Congressional Research Service

Report RL33480

Dam Removal: Issues, Considerations, and Controversies

Nic Lane, Resources, Science, and Industry Division

November 20, 2006

Abstract. As America's dams age, their owners, regulatory agencies, and the public must decide how to manage these structures. Although decisions regarding dams are unique to each location and highly reflective of local interests, Congress has been, and will likely continue to be, asked to fund dam removal programs and to become involved in specific dam removal issues. Considerations leading up to dam removal, and issues related to dam removal itself, are the focus of this report.

Order Code RL33480

CRS Report for Congress

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Prepared for Members and Committees of Congress

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Summary

River management is complex, and in many cases decisions must be made to balance conflicting values. Dams are built because they provide numerous benefits to society, including flood control, navigation, irrigation and drinking water, hydropower, and recreation. But they are not without their detriments: dams also block fish passage, alter natural river systems, modify sediment and water temperature regimes, and inundate sites of cultural importance. Every dam is built with an expected life span and will eventually need to be repaired, replaced, or removed.

While dams may once have been viewed as almost entirely beneficial, today they are seen as having both positive and negative attributes. In this light, policy-makers and the public have come to view dam removal as one option in the effort to balance the costs and benefits of river management. Congress has legislated dam removal through the Elwha River Ecosystem and Fisheries Restoration Act (P.L. 102-495), and the President requested FY2007 funding for a dam removal program — the National Marine Fisheries Service's Open Rivers Initiative. Congress had also made clear its intent to ensure oversight in dam removal issues. As an example, P.L. 106-60, §316, limited the authority of the Bonneville Power Administration in its cost recovery, to ensure that the agency did not generate surplus revenue to be put toward Snake River dam removal.

The benefits and detriments of a dam are case-specific, and stakeholders' evaluation of whether dam removal is an attractive option depends on the values that they assign to those qualities. Some federal dams — notably, four projects on the Lower Snake River in Washington — have generated contentious debate, litigation, and specific legislation (cited above). In recent years, dam removal has become a more commonly considered choice among the available options for managing the public's investment in our national inventory of dams. In many cases — there have been some 500 documented dam removals in the United States — removal may provide greater economic, environmental, public safety, aesthetic, and recreational benefits than dam maintenance, modification, and upkeep, particularly for aging and smaller dams. But there are other circumstances when dam removal may not be the appropriate choice, when removal would cause socially unacceptable effects, such as the loss of flood protection for critical areas, the destruction of wetlands created by the dam, or the loss of energy from a hydropower project.

As America's dams age, their owners, regulatory agencies, and the public must decide how to manage these structures. Although decisions regarding dams are unique to each location and highly reflective of local interests, Congress has been, and will likely continue to be, asked to fund dam removal programs and to become involved in specific dam removal issues. Considerations leading up to dam removal, and issues related to dam removal itself, are the focus of this report.

Contents

List of Figures

Dam Removal: Issues, Considerations, and Controversies

Introduction

The United States' investment in dams has provided numerous benefits, such as flood control, navigation, irrigation and drinking water, hydropower, and recreation. But dams are not without their detriments; dams block fish passage, alter natural river systems, modify sediment and water temperature regimes, and inundate sites of cultural importance. While dams may once have been viewed as almost entirely beneficial, today they may be seen as having both positive and negative attributes.[1] Congress has legislated dam removal and has been asked to fund a federal dam removal program.[2]

Dam removal continues to be a legislative issue. The Energy and Water Development Appropriations Act of 2007 (H.R. 5427), §108, directs the Corps of Engineers not to spend any funds on removing Oregon's Elk Creek Dam, and the Water Resources Development Act of 2005 (S. 728), §2037, would authorize the Corps of Engineers to remove small dams. Congress has made clear its intent to ensure funding oversight in dam removal issues. As an example, P.L. 106-60, §316, limited the authority of the Bonneville Power Administration in its cost recovery, to ensure that the agency did not generate surplus revenue to be put toward Snake River dam removal. Though dam removal can be a controversial issue for local stakeholders — there has been litigation in the Columbia River basin based in part on whether the Snake River dams should be considered for removal because they may threaten some species of salmon with extinction — congressional involvement in decisions regarding the management of the United States' inventory of dams[3] will likely increase as these projects age, requiring more frequent and extensive

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[1] The Aspen Institute, *Dam Removal: A New Option for a New Century* (Washington, DC: 2002), p. iii.

[2] The Elwha River Ecosystem and Fisheries Restoration Act (P.L. 102-495) and the National Marine Fisheries Service's Open Rivers Initiative, respectively.

