C O L O R A D O P A R K S & W I L D L I F E

Dam Maintenance and Safety

Colorado Parks and Wildlife Dams

In addition to managing state parks and wildlife areas, outdoor recreation opportunities, and Colorado's wildlife, CPW owns and operates many dams throughout the state. With an inventory of over 115 dams, CPW is the largest dam owner in Colorado. The water impounded by CPW's dams is used for downstream irrigation, fish hatcheries' operations, and a multitude of recreational activities including fishing, boating and swimming.
CPW's reservoirs are some of the most popular places to visit in the state. However, public infrastructure and population centers are often located downstream, which increases the likelihood of devastating consequences in the event of a dam failure. As such, maintenance and rehabilitation of CPW's dams is paramount for upholding its commitment to public safety.

Public Safety is CPW's First Priority

Who oversees CPW's dams?
CPW has three full-time Dam Safety Engineers who, with the help of other dedicated staff located around the state, manage all the work and monitoring on CPW's dams. They perform regular dam safety inspections on all CPW-owned dams and maintain current Emergency Action Plans for First Responders.
CPW is making dam rehabilitation a priority by allocating capital construction funds to dam improvement projects ahead of less critical capital construction projects. Prioritizing the financial needs of CPW's dams has allowed for significant improvements in the operating condition of CPW's dam inventory over the last few years.

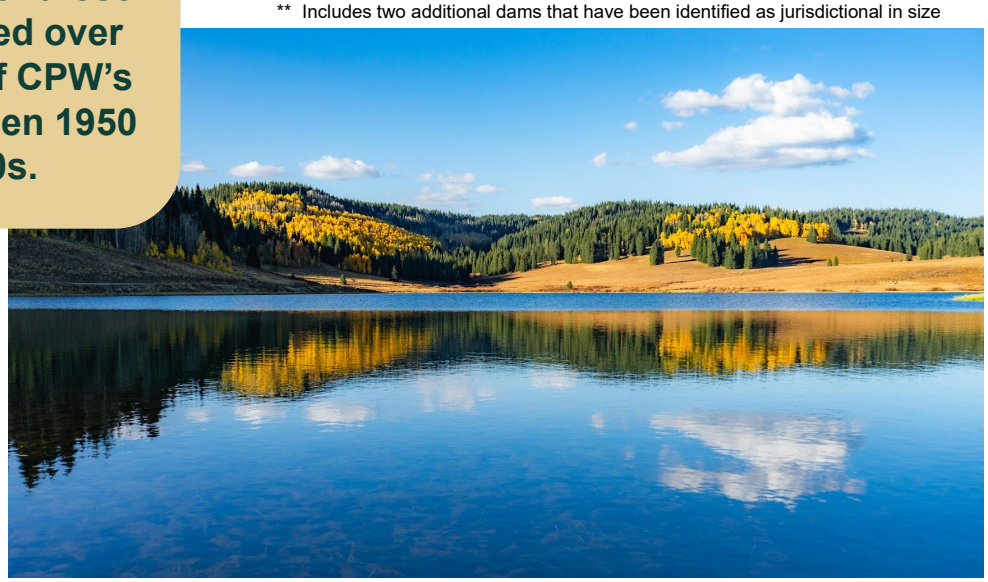
The average age of CPW's High and Significant Hazard dams is 74 years. Six of these dams were constructed over 100 years ago. Most of CPW's dams were built between 1950 and the mid-1970s.

Hazard Classification of CPW's Dams

CPW owns over 115 dams, of which 90 are jurisdictional. A dam is considered jurisdictional once its size is large enough to threaten human life and/or property downstream if it should fail. A jurisdictional dam is given one of four hazard classifications, based on the criteria below. As a dam's assigned hazard level increases, so too do the regulations and degree of resiliency required of the dam's operations and its appurtenant structures.

