

A NEW ERA IN RIVER MANAGEMENT: DEVELOPING POLICIES FOR DAM REMOVAL

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Abstract

The recent surge in dam removals across the United States marks the beginning of a new era in water resource management. Increased structural repair and maintenance costs for aging facilities and an expansion in approaches toward river restoration have propelled the removal of over 500 dams nationwide. While there are many water resource professionals who have praised this recent trend, others have raised concerns over removals. One issue of concern is the lack of a consistent protocol for assessing the impacts and making decisions regarding a dam's removal, and for monitoring and evaluating the results. New England has numerous older dams, an increasing number of which are considered to be safety hazards. Additionally some of these facilities are located on rivers targeted for ecosystem restoration programs. As a result, government agencies that regulate dams have felt increased pressure to raze them as a way to address safety and ecosystem hazards. This paper focuses on the decision-making process that occurs around dam removal and the status of state policies available to structure it. The process of dismantling dams within New England and the conditions that facilitate as well as impede the process are examined. The consideration of dam removal in New England highlights the need for unambiguous and uniform policies to evaluate dam removal proposals, key leadership to help navigate the removal process and secure critical funding, and guidelines for monitoring the post-removal impacts.

Keywords: *Dam Removal, Removal Policies, Ecosystem Restoration, New England*

1 INTRODUCTION

In the 20th Century, dams emerged as powerful symbols of modernization and economic prosperity for countries around the globe. The United States, a leader in large dam construction during the past century, has approximately 76,000 dams over 1.8 meters (6 feet) in height with 5,500 of these over 15.25 meters (50 feet) (USACE 2000). In addition to these larger dams, approximately 2 million smaller structures, some several centuries old, can be found in U.S. rivers and streams (Haberman 1995). The vast infrastructure of dams offer a host of water-related social benefits. Dams provide water supplies, hydroelectric power, recreation and navigation. While the vast majority of dams in the U.S. will continue to provide these benefits well into the 21st Century, a significant number of dams have been removed during the last decade and an increasing number have been targeted for removal in the near future.

With roughly 500 removals across the country, the U.S. now leads the world in razing dams (American Rivers *et al.* 1999). Dam removal has been actively pursued for a variety of reasons including safety concerns, environmental issues, and/or the cost associated with repair or retrofitting. Often, a dam is removed for a combination of reasons. Until recently, however, the rationale behind most removals was not adequately documented.

While dam removal is not an entirely new concept, a trend toward increased removals has occurred since the 1990s. Today, dam removal has clearly emerged as a viable management option across the country. Despite this, policies to guide both the evaluation of dams for removal and the dismantling process itself are largely lacking at both the national and state levels. Essentially, at the federal level, no overarching policies exist to address dam removal.

At the state level, only a handful of states have developed policies and programs specifically covering present day dam removals. Baish, David and Graf (2002, 22) state that as a result of the lack of policy "...the decisionmaking process most often must be reinvented for each individual case." This can result in a confusing and lengthily process for those who attempt to navigate it. Doyle, Harbor and Stanley (2003) point-out that a case-by-case approach is only acceptable if a few dams are under consideration. It appears that a number of states are reaching a point at which dam removal is increasingly considered as a viable management option. Therefore, a clear decision-making protocol and evaluation criteria is needed.

Much national media attention has focused on the debate over large dam removals that fall under the purview of federal agencies. However, far more decisions are being made by state agencies over the fate of smaller facilities. Indeed, most dams removed have been small, privately owned, older facilities, a number of which are considered obsolete in function (Poff and Hart 2002). The decision to call for, undertake, or simply approval these removals has largely fallen to the natural resource agencies within states. As the number of dams considered for removal has greatly increased within the last decade, it becomes important to examine the circumstances of removals today and more importantly the policies and programs available to guide state decision-makers.

