A second life for the Elwha PG. 18

Restore

RESPONSIBLY REVIVING AMERICA'S RIVERS

A SPECIAL PUBLICATION BY THE HYDROPOWER REFORM COALITION

Letting dams go

... and letting rivers find their new equilibriums PG. 10

9 dams that are now gone

+ three more that will be soon

BC's bad gamble on small diversion

PG. 40

director's note

Our hope

Restore is a special publication of the Hydropower Reform Coalition, which provides an overview of dam removal nationally, and documents past, current, and planned removals in the Pacific Northwest.

The Coalition developed this report to discuss removal of hydropower and other dams as a topic and to highlight restoration successes and community and watershed benefits from dam removal in Alaska, Idaho, Montana, Oregon, and Washington.

Providing timely and credible data, and facilitating dialogue regarding dam removal to decision makers, stakeholders and other community members is another goal of this publication. Our hope is that this dialogue will be useful in determining the benefits and costs of future dam removal opportunities.

OUR COALITION: The Hydropower Reform Coalition is an association of more than 150 organizations representing more than one million conservationists, anglers, boaters, and homeowners that have effectively reduced the footprint of hydropower dams on rivers. The Coalition has more than seventeen years of on-the-ground experience with river protection and restoration efforts at individual hydropower dams regulated by the Federal Energy Regulatory Commission, as well as a long history of developing diverse and long-lasting partnerships with industry, agencies, tribes, and nonprofit organizations. Our members have participated in improving and restoring fish habitat, natural flows, water quality, sediment management, riparian land protection, and recreational opportunities to rivers harmed by hydropower dams.

We have also been the nation's leading voice on the environmental aspects of hydropower policy.

OUR MISSION: The mission of the Coalition is to protect and restore environmental and recreational values at rivers affected by hydropower projects and to reform hydropower policy to guarantee needed environmental protection measures in hydropower regulations.

STEERING COMMITTEE: In the Northwest, Steering Committee members include American Rivers, American Whitewater, Idaho Rivers United and Trout Unlimited. Additional information can be found on the Coalition's website: www.hydroreform.org.

Restore
RESPONSIBLY REVIVING AMERICA'S RIVERS

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The primary focus of the Coalition is river restoration and reoperating of existing dams for environmental gain. Coalition members do not advocate removal of all dams. For each dam removal example in this publication, the owners and operators have agreed to removal as a final option. The report attempts to provide complete and accurate information, but the Coalition does not make any warranty, express or implied, or assume any legal responsibility for the accuracy, completeness, or usefulness of any information or process described or contained in this document. The information in this document does not represent a complete record of dam removal nationally or in the Pacific Northwest. This document is intended for general information purposes only and should not be construed as legal advice or a legal opinion.

HYDROPOWER REFORM COALITION
Putting water, wildlife, and people back in rivers.

Fall-time angling on Idaho's Boise River.

photo by rich bowers

When we try to pick out anything by itself,
we find it hitched to everything else in the universe."
— JOHN MUIR

About the cover

The Hydropower Reform Coalition was organized to capitalize on a change to federal law that requires the Federal Energy Regulatory Commission (FERC) to give equal consideration to non-power values like water quality, recreation, and the protection of fish and wildlife when issuing the federal licenses that established the operating requirements for hydropower dams.

The cover photo of the Chelan River Gorge is an example of when non-power values were well-balanced with operating requirements. The November 2006 license issued for the Lake Chelan Project restored flows and recreation to four miles of the Chelan River Gorge, improved 55 miles of Lake Chelan through balanced and comprehensive management, as well as 10 miles of fisheries improvements in the Stehekin River and other lake tributaries.

This photo: *S. Fk. of the Skykomish's Eagle Falls.* **Photo by Christian Knight.**
Cover: *Chelan Gorge during an American Whitewater-coordinated recreational release.* **Photo by Rich Bowers.**

fall 2010

feature

essay

departments

on the web

WWW.HYDROREFORM.ORG
Learn the most recent developments in hydropower policy and events; learn more about the Coalition's diverse array of member organizations and get involved.

the last benefit

Dams provide an array of benefits to society. But as they age, those contributions morph into liabilities of safety, economics and environmental harm. The last gift of an aging dam might be its own disappearance.

STORY BY RICH BOWERS ■ PHOTO BY THOMAS O'KEEFE

Eleven years ago, a bell in a church's steeple began ringing up on the hill. It had rung every Sunday since the late 1800s to usher in Augusta, Maine's French Catholic parishoners. But on July 1, 1999, it was ringing on a Thursday. And instead of ushering in another congregation, it was ushering in a new era. A new era of dam removal. The Kennebec's Edwards Dam was the first removed by order of the Federal Energy Regulatory Commission. And since then, owners and regulators have removed another 460 — accounting for nearly half of the 836 removed dams counted by American Rivers, the national non-profit river restoration organization.

This trend acknowledges what dam removal advocates have been saying for some time: That all dams — even the best-built dams — age.

This is true of the dam built yesterday. It's true of the 18,690 built in the 1960s (according to the Army Corps of Engineers) and it's especially true of the 14,615 completed before the turn of the century.

As dams' structural integrities deteriorate, so do their benefits to society.

The power they once generated is weakened by a century's worth of accumulated sediment pressing against their bases. The fields they were retrofitted to irrigate may now be parking lots.

These diminished benefits come with risks—the risks of breaches that could result in catastrophic flash floods; bankrupting repair requirements; harm they impose on our most threatened species.

"The number of deficient dams has risen to more than 4,000, including 1,819 dams with high hazard potential," asserted the American Society of Civil Engineers' 2009 report card. "Over the past six years, for every deficient, high-hazard potential dam repaired, nearly two more were declared deficient. The average age ... exceeds 51 years."

The gorge wall of Cornell University's Triphammer Dam was completed in 1902.

In these circumstances—when environmental damage or safety risks outweigh the economic or power benefits of maintaining the dam—the Hydropower Reform Coalition recognizes that dam removal is an increasingly useful tool for river restoration.

In these circumstances ... the Coalition recognizes that dam removal is an increasingly useful tool for river restoration.

The Coalition also recognizes the value of maintaining—and upgrading—some dams, especially those that produce sufficient energy.

"More than 2,500 megawatts of power could be added by simply improving efficiencies at existing hydroelectric plants and adding hydro to non-generating dams," concluded the 1997 U.S. Hydropower Resource Assessment for Washington State.

THE NORTHWEST PERSPECTIVE

Dam removal has been studied or successfully undertaken on more than 80 rivers in Alaska, Montana, Oregon and Washington. This includes dam removals on Oregon's Rogue and Sandy Rivers, Idaho's Bear River, Washington's Trout Creek, Montana's Clark Fork, Oregon's Hood River, and others. A number of additional dams are either currently under study for removal or are being removed, such as Condit Dam on Washington's White Salmon River, Mill Pond on Sullivan Creek, Elwha and Glines Canyon dams on the Olympic Peninsula, Iron Gate, Copco, and J.C. Boyle dams on the Klamath. A number of other dams, such as the Middle Fork Diversion on Washington's Nooksack River and Growden Dam within Washington's Colville National Forest are also being considered for future removal.

Dam removal in the Northwest has restored hundreds of miles of river and provided more fish, wildlife, recreation, improved public safety, flood protection, and better water quality.

836

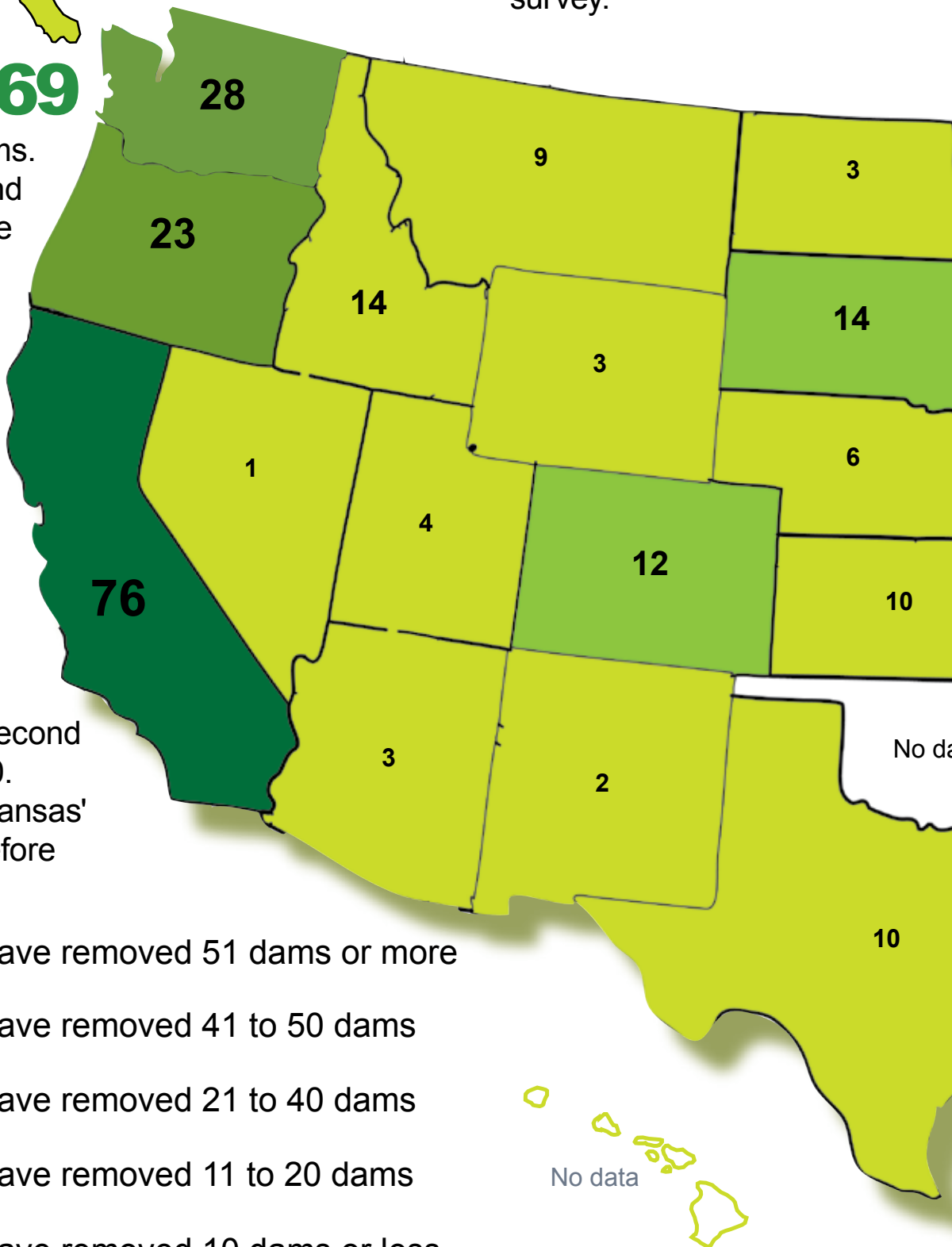
The number of dams removed through 2009, according to American Rivers' most recent survey.

1960-1969

The decade of dams. U.S. companies and agencies built more than 22 percent (18,690) of the nation's dams during this era. The second most prolific era of dam building occured prior to 1900.

Kansas

has 6,087 dams, second only to Texas' 7,170. Thirty percent of Kansas' dams were built before 1900.