[3] The National Inventory of Dams (NID) lists information for approximately 79,000 dams in the United States. However, a dam is listed in the NID only if it meets certain size criteria. A dam is included in the NID if it (1) is designated as having high or significant hazard potential, (2) is a low-hazard dam that exceeds 25 feet in height and 15 acre-feet storage, or (3) is a low-hazard dam that exceeds 50 acre-feet storage and 6 feet in height. See [http://crunch.tec.army.mil/nid/webpages/nid.cfm]. However, there are many smaller dams that do not meet the criteria for inclusion in the NID. There are 3,700 dams in a Wisconsin state inventory, but only 1,200 of these are logged in the NID according to the Aspen Institute (Aspen Institute, op. cit., p. 2). NOAA Fisheries estimates that there are more than 2 million small dams on U.S. rivers and streams; see [http://www.nmfs.noaa.gov/habitat/restoration/projects_programs/crp/partners_funding/backgroundondamremoval.htm].

maintenance, or as they come due for relicensing and their current environmental conditions are reassessed.

Many dams were constructed in the first half of the last century. As they age, maintenance and repair costs often increase substantially, making continued investments a questionable decision. Older dams may not serve their purpose as well as they did when they were built, as sediment accumulates and displaces the amount of water that can be stored in the reservoir. At some point, routine repair and maintenance may no longer ensure the structural stability of the dam, increasing the potential for dam failure and associated losses in property damage and possibly human life. For privately owned dams, these situations may result in substantial increases in the costs of liability insurance, and instead of spending large sums of money to repair these facilities, it may make economic sense to remove the structure. It is increasingly common for decision-makers and dam owners to view removal as an option in the effort to balance the costs and benefits of river impoundment and dam upkeep.[4]

Environmental, safety, regulatory, economic, and cultural issues may all be important aspects when deciding how best to manage a river system. Perhaps an existing dam's economic value is so great that the best way to address fish and wildlife concerns is through modifying the dam structure and operations. A community may decide that it would prefer a natural river for aesthetic reasons and that it is willing to forego the recreational opportunities provided by a dam (in favor of the recreational opportunities provided by a free-flowing river). A power company might evaluate power production revenue against the cost of relicensing and environmental mitigation in its decision to maintain or remove a dam.

Reasons for Dam Removal

There are a number of reasons dam owners might conclude that dam removal would be the best course of action. While one primary benefit may be the principal reason for the decision — avoiding costly repairs, restoring a fishery, eliminating a safety hazard — it is likely that more than one reason will factor into the decision to remove a dam.

Shifting Public Values. Members of a community may decide that they prefer the aesthetic value of a free-flowing river to that of still water. Public perceptions can change over time and an area's residents may shift their collective desire to having a more natural waterscape as part of their home. A similar issue of public sentiment beyond community values is that dams and reservoirs are often located in relatively rural natural and semi-natural settings. Many people have expressed distaste for manmade facilities in otherwise wild, scenic, and natural conditions. This may especially be the case in communities where dams once served a commercial purpose that is no longer viable (e.g., grist mills; see "Outdated Purpose," below).

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[4] See [http://www.usbr.gov/pmts/economics/reports/DamRemovalPaper2.pdf].

Environment. Environmental concerns are among the primary reasons for dam removal. Dams block fish passage, flood habitat, and dramatically change the characteristics of a river, affecting the river channel, water velocity, turbidity, and temperature.

Fish and wildlife issues are a primary aspect of the environmental impact of dams. Dams block access to spawning habitat for anadromous or migratory species, and can create new habitat that favors invasive species. A dam may create a large, warm body of water from a river that was once swift and cold. Warmwater species, such as bass that might be introduced to create a sport fishery, can thrive in this environment and threaten native fish by competing for food or through predation.[5] Another environmental consideration is wetland habitat. Wetland areas are often eliminated or shifted by dams, and the flood protection provided by dams reduces the frequency of inundation in channels downstream as the river flow is altered. This tends to modify and move the area and nature of wetlands and affects the floodplain by preventing inundation, which brings sediment deposits.[6]

Sediment movement is an important component of river ecosystems. Dam construction impounds not only water but sediment as well, having impacts both upstream and downstream. Sediment accumulation behind a dam reduces water depth and changes the characteristics of aquatic habitat. Conversely, downstream areas may suffer from a lack of sediment through beach erosion and damage to aquatic habitat brought about by too little sediment.[7]

Dams and reservoirs are often located in places of cultural, historical, or archeological significance, and these resources may be affected by alterations in dam structure. Native American artifacts and burial sites may have been inundated by reservoirs, and they could be exposed by dam removal. The dam itself may be of historical significance based on its construction or role in the community. An evaluation of the possibility of uncovering cultural artifacts and the historical significance of the dam and facilities themselves may be important considerations when weighing dam removal as an option.

Outdated Purpose. A dam may be considered for removal because it no longer serves its intended purpose. An impoundment created to generate power for a long-gone mill would be an example. An example is the White River Dam in Wisconsin. The dam was built in the 1800s to support commercial shipping through locks, but the locks were abandoned in the 1950s and the no-longer-useful dam fell into disrepair.[8] The removal of the dam in 2003 marked Wisconsin's eighth dam taken out in that year. The state has been a national leader in small dam removal, and

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[5] See [http://www.americanrivers.org/site/PageServer?pagename=AMR_content_a9ae].