Classification (Based on CO Dam Safety Standards)	Number of CPW Dams
Total Jurisdictional — A dam exceeding 10 feet in height, 20 acres in surface area, or 100 acre-feet storage	92**
High Hazard — Loss of human life expected in the event of dam failure	22*
Significant Hazard — Significant damage expected in the event of dam failure, no life loss expected	15
Low Hazard & No Public Hazard — Minor damage expected in the event of dam failure that will be confined to non-critical infrastructure (low hazard) or CPW property only (No Public Hazard), no life loss expected	55**
Non-Jurisdictional — A dam having less than or equivalent to 10 feet in height, 20 acres in surface area, and 100 acre-feet storage	27+
Total number of CPW dams	119+

* Since 2016, five dams have been reclassified from Low or Significant Hazard to High Hazard, following a change to public safety conditions downstream
** Includes two additional dams that have been identified as jurisdictional in size



Meadow Creek Dam, Garfield County

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Funding CPW Projects

By State statute, Parks funding and Wildlife funding must remain separate; therefore, CPW cannot use Parks funds to fix dams in State Wildlife Areas, and vice versa. Funds are strictly monitored when completing these projects.

What is CPW doing about its dams?

As dams age and their structures deteriorate, more involved activities are needed to bring them back into compliance with safety regulations. Given the significant costs associated with those necessary repairs and maintenance, CPW performed a Screening Level Risk Analysis (SLRA) study in 2014 to provide an overview of its dams' risk profiles and assist in the prioritization of future projects. The SLRA study identified the most critical rehabilitation needs on CPW's High and Significant Hazard dams. The SLRA evaluated the potential risk of CPW's High and Significant hazard dams based on the following criteria in the event of a dam failure:

Primary consideration

- Loss of human life downstream

Secondary Consideration

- Environmental impacts
- Economic impacts
- Recreational impacts

Based on these measures, the SLRA identified 11 dams in CPW's portfolio that posed a higher risk than the others. Since the 2014 release of the SLRA's findings, 4 additional dams were added to that list when their routine safety inspections revealed conditions that surpassed an acceptable level of risk. Of these 15 dams, 3 are Parks-owned dams and 12 are Wildlife-owned dams. There is also a cost to maintaining and rehabilitating the dams posing a less critical risk. The current maintenance and repair estimate for all of CPW's dams is approximately $120.7 million. Most of this cost will be incurred by the wildlife part of the agency, as the majority of the dams are Wildlife-owned.

Funding for CPW dams

The majority of Parks dams are funded with Colorado Lottery and GOCO money, while the majority of Wildlife dams are funded with wildlife cash funds (money gained through license sales), federal match dollars, and more recently, GOCO funds. By funding a 50 percent reduction to the backlog of CPW's dam maintenance and repairs, the 2018 Future Generations Act will allow CPW to further reduce risks to life and property and sustain water-based recreation opportunities.

Since July 2015, CPW has further allocated funding for routine dam

maintenance. The availability of this maintenance funding allows for proactive attention and care for these assets in an effort to reduce the need for large-scale, costly rehabilitation that can result from prolonged deferred maintenance.

Over the last five years, CPW has experienced at least one emergency dam repair annually. Projects of this nature require a quick response and reallocation of available funds, including dam maintenance funds, to stabilize rapidly developing, adverse conditions.

2021 CPW Successes

- **Critical repair items at North Michigan Creek Dam were completed on-time and within budget.**
- **Repairs at Chief Creek #4 Dam were completed within budget.**
- **Remote monitoring was successfully installed at 4 High and Significant Hazard dams this year.**

CPW Challenges

The total maintenance and repair estimate for all CPW dams is $120.7 million. CPW has allocated over $71.5 million for this work, leaving $49.2 million in funding needs remaining. The majority of the remaining work is for Wildlife-owned dams.