States that have removed 51 dams or more

States that have removed 41 to 50 dams

States that have removed 21 to 40 dams

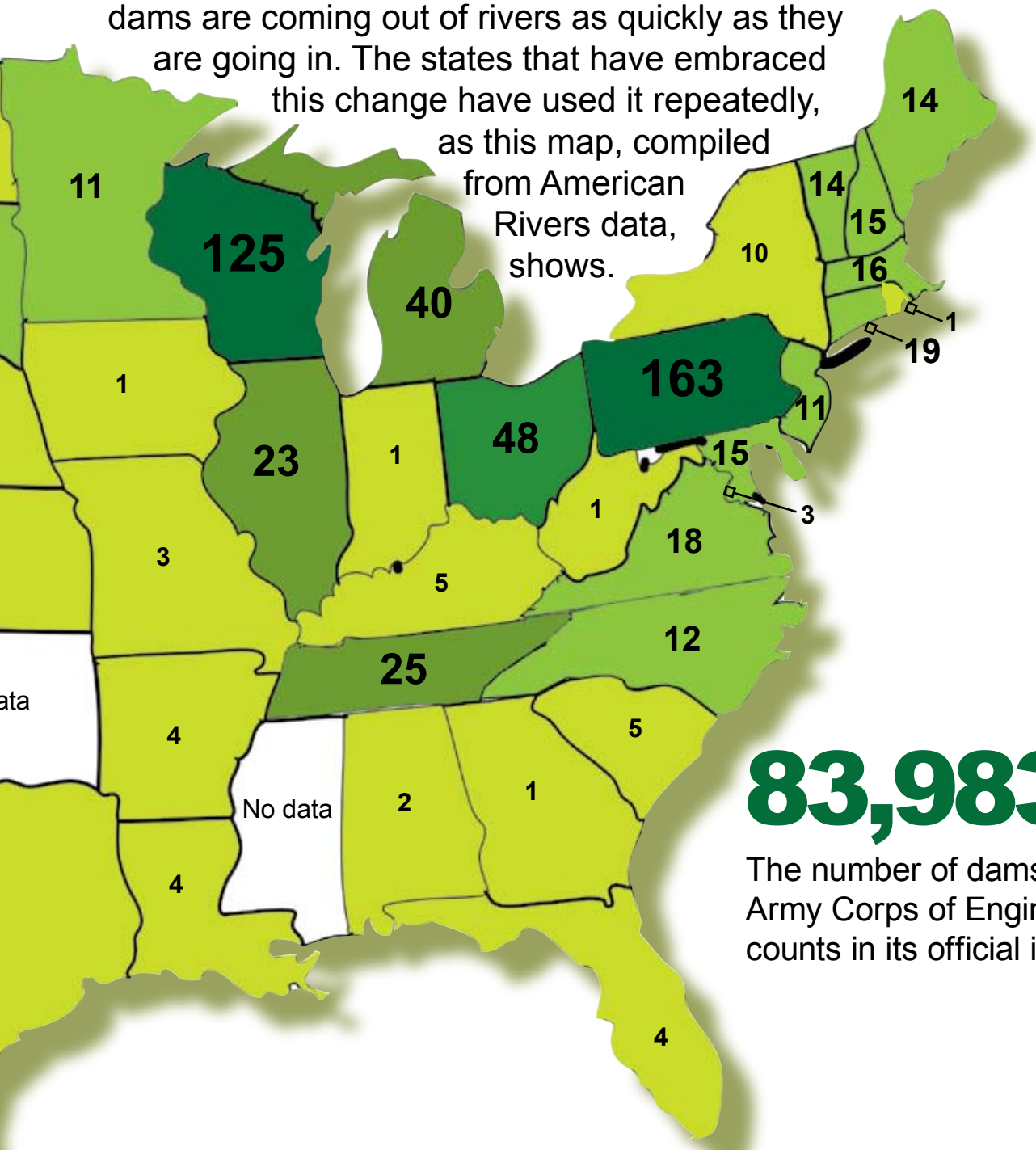
States that have removed 11 to 20 dams

States that have removed 10 dams or less

** All data retrieved from American Rivers (americanrivers.org) and the U.S. Army Corps of Engineers (usace.army.mil).*

DAM nation

For the first time since the beginning of last century, dams are coming out of rivers as quickly as they are going in. The states that have embraced this change have used it repeatedly, as this map, compiled from American Rivers data, shows.



460+

The number of dams removed since the July 1, 1999 removal of Maine's Edwards Dam on the Kennebec River.

83,983

The number of dams the U.S. Army Corps of Engineers counts in its official inventory.

2,500,000

The National Research Council's total estimate of U.S. dams, including small dams, which are not claimed or maintained. *From: National Research Council's 1992 report, Restoratoin of Aquatic Ecosystems: Science, Technology and Public Policy.*

A new equilibrium

Even after a century of impoundment, nature will discover balance.

We've all broken our parents' hearts. At least once. On that day when we told them they did a good job and then told them goodbye.

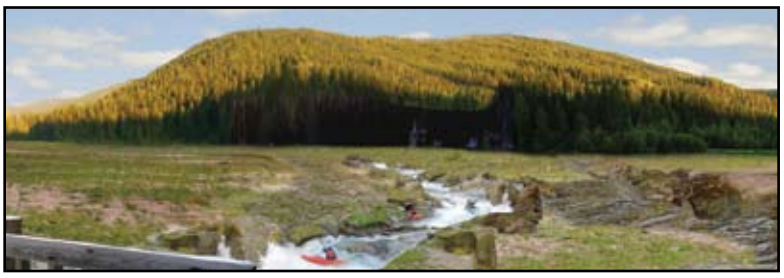
Of course we weren't gone for good. We'd visit on the weekends, for sure. And all the major holidays.

But they wept anyway because they knew the relationship had changed. They knew that we had begun our quest for a new equilibrium.

Getting there, our parents knew, would be messy. It would be replete with broken cars, fold-out beds, empty refrigerators, break-ups and two-week notices.

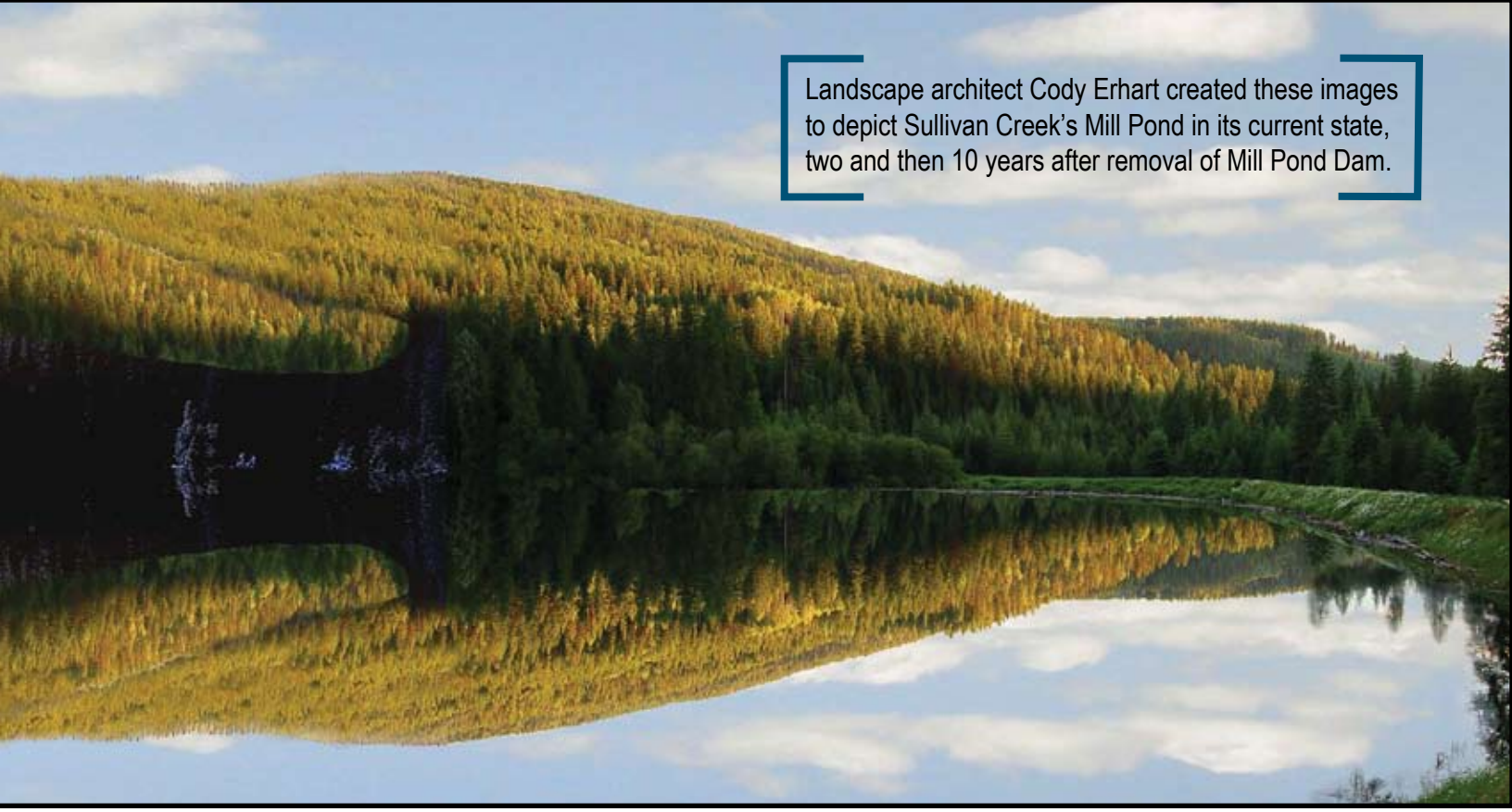
A river's re-entry into its native riverbed can be every bit as volatile. Before establishing its own new equilibrium, it must deposit many decades worth of sediment, scour lakeside wetlands, and drain. It can be messy. But we still need to let the river go.

When the dam is new, we fool ourselves into believing the structure and the lake it formed will be with us forever, that it has become a part of our landscape.



But dams, like children, age. After 50 years, their concrete rapidly begins to decay and eventually crumble. Sediment, intended to provide mortar for the river's downstream banks and nutrients for its species, instead halts at the dam, accumulating every day like cobwebs in the attic.

The existing riverbed, vulnerable to the force of floods now, changes regularly. Microscopic life, whose



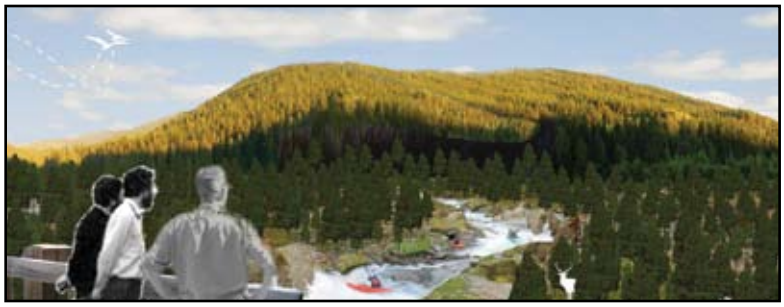
Landscape architect Cody Erhart created these images to depict Sullivan Creek's Mill Pond in its current state, two and then 10 years after removal of Mill Pond Dam.

survival has depended on that sediment for millions of years, disappear. So do entire salmon and steelhead runs.

Of course, these effects are invisible to most of us. What we see is the lake—our favorite picnic spot, the place where, that one time, we caught a 10-ounce Small Mouth Bass.

The place that could take the burn out of the hottest summer day.

This is what we see when we gaze upon the lake. And so, we try to hold onto it. Even though the dam no longer produces electricity. Even though its fish passage system has aged so mercilessly, it now kills the very fish it was originally engineered to protect.



And to make the dam owners think twice about removal, we do what our parents did to us when we left their homes: We fret over the transition process.

"But where will you stay?" they asked us. "How will you eat?"

With dam removal, the vernacular is different, but the message is the same: "Where will all that sediment go?" we ask. "What will those migratory birds eat?"

Yes, the transition is always a little messy. Despite all the scaled models, expert analysis, environmental impact statements, it's always a little uncertain. At least in our own minds.

But that doesn't mean we should stop it. Nature designed rivers to run to the sea the same way our parents raised us to explore the world, to become self-sufficient. And until a river gets there, it will always be out of balance.

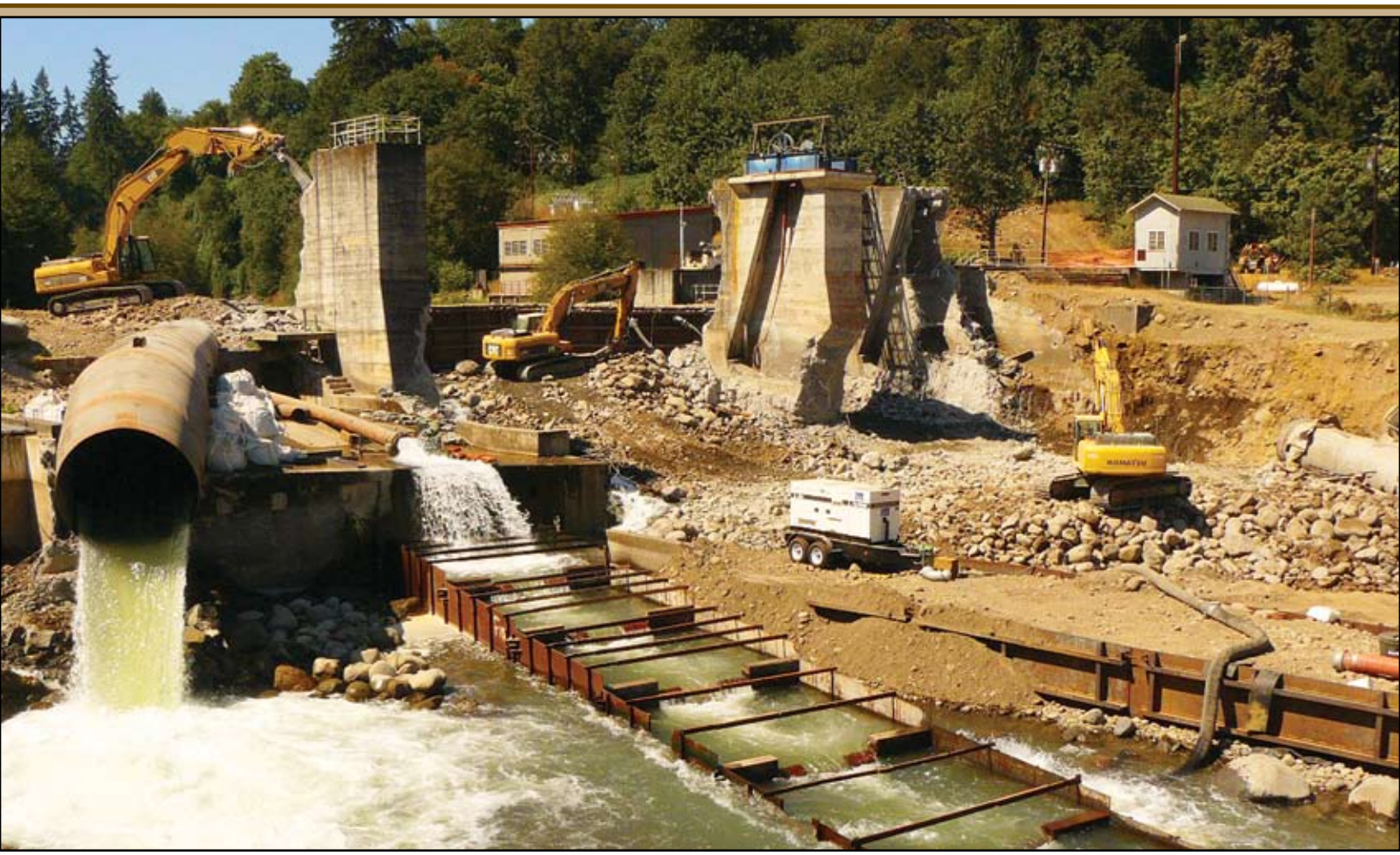
"In the lifetime of a river, a dam for 100 years matters very little," says U.S. Forest Service hydrologist Gordon Grant. "From a geological perspective a dam that sits for 100 years does not cast a long shadow."