[6] See [http://www.ussdams.org/c_decom.html].

[7] American Rivers and Trout Unlimited, *Exploring Dam Removal: A Decision-Making Guide* (August 2002), at [http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641].

[8] See [http://www.silentsports.net/shorts_april_2004.html#9].

has a successful river restoration program that leverages the efforts of community advocates and state and local governments.[9]

Economics. Dam owners often consider removal because of the costs associated with maintaining the projects. These costs include normal maintenance and upgrades to improve safety and meet regulatory requirements. Regulatory costs may include costs associated with mitigating environmental damage caused by the dam and could include altered dam configuration, operational changes, or habitat repair, to name a few common examples. If the benefits provided by the dam are reduced, owners may be reluctant to invest in maintenance; this comes with its own potential cost in the form of increased liability risk.[10] There may also be considerable cost associated with Federal Energy Regulatory Commission (FERC) relicensing of dams that produce electricity. FERC estimates the cost of relicensing to be $58 per kilowatt of project generation capacity.[11]

PacifiCorp, a western U.S. utility company, is removing its 14.7 megawatt Condit Dam on the White Salmon River in Washington for this reason. In 1991, the company filed an application with the FERC to renew the dam's operating license, which was scheduled to expire at the end of 1993. FERC issued its final Environmental Impact Statement (EIS) for the project in 1996. The EIS recommended fish passage facilities that would cost an estimated $30 to $50 million. Rather than continue the relicensing process and invest that amount of money in the project, PacifiCorp agreed to consider dam removal as an option. The company reached a settlement agreement with interested parties and has plans to begin removing the dam in 2008. The estimated cost of removal is $17 million (1999 dollars).[12]

Safety. A dam that is in danger of failing or that presents other public safety issues, posing a hazard to navigation, for example, may also be a candidate for removal. Public safety concerns are also closely linked to economics — liability insurance and the necessary maintenance to make a dam safe may outweigh the benefits the dam provides. Safety concerns are one of the most common reasons for dam removal.[13] In Wisconsin, safety concerns are one of the primary drivers of dam removal and the removal of unsafe structures is codified in state law.[14]

Multiple Reasons. In reality, although there may be a primary reason for dam removal, such as economics or safety, there are likely a number of complementary

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[9] See [http://www.irn.org/revival/decom/brochure/rrpt2.html].

[10] See [http://www.ussdams.org/c_decom.html].

[11] Most private hydropower dams must be licensed by FERC, and many of the dams licensed when they were built are coming due for license renewal. See CRS Report RL31903, *Relicensing of Nonfederal Hydroelectric Projects: Background and Procedural Reform Issues*, by Nic Lane.

[12] See [http://www.pacificorp.com/Article/Article46835.html].

[13] See [http://www.irn.org/pubs/wrr/9708/decom.html].

[14] See [http://www.dnr.state.wi.us/ORG/water/wm/dsfm/dams/removal.html].

issues that make dam removal the final choice when considering river management. PacifiCorp's Condit Dam, cited above, may be slated for removal primarily for economic reasons, but the removal of the project will address an environmental issue by improving habitat and river conditions for salmon and steelhead. (The economic issue for PacifiCorp was the expense of a recommendation to provide fish access and additional flows from the dam.)[15] The dam's removal also has substantial public value as evidenced by the indicated interests who are parties to the removal agreement.[16]

Issues When Considering Dam Removal

The reasons why a dam owner, community, or governing body might consider dam removal are outlined above, but several concerns may lead some parties to oppose dam removal or may have to be addressed when planning a removal project. Concerns about the outcome of a dam removal effort are often based on perceptions about the final result — for example, community members may worry that the drained area behind the dam will be an unsightly mud flat — or other practical decisions about the management of stored sediment and its impact on water quality.

Societal Concerns

Stakeholders may consider a number of issues when evaluating dam removal. Those termed societal concerns in this report deal with the human factors that might be considered in dam removal planning. When considering the social values associated with a river, dam, or reservoir, the decision-making process is improved when interested and affected parties are presented with reasonable predictions about how the river, dam owner, and community will be affected in the short and long term both with and without the dam.[17]

Ownership and Use of Exposed Land. Who owns land that was once underneath a reservoir? Ownership can vary in each case and may be straightforward or more complex depending on the number of parties involved and different state property laws. If a single landowner built a dam on his or her property, then ownership is easy to determine. However, in cases involving multiple owners, deeds may specify that property extends to the water's edge or the center of the river bed. The outcome of these scenarios is unclear and is a concern that may leave some landowners wary of dam removal as an option, even if they support the idea of restoring the river.[18]

Recreation. If an impoundment is popular for fishing, boating, swimming, and other activities, the loss of this recreation resource may be frustrating to its users.