The region of New England has a number of dams that are currently being considered for removal. Long before the national boom in large dam construction, thousands of small structures were already in place in New England. This region has depended upon small run-of-the-river structures; some built during early European settlement, to power sawmills, gristmills, and textile factories (MacBroom 1998). While dams played a vital role in the early development of New England, today many of these structures have fallen into disrepair and/or considered obsolete. Increasingly the costs of repairing, maintaining and operating many of these old facilities have exceeded the benefits produced (Trout Unlimited 2001). Additionally, recent river restoration initiatives have targeted some of these structures as ecohazards and a variety of organizations have begun to call for their elimination.

This paper focuses on dam removal in the United States and more specifically on the state level decision-making process that occurs around removals. After outlining the rationale behind dam removals and the federal and state agencies most involved, the paper will explore the process in New England, including state policies and programs. Lastly, the paper will conclude with a discussion of the conditions at the state level that facilitate the dismantling of dams.

2 RATIONALES FOR DAM REMOVAL

A number of situations have propelled dam removal in New England and across the country. Limited to no documentation is available regarding the rationale in the majority of cases. However, as the number of removals increased in the 1990s, state and federal agencies, environmental organizations, and researchers became more diligent in recording the primary reason for each removal. Thus, there is more certainty about the goals for dam removals today.

Until the last decade, the most common reason cited for disassembling a dam was safety concerns (Shuman 1995). The average life expectancy of a dam is 50 years. In 2000, over 30% of dams in the US were older (ASDSO 2002). The percentage of dams over 50 year of age will rise to 85% by the year 2020. Many dams now in operation are much older, as the functional life expectancy of some dams is considered to be 60 to 120 years (American Society of Civil Engineers 1997). The earlier dams built in this country are much older, and were originally constructed with timber, rock or earthen mounds. Overtime, some fell into disrepair and were abandoned, while others were structural modified with concrete.

In general, older facilities require increased maintenance and repair as the structural integrity is weakened and some become hazards for communities. To monitor and regulate the safety of

dams, states have typically developed routine inspection programs. If safety concerns arise, most states can require that the problem be addressed by either repair or removal.

Related to safety concerns is the high cost of repairing an aging or structurally damaged facility. In many cases, the cost of removing a small dam is significantly less than the cost of repairing it. Born and others (1998) found that in Wisconsin, small dam removal typically cost between \$100,000 and \$1 million dollars which was 3 times less than the estimated cost of repair. When repair costs fall upon private owners or a community and the dam facility is no longer producing significant benefits, removal becomes the least costly alternative (Whitelaw and MacMullan 2002). In years past, communities would attempt to finance repairs. Today these communities are increasingly considering the merits of removal as a least costly and potentially more desirable option.

While historically safety and related costs issues led states to consider most dam removals, during the 1990s an increased number of dams dismantled nationwide occurred because of environmental reasons. Neglected during much of the 20th Century, today there is a greater understanding and awareness of the environmental costs associated with dams. Dams have dramatically altered our rivers' ecosystems transforming a naturally regulated and connected system into a partial controlled and fragmented system. Dams reduce river levels, alter the timing of flows, block migrating species, increase predator risk for threatened species, and have negative impacts on water quality (Bednarek 2001; Doppelt *et al.* 1993).

Removal of a dam can result in the reconnection of riparian and aquatic habitats as natural flows are allowed to inundate adjacent land areas (Bednarek 2001). River restoration projects involving fish passage improvements for migratory species have increasingly proposed dismantling dams as an effective way to achieve restoration objectives. In the case of Maine's Edwards Dam, its removal in 1999 allowed for the migration of several native species up the coastal Kennebec, which had been blocked for 162 years.

Pohl (2002) examined 417 dam removals in the US and found that the rationale for removal was determined for only 153 structures (37%). This was largely the case for the earlier dam removals. She also found that dams removed for safety or economic reasons tended to be larger structures than dams removed for environmental reasons. However, in more recent years, more removals of dams both large and small have been pursued as a means of ecosystem restoration.

3 DECISION-MAKERS AND POLICIES FOR DAM REMOVAL

No one entity is involved with the decision to remove a dam, as it depends upon the type of dam, its functions, ownership and type and significance of the dam's impacts. Decision-making may fall to a federal agency, a state agency, or a private dam owner (Baish *et al.* 2002). The decisionmaking process to remove a dam varies depending on who initiated the removal and why. Many of the high profile dam removals such as the removal of the Edwards Dam took place as a result of a federal legal proceeding.