But letting a dam go allows the river to develop what Grant calls "a new equilibrium."

"Fundamentally, once you remove a dam, you initiate a set of processes, some fast, some slow, by which a river re-establishes a new equilibrium," Grant explains. "This new equilibrium may have never existed that way before."

In 2010, PacifiCorp began removing Hood River's Powerdale Dam, pictured below.

photography by sam drevo



Natural consequences

Eventually, most of the nation's two million dams will be removed. The question is: At nature's whim or human's engineering?

The Ka Loko Dam never should have breached because its owner never should have graded over its spillway.

It never should have become dilapidated because state inspectors should have evaluated it every five years, and forced its owner to maintain it.

And it never should have had to hold so much water, because even in Kauai—Hawaii's Garden Island—the heavens rarely dumped so much water for so long.

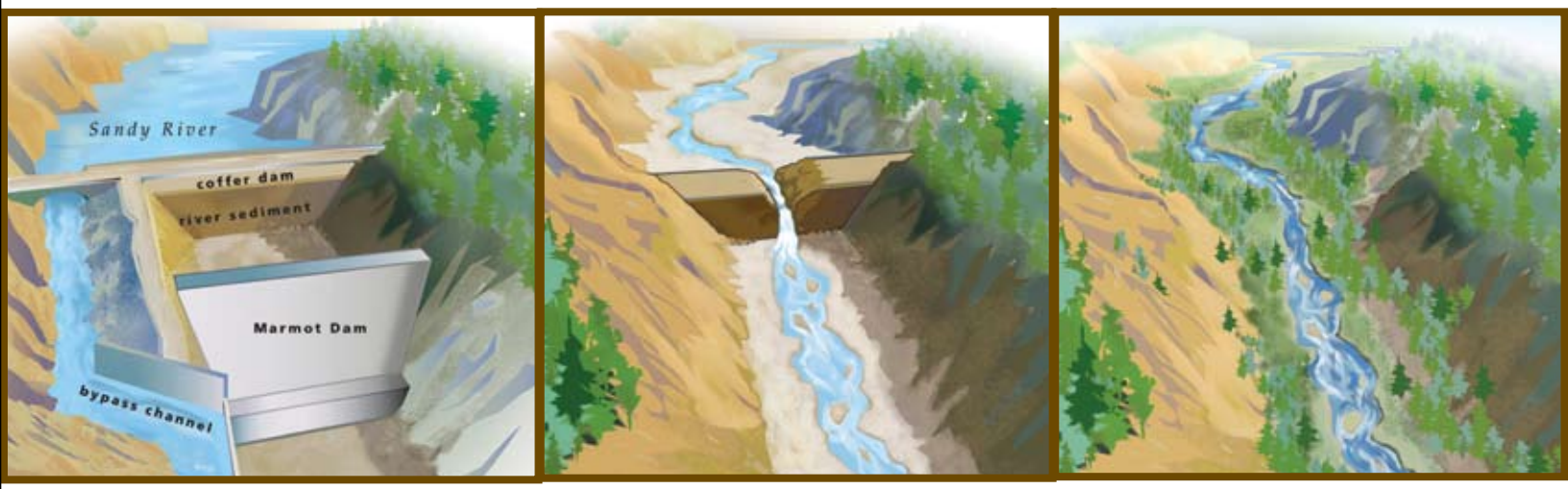
None of these three culprits should have ever converged.

In the sleeping hours of March 14, 2006, however, the worst of greed, poor regulation and nature conspired to unleash 300 million gallons of water in a series of 30- to 70-foot waves. The torrent uprooted trees, devoured the land and drowned seven people—one of them a pregnant mother and another a 2-year-old boy.

Compared to Arizona's Mead and Washington's Ross, the Ka Loko Reservoir was tiny. It measured less than 20 feet high. But it proved—as history has so many times—that pent up energy can wreak a

Oregon's Sandy River is recovering, according to the models, illustrated below.

illustrations by pacificorp



disproportionate amount of damage.

The United States has 83,983 dams listed on its inventory and, some say, a couple million more, which are not.

Of those inventoried dams, more than 26,000 pose a significant or high hazard to the people and lands that are downstream, according to the U.S. Army Corps of Engineers. And most of those, roughly 73 percent of them, are privately owned. This requires each respective state to inspect dams for weaknesses and order the owners to maintain them. But just like the Ka Loko Dam, states don't always have the budgets and the man-power to regularly inspect the dams. And owners frequently don't have the money to repair them.

The result is a dangerous concoction of ever weakening dams, growing downstream populations and more surface water, which combined can devastate the land and lives of the people who live beneath them. This is why so many owners are resorting to a third option: Removing the dams. Allowing rivers to return to their natural states.

Michigan is one of the nation's leaders when it comes to dam removal. It has an estimated 2,500 dams, 114 of which produce hydropower. Because so many of Michigan's dams were built more than a half-century ago—and, as in the case of the Boardman River, more than a century ago—many have outlived their purposes.

They've aged. Sediment has built up behind them.

Their power generation significance has dwindled. And they need to be retrofitted.

"To own and maintain a dam it costs a lot of money," says David Hamilton, the water section manager of Michigan's Department of Natural Resources and Environment. "It's cyclic when you need money. You'll go years and years and there'll be need for investment. And all of the sudden one year, big years, they drop."

In 1986, floods swept through much of Michigan, toppling several dams, which destroyed property and lives. In response, Michigan passed the Dam Safety Act of 1989, which accomplished several things.

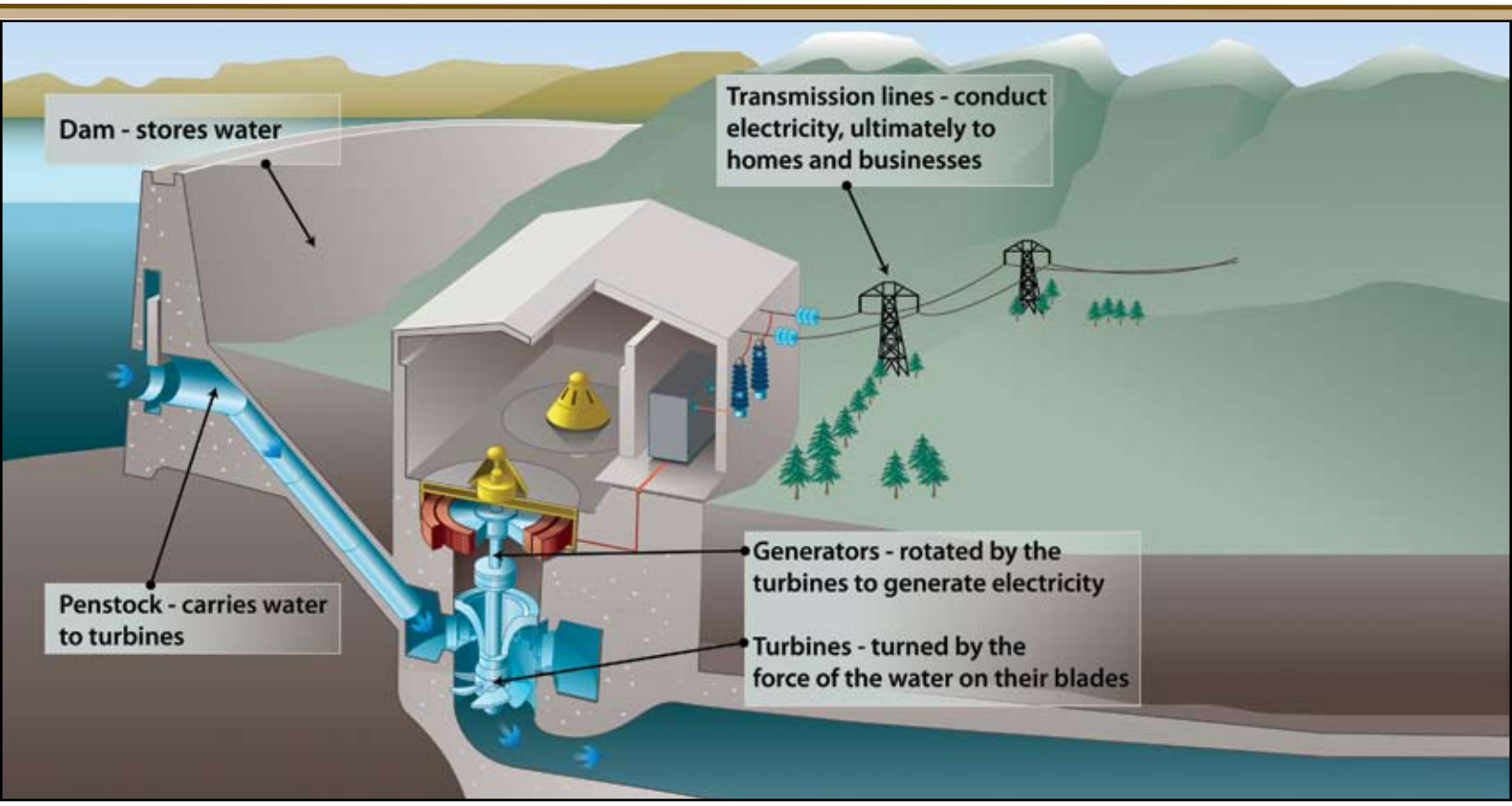
The act set standards for dam safety. It established classifications for the dams—high potential for failure or low potential—and it required regular inspections.

Budget shortfalls have forced the department to focus on the high potential and significant potential dams. Despite the shortfalls, Michigan has removed 40 dams through 2009, behind Pennsylvania (163), Wisconsin (125), California (76) and Ohio (48).

"That program is making sure dams in place are safe, well-maintained and regularly inspected," Hamilton says. "When we find dams that are not safe we say something needs to be done with them. We work with the owner to make sure they fix the dam or that they remove the dam. Our position as an agency is we don't care whether the dam stays in place or is removed. But if it is in place, it needs to be safe."

For more federal information on hydropower, visit: www.eere.energy.gov

illustration by the u.s. department of energy



How do they compare?

Run-of-river and impoundment dams differ more in industry semantics than practical application.

RUN-OF-RIVER projects facilitate the energy of the river's current to produce electricity. Nearly all require a small reservoir to divert water through a penstock or flume and into turbines, and then return the water downstream.

ADVANTAGES: Require less flooding. Produces fewer carbon emissions.

DISADVANTAGES: Their power supply can't be coordinated with consumer-demand. "Eco-friendly" label gives false sense of benign nature, despite minor flooding and destruction of ecosystems.

EXAMPLES: Bonneville and Wells dams on the Columbia, and most of British Columbia's Independent Power Producer projects are run-of-river dams.

IMPOUNDMENT dams rely on stored water, which when needed generates electricity. Impoundments are the most common form of hydropower plants and consist of the world's largest projects.

ADVANTAGES: Provides stable and predictable energy supply. Produces relatively insignificant carbon emissions. Public scrutiny ensures utilities construct and operate with significant mitigations of dam impacts.

DISADVANTAGES: Requires large-scale flooding, which destroys habitats, blocks salmon runs and rots vegetation, which releases carbon dioxide.

EXAMPLES: Hoover and Glen Canyon, Rocky Reach (Columbia), Three Gorges (China).