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[15] See [http://www.pacificorp.com/Article/Article46835.html].

[16] See [http://www.pacificorp.com/File/File46709.pdf].

[17] Ibid.

[18] William H. Graf, ed., *Dam Removal Research Status and Prospects* (Washington, DC: The H. John Heinz III Center for Science, Economics and the Environment, 2003), hereafter referred to as *Dam Removal Research*.

Stakeholders must consider whether a free-flowing river would provide some of the same, or other, recreational opportunities and whether users would adapt to the change. Conversely, if a reservoir has become filled with sediment, its removal may create new recreational opportunities for community members where there were none, such as fishing or rafting opportunities.[19]

Aesthetic Concerns. One of the most consistent issues raised in discussions of dam removal is concern about the appearance of a drained reservoir after dam removal. Some of these concerns reflect personal preference — one person's appreciation of still water views over a flowing river or vice versa. Other concerns may reflect a lack of understanding about how river systems function. For example, two of the most common aesthetic issues raised are fears that, without the dam, the river will dry up, or that the drained reservoir will remain a permanent mudflat. These concerns can be addressed by developing restoration options and public education efforts as part of the removal planning process.[20]

Physical Concerns

Physical concerns associated with dam removal go beyond personal or community values about the desirability of one landscape over another, property rights, or recreational choices. Physical concerns relate to the health of the river, effects on structures in the river, the potential for property damage, and similar issues. Both societal values and physical concerns are important to address when evaluating dam removal as an option; however, health and human safety may be affected by the physical impacts of dam removal.

Sediment. Rainfall, melting snow, and river erosion provide a constant stream of sediment that is transported through a river system. In an undammed river, this sediment is both deposited to, and resuspended from, the riverbed. Dam construction affects this dynamic, causing more sediment to be deposited upstream, and less downstream, than if the dam were not there. If a dam is to be removed, the sediment collected upstream must be managed to avoid uncontrolled release of the accumulated sediment, which may alter the river system and affect navigation, water quality, fisheries, and other important aspects of the river.[21]

Each dam is unique, and sediment management must be considered on a case-by-case basis. However, four primary sediment management strategies are:[22]

- no action, simply leave the sediment in place;
- sediment removal by natural river erosion;
- physical removal of sediment as part of dam removal; and,

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[19] Ibid.

[20] Ibid.

[21] American Society of Civil Engineers, *Guidelines for Retirement of Dams and Hydroelectric Facilities* (New York, NY: 1997), pp. 71-73.

[22] *Guidelines*, p. 77.

- sediment stabilization, which requires modification of the dam facilities or river channel.

The final decision on sediment management is generally the result of a number of considerations listed above, including navigation, fisheries, and water quality. Sediment that contains toxic material presents a specific management problem, and can complicate dam removal or limit the choices among sediment management strategies. Concentrations of hazardous contaminants in sediment that are significantly higher than those found elsewhere in the river system may eliminate the possibility of dam removal or could likely limit the choices among sediment control options to physical removal or stabilization prior to dam removal.[23]

Flooding. Community members and other interested parties near a dam being considered for removal may express concerns about the possibility of increased flooding in the area after the dam is removed. During the actual removal process, it is important to plan carefully to regulate the release of stored water so that short-term flooding does not occur. However, there is also often a fear of more frequent flooding without the dam present. Many dams — including larger run-of-river dams that have little storage capacity, but particularly the smaller dams that are most often considered for removal — provide little or no flood control.[24] In some cases, owing to disrepair or the manner in which they are operated, some dams can increase flood risk to upstream and downstream areas.[25] Nevertheless, an evaluation of the project's flood control capacity is important if dam removal is considered. If a dam under consideration for removal does have significant flood reduction benefits, removal options may be limited, or alternate plans for flood mitigation could be considered to ensure continued flood protection, if desired.[26]

In-River Structures. Dam removal alters the flow rate and pattern of a river, and the results of this change can affect existing infrastructure, such as storm water runoff culverts, water intakes, utility lines, docks, levees, and bridges.[27] Additionally, the structure of the river channel may be altered to the point that it affects navigation.[28] The degree of any of these impacts would be unique to each dam, and may not apply at all, depending on circumstances. The important issues are awareness of the potential for this type of damage, evaluation of its severity, and planning to avoid or mitigate any structural impacts if dam removal is chosen as a preferred option.

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[23] *Dam Removal Research*, p. 84.

[24] *Guidelines*, p. 19.

[25] See [http://www.des.state.nh.us/factsheets/dam/db-19.htm].

[26] *Guidelines*, p. 19.

[27] See [http://www.wisconsinrivers.org/documents/dams/restoring.pdf].

[28] *Guidelines*, pp. 96, 162.