Two government agencies, the Federal Energy Regulatory Commission (FERC) and the US Army Corps of Engineers (USACE), are the main federal players. Bowman (2002) found that FERC is able to use 3 different regulatory powers to rule on a dam removal case: "(1) dam relicensing, (2) dam safety inspections, and (3) the surrender of a dam's operating license." This agency provides a 30 to 50-year operating license to hydroelectric facilities owned by utility companies, private entities, and municipalities. In general, during any evaluation, a dam's operation is considered in terms of its public benefits. A newer Act impacting this process is the 1986 Electric Consumers Protection Act, which requires FERC to give equal consideration to environmental costs and benefits associated with dams during the evaluation for licensing. One of the first battles over removal between FERC and a dam owner occurred in Vermont. In a 1996 Environmental Impact Statement, FERC made a landmark

recommendation for the removal of the partially breached Newport No. 11 Dam on the Clyde River in Vermont's Northeast Kingdom largely for environmental reasons.

In addition to the licensing process, FERC is called to inspect dams for safety approximately every 5 years. If safety concerns arise, a dam owner can be required to repair any problems or remove the hazardous structure. Lastly, dam owners can petition to surrender a license which then FERC can require removal as a condition for acceptance.

The US Army Corps of Engineers (USACE), under the Clean Water Act regulates dredge and fill activities on navigable waters. Approval of most dam removals requires a permit for dredging and discharging sediments. The loss of wetlands must also be considered in the issuing of this permit. The advantages of a dam removal must outweigh the negatives associated with the loss of wetlands.

Other federal agencies commonly involved in removal decisions include the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). Through the Endangered Species Act, federal agencies such as USFWS and NMFS, can rule that a dam is threatening an endangered species, thus the agencies can call for removal. These two agencies are also often consulted when considering impacts on non-endangered species. Additionally, environmental impact statements may be needed for some dam removals as a National Environmental Policy Act requirement and this will commonly necessitate USFWS and/or NMFS involvement.

At the state level, policies and programs impacting dam removal vary dramatically. In some states, dam removals fall under the wetland permitting process such as in Rhode Island. In other states, a dam removal is largely considered under statutes crafted to address dam construction such as in Connecticut. Safety legislation also impacts the approval process for dismantling dams in states. Historic preservation laws within a state many require consideration, as well as state environmental policy acts.

State regulated dams may be divided between various government agencies. For example, in Vermont the Public Service Board regulates hydroelectric dams, the Natural Resource Conservation Districts regulates many agricultural dams, and the Department of Environmental Conservation regulates all other dams and is the lead agency regarding dam removal decisions. For Maine, the Department of Environmental Protection is charged with making state decisions regarding dam removals in organized towns and cities and the Land Use Regulatory Commission, a planning, zoning and permitting agency is charged with decision-making for dams outside these organized units. In Connecticut, Massachusetts, New Hampshire and Rhode Island specific divisions within departments of environmental management have the authority to approve removals.

While more than one agency is often involved in a decision to approve and/or undertake a dam removal, there is often a lead agency who is charged with the final approval. In most cases, this is the water resources division within a department of environmental management. In some cases, a dam bureau division charged with safety inspections will make the final ruling.

4 DAM REMOVAL IN NEW ENGLAND

Dams have played a vital role in the settlement and development of New England. This region is most commonly defined as the six states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. By the mid-1800s, long before the national boom in large dam construction, thousands of small dams were already in place on almost every perennial stream in New England. Run-of-the-river structures had been built to power sawmills, gristmills, and textile factories (MacBroom 1998). While only a few meters in height, these structures played a significant roll in the region's early economic development. Many of these

older mill dams ended operations by the late 1800s. By the early 20th Century, newer dams built were typically larger, multi-purpose facilities. Hydroelectric power became an important social good produced by a number of these dams. As flood control became a national responsibility in the early 1900s, many newer structures were built to mitigate flooding.