U. of Minnesota's Center for Earth's Surface Dynamics is the place to go for models.

photography by gordon grant

Role of the model

When a group of fishermen decided in 1902 to remove a Rogue River dam, they didn't conduct feasibility studies, environmental impact studies or sediment studies. All they did, was light the fuse. Stream ecology has progressed in the last century and hydrologists today often rely on models to reduce uncertainty in large-scale projects.

The removal of Marmot Dam relied on the prediction of a scaled, 60-foot-long, five-foot-wide model of the Sandy River.

When the Elwha and Glines Canyon dams come out starting in the fall 2011, a 45-foot-long scaled model will guide the $351 million deconstruction.

The researcher involved with both of these models is Gordon Grant, a research hydrologist from Oregon State University and the U.S. Forest Service. Below are his words on the models.

ACCURACY: "We were surprised at how quickly the sediment [at Marmot Dam's removal] was evacuated under very modest flow conditions. About 20 percent of the total volume [of sediment] stored, was evacuated during the first 48 hours. It came out very quickly. The physical model predicted that, but we didn't believe it. On the river ... the numerical models predicted that sand would flush and gravel would linger ... The models predicted that pretty well."

TRIAL AND ERROR: "[Physical] models are expensive and hard to build. We use them to test ideas. No one had done this [removed a significant dam with natural erosion] before. [The models] get run a lot. We ran 10 experiments with the Marmot model. We wrote a paper on it. It's great fun."

PAPIER MACHE? "The basic form is plywood with concrete poured over the form and painted. The Marmot model cost $30,000 to $40,000."

WHO BUILDS THEM: "[The University of Minnesota's Center for Earth's Surface Dynamics] are masters of the model. [The Marmot model] took about a month to build, for a team of four to five people. The team consists of lab techs and engineers. Lots of engineering is done with these models."

■ *To see video of the model's construction and test go to: http://www.youtube.com/watch?v=sd2CfsFpjAU*

and

http://www.youtube.com/watch?v=UTMW4-PVPI8

The Forest Service expended more than 1,000 logs to anchor the creekbed.

photography by gifford pinchot national forest

Check out http://www.bpa.gov/corporate/BPANews/ArticleTemplate.

Trout Creek revival

A day after removal of the Hemlock Dam, a young adult steelhead swims upstream

For 75 years, one half mile of Trout Creek lay buried in sediment. The 22-foot-high dam had justified the 1935 drowning of this section of the Wind River tributary by generating power for a 200-man logging camp into the 50s, irrigating a conifer nursery into the 90s, and providing a swimming hole warmed by its perpetual exposure to the Columbia River Gorge's sunshine.

But the warmth, which took the sting out of a summer's dip for swimmers above the dam, had evicted or killed the young steelhead below the dam. The concrete, which had provided jobs and electricity for decades, had also severed the creek's upper 20 miles from its lower two miles. Ultimately, the dam contributed to the 1998 Endangered Species listing of the Lower Columbia steelhead.

And so after several years of studying the watershed, the Gifford Pinchot National Forest decided in December 2005 to remove the dam and allow the creek to become again what it once was: the Wind River watershed's most important habitat for native steelhead. Beginning in July 2009, the James Dean Construction company toiled 17 hours a day for 40 days, excavating 2,000 dump truck loads (60,000 cubic yards) of sediment in a search for the original creekbed.

Crews discovered the original splash dam that lumberjacks used to transport timber downstream. The Forest Service would use those buried cedars to help anchor the recovering streambanks and to build picnic shelters, kiosks and other Forest Service assets. Hemlock Dam came down in three days. The creek's recovery was just beginning. And much of its success relied on the contributions of humans—the same species that had drowned the creek 75 years earlier.

Using more than 1,000 trucked-in logs and some of the old growth conifers from the splash dam they had uncovered during excavation, the Forest Service rebuilt the Trout Creek riverbed and banks and incrementally pumped water around the restoration zone and back into the river below the dam.

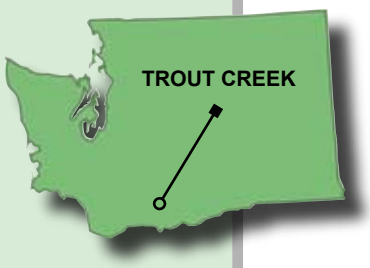
On that first day, U.S. Forest Service hydrologist and project manager Bengt Coffin witnessed the first glimpse of a long recovery: A young adult steelhead approached the worksite and swam upstream through the rebuilt streambed.

Removal costs of Hemlock Dam were provided by the U.S. Forest Service, Salmon Recovery Funding Board, the Yakama Nation, U.S. Fish and Wildlife Service, Ecotrust, Mid Columbia Fisheries Enhancement Group, NOAA Fisheries and American Rivers.

"This project is a great example of the painstaking science behind our efforts to protect and enhance habitat for fish. In this case, dam removal made perfect sense," said Bill Maslen, BPA Fish and Wildlife official.

HEMLOCK DAM

- Removed 2009
- Wind River is considered Tier I Key Watershed
- Project exhausted 1,000 logs for bank reinforcement
- Old growth conifers from splash dam provided logs for bank reinforcement, plus milled wood for kiosks, signs and picnic shelter
- Removal re-connected upper 20 miles to lower two miles of creek



Glines Canyon Dam reveals the wear of age. It traps 14 million cubic feet of sediment.

photography by thomas o'keefe

This time, it's for real

Efforts to remove the Elwha River's two dams began two decades ago. But the August 2010 announcement of a $27-million contract gives advocates genuine optimism for a 2011 start date.

Twenty years ago, Gordon Grant sat around the dinner table with fellow scientists, making wagers on a napkin.

The bet: the fate of the Elwha River's two dams—the only man-made barriers obstructing the pristine river's source in the mountains of Olympic National Park from its mouth at the Strait of Juan de Fuca 45 miles and 4,500 vertical feet downstream.

And Grant, being a skeptic, waited until the last of those scientists had placed his wager.

"I, of course, would pick the one day after the last day claimed," says the Forest Service hydrologist, responsible for modeling the removal. "It's been on the books for 20 years. The removal date has been pushed back four times."

The dams' fifth removal date is October 2011. And if Grant were sitting around the dinner table with a bunch of scientists and a spare napkin, the date he'd scribble on that napkin would be October 2011.

"It does look like it'll come out in the next year," he says.

The delays resulted from similar—but more intense—issues that have delayed the removal of so many unproductive dams throughout the United

The announcement of a $26 million contract indicates removal will begin late 2011.

States. Permits. Red tape.

Now that the removal seems imminent, however, Grant—and the group of scientists to which he belongs—has shifted his attention from the question of when the dams will be removed to how. How do you make thousands of tons of 100-year-old concrete disappear? How do you delete 20 million cubic yards of trapped sediment from an empty lake? How do you undo a century's worth of human interference?

Of the 600-plus dams removed since the Kennedy administration, Glines Canyon would represent the biggest. Elwha Dam would be the second largest.

No one has ever done this. Except by model.

In 2010, a team of engineers from the University of Minnesota's National Center for Earth's Surface Dynamics built a 35-foot long precisely scaled model of the Elwha River out of concrete and plywood.

And since that time, Grant has been testing a series of hypothesis with the model.

ELWHA DAMS

- Owned by U.S. Dept. of Interior
- Elwha built in 1913; Glines built in 1927
- Combined capacity of 28.1 megawatts
- 18 million cubic yards of sediment; 14 million behind Glines Canyon Dam
- Removal would restore 70 miles of habitat
- Both dams impound combined 36,500 acre feet of water

The first lesson he learned is the natural erosion method used during the Marmot Dam removal won't work for the Elwha and especially for the Glines Canyon Dam. Most of the 800,000 cubic yards of sediment stacked up behind the 47-foot-high Marmot Dam was front-loaded, as if consolidated at the end of a wheelbarrow. All it needed was a big gush of water to shove it out. The 17 million cubic yards of sediment behind Glines Canyon Dam, by contrast, is dispersed throughout 140 of Lake Mills' 415 total acres. The gush of water would be more like the spout from a garden hose cutting a channel right through the middle of it.

"It would leave a 115-foot-high canyon full of unstable sediment," Grant says. "The thing would be calving, landsliding and bleeding for years to come."

The best method, Grant says, is to remove the dam 15 vertical feet at a time, then drain and to repeat this process over and over and over again.

"If you do it in stages, if you allow the river to reach equilibrium with each new stage," Grant says. "Each new stage redistributes the sediment. Each time you lower the dam, you have a new delta. It's a very effective strategy." This method releases about 25 percent of the sediment and redistributes the rest along the sides of the canyon.

The dam would be gone in two years.

But the model revealed another potential hazard. The current, given too much freedom, could wander away from the location of its buried riverbed and cut a new channel through the sediment along one side of the canyon or the other. This could undercut the canyon's unstable sediment walls and result in a perpetual state of landslides and salmon-choking turbidity levels. To avoid this problem, Grant says, an excavator will cut a pilot channel through the middle of the riverbed.

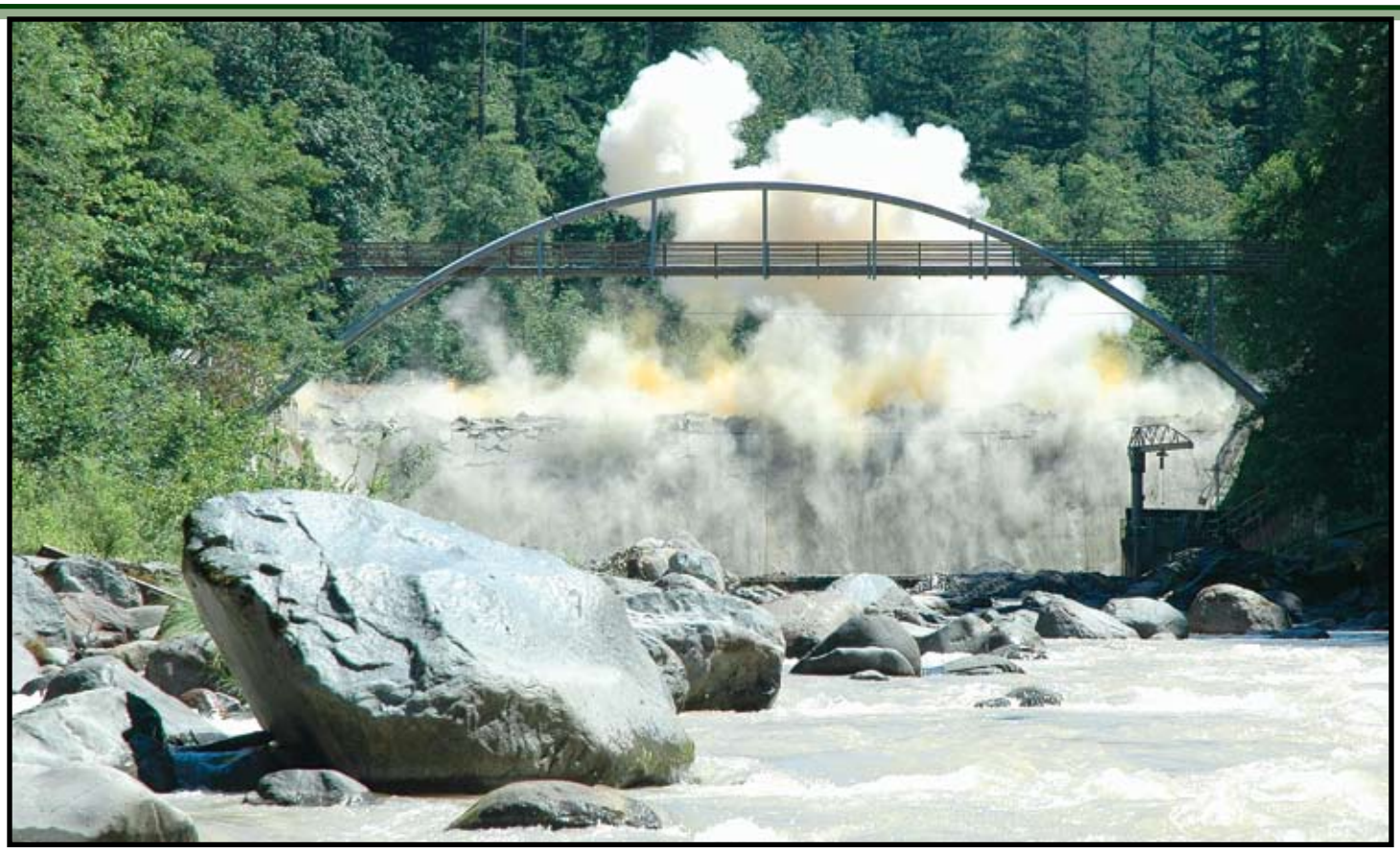
And, if the 45-mile river replicates its 35-foot scaled model, the Elwha River could once again host runs of 400,000 salmon per year relatively soon.

But it wouldn't be the same river that it was before 1910, when the Elwha Dam severed the river's lower 4.9 miles from its upper 38 miles.