Tarryall Dam, Park County

Summary of CPW's Highest Risk Dams as of January 2022

Dam	Remaining Needs as of January 2022	Status as of January 2022
Alberta Park (W) High Hazard Area 17 – SW Mineral County Constructed: 1953	Dam Rehabilitation to address: - Inadequate spillway flow capacity and deteriorated condition - Deteriorating outlet conduit and outlet gate - Inadequate seepage control - Set monitoring instrumentation as required by the SEO for High Hazard dam	Unforeseen emergency repair work was needed in July 2017 during initial reconnaissance work for the outlet rehab design. Following the emergency repair, it was decided to pursue a full dam rehab and not just an outlet rehab first. Planning and preliminary design work completed in 2021 included a Hydrology Study, Geological Study, and Dam Rehabilitation Alternatives Analysis for a full rehabilitation. During 2022, work will continue on development of the rehabilitation design for the dam, through a CM/GC design and preconstruction approach. Construction of the rehabilitation is anticipated to begin during summer 2023.
Willow Creek (P) High Hazard Steamboat Lake SP Area 10 – NW Routt County Constructed: 1966	- Maintenance for the remote data acquisition system to increase reliability - Installation of new operator for the low flow gate - Seepage mitigation system maintenance	Construction was completed in Fall 2018 that included rehab of the outlet works system and structure, installation of a seepage mitigation system, and installation of a remote data acquisition system. The construction completed in 2018 adequately addressed dam safety concerns. Operations and maintenance items remain.
Rito Hondo (W) Significant Hazard Area 17 – SW Hinsdale County Constructed: 1956	- Address loss of seepage control on embankment and abutments - Evaluate and address spillway deficiencies - Set monitoring instrumentation as required by the SEO	Outlet works rehabilitation construction was completed in 2019 and the reservoir was refilled in spring 2020. Unforeseen emergency drawdown of the reservoir was required in summer 2020 due to a loss of seepage control following refilling. The reservoir is currently empty due to a 'zero storage restriction'. Planning and preliminary design work for a complete dam rehabilitation was started in 2021, which includes a Hydrology Study, Geological/ Geotechnical Study, and Dam Rehabilitation Alternatives Analysis. The planning and preliminary design work is anticipated to be complete by mid-2022. During mid-late 2022, work will continue on development of the rehabilitation design for the dam, likely through a CM/GC design and preconstruction approach. Construction of the rehabilitation is anticipated to begin during summer 2023 or 2024.
Trujillo Meadows (W) High Hazard Area 17 – SW Conejos County Constructed: 1956	- Spillway modification to prevent backwater of outlet and erosion encroachment on dam due to current alignment - Set monitoring implements as required by the SEO	Construction to address deteriorated outlet works was completed as of October 2018, which adequately addressed the pressing dam safety concerns. Operations and maintenance items remain. A Hydrology Study is planned for FY 23. The Study will inform potential spillway modifications to meet State Dam Safety criteria. A risk-informed prioritization will then be used to determine the scope and timing of a future spillway rehabilitation project.
Big Meadows (W) High Hazard Area 17 – SW Mineral County Constructed: 1968	- Piezometer and seepage monitoring on main dam and saddle dam	Video inspection of outlet works completed in 2021 identified that the outlet gate leaf is in adequate condition and is not cracked. CPW plans to begin instrumentation installation and seepage investigation efforts in summer 2022.
Spring Creek (W) High Hazard Area 16 – SW Gunnison County Constructed: 1961	- Investigate and repair deteriorating concrete service spillway - Set additional monitoring implements as required by SEO	Construction to rehabilitate outlet pipe and improve dam monitoring implements was nearly completed in 2021. Installation of gate and operator to be completed spring 2022. Future Project will address other deficiencies with spillway.
Sylvan Lake (P) High Hazard Sylvan Lake SP Area 8 – NW Eagle County Constructed: 1947	- No further repairs are needed at this time	Construction was completed in Summer 2020, which addressed: - RCC overtopping protection due to undersized spillway - Replace deteriorated outlet conduit - Rehab deteriorating outlet gate - Set monitoring implements as required by SEO Warranty work occurred in Winter of 2021, and the dam is now considered to be fully repaired. Finalization of the remote data acquisition system is nearly complete.
Black Lake #2 (W) High Hazard Area 8 – NW Eagle County Constructed: 1957	- Evaluate if an Early Warning System Program is justified/required	A Hydrology Study was completed by CPW during 2021. The study indicated that an Early Warning System Program (EWSP) may be required due to the existing spillway size. CPW plans to evaluate implementing an EWSP during 2022 or 2023.