In general, dams in New England, given their limited size, have not altered the hydrology or ecosystem to the degree that the larger dams in the western US have (Graf 1996). Still, eastern dams have not been without environmental consequences. They have impacted migratory species, stored sediments behind the structures, fragmented rivers, and modified connections between riparian and aquatic systems.

The total number of dams in New England is unknown, however, the six states track around 15,000 dam structures. While more dams can be found in the region, the vast majority of non-tracked dams are obsolete in function. Within New England, approximately 38 dams have been removed, with two-thirds of these removals occurring since 1990. The vast majority of dams removed have been smaller structures under 5 meters (15 feet) in height that no longer serve a purpose.

The state of Connecticut leads the region with approximately 16 removals. Maine and Vermont follow with 9 and 8 removals respectively. New Hampshire has dismantled 4 dams and Massachusetts 3 dams. The smallest state in the region, Rhode Island, has only removed one facility.

Two states in New England in the lead in terms of establishing policies and programs to specifically address dam removal. New Hampshire and Massachusetts have both instituted dam removal programs. In 1999, Massachusetts launched the River Restore Program. The goal of this program is assisting ecological restoration through selective removal of dams (Peltro 2002). The program targets dams that no longer serve their original purpose, and are noted for their threat to the environment and/or have become safety hazards. Housed within the state Department of Environmental Management, a coordinator manages the program, and provides assistance to agencies and private dam owners pursuing removals. While the River Restore Program is promising in terms of providing technical and even financial support, one significant barrier to dam removal in Massachusetts is the long list of state regulatory permits required. These requirements make dam removal a less attractive option for many private owners, as the application approval process is time-consuming and potentially costly.

New Hampshire, in 2000, established a River Restoration Task Force to identify removal candidates, develop a protocol for the removal process, and identify funding mechanisms. In general, the criteria for candidacy are: 1. dams with no beneficial use and an interested owner; 2. run-of-the-river facilities; and 3. dams with current safety issues. Based on the criteria, around 30 dams were selected for further removal consideration. The New Hampshire program was furthered in 2002 when a coordinator was hired to oversee the program. In first few years the River Restoration Task Force targeted and removed dams on a river in the southwest corner of the state. The 64-mile Ashuelot River, a tributary of the Connecticut River, has 23 recognizable dam sites. Programs to reintroduce the Atlantic salmon as well as other species such as Shad have driven dam removal in the basin. Two dams have been removed in the last 2 years, and a third is targeted for future dismantling.

As noted, Connecticut has razed the largest number of dams in the region. Despite this fact, they do not have an official dam removal program as found in Massachusetts and New Hampshire. Instead, Connecticut has a Migratory Barrier Task Force within the Department of Environmental Protection's Inland Fisheries Program. Connecticut's removals have taken place largely as a result of leadership provided by the state fisheries interests. For example, in the 1990s Connecticut removed 3 dams on the Naugatuck River as part of a migratory fish restoration project. The anticipated environmental benefits of the Naugatuck removals include

the restoration of shad, blueback herring, alewife and sea-run brown trout. This project has been one of the most ambitious watershed restoration efforts in the Northeast to date (American Rivers *et al.* 1999).

The states of Vermont and Maine have also progressed in terms of establishing formal groups to address dam removal. The Vermont Agency of Natural Resources established a Dam Task Force in 2000 to work with dam owners and local watershed groups to identify candidates for removal. In Maine, a Dam Removal Policy Advisory Group within the State Planning Office was established in 2002. This group, comprised of legislators, stakeholders and agency personnel, has been working toward the development of a Dam Removal Policy for the state.

Rhode Island has not progressed in terms of dam removal. Only one dam has been removed. That removal occurred in 1979 after the state declared the dam a significant safety hazard. A Governor's Task Force on Dam Safety and Maintenance recommended that a specific approval process be developed to address construction, alterations, repairs, and removal of dams (RIGTF 2001). Safety appears to be driving the move toward developing a more specific removal protocol in Rhode Island, although to date, little progress has been made.