"In the lifetime of a river, a dam that sits there for 100 years matters very little," Grant says. "Fundamentally, once you remove a dam, you initiate a set of processes, some fast, some slow, by which the river reestablishes a new equilibrium. The new equilibrium may have never existed that way before. It's a new river, a new equilibrium."

As models predicted, the force of the river eroded the stacked sediment quickly.

photography by portland general electric



Nudging natural erosion

The removal of the Sandy River's Marmot Dam was a first for the natural erosion method. And scientists have studied it carefully.

The 2007 removal of Marmot Dam sparked a lot of theories about what would happen to the 43 miles of Oregon's Sandy River below the 47-foot-tall hydroelectric project. But none of the hydrologists, geomorphologists and engineers really knew exactly how the river would digest all that sediment.

"No one had ever done this before," said Gordon Grant, a research hydrologist with the United States Forest Service.

Since its construction in 1912, Marmot Dam had been impeding fish passage and trapping sediment. Lots of sediment.

Portland General Electric rebuilt it in the late 1980s and by 2007, the dam had piled 800,000 cubic yards of sediment up to its brim and spread it a mile upstream.

This was the equivalent of 150 Olympic-sized swimming pools worth of sediment.

Some forecast models were dire: They predicted the river would require two- to five years to disburse half of the sediment. And in the meantime, the sediment would block salmon from downstream tributaries, bury spawning beds and suffocate salmon.

But that's not what happened. After 18

To see time-lapse video, go to: http://www.youtube.com/watch?v=CaNb2wouYUk

months of negotiation, members of the Hydropower Reform Coalition, Portland General Electric and 21 other signatories had considered two plans: Excavate the sediment mechanically or allow the river to erode it naturally.

The former plan would be expensive, would require at least a year of excavation and would stir up turbidity that could choke salmon for the entire time. According to a plethora of models, the latter option would be faster, more natural and unprecedented.

"At the time, it represented the single largest instantaneous release of sediment," Gordon Grant says.

Portland General Electric began preparing for the removal late in the summer of 2007, when the water was low. And on October 19, 2007, after a series of rainstorms swelled the Sandy and strained the cofferdams, PGE provided the final push that allowed the river to once again control the riverbed.

"For me personally, it moved faster than I had anticipated," says John Esler, one of PGE's project managers for the removal. "Once the cofferdam was moved out of the way, the sediment just left. About as fast as you could watch it. It came out amazingly fast."

The next three or four storms continued to disperse the sediment. The fine sands, the stuff that can choke or suffocate fish, moved through the system quickly, Esler says.

The gravel never blocked side-channels.

It never cut off the tributaries.

"The main concerns about blocking never materialized," Esler says. "We had Coho spawning the next week. Literally. It was amazing. You could stand up on the bridge, look downstream and feel like you were looking at a river in the Olympic Peninsula."

The Sandy River's faster-than-hoped-for restoration has been the reward for PGE's pursuit of a modeled, yet untried method of removal. But the impetus for removal wasn't environmental.

It was economic. PGE began preparing to renew its license in 1998—six years before its current license would expire.

Its financial officers quickly realized the 22 megawatts of power wouldn't justify the expense of the modifications necessary to relicense the project.

"It came down to simple exercise," Esler says. "On one side, we were considering what the agencies were asking for, such as higher flows, rebuilding the fish ladder, a screen system that put fish back into the river, the need to leave water in the Little Sandy," Esler says.

"Then, with a simple Excel spreadsheet, we added up the costs that we were going to do, plus maintenance. On other side, we considered the value of energy. It was about a wash."

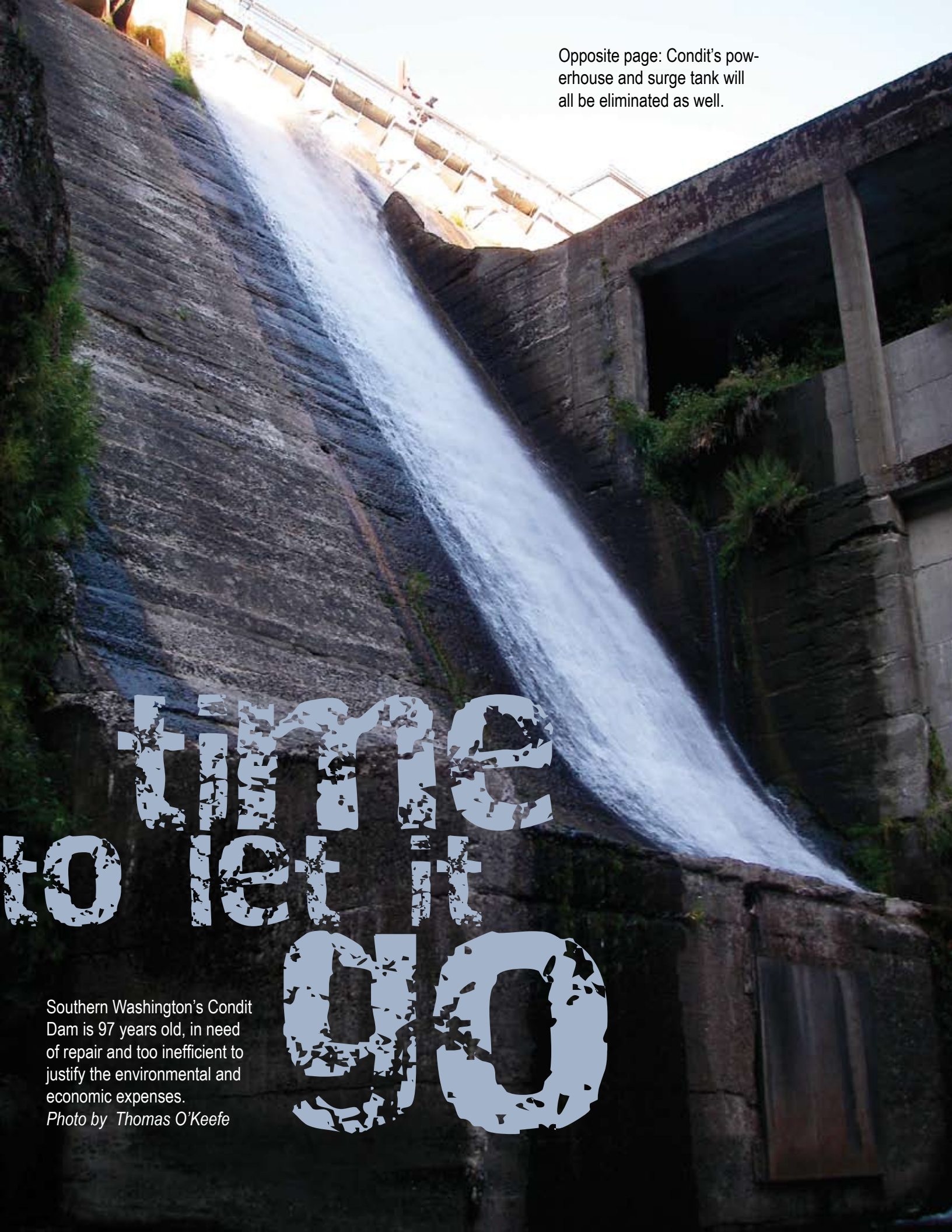
The removal connected 100 miles of river, and led to the donation of 1,500 acres of PGE's land to the public.

"As much as the public complains about dams on rivers, they get used to dams on rivers," Elser says. "That's the status quo. If we had not been as committed as an entity to see this thing through, there would have been 100 ways to stall this thing from happening.

"The team [at] PGE had to bulldog this to keep it on track. But it's understandable. It was different. No one had ever done this before."

MARMOT DAM

- 23 organizations signed the settlement agreement
- First major U.S. dam to be removed with natural erosion method
- 800,000 cubic yards of sediment was 47-feet thick and extended a mile upstream
- The 2007 removal connected 100 miles of river
- PGE donated 1,500 acres of land to the public



Opposite page: Condit's powerhouse and surge tank will all be eliminated as well.

time to let it go

Southern Washington's Condit Dam is 97 years old, in need of repair and too inefficient to justify the environmental and economic expenses.
Photo by Thomas O'Keefe

Five years and three postponements after Condit Dam's original removal date, PacifiCorp, the project's owner, received one of the final go-aheads to remove the 125-foot-high, 471-foot-wide wall of concrete from the lower White Salmon River.

The state order for this $28 million removal project came October 12, 2010 in the form of the Washington Department of Ecology water quality permit.

Just getting to this point has required the collaboration of 23 stakeholder groups, and scientists from several state, federal and local resource agencies to study every detail and consequence of removal.

And though they all acknowledge the short-term impacts of removal, they all agree it is necessary for the survival of the White Salmon River ecosystem and the restoration of one of the region's most prolific salmon and steelhead habitats.

Photo by TomasO'Keefe


Photo by Nicholas O'Neil


Photo by ThomasO'Keefe

Seven million eggs

1907: Biologists collect more than seven million Chinook eggs at a hatchery near the mouth of the White Salmon River.

Harnessing the power

1913: Northwestern Power Company builds 125-foot-high, 471-foot-wide Condit Dam to generate power for processing local paper operations and to supply power for a growing population. The dam, equipped with a wooden fish ladder, barricades southern Washington's White Salmon River 3.3 miles from its mouth with the Columbia and about 40 miles from its source on the southern slope of Mount Adams.

No more fish? Oh well.

1919: After floods destroyed the original fish ladder and its replacement, the dam's owner absolves itself of fish migration responsibilities by paying the Washington Fish Commission $5,000 for a mitigating fish hatchery. This extinguishes the local populations of native fall Chinook, coho and steelhead.

Historic photographs show construction, and the narrows section before Condit

The federal power act

1920: Congress passes the Federal Power Act, which creates the Federal Power Commission—now the Federal Energy Regulatory Commission (FERC)—to coordinate hydroelectric projects and maintain "reasonable, nondiscriminatory and just rates to the consumer."

A new lease on power

1968: PacifiCorp renews its license through FERC to operate the Condit hydroelectric project. The lease will expire in 28 years.


Photo by Rebecca Sherman

Necessary imposition

1984: The U.S. Supreme Court rules Section 4(e) of the Federal Power Act gives FERC no discretion to reject the conditions imposed upon a hydropower operator by federal land reservation managers, such as the U.S. Forest Service.

Flower power

1986: The Electric Consumers Protection Act amends the Federal Power Act to give "equal consideration" to the preservation of recreational, ecological, and other values of natural rivers.

Combined with the 1984 Supreme Court decision and a 2000 decision by the Ninth Circuit court, these interpretations of the Federal Power Act recognize the rights of federal and state agencies to influence the outcomes of the licensing process.

New license, please

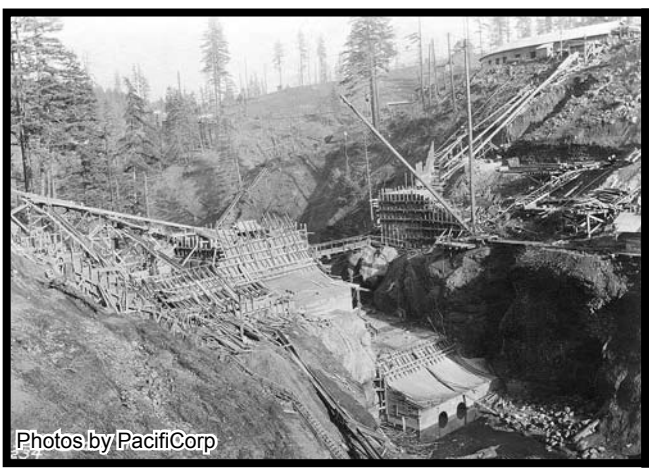
DECEMBER 27, 1991: PacifiCorp applies for a new license to continue operation.

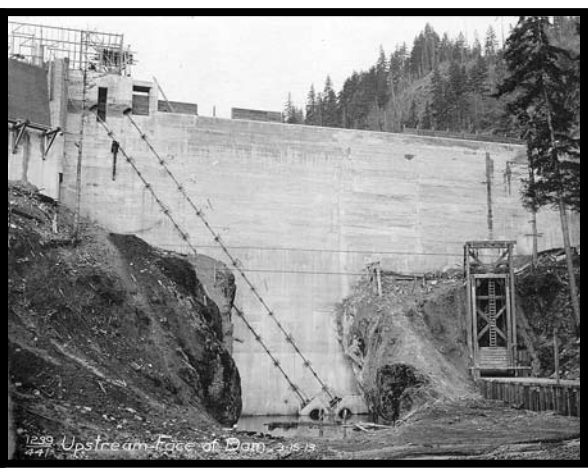
FERC modifies PacifiCorp's idea

OCTOBER 1996: After considering five options for Condit Dam's fate, FERC recommends PacifiCorp's proposal to maintain the dam with modifications.