Regulatory Issues

Dam removal as an option for river management is a relatively new approach. Not long ago, dam removal was considered a radical approach to river restoration.[29] Because implementation of this option is comparatively new, regulatory and permitting agencies may not be well practiced in processing applicable permits in the context of dam removal. Parties seeking these permits may experience delays and may find it useful to be aware of the various laws affecting dam removal generally and their project in particular.[30]

Federal Permits. Some or all of the following federal permits may be required for a dam removal project.[31]

- A Clean Water Act (CWA; 33 U.S.C. §1344) §404 Dredge and Fill Permit is required by the Corps of Engineers when there will be dredging of a navigable waterway. This permit is required for most dam removals.[32]
- A Rivers and Harbors Act (33 U.S.C. §403) §10 permit may be required in conjunction with a CWA §404 permit. The Rivers and Harbors Act is administered by the Corps for federal activities affecting structures in a navigable waterway.
- A FERC License Surrender or Non-Power License Approval is required if the dam to be removed is a hydropower dam regulated by FERC. The dam owner must apply for surrender of the FERC license or issuance of a non-power license.[33]

Federal Reviews and Consultations. Before, or in the course of, issuing any of the above, the Corps or FERC may have to consult with regulatory agencies to meet the requirements of federal laws.[34] Consultations may be necessary under several statutes:

- Endangered Species Act (ESA; 16 U.S.C. §§1531 et seq.) §7 consultation with the Fish and Wildlife Service and/or the National Marine Fisheries Service (NMFS) may be required, if threatened or endangered species are present at or near the dam. The relevant federal agencies must complete a biological assessment and ensure that proposed actions are "not likely to jeopardize the continued

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[29] See [http://www.americanrivers.org/site/PageServer?pagename=AMR_content_997d].

[30] See [http://www.americanrivers.org/site/DocServer/DR_-_Resource__Obtaining_Permits_to_Remove_a_Dam.pdf?docID=1602].

[31] Ibid.

[32] More information on Corps permitting is available at [http://www.usace.army.mil/inet/functions/cw/cecwo/reg/oceover.htm].

[33] More information on FERC licensing is available at [http://ferc.gov/industries/hydropower/gen-info/licensing.asp].

[34] Ibid.

existence" of any endangered or threatened species, nor to adversely modify critical habitat.

- Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1855(b)(2)) consultation may be necessary with the NMFS regarding the impact of the dam's removal on any fishery management plan developed by a Regional Fishery Management Counsel.
- The National Historic Preservation Act (16 U.S.C. §470f) §106 requires federal agencies (the Corps or FERC in this case) to assess the impact of the action on historic properties. This consultation is conducted with the State Historic Preservation Officer (SHPO).
- National Environmental Policy Act (NEPA, 42 U.S.C. §§4321 et seq.) review is required for "federal actions significantly affecting the human environment" (§4332 (c)). Permitting action by a federal agency (the Corps or FERC in this case) may require the preparation of an Environmental Impact Statement or Environmental Assessment pursuant to NEPA. These documents must examine the environmental impacts of the proposed activity and any alternatives. An opportunity for public comment is required as part of the NEPA review.

State Role. In addition to federal requirements, each state or locality may have other certifications and requirements that could apply to a specific dam removal project. Typically, these could include waterways development permits, dam safety permits, state environmental policy, or historic preservation requirements. Most states also require review of any activity that could change the 100-year flood plain. Corps and FERC actions may also trigger federal statutes that require states to provide certification that these actions are consistent with their implementation of federal law. For example, states may issue certification related to water quality pursuant to CWA §401 (33 U.S.C. §1341), and to coastal zone management in accordance with the Coastal Zone Management Act (16 U.S.C.§§1451, et seq.).[35]

Case Studies

Elwha and Glines Canyon Dams

Elwha Dam was built between 1910 and 1914 on the Elwha River on Washington's Olympic Peninsula. The Glines Canyon Dam was constructed between 1925 and 1927 about 8.5 miles upstream of Elwha Dam. Both structures were built and operated to provide hydropower. They have a combined average generation output of 18.7 megawatts.[36]

