The Removal of Small Dams in the U.S.:

An Approach Towards Soft Path Water Conservation

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Introduction About Dams

- Roughly 75,000 large dams in U.S. (6 ft. and taller)
- Nearly 2 million small dams
- More than 1,150 dams have been removed
- Most dams are privately owned
- Large portion of dams were built in the 20th century

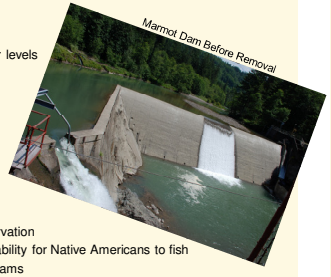
Why Were Dams Built?

- Generate electricity
- Irrigation for crop lands
- Protection from flooding
- Assist in navigation and transportation
- Supply municipal water systems
- Provide recreation in reservoirs

Reasons For Dam Removal

Environmental:

- Reduce water levels of river
- Block free-flowing water systems
- Change chemical, physical, biological processes of rivers and wildlife
- Hinder flow of nutrients and sediments
- Produce stagnant reservoirs
- Alter flow timing
- Alter habitat
- Slow river flow
- Cause drastic fluctuation of reservoir levels
- Block fish passage
- Alter water temperatures
- Hold back silt, debris, and nutrients
- Increase predator risk



Social:

- Alter public river access
- Harm aesthetics
- Reduced need for irrigation
- Reduced energy use through conservation
- Create cultural problems such as inability for Native Americans to fish
- Few beneficiaries in favor of some dams
- Push for removal from nonprofit organizations

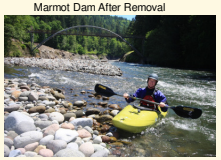
Political:

- Federal Government requires appropriate fish passage for ocean-going fish
- Clean Water Act has created a want for recreation on rivers
- FERC (Federal Energy Regulatory Commission) inspects dams
- State support for dam removal

Economic:

- Cheaper to remove dams than to keep them running in some instances
- Dams become less efficient with age
- Potential liability such as possible dam failure (safety hazards)
- Create temporary jobs for removal

Marmot Dam After Removal



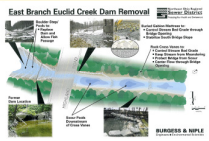
Euclid Creek East Branch Dam

Background

- A low head dam (6 feet high and 40 feet wide) constructed of concrete in the early 1930's
- Established near a confluence the East Branch and the Euclid Creek mainstem in the Euclid Creek Metropark Reservation in a heavily urbanized tributary to Lake Erie
- Made to impound water for swimming at a YMCA camp
- Has not served a purpose in decades
- Pool behind dam had completely filled with sediment
- Stopped fish migration upstream from the mainstem of the Euclid Creek

Why Was it Removed?

1. Reintroduce and re-establish native fish species
2. Increase recreational fishing
3. Restore aquatic habitat diversity
4. Restore natural flow
5. Provide fish passage and enhance stream health
6. Assist in reaching water quality standards



Benefits of Removal

- Restored 2.3 acres of wetlands and 1.16 acres of floodplain
- Restored 1,100 feet of the creek to its natural, historic alignment
- Increased fish habitat and spawning for recreational species (improved recreation and fishing for the community)
- Increased habitat for birds and amphibians
- Stabilized 435 feet of eroding stream bank in three different locations
- Controlled and managed 3.2 acres of pervasive invasive plant species
- Assisted Euclid Creek in reaching State of Ohio water quality attainment standards
- Aided in delisting Cuyahoga River and area of concern
- Had a positive economic impact of $2.4 million (double the project cost)

Marmot Dam on the Sandy River

Background

- Generated hydropower on the Sandy River in Oregon for nearly a century
- The dam was 47 feet tall and the network included a concrete-lined canal that took water to the dam through three tunnels to the Little Sandy River, a 16-foot-high Little Sandy Dam, a three-mile wooden-box flume, Roslyn Lake, and a 22-megawatt powerhouse
- Contained a fish ladder but it performed poorly and required frequent upgrades and maintenance
- At the time, it was the largest concrete dam ever removed in the United States
- Removal resulted in the biggest sediment release accompanying any dam removal

Why Was it Removed?