They all agree

SEPTEMBER 1999: Fifteen environmental groups, two tribal entities, and five government agencies negotiated a comprehensive agreement for an October 2006 removal of what would be the nation's largest hydropower dam. PacifiCorp estimates removal will cost $17.5 million. Environmental signatories include: *American Rivers, American Whitewater, Columbia Gorge Audubon Society, Columbia Gorge Coalition, Columbia RiverKeeper, Federation of Fly Fishers, Friends of the Columbia Gorge, Friends of the Earth, Friends of the White Salmon, Rivers Council of Washington, The Mountaineers, The Sierra Club, Trout Unlimited, Wild Fish Conservancy, Washington Wilderness Coalition.*


Photos by PacifiCorp



Condit Dam has a peak capacity of 14.7 megawatts, good for 7,500 homes.

It will come down, one day

OCTOBER 1999: PacifiCorp applies for extension of license to October 1, 2006, at which point PacifiCorp would remove the dam. This increases the license term from 28 to 41 years.

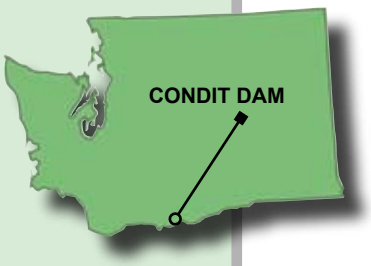
Send it all to our landfill

FEBRUARY 2000: FERC responds to environmental analysis by conducting hearings on the array of alternatives for Condit Dam's fate. Klickitat, Skamania counties and U.S. Sen. Slade Gorton, R-Wash. are concerned with the short-term consequences of the sediment-flush, the loss of Northwestern Lake's trout fishery and lakefront property values.

The counties urge FERC to mandate dredging and disposal of most of the four million tons of sediment blocked by the dam and dumping this into Klickitat County's landfill.

CONDIT DAM

- Impounds 2.4 million cubic yards of sediment
- Built from 1911 to 1913
- Provides maximum capacity of 14.7 megawatts
- Settlement agreement was signed by 23 groups in 1999
- Removal would connect lower 3.3 miles to the upper 29 Wild and Scenic River miles
- Was first designated Wild and Scenic in 1986; then again in 2005



We will sue, if ...

2002: Klickitat and Skamania counties threaten to sue the Department of Ecology if the state agency allows PacifiCorp to violate the state's water quality standards by releasing sediment downstream.

Federal Power Act loses power

2005: After a decade of lobbying by utility operators, Congress amends the Federal Power Act to weaken the power of resource managers to prescribe conditions that would mitigate the project's impact on fish. The amendment allows any stakeholder to propose alternatives to the prescribed conditions, which must be fully evaluated before accepting.

Rain check

FEBRUARY 2005: All signatories to the Condit Dam settlement agreement agree to postpone removal until October 2008. The extra time allows PacifiCorp an extra two years to acquire permits and accrue $3.3 million to cover unanticipated permitting and mitigation expenses.

Agencies agree

2006: National Marine Fisheries Service and U.S. Department of Fish and Wildlife issued biological opinions under the Endangered Species Act, which agree the long-term advantages of removal outweigh short-term impacts of the sediment flush.

Long-term benefits outweigh short-term costs

2007: The Washington state Department of Ecology asserts in its Environmental Impact Statement that removal will benefit salmon and steelhead populations.

Waiting on permits

FEBRUARY 2010: As it waits for two water quality permits—one from the Army Corps of Engineers and one from the Washington state Department of Ecology—PacifiCorp files for another one-year extension, postponing the removal date until 2011.

Success is within reach

OCTOBER 2010: Ecology issues the 401 water quality permit, one final barrier between fish and several miles of free-flowing White Salmon River. This sets up a Fall 2011 removal.

Except for leakage, the narrows section has been dewatered for a century.

photography by **thomas o'keefe**

Sediment solution

Beginning in 2006, FERC has been trying to figure out what to do with Condit Dam. Much of the problem lay in the 2.4 million cubic yards of sediment buried beneah the surface.

In 1996, shortly after PacifiCorp's license expired, the Federal Energy Regulatory Commission (FERC) reviewed PacifiCorp's plans for bringing the 125-foot-high dam into compliance.

At the time, both PacifiCorp and FERC rejected removing the dam in favor of modifying it for fish passage. PacifiCorp quickly realized, however, removal was more cost-effective than modification and FERC realized the chronic effects of maintaining the dam would be far more destructive than the short-term trauma of removing it.

In 1999, a negotiated settlement between environmental and recreational organizations and PacifiCorp advocated removal. After a second environmental analysis, FERC agreed—with some caveats. The next two pages summarize the primary options considered in 1996 and then in 2002.

The impacts of Condit Dam reveal themselves in biology, recreation, and ecology.

1996 FERC removal options

Basic upgrades, $9.39 million

Upgrade turbines, generators, transformers and electrical auxiliaries for more efficiency.

Photo by Rebecca Sherman


Photo by Rebecca Sherman

Photo by Daniel Dancer


Photo by Tomas O'Keefe

The plan would also create a tailrace barrier to protect fish. These upgrades would increase megawatt production from 14.7 to 15.8 while reducing by 100 cfs the amount of water necessary for energy production.

FERC additions to upgrades, $24 million

FERC's version of the plan adds to PacifiCorp's proposal to include upstream/downstream fish passage, spillway modifications, seasonal ramp rates, gravel enhancement, post-installation monitoring studies, and converting the dam from a peaking/pulsing operation to a run-of-river operation.

Removed, sediment flushed, $35 million

To remove the dam, PacifiCorp would draw down the lake with scheduled spills for two to three months. For the next two years, a diversion tunnel would transport the lake's remaining sediments around the dam and back into the riverbed.

Once back, the current would push the sediment downstream, where it would likely form a delta in the Bonneville Pools at the White Salmon's mouth. FERC eliminated this method as a viable option.

"The river would not flush these sediments from this wide shallow area for 10-20 years, creating an unacceptable situation from a fisheries stand point."

Removed, dry excavation, $72 million

To de-water Northwestern Lake, PacifiCorp would build a 1,000-foot diversion tunnel and gate capable of withstanding a five-year flood.

The project would require a series of cofferdams to divert the water and the transformation of 50 acres of privately owned pear orchard into a sediment disposal site.

PacifiCorp would transport much of the one- to-two million cubic yards of sediment and 50,000 cubic yards of loose concrete to the disposal site using off-highway haul vehicles. To get the sediment from the dry lakebed to the disposal site, the energy company would have to build a 2.5 mile road for access. Total time: one year.

Removed, wet excavation, $83 million

This operation would require the 2.5-mile, temporary road, 1,000-foot diversion tunnel and cofferdams. It would also require a diesel-driven hydraulic cutter head, which would dredge into the entire lake, starting at the upstream end, working its way toward the dam.

A floating pipeline would transport the dredged slurry to the shore, where a pump would push it uphill to the disposal site. With a connecting pipe, this disposal site would drain the water and suspended-silt to a smaller treatment pond.

Partial dam removal, $67.066 million

Partial removal would decrease the height of the 125-foot dam to 25 feet and eliminate two million cubic yards of sediment from the lake-bottom.

The plan would require an intake and pipeline, the disposal of two million cubic yards of wet sediment and the construction of a new hydropower diversion

Photo by Thomas O'Keefe

Husum Falls and Double Drop are a few of the rapids that attract thousands of paddlers.

at the head of Northwestern Lake that would release 200 cfs into the 2.8-mile bypass reach. This would provide full fish passage and eliminate the need to remove the trapped silt.

The signature of the partial removal option is the construction of a waterfall directly downstream of the removed dam.

The intent of this system is to allow upstream and downstream fish and kayak passage.

—FERC Environmental Impact Statement (EIS), October 1996; retrieved from: http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=11720120

2002 FERC removal option

1.) Settlement Agreement: Twenty-three signatories agreed to cap PacifiCorp's liability at $17.15 million (in 1999 value). The plan calls for PacifiCorp to excavate a 12-foot-high by 18-foot-wide drain tunnel at the base of Condit Dam. Models predict this would drain the lake at a rate of 10,000 cubic feet per second and would flush 65 to 70 percent of the sediment downstream. In six hours, Northwestern Lake would be gone.

Using rock-quarrying techniques, PacifiCorp crews would then remove the dam and power station with the advantage of a dry lakebed. The dam would be gone in one year. FERC predicts this method would release a lethal amount of sediment downstream that would eliminate entire fish populations, scour a .4-acre wetland and, for two years, bury the spawning beds at the Bonneville Pools at the mouth of the Columbia. PacifiCorp would mitigate these temporary impacts through engineering, fish capture and hatchery, and the development of several programs.

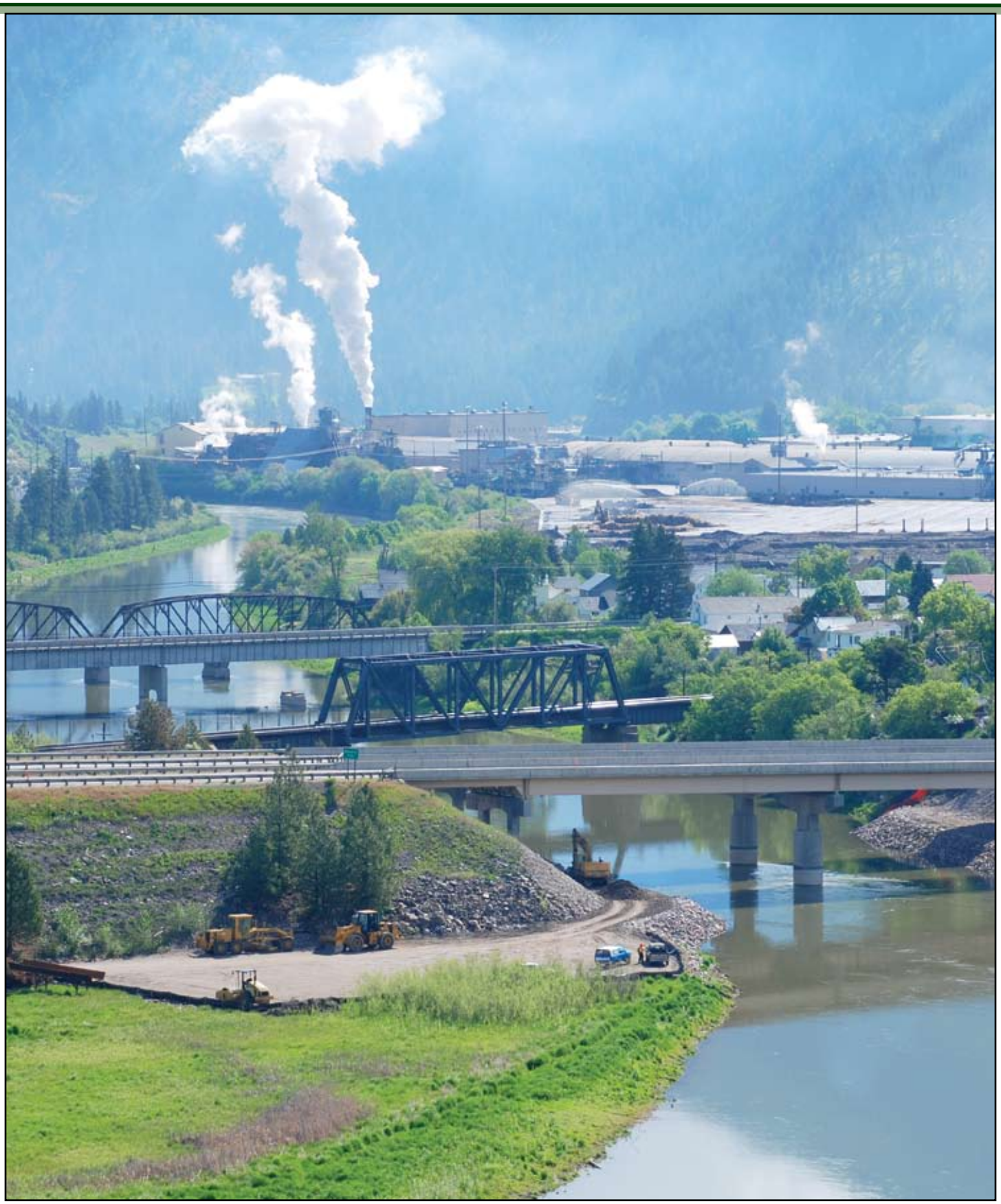
"In the 1996 FEIS, we concluded that the no-sediment treatment would be unacceptable because it would result in the long-term (10-to 20-year) deposition of sediments …" the 2002 FERC EIS says. "[T]he issue [with no sediment treatment] is where the sediments are deposited, not how they get there."

The plan earned the support of 23 vested interests, ranging from those representing conservation and fishing to utilities and the Yakama Nation. FERC amended the settlement agreement with additional mitigations. This plan provides the blueprint for removal in October 2011.

--Federal Energy Regulatory Commission. (2002). Final Environmental Impact Statement. Washington D.C. pp. B-6.

Photo by Thomas O'Keefe

The end of an era began with deconstruction in 2007 and with a 2008 organized breach.



The $225 million settlement to remove Milltown Dam was reached in 1998.

photography by thomas o'keefe

Undoing the harm

Mining turned Milltown into one of the nation's largest Superfund sites. The removal of 98-year-old Mill Town Dam is changing that.