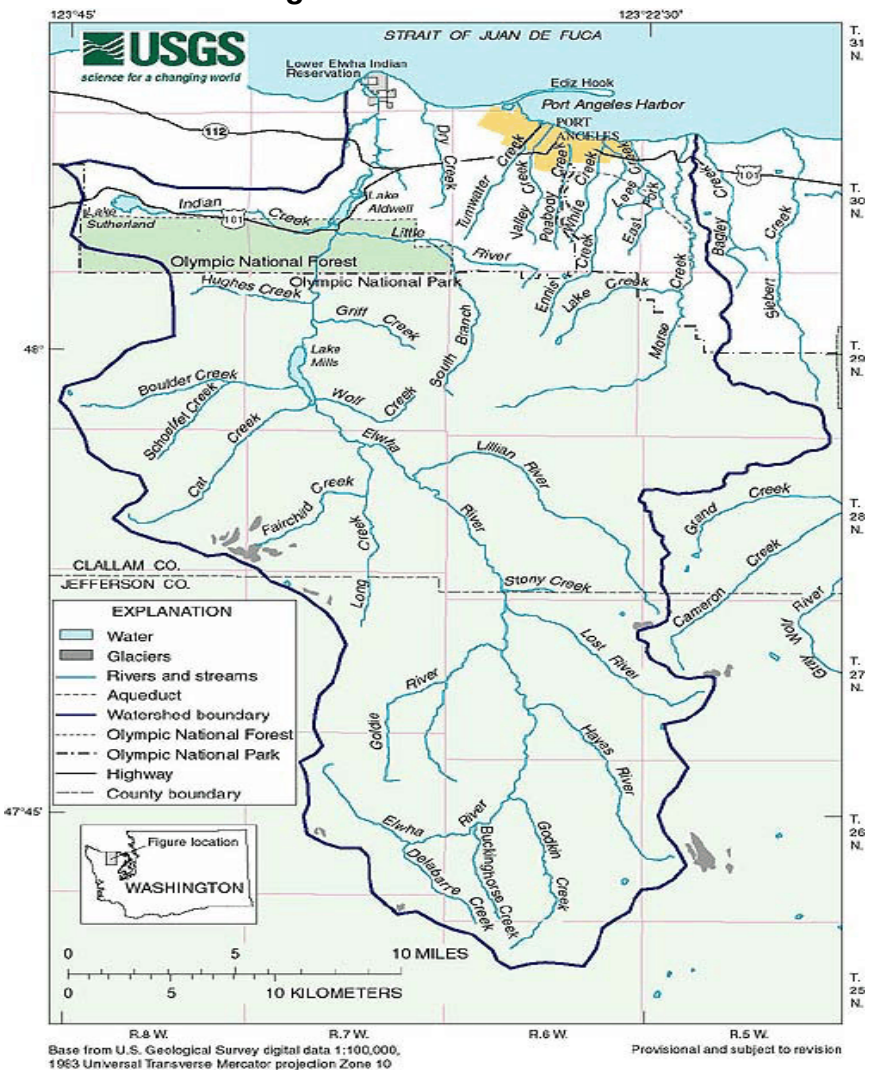
Neither project has fish passage facilities. The construction of the Elwha Dam blocked access to approximately 93% of the historical anadromous fish habitat on the

[35] Ibid.

[36] *Guidelines*, pp. 148-150.

Elwha River. The dams form Lakes Mills and Aldwell, as shown in **Figure 1**. Before the dams were built, the river produced an estimated 380,000 anadromous salmon and trout, while current, largely hatchery-based, fish runs in the Elwha River average around 10,000 annually.[37] The Elwha Dam had never been licensed and the dam owners applied for a new license for the project in 1968. The Glines Canyon Dam had a Federal Power Commission (now FERC) license that expired in 1973. During the 1980s, the FERC licensing process was subject to bitter controversy and extensive delay due in large part to the policy implications of licensing a project within a national park (Olympic National Park), conflicting federal, state, and tribal resource goals, and legal challenges from the environmental community. Pursuit of a resolution through traditional licensing mechanisms might have resulted in numerous, protracted litigation.[38]

Figure 1. Elwha River Basin



Source: [http://wa.water.usgs.gov/projects/elwhawra/Maps/main_map.jpg].

[37] Ibid.

[38] Ibid.

Congress legislated a resolution to the conflict. The Elwha River Ecosystem and Fisheries Restoration Act, P.L. 102-495, was enacted on October 24, 1992. P.L. 102-495 was a negotiated solution to avoid litigation, protect jobs at the paper mill whose power is generated by the dams, generate economic growth through fishing, tourism, and recreation in the area, restore fisheries and the river ecosystem, and meet federal tribal trust responsibilities.[39]

The act directed the Secretary of the Interior to develop a report for Congress assessing alternatives that would lead to ecosystem restoration and fisheries recovery. A final Programmatic Environmental Impact Statement (EIS) released in June 1995 recommended removal of both dams. An additional Implementation EIS (November 1996) recommended using natural erosion to dispose of accumulated sediment behind the dams. The total estimated cost of the dam removal and river restoration project, including dam purchases at $29.5 million as stipulated by the Elwha Act, is estimated to be $113 million. Dam removal is scheduled to begin in 2008.[40]

Klamath River Hydroelectric Projects

The Klamath River basin (see **Figure 2**) has garnered national attention due to a series of complex natural resource issues including water allocation, water quality, and threatened and endangered species.[41] At one time, the Klamath River was the third-largest producer of salmon on the West Coast of the United States, after the Sacramento and Columbia Rivers. In 2001, water supply diverted from irrigation to the support of certain fish species gained national attention; and in 2002, a die-off of more than 33,000 adult salmon on the Klamath River brought renewed attention to this area.[42]