In addition to task forces groups within most states in the region, the Northeast Stream Barrier Task Force was established for all six New England states and the state of New York. The Task Force is composed of approximately 30 individuals representing various government agencies and non-government organizations. Many of the agency representatives are the key individuals involved with dam removal decisions within their respective states. The goal of the Task Force is ecosystem restoration including the improvement of rivers for migratory species.

5 CONDITIONS FACILITATING DAM REMOVALS

In examining the removals that took place within New England during the last decade, a number of factors facilitating removals emerged. One noted aspect of past removals was that the successful completion of many removals required committed leadership coming from state agencies such as departments of fish and wildlife or environmental quality. Organized environmental groups also provided invaluable support, sometimes including financial. Staff from both public and private organizations can, when the dam owner is willing, initiate and assist with the application process and provide technical assistance.

Securing adequate financial resources becomes another critical factor. Dedicated state funds for dam removal are uncommon in the region as well as in states in other parts of the country. While Massachusetts has a dedicated fund for dam removal, this is the exception rather than the rule in New England. However, funding can be found through state dam safety or river programs. Greater sources of funding for dam removal are available through federal programs most commonly associated with fish and wildlife initiatives and river restoration and protection programs (American Rivers 2000). To access these funds, however, the dam owners must know the sources exist, file a grant application, and in some cases provide cost-share funds. These hurdles may prove too difficult for private dam owners. Securing funds and thus removal is more likely when state agencies and/or non-governmental organizations can provide assistance.

Clear procedures for the removal application permit and decisionmaking can further some desired dam removals. State agencies should push for legislative guidance and/or develop clear agency protocol to facilitate the dam removal approval process. A cumbersome or unclear application and review process can discourage an owner from pursuing a removal. New Hampshire addressed this concern by developing a clear unambiguous set of application procedures and criteria for approval. Too many application requirements, however, can impede dam removal as in the case of Massachusetts. While it is desirable to provide a systematic evaluation of potential costs and benefits from any proposed removal project, states should keep a balance between too many and too little evaluation requirements.

Public forums that attempt to disseminate information about the costs and benefits of a given removal as well as allow for public input can help reduce conflict that might surface around a project. Johnson and Graber (2002) note that while state agencies may have actual legal authority to approve a dam removal, public support or lack of can facilitate or impede the process. While public review periods for dam removal are requirements in all New England states, public forums are not as commonly required. For example, in Maine all state permit proceedings are given an opportunity for a public hearing but none are required.

6 CONCLUSION

While states are becoming increasingly active in dam removal decision-making, the state agencies involved with dam removals have few if any formal policies to guide them. Outside of state laws requiring safety inspections for dams, little legislation exists for considering other factors driving dam removal. Few states have policies addressing dam removal and many are relying upon legislation crafted decades ago that often fail to address present day dam removal considerations. Additionally, the state decision-making process for removals continues to proceed on a case-by-case basis.

Four New England states, New Hampshire, Massachusetts, Vermont and Maine have at least considered developing guiding policies. Massachusetts and New Hampshire both have established removal programs, and Vermont and Maine have crafted guiding documents and established Task Forces. However, the state that has dismantled the most dams, Connecticut, does not have a dam removal program or policy. Fish and wildlife initiatives within state agencies have spawned a number of removals in Connecticut. In this state and others in New England, a number of committed individuals within public agencies have pushed forward when a dam removal was deemed desirable. Additionally, active environmental groups have pursued a number of removals in the region. Although a high percentage of New England's dams are older, smaller facilities, some of which are considered safety concerns, most removals have occurred because of river restoration projects initiated by environmental-related groups and/or government agencies.

As noted, the pace of dam removal is expected to increase in future years as safety issues and costs of repair and maintenance mount; and as our desires to restore ecosystem are expressed more fully. The states within New England are moving forward in terms of crafting policy and criteria for dam removal decision-making. While much work and research is needed in terms of policies, evaluation criteria, and pre and post project monitoring, it is clear that dam removal is moving the US toward a new river management era.

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