A few months after copper mining tycoon William Clark had completed the Milltown Dam in the summer of 1908, a series of torrential rains flooded the Clark Fork Valley, washing millions of tons of mine waste from the Butte shafts—arsenic, copper, lead, zinc—toward the base of Mill Town Dam.

For the next 100 years, the toxic sediment contaminated anything it contacted—river water, drinking water, aquatic life, and the sediment that accumulated at the dam every second of every day.

By 2008, scientists estimated 6.6 million cubic yards of sediment had settled at the dam's base. And every once in a while, a flood or an ice jam would send a pulse of toxic water over the dam and downstream, resulting in periodic destruction of fish and insect populations.

This happened in 1996, when an ice jam scoured the toxic sediment from above the hydroelectric dam and gushed it downstream.

The resulting fish kill—combined with contaminated drinking water and a 1983 Superfund listing—compelled the Environmental Protection Agency to order in 2004 the dam's removal, and the dredging and disposal of the sediment.

The $225 million project began in the summer of 2006. Crews initiated the drawdown process in 2007 by first excavating 700,000 cubic yards of toxic sediment. They breached the dam in 2008. And in the coming years, the river will redeposit 300,000 tons of non-toxic sediment downstream.

"We all know Montana is perfect," Sen. Max Baucus, D-Montana, told a crowd gathered at the dam during the March 2008 breach. "And today we are making it more perfect."

In time, 200,000 fish—trout, suckers, pike minnows— will swim past the dam. And already, scientists have marveled at how quickly aquatic life has rebounded in the renewed river.

"Over the last few years, almost three million cubic yards of sediment has gone, and remediation is almost complete," Montana Fish, Wildlife and Parks biologist Dave Schmettering told *The Missoulian* and a crowd of fishing guides last March. "And it's had an effect on the watershed.

"The impacts of the dam removal are now behind us by a couple years. We're going to see lots more diversity, and not just the pollution-tolerant insects or the ones that were limited to certain substrates."

MILLTOWN DAM

- 2008 removal reconnected Clark Fork and Blackfoot Rivers
- Milltown Dam part of West's largest Superfund site
- All but seven Montana Superfund sites are mining related
- ARCO took responsibility for part of cleanup
- To see video, go to: http://www.youtube.com/watch?v=ISLInzprz3M

Removal of Cove Dam provided 30 miles of critical habitat to a threatened species.

photography by idaho parks and recreation

A fair trade

To pay for the removal of the Bear River's Cove Dam, conservationists had to give up 17 cfs. In return, they got 30 miles of restored river habitat.

Up until October 2006, the Bear River began its 500-mile journey to the Great Salt Lake in eastern Utah's Unita Mountains, 100 miles away. Along the way, the river visited Wyoming and Idaho, and then Wyoming again before it circled back into the state of its origin and spilling into its destination.

In those 500 miles, the Bear River plummeted over six dams and, for 26,000 feet, funneled through an open, concrete and wooden flume. The Bear River's journey from the Unita Mountains to the Great Salt Lake is still basically the same today as it was in September 2006—except for one small, but significant detail: It now plummets over five dams, not six. And no longer does it have to funnel around Black Canyon in a six-mile-long wooden flume.

The key to agreement was 17 cubic feet per second of water.

This, due to a creative solution proposed by an energy company official and the willingness of conservationists, such as Idaho Rivers United, American Whitewater and Trout Unlimited, to work with it.

PacifiCorp had agreed in 2002 to strongly consider removing the unproductive 26-foot-high by 140-foot-wide Cove Dam and all of its facilities. But that removal would have cost the company more than $3 million.

And PacifiCorp hadn't included the costs of Cove Dam's removal in its budget. The only money it could devote to its decommissioning would have to come from other funds, such as the habitat mitigation fund.

"No one wanted to give up their fund," says Charlie Vincent, a regional representative for American Whitewater. "So we looked at grants. But grants are for thousands of dollars. Not millions."

After 10 months of dead ends, PacifiCorp project manager Monte Garrett asked if the signatories would be willing to give PacifiCorp 17 cfs of water.

Up until 2002, you see, PacifiCorp had the right to funnel all of the water around the six-mile-long Black Canyon and pump it through a powerhouse at the end of the gorge.

The agreement of 2002, however, mandated the release of 80 cfs into Black Canyon—an amount devoted to restoring some habitat for the Bonneville Cutthroat Trout. Garrett calculated that PacifiCorp could pay the $3 million removal bill with the extra revenues generated from an additional 17 cubic feet per second of water.

The environmental groups concerned with the health of the fish, in turn, realized habitat recovery could work with 63 cfs, nearly as well as with 80 cfs.

Both sides took the deal.

The agreement freed up 30 miles of river, restored habitat to the threatened Bonneville Cutthroat Trout, and guaranteed whitewater releases for paddling enthusiasts. "Reestablishing as much connectivity as possible will help that species to survive," says Kevin Lewis, conservation director for Idaho Rivers United. "Reestablishing a habitat where fish can move up and down the river is a big win."

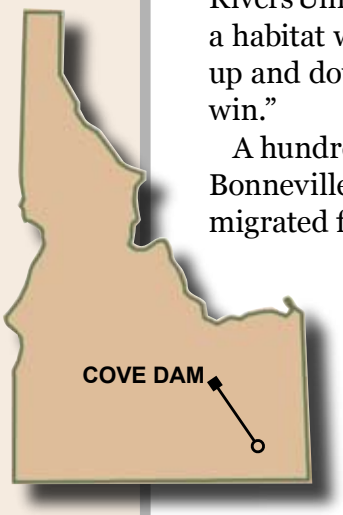
A hundred years ago, the Bonneville Cutthroat Trout migrated freely through the Bear River. They were easy to catch, highly nutritious and plentiful to the point of being a nuisance. For 70 years, starting in the 1850s, communities near the Bear River relied on the Bonneville Cutthroat Trout for food and for trade. And that intense reliance, combined with six World War I-era dams, strained the species' survival. Now, it is listed on Utah's Sensitive Species list.

The removal of Cove Dam, however, represents a possible comeback point for the Bonneville Cutthroat Trout. And the opportunity revealed itself in the non-functioning flume of Cove Dam.

"The flume had become a significant maintenance problem," says Dave Eskelsen, spokesman for PacifiCorp's subsidiary Utah Power. "It would have required wholesale maintenance construction. As we looked at the work required to operate Cove, it made more sense for our electricity customers to decommission the project than to perform this kind of work needed to keep it running."

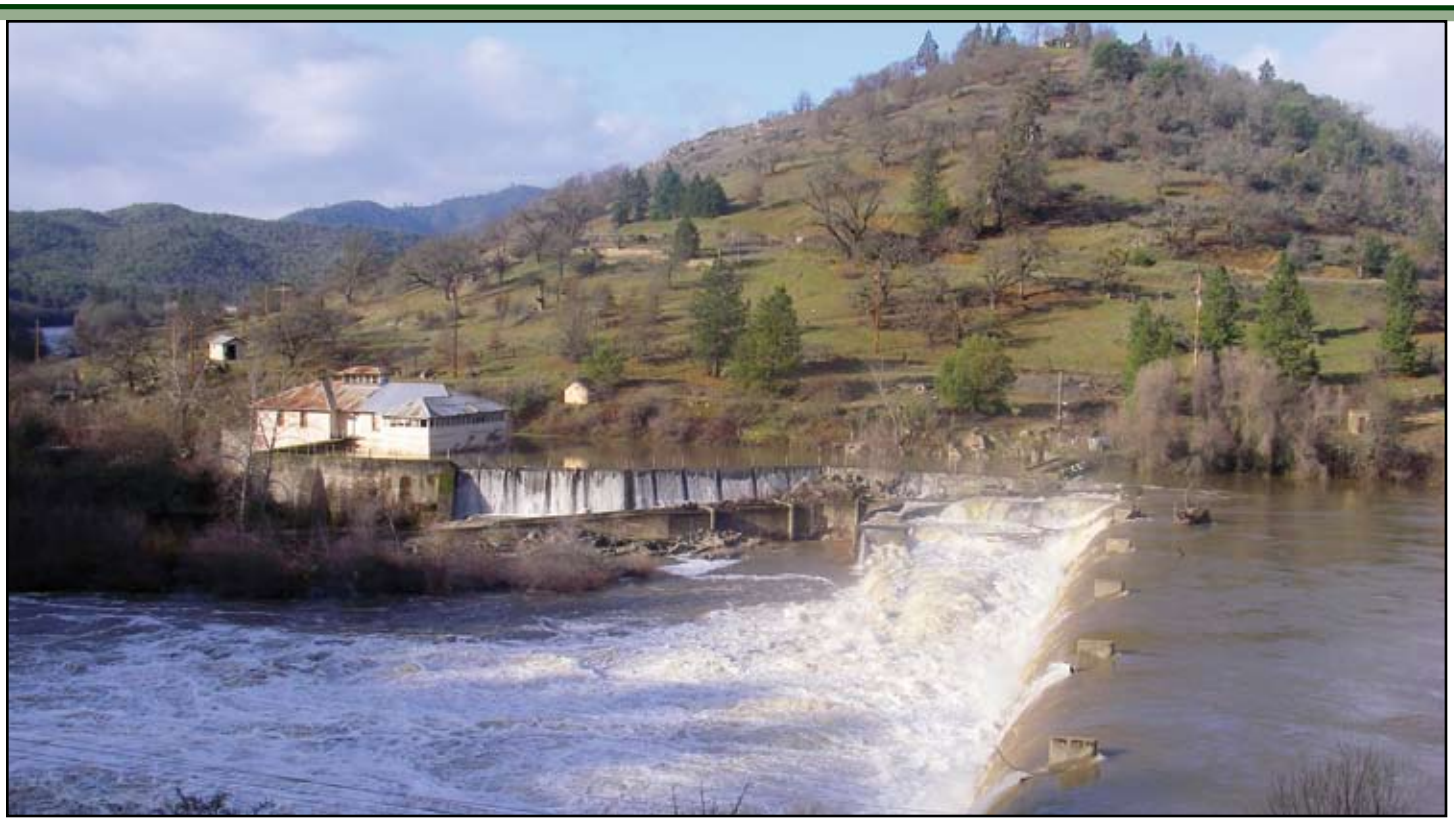
BEAR RIVER

- Cove Dam included a 26,000-foot flume, through which the entire river was transported to a powerhouse at the bottom of Black Canyon.
- 2006 removal restored 30 miles of habitat for the native Bonneville Cutthroat Trout.
- $3 million-removal was paid for by extra energy produced from 17 cfs.
- Was one of six on the 500-mile-long Bear River.
- Cove Dam was built in the World War I era.



Gold Ray Dam, pictured below, was the last of the four Rogue River dams to fall.

photography by thomas o'keefe



The Rogue runs wild

In a matter of three years, four of the Rogue River's five dams have become non-existent, freeing up more than 150 river miles.

Since the end of the last century, some dam removals have required a decade of coordination and negotiation. It requires scientific analysis of stream habitat, spawning beds, sedimentation, turbidity and countless other details to which most humans are oblivious. Deconstruction itself can cost millions of dollars and much more time than exists on the dam-owner's license.

But in 1902, all removing a dam required was a group of angry men and a few sticks of dynamite.

The Golden Drift Mining Company had promised the people of Grants Pass, Oregon, that its dam would provide the community with irrigation water and power generation. The fish tunnel would still allow salmon to run the river freely, the company assured them.

But these were all unfulfilled promises.

"The salmon piled up below it and wouldn't go through the dark tunnel of a fishway," wrote local Glen Woolridge in his 1982 book, *The Rogue: A River to Run*. "It destroyed more salmon than the commercial fishermen ever caught."

And so, in 1912, a group of vigilantes dynamited a portion of the Ament Dam. In 1921, it was legally removed, the first of the Rogue River dams to be removed. In the nine decades since, four of the Rogue River's dams have aged into obsolescence and expensive maintenance. This combined with the Rogue's status as one of the nation's original eight Wild and Scenic Rivers and Oregon's most active salmon run, has encouraged dam owners to take them out.

Just one dam remains between the upper Rogue, pictured below, and the Pacific.

photography by rich bowers

GOLD HILL, JULY 2008

Even after the Gold Hill Dam stopped producing electricity in the 1970s, the city of Gold Hill kept it around for water diversion. But in 2006, the eight-foot-high dam lost that purpose as well, when the city installed a pumping station to deliver its water, allowing the Rogue's second-greatest hindrance to fish passage to be removed.

ELK CREEK , JULY 2008

Not so long ago, Elk Creek provided spawning habitat for 30 percent of the Rogue River's Chinook and coho. But in the 1980s, construction began—and 80 vertical feet later halted on the Elk Creek Dam. The massive concrete obstruction blocked fish travel for 30 years and offered no benefit in return. In July 2008, the Army Corps of Engineers blew a river-wide notch in the dam with a series of blasts, enabling that portion of river to flow free.