PacifiCorp, a large utility in the western Unites States, owns and operates seven hydroelectric dams in the Klamath basin. Known collectively as the Klamath River Hydroelectric Project, the dams (FERC license number 2082) were built between 1908 and 1962 and produce 151 megawatts of electricity.[43] The U.S. Department of the Interior's Bureau of Reclamation owns Link River Dam, which PacifiCorp operates in coordination with the company's projects. The Link River Dam, located upstream of PacifiCorp's projects, forms Upper Klamath Lake, the largest freshwater lake in Oregon. In addition to diverting water for PacifiCorp hydroelectric generation, water releases through Link River Dam from Upper Klamath Lake fulfill other objectives, including irrigation, flood control, and in-stream flows for anadromous fish.[44]

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[39] Ibid.

[40] Available at [http://www.nps.gov/olym/elwha/history.htm].

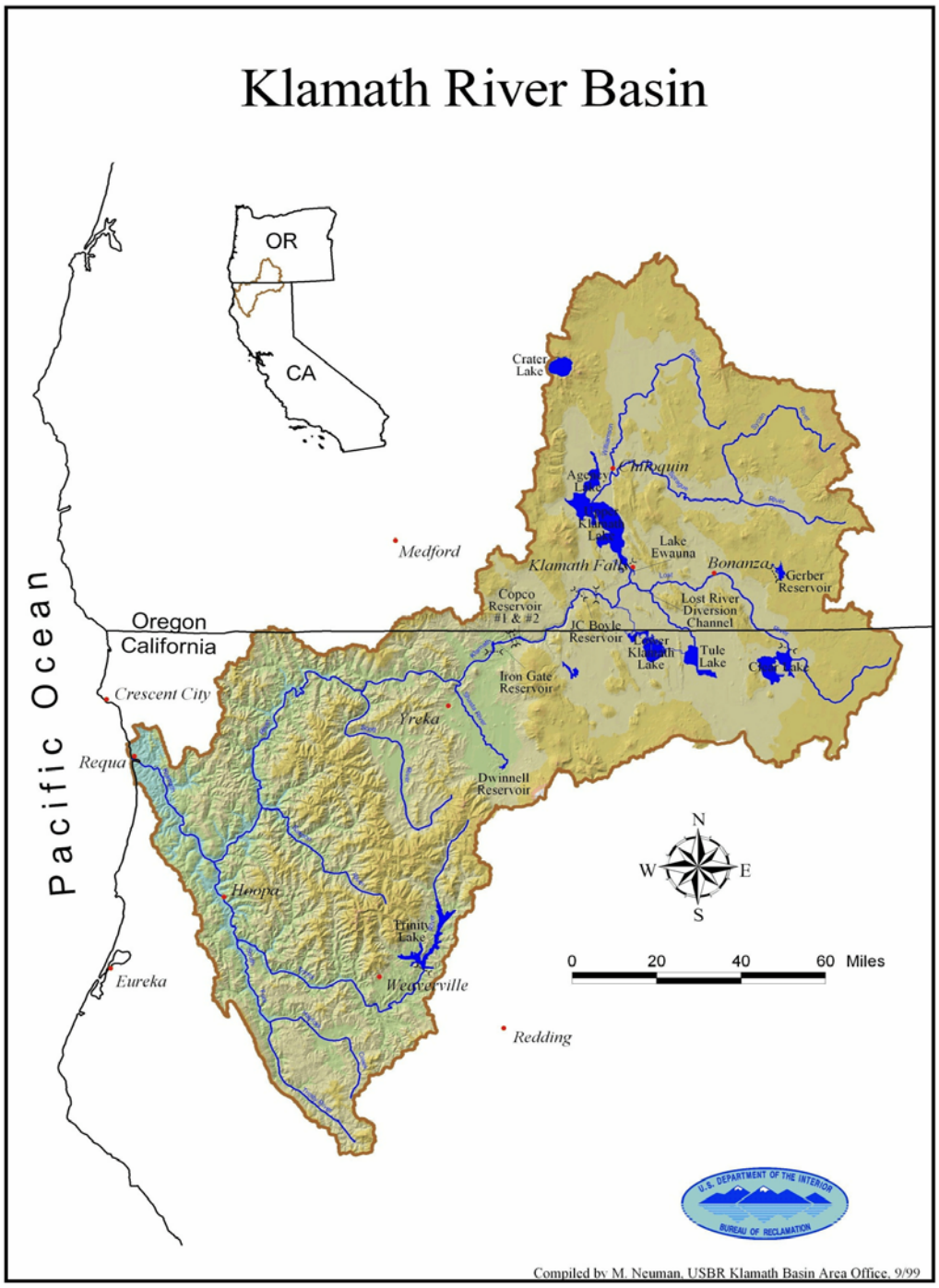
[41] See CRS Report RL33098, *Klamath River Basin Issues and Activities: An Overview*, coordinated by Kyna Powers.