Haviland Lake (W) High Hazard Area 15 – SW La Plata County Constructed: 1927	- Evaluate and plan for potential rehab needs due to suspected undersized spillway - Set monitoring implements as required by the SEO	Construction for outlet rehabilitation was finalized in Spring 2021. The reservoir was equipped with a remote data acquisition system in Fall 2021. A Hydrology Study is planned for FY 23. The Study will inform potential dam modifications that will be needed to achieve safety of the 95-year-old structure and SEO compliance for spillway capacity. A risk-informed prioritization will then be used to determine the scope and timing of a future spillway rehabilitation project.
Chief Creek #4 (W) Significant Hazard Area 3 – NE Yuma County Constructed: 1956	- Potential rehab for deteriorated and undersized spillway	Construction was completed in early 2021 that resulted in a rehabbed outlet conduit, new gate, repaired upstream concrete slope protection, abandoned obsolete conduit, and improved dam monitoring implements. Additional analysis to assess the need for spillway modifications will be completed in 2022.
Tarryall (W) High Hazard Area 1 – NE Park County Constructed: 1929	- Left abutment rock stabilization - Downstream material scour protection - Repair to joints and waterstops to limit leakage	The alternatives analysis was completed in 2021. This included completion of the risk analysis, structural analyses, hydrology study, preliminary hydraulic analysis, and development of the preferred alternative. The results of the analyses aided in the development of reasonable risk estimates and a targeted conceptual design. Phase 2, preconstruction and completion of the final design for rehabilitation will begin early 2022.
Two Buttes (W) High Hazard Area 12 – SE Baca County Constructed: 1908	- Rehabilitate intake tower - Implement early warning system program as required by SEO	Construction to replace the outlet gates was completed in spring 2021. Construction to rehabilitate the intake tower will begin in February 2022 and should be complete by April 2022. Early Warning System Program planning began in 2021 and program implementation is planned to completed in 2022, which is anticipated to result in the storage restriction being removed by SEO.
North Michigan Creek (P) Significant Hazard State Forest SP Area 10 – NW Jackson County Constructed: 1963	Construction needed (Phase II): - Minor site reclamation, permanent fencing and revegetation	Phase I was completed in Spring 2021 and covered final engineering design and preconstruction planning for a full rehabilitation. To reduce construction risks, early contractor involvement was used for the rehab project. Phase II construction is approximately 98% complete and only minor, non-critical work items remain. Between June and December of 2021, the following work was completed: - Remove and replace deteriorated spillway - Construct internal filter system at right abutment and under spillway to address significant seepage problem - Comprehensive outlet works rehabilitation, including installation of a cured-in-place pipe, a new gate and new intake structure - Set monitoring implements as required by the SEO; install remote data acquisition system In Spring of 2022 after the remaining work is completed, the dam will be fully repaired on time and within the original project budget.
Skaguay (W) Significant Hazard Area 13/14 – SE Teller County Constructed: 1901	- Investigate, design, and rehab upstream steel face - Rehab spillway and outlet works, including structural analysis of retaining wall - Set monitoring requirements by the SEO	Gate stem replaced and outlet works inspection completed in Spring 2018. Hazard Classification Study completed in 2021 that confirmed Significant Hazard classification. Additional monitoring began in 2021 and will continue in 2022. Vegetation Maintenance on the dam and in the spillway was completed in 2021.
Beaver Park (W) High Hazard Area 17 – SW Rio Grande County Constructed: 1912	- Site work needed to eliminate inundation of adjacent, low-lying areas when reservoir is at full storage - Troubleshooting the integrated controls systems related to the outlet works	Construction on this 110-year-old dam was completed in 2016, which addressed deficiencies with the spillway, outlet works, seepage, slope instability, and access limitations. Road improvements are planned for Summer 2022, which will address low-lying areas adjacent to the reservoir. Troubleshooting on the outlet works systems is as complete as it can be at this time. Final project scope will be completed in Spring 2022 when the reservoir is at full storage and the high-elevation site can be accessed again.

(W): Wildlife-owned dam; (P) Parks-owned dam
SEO: Colorado Dam Safety Branch (Regulatory authority under the CO State Engineer's Office)