prevent loss of life and to minimize property damage from a dam failure. Even though information might be similar for several dams in a local area, each dam has its own characteristics, making an individualized plan necessary for each dam. To assist in preparation, a model EAP can be obtained from the Office of the State Engineer in Denver, from any Water Division office, or from the DWR website.

The regulations require owners of High and Significant Hazard dams to have a copy of their EAP on file with the Office of the State Engineer. The owner must also provide the Colorado Office of Emergency Management and the Local Emergency Manager with a copy of the plan. An EAP is not required for Low Hazard and No Public Hazard dams, but a plan would be valuable for the owner to help mitigate damages and liabilities.

## WATER RIGHTS

**Constructing** a dam to create a reservoir does not assure the owner the right to store water. On the other hand, having a water right does not constitute an approval to construct the dam. A water right must be obtained through the Water Court. Approval for construction of a dam must be obtained from the State Engineer.

The Office of the State Engineer has responsibility for both Dam Safety and Water Administration. An owner will be allowed to store water if the State Engineer has determined the dam is safe and water is legally available. Any Water Division office can answer questions related to water rights, how to apply for water rights, and how the available water in the streams and rivers are allocated.

## SOURCES OF FINANCIAL ASSISTANCE

**Financial** programs to assist with the cost of construction or repair of a dam are available from several state and federal agencies. Following is a partial list of agencies with loan programs known at the time of publication:

- Colorado Water Conservation Board (CWCB)
- Colorado Water Resources and Power Development Authority
- Colorado Division of Wildlife
- U.S. Agricultural Stabilization and Conservation Service (ACSC)
- U.S. Natural Resources Conservation Service (NRCS)
- U.S. Farmer's Home Administration (FMHA)
- U.S. Bureau of Reclamation

Money may be available in the form of low interest loans, grants, and/or cost-sharing depending on the purpose of the dam (see Table 2). Contact the local office of the agency for more information.

**TABLE 1**  
**OFFICE OF THE STATE ENGINEER**  
**SAFETY OF DAMS PROGRAM**  
**REFERENCE PUBLICATIONS**

**1. Rules and Regulations for Dam Safety and Dam Construction**

(September 30, 1988)

These rules are promulgated pursuant to the authority given to the State Engineer in Sections 37-87-102 and 37-87-105, C.R.S. (1973 & 1988 Supp.) and Section 37-80-102(11k), C.R.S. (1973), pursuant to Section 24-4-103, C.R.S. (1973).

**2. Dam Safety Project Review Guide**

(May 16, 1996) (No Charge)

This guide provides information for the engineering community involved in the design of dams under Colorado statutes, including specific directives for submitting plans and specifications.

**3. Model for Preparing a Dam Safety Emergency Action Plan**

(April 1997) (No Charge)

This model was developed to provide the minimum information required to complete an acceptable Emergency Action Plan.

**4. State of Colorado Dam Safety Manual**

(Revised January 2002)

This manual provides specific guidance to dam owners on how to maintain a safe dam.

**5. Water Division and District Boundaries Map**

(1979)

This is a map showing the seven divisions along with their water districts, rivers, and drainages.

*Note:* Copies of these publications may be obtained from the Office of the State Engineer for fees established by regulation or statute, or from the DWR website at <http://www.water.state.co.us>.

**TABLE 2: AGENCY FINANCE PROGRAMS**

AGENCY	LOAN/GRANT	TERMS
Agricultural Stabilization and Conservation Service (ASCS)	Cost sharing assistance for a maximum of \$3,500 per year per person, or \$10,000 per entity.	Generally one year cost sharing per project, except for qualifying long term agreements (LTA's).
Bureau of Reclamation	Loans up to 2/3 of maximum allowable total project costs. Grants are available for multi-purpose with flood control recreation or fish and wildlife.	Interest-bearing loans for municipal or industrial supply and power generation. Interest rate is determined at time of loan. Loans up to a maximum of 40 years.
Colorado Water Conservation Board (CWCB)	Loans generally up to 50% of project cost. No grants.	Currently, interest rate are about 5%. Loans up to a maximum of 4 years.
Colorado Water Resources and Power Development Authority	Loans funded through revenue bonds. No grants.	Application must show ability to repay loan. Loans up to 30 years.
Farmer's Home Administration (FMHA) Community & Business Programs	Loans up to 100% of the project cost. Grants up to 75% of eligible project cost.	Interest rate depends on median income of community. Loans up to a maximum of 40 years.
Farmer's Home Administration (FMHA) Farm Programs Division	Amount of loan depends on needs. If FMHA makes the loan directly, the maximum is \$200,000. If a private lender makes the loan, FMHA guarantees 90% repayment up to \$300,000.	Call for approximate interest rates. Loans up to a maximum of 40 years.
Natural Resources Conservation Service	Cost sharing up to 70% of project costs for Livestock Water Tanks or Erosion Control Dams. Cost sharing up to 50% of project costs for irrigation structures.	Determined by local county offices. Contract for a lump sum of up to \$35,000. Structures must be built within 3 to 10 years.

CLIENTS	COMMENTS
Agricultural procedures	Cost sharing through the Agricultural Conservation Program (ACP). For priority conservation projects as determined by local county ASCS offices. Structures must be maintained by recipients for 10 years or ACP money must be refunded. Technical assistance must be done through NRCS. No application fee.
Government agencies, political subdivisions, conservancy districts, irrigation districts, water-user organizations and interstate compact agencies.	Water use must include irrigation. Loan/grants under the Small Reclamation Project Act of 1956 (Public Law 84-984). Cost \$5000 to process application plus the cost of any special studies.
All water users	For recreation and rehabilitation of raw water storage and transmission. Application is processed not at cost, but a feasibility study is required.
Public entities such as municipalities and conservancy districts.	For all types of water use. No application fee.
Rural municipalities with populations under 10,000, water districts, non-profit water association and Indian Tribes.	For domestic water. Applicants must be unable to obtain credit elsewhere. No application fee.
Individual farmers, ranchers, qualifying corporations, partnerships, and co-ops.	For irrigation, drainage improvement, soil and water conservation. Applicants must be unable to obtain credit elsewhere. For erosion control projects, FMHA recommends costs sharing through ASCS and use of SCS to help design the structure. No application fee.
Non-urban individuals or entities in the plains counties or the San Luis Valley.	Cost sharing available through the Great Plains Conservation Program (GPCP). The program also has a maintenance agreement which is related to the contract term. If the maintenance agreement is not kept, the client must return GPCP money. No application fee.

*Note: A client may be able to combine funding from several of the above sources to raise the necessary capital to build a dam.*