[42] See [http://www.epa.gov/region9/water/watershed/klamath.html].

[43] PacifiCorp indicated that 151 megawatts is enough energy to supply 70,000 customers. See [http://www.klamathforestalliance.org/Newsarticles/newsarticle20060408.html].

[44] See [http://www.pacificorp.com/Article/Article1152.html].

Figure 2. Klamath River Basin



Source: [http://www.usbr.gov/mp/kbao/maps/1_basin.jpg].

The project's FERC license expired on March 1, 2006. Until a new FERC license, valid for 30-50 years, is approved, the project will operate under annually renewed temporary licenses. As part of the new license application, NMFS and FWS, the federal agencies responsible for fish and wildlife, have submitted preliminary prescriptions for fishways to allow upstream and downstream fish passage at four of the dams. The federal agencies state that the fishway prescriptions would restore access to 58 miles of habitat for coho and chinook salmon, steelhead, and lamprey,

and improve connectivity for resident fish, such as trout. This includes 46 miles of habitat for the coho salmon population listed as endangered under the ESA (16 U.S.C. §§1531, et seq.). Fish passage would also create the opportunity for reintroducing salmon, steelhead, and lamprey to more than 300 miles of historic habitat above the dams.[45]

PacifiCorp estimates that the cost of implementing the NMFS and FWS preliminary license prescriptions could be as much as $200 million, and it has concerns that this expense would not resolve the basin's fisheries issues, owing to, among other things, poor water quality upstream of the PacifiCorp dams.[46] Dam removal might cost half as much as installing fish ladders, but along with PacifiCorp, some members of the academic community also share concerns that expected positive impacts of dam removal may be exaggerated, citing high phosphorous levels in the upper basin as well as agricultural runoff and other pollution.[47]

Because dams are blamed for the decline of fish populations in the basin, some environmental and tribal interests are pushing for their removal to improve habitat and river flows for fish. PacifiCorp however, has not considered dam removal in its license renewal application.[48] The issues at play in the region regarding endangered salmon, tribal fishing rights, and the human benefits from the power provided by the dams — and the potentially high cost of modifying the dams should the preliminary prescriptions be upheld in the final license — are typical of the complex problems to be weighed when considering river management choices. Under §241 of the Energy Policy Act of 2005 (P.L. 109-58), FERC license applicants, or other parties to the proceedings, may challenge federal agencies' fishway prescriptions and suggest alternatives.[49] PacifiCorp has requested a hearing on this matter and proposed alternatives to the federal governments' fishway provisions that include trapping and transporting fish around the dams.[50]

In September 2006, administrative law judge Parlen McKenna found that the proposed prescriptions made by the Departments of the Interior (FWS and Bureau of Reclamation) and Commerce (NMFS) would benefit salmon, steelhead, and lamprey by providing access to an estimated 58 miles of habitat between PacifiCorp dams. FERC will base its final licensing decision on the result of this hearing and comments received on its draft environmental impact statement. This case was the first to go through the new hearing process under P.L. 109-58, §241, and though the final license conditions are not set, the judge's ruling in favor of the federal

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[45] See [http://news.fws.gov/newsreleases/showNews.cfm?newsId=6C01A8E7-91EC-AD92-7D2BC18A63DB61DD].

[46] See [http://www.klamathforestalliance.org/Newsarticles/newsarticle20060408.html].

[47] "U.S. Acts to Help Wild Salmon in Klamath River," *Los Angeles Times*, Mar. 30, 2006 (Sect.: California, Metro, Metro Desk), p. B1.

[48] Ibid.

[49] See CRS Report RL31903, *Relicensing of Nonfederal Hydroelectric Projects: Background and Procedural Reform Issues*, by Nic Lane.

[50] See [http://ferris.ferc.gov/idmws/common/OpenNat.asp?fileID=11016830].

government may make dam removal a more appealing option than it would have been without the prescription for fishways.

Conclusion

Though decisions regarding dams are unique to each location and strongly reflect local interests, Congress has been asked to fund dam removal programs and to become involved in specific dam removal issues in the past and in the Administration's FY2007 budget request. Until recently, dam removal was considered a radical approach to river management. Though dam removal may still be a controversial issue, in recent years it has come to be seen as one of several choices that may be made about the river systems in our communities; sometimes, it may be the most cost-effective choice.[51] There are numerous circumstances when dam removal may not be the appropriate management choice, especially when removal would have a result that society deems unacceptable, such as the loss of flood protection for critical areas, the potential destruction of wetlands created by the dam, or the loss of energy from a hydropower project. There have been some 500 documented dam removals in the United States.[52] Particularly with America's scores of small dams, removal may provide substantial environmental, public safety, aesthetic, economic and recreational benefits.

[51] See [http://www.americanrivers.org/site/PageServer?pagename=AMR_content_997d].

[52] See [http://www.irn.org/revival/decom/brochure/rrpt2.html].