- The reservoir behind the dam contained approximately 900,000 cubic yards of sediment
- The company that owned the dam decided to use other power sources because it was too costly to maintain the aging equipment and make fish passage upgrades
- PGE (Portland General Electric), 22 environmental organizations, state and federal resource agencies, and local government and businesses wanted the dam removed

Benefits of Removal

- The Sandy River has been restored to a wild, free-flowing river from Mt. Hood to the Pacific Ocean
- Sediment flowed down river faster than expected and has settled into evenly sloping riverbeds which are ideal for fish passage and spawning
- Salmon and steelhead began to migrate and spawn upstream of the former dam
- 1,500 acres of the dam site were protected in a natural refuge and public recreation area after removal

Key Findings

- The better-than-expected results of the dam removal are likely to guide future dam removals in the future and offer dam managers a cost-effective option for sediment disposal in some cases
- Even under modest flows, a river with sufficient gradient can rapidly transport very large stores of sediment
- The cofferdam (temporary earthen dam) that was used to control the river during the dam removal by diverting water around Marmot Dam was easily eroded after the deconstruction project was finished
- New bars and riffles were quickly developed in a braided channel that was once a single threaded channel

Conclusion

Every case is different. Some dams are still needed to provide for hydropower, flood control, irrigation, etc. while others serve no essential purpose anymore, or the negative impacts of maintaining the dam outweigh the benefits. In any case, it seems that some sort of problem(s) (i.e. environmental impact, cost of maintenance, burden on taxpayers, safety issues, etc.) must have more of an impact than the revenue created by the dam. The average life expectancy of a dam is about 50 years. By 2020, 85% of dams in the United States will be a half century old and in need of repair. The cost of maintenance is in many instances the deciding factor for dam owners to willingly remove their dams. They cannot keep up with the costly repairs and if dam removal is the cheapest option, many of the owners will sway towards that outcome, so it would not be surprising to see an even greater surge to remove dams in future years. This also goes for the cases where taxpayers are the ones who have to pay for the upkeep of dams.

Most dam removal projects include tearing down small dams for many different reasons. Removing large dams would have too great of an impact on the economy of a given region for instance both because large dams provide more revenue such as energy, and because tearing down large dams requires a large sum of money. Because most candidates for dam removal are six feet and below, they do not typically cost an arm and a leg to remove.

Dam removal is only a small fraction of the big picture towards the soft path of water management. The soft path is a more integrated and effective alternative to supply-side water resource management. Supply-side management is more focused on meeting demands for water through centralized, large-scale infrastructure and centralized water management systems, which was focused on constructing dams and drilling deeper wells during the 20th century. The soft path is a demand-side management which focuses more on making current practices more efficient.

Dam removal is not always the best practice towards the soft path. Removing a dam can harm the environment more than it would help it, by polluting the river with sediment that has been trapped behind the dam, causing erosion downstream, and altering the habitats that have been established due to the dam's presence. Some dams have been in place for nearly a century, creating a new ecosystem that has been able to establish and flourish for decades. Removing a dam could destroy that ecosystem. That is why it is important to figure out which dams should and which dams should not be removed because every dam is different and the ramifications of dam removal are not all the same. Removing a dam is not always isolated, it can very easily have wide-ranging effects on large ecosystems. After removing a dam, the reservoir behind it is immediately drained, releasing whatever has been collecting there for decades downstream. There have been cases where sediment buildup has caused the elevation of the river bottom to rise drastically and destroy fish and wildlife habitats and allow for erosion on the riverbanks to occur more easily. Dam removal has allowed for invasive species to thrive in the area the dam and reservoir once stood and has been the cause for mud flats where the reservoir has once been. However, dam removal is a necessary part to the soft path approach. With an environmentally conscious approach to dam removal, many of those concerns could be nearly nonexistent. Buffer zones can be repaired using nature to absorb water and prevent flooding, native species of plants can be instituted to prevent invasive species from taking over.

References

American Rivers. American Rivers, 2014. Web. 6 Apr. 2014.
Austin, Elizabeth. "Environmental and Social Implications of Dam Removal." The Encyclopedia of Earth. Boston University, 22 Feb. 2012. Web. 7 Apr. 2014.
Dam Removal Success Stories: Restoring Rivers Through Selective Removal of Dams That Don't Make Sense. Friends of the Earth, American Rivers, and Trout Unlimited, 1999. Print.
"Dams and Rivers: Human and Ecological Consequences." The Global Change Program. University of Michigan, 12 Feb. 2010. Web. 6 Apr. 2014.
"Euclid Creek East Branch Dam Removal and Stream Restoration Project." Euclid Creek Watershed Program. Cuyahoga SWCD, n.d. Web. 7 Apr. 2014.
Klamath Basin Water Issues. KlamathRestoration, n.d. Web. 4 Apr. 2014.
Podolak, Charles. Channel Bed Response to an Increased Sediment Supply. Baltimore: John Hopkins University, 2012. Print.
"Sandy River: Marmot Dam's Removal in 2007 has Returned the Sandy River to a Wild, Free-flowing River." Portland General Electric. PGE, n.d. Web. 22 Apr. 2014.
"Stream and Wetland Restoration Project in Wildwood State.Park." Euclid Creek Watershed Program. Cuyahoga SWCD, n.d. Web. 7 Apr. 2014.

Acknowledgements

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