SAVAGE RAPIDS, OCTOBER 2009

The Savage Rapids Dam replaced the Ament Dam as a means of providing irrigation water to local farmers. The installation of 12 irrigation pumps, which provide water to 7,500 acres in the Grants Pass valley, however, rendered the 89-year-old dam useless. In April 2009, construction crews began the five-month process that re-connected an additional 50 miles of river.

GOLD RAY, AUGUST 2010

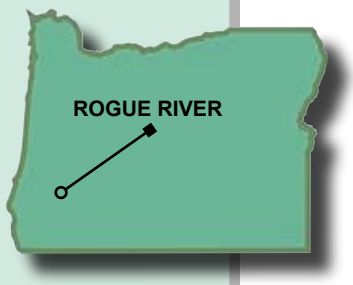
After Gold Ray Dam stopped producing hydroelectricity in 1972, Jackson County, Oregon, assumed responsibility of this 106-year-old, 38-foot-high dam from Pacific Power. Maintenance costs quickly convinced the County to decommission the dam and remove it.

So did the Oregon Department of Fish and Wildlife's listing of the dam as the state's fifth-highest priority for removal or modification. In August 2010, with the help of $5 million of stimulus funds, construction crews drained a slough causing a cofferdam connected to a sand spit to fail.

Most of the slough drained, which exposed the original log dam and freed up more than 157 miles of the Rogue River.

ROGUE RIVER

- Was one of the original eight rivers included in the 1968 Wild and Scenic Rivers Act.
- Rogue is Oregon's most prolific salmon spawning river.
- Removal of four dams freed 150 miles of river and more than 500 miles of tributaries.
- The Rogue's water quality is rated between 85 and 97 on the Oregon Water Quality Index.



The 2009 removal of Savage Rapids Dam reconnected 500 miles of stream.

photography by thomas o'keefe

Survival is more likely

For fish, the removal of Savage Rapids Dam means a better chance at life.

If you're a juvenile Coho making your way along Oregon's Rogue River to the two-year-long feast awaiting you in the Pacific Ocean, you'd have already survived as many as three other dams. And you might be feeling good about that.

That good feeling would disappear at river mile 107, however, when you'd encounter something of a medieval fish gauntlet. In the 3.5-mile placid pool just ahead, you'd see a congregation of pikeminnow, the predator that accounts for so many of your fellow species deaths every year. Hovering above you, you'd sense the acute attention of a Great Blue Heron or two. And all around you, you'd see nothing but placid water with few places to hide. Your prospects suddenly seem hopeless.

But millions of years of evolution have programmed you to continue. And so you do. Often at your peril.

If somehow you survive the 3.5-mile traverse, your fate hinges on the functionality of an 88-year-old fish-elevator. You might feel safe here. But you shouldn't. Instead of depositing juveniles in the bubbling pool below the Savage Rapids Dam, the elevator sometimes deposits them into the dam's pumps or into its turbines. Either route ends with the same result: death.

This is half the reason federal fish agencies referred to this 88-year-old dam as the Rogue River's most prolific fish-killer. (The dam's convoluted fish ladder is the other half of that label.)

It is also part of the reason a salmon traveling the Rogue after 2009 would no longer encounter the gauntlet that once was Savage Rapids Dam.

But the main reason you, the juvenile coho, no longer have to worry about that 3.5-mile traverse and the murderous elevator is that the dam had simply become obsolete. It was built in 1921 to provide irrigation water to the Grants Pass agricultural community. It never provided flood-control or electricity. And its costs far out-weighed its benefits.

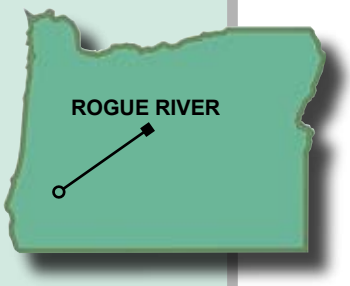
"A lot of people lead more with emotion and don't want change," said Grants Pass Irrigation District Manager Dan Shepherd in a *WaterWatch* short film about the Savage Rapids removal. "But the district had to look at change to be able to survive and go into the future. There would be in the future some very big costs to keeping the dam. Which is no doubt above the districts ability to do it."

Contingent on an agreement for the irrigation district's ability to provide irrigation water through a new 12-pump system, the Bureau of Reclamation began removing the dam in 2006. It completed the $40 million removal in October 2009.

The elimination of Savage Rapids Dam re-opened 500 miles of salmon and steelhead spawning habitat on upstream tributaries, including an additional 50 miles on the Rogue itself. This has fish biologists estimating the annual return of an additional 114,000 adult salmon and steelhead to the river.

SAVAGE RAPIDS

- Dam impacted 500 miles of upstream spawning habitat
- Removed 2009
- Economists expect the wild river will lead to $5 million of additional economic activity
- Was primarily devoted to irrigation



SAVAGE RAPIDS DAM

WaterWatch is a coalition member and a front-row advocate for all Rogue River dam removals.
To see video of the dam's removal, check out http://www.youtube.com/watch?v=sd2CfsFpjAU

Milll Pond Dam hasn't produced energy since the 1950s.

photography by rebecca sherman

An elegant solution

Stakeholders discover Mill Pond's solution in Boundary Dam's problem.

Nobody wanted Mill Pond Dam. It was 98 years old. Its wooden flume had already collapsed and meshed with the surrounding slate, cedar and pine. Worst of all, it hadn't produced a single watt of electricity since 1958. It didn't store water. And at 50 feet tall, it committed all the sins of the nation's most harmful dams: It prevented the free-flow of sediment downstream and cut Bull Trout from 18 miles of habitat.

Everyone, including its owner, the Pend Oreille Public Utility District, agreed the dam should go.

Paying for that process was the entire problem. With its 8,500 ratepayers, the Pend Oreille PUD could not afford the estimated $15 million removal and restoration process.

And so, for about a year, 17 federal, state, local, tribal and environmental agencies and groups brainstormed strategies to pay the bill.

Meanwhile, in 2008, Seattle City Light was contemplating the conditions of relicensing its 350-foot-high Boundary Dam. One of those conditions required the restoration of Bull Trout and other native species in the watershed. To do this, Seattle City Light would have had to find a suitable stream for habitat

Seattle City Light recognized Sullivan Creek's value as a cold water tributary.

restoration or decrease the temperature of the Pend Oreille River. This is an impossible task, considering the Pend Oreille drains 25,000 cubic miles, starting in Montana. Even in September, it gushes 15,000 cubic feet per second.

In the winter of 2009, U.S. Forest Service representatives Glen Koehn and Kristen Bonanno helped put the two interests together. Sullivan Creek, they argued, was the biggest tributary in the Boundary Dam area and as such, represented Seattle City Light's best hope for cold water and Bull Trout habitat. The removal of Mill Pond Dam would satisfy these two conditions of relicensing for Seattle City Light.

As it happens, Seattle City Light had been anxious to demonstrate its own commitment to its stewardship mission and this, officials agreed, was a perfect opportunity.

"We're very excited about it," says Barbara Greene, a project manager for Seattle City Light. "This gives us a chance to pursue our stewardship goals. When they asked us to come to the negotiation process in the winter of 2009, we were very excited."

All 17 parties signed the agreement, which plans for the removal of Mill Pond Dam. This will free up all 18 miles of Sullivan Creek from Pend Oreille Lake to its mouth on Pend Oreille River. Consensus—even ambivalent consensus—is a welcome destination for any relicensing journey. Considering where this debate started, however, consensus seems almost miraculous. Mill Pond Dam hadn't produced a watt of electricity since 1954 and in 2008, the license for Pend Oreille PUD to operate it, would expire.

"We've had that project since 1958," says Mark Cauchy, director of regulatory and environmental affairs for the Pend Oreille PUD. "We've been trying to put generation in there since. The last time we tried, the conditions made power too expensive."

So in 2003, the PUD gave up. It asked the Federal Energy Regulatory Commission [FERC] for permission to surrender the project.

Before FERC could agree, American Whitewater and the United States Forest Service appealed the request.

American Whitewater and the Forest Service were concerned Pend Oreille PUD would simply walk away from the 50-foot obstruction and let it decay into the landscape.

"There's all these dams around the country that no one owns and no one manages," says Kevin Colburn, stewardship director for American Whitewater. "We were very concerned the same thing could happen to this one. A lot of the project had already been abandoned. The flume that carried water for the hydro project was allowed to disintegrate. Decades ago, they had poured cement into the turbines of the powerhouse. And it stopped generating power in the mid-50s."

Cauchy, Pend Oreille PUD's director of regulatory and environmental affairs, doesn't disagree.

"We didn't know what was going to happen to the dam," he says. "Our intention was to have an open mind in negotiations. Potentially, the dam could have stayed. It could have had fish passage. Or it could have been removed. We didn't know."

In the end, however, everyone got what they wanted. And in less than a decade, Sullivan Creek will run free for the first time since 1908.

"This one was very, very cool," says Colburn. "It was an elegant solution."

SULLIVAN CREEK

- Is the most significant cold water stream in the Pend Oreille watershed
- Removal of Mill Pond Dam would open 16 miles of cold water habitat
- Settlement agreement signed March 2010; FERC expected to approve settlement agreement in the fall 2011
- The Lands Council, Selkirk Conservation Alliance, American Whitewater helped form solution.

Construction on the Ashlu reveals the so-called "minimal impacts" of small hydro.

photography by brian smith and rich bowers

Power rush

British Columbia has marketed its signature resource as green energy. Their impacts, however, are not be so green, or easy to sell.

British Columbia's resigning Premier spent much of August 2010 peddling his signature product—run-of-river hydropower—to his province's biggest potential customer: The state of California.

With the prospects of a sale in California growing dim, however, the premier has now shifted his pitch to Oregon and Washington.

Finding a buyer for the surplus of energy British Columbia has generated off run-of-river hydro has become a provincial controversy, as the price of that energy has become more apparent.

"[BC] Hydro is paying IPPs more than double the open market rates prevailing in western North America," wrote economist Erik Andersen in his August 16, 2010 article *Sinister Vectors at BC Hydro*. "Meanwhile, exports collapsed by 50 percent in 2009/2010."

This, coupled with reduced energy demand throughout the province has the economist suspicious.

"As the evidence of need for more electricity in BC is not apparent, the aggressive borrowing/investing/contracting with IPPs is plain wrong," he concludes.

The day after Gordon Campbell became the premier of British Columbia in 2001, he made good on his vow to reduce personal income taxes by 25 percent. In his first year, he cut most corporate income taxes and eliminated the Corporation Capital Tax. To pay for these cuts, Campbell sold off some of British Columbia's most prized assets — its ferry and railway system and the power producing core of BC Hydro.

In 2007, the Ashlu was one of 38 contracts awarded to Independent Power Producers.

In 2002, Campbell introduced BC's new Energy Plan, which transformed BC Hydro, the province-owned power producer and provider — into a middleman. The plan allowed private corporations to compete for permits at an application fee of $5,000 or $10,000, build and operate a hydropower facility on one of British Columbia's creeks and then guarantee the sale of the power back to BC Hydro for 25 years.

This plan, Campbell assured British Columbia's citizens, would transform their province from an energy importer into an energy exporter. And the product couldn't have been more appropriate for its era.

2002 was also the year California passed legislation, which established a 2010 mandate that 20 percent of the state's electricity derive from renewable resources. To get this renewable energy, the state is willing to pay double what it pays for non-renewable energy.

"We have enormous resources in British Columbia," Campbell told a conference of Independent Power Producers in November 2009. "And those resources allow us to provide not just the people that live in this province with green and clean, low-carbon power, it allows us to expand our horizons to build an economy ... and we have to do that together, and that means we have to do that with the independent power producers of British Columbia."

Unfortunately for BC Hydro, California law excludes most of the excess energy generated by British Columbia's run-of-river projects from the category of renewable energy because most of British Columbia's run-of-river standards conflict with California's environmental standards.

Campbell's August 2010 visit was the most recent in a string of unsuccessful lobbying efforts by British Columbia's energy and government officials. Their pitch: Just relax your standards a little bit so we can sell you our power.

British Columbia is as blessed with steep, cold rivers as Utah is with canyons; as Wyoming is with wildlife; as Hawaii is with beaches.

And Campbell, the province's pro-business premier, has devoted much of his nine-year term trying to capitalize on his province's hip, and lucrative natural resource.

To do this, however, Campbell and parliament have stripped local communities' authority to zone with the 2006 Ashlu Bill.

"Let's just say a local government says 'we don't want this development going on in this area,' says Shane Simpson, the environmental critic for British Columbia's New Democratic Party. "The province says 'tough luck.' I think that's fair to say this government was anxious to allow Independent Power Producers to proceed and they weren't going to let municipal governments stand in the way."

As a result, scores of developers are harvesting hundreds of British Columbia's most pristine streams—many of them whitewater gems—for energy.

"It's like the Wild West," Simpson says. "There's a lot of people making a lot of money up here. Many of those licenses were bought up by Liberal Party friends and insiders. We see it as a great give-away from the public to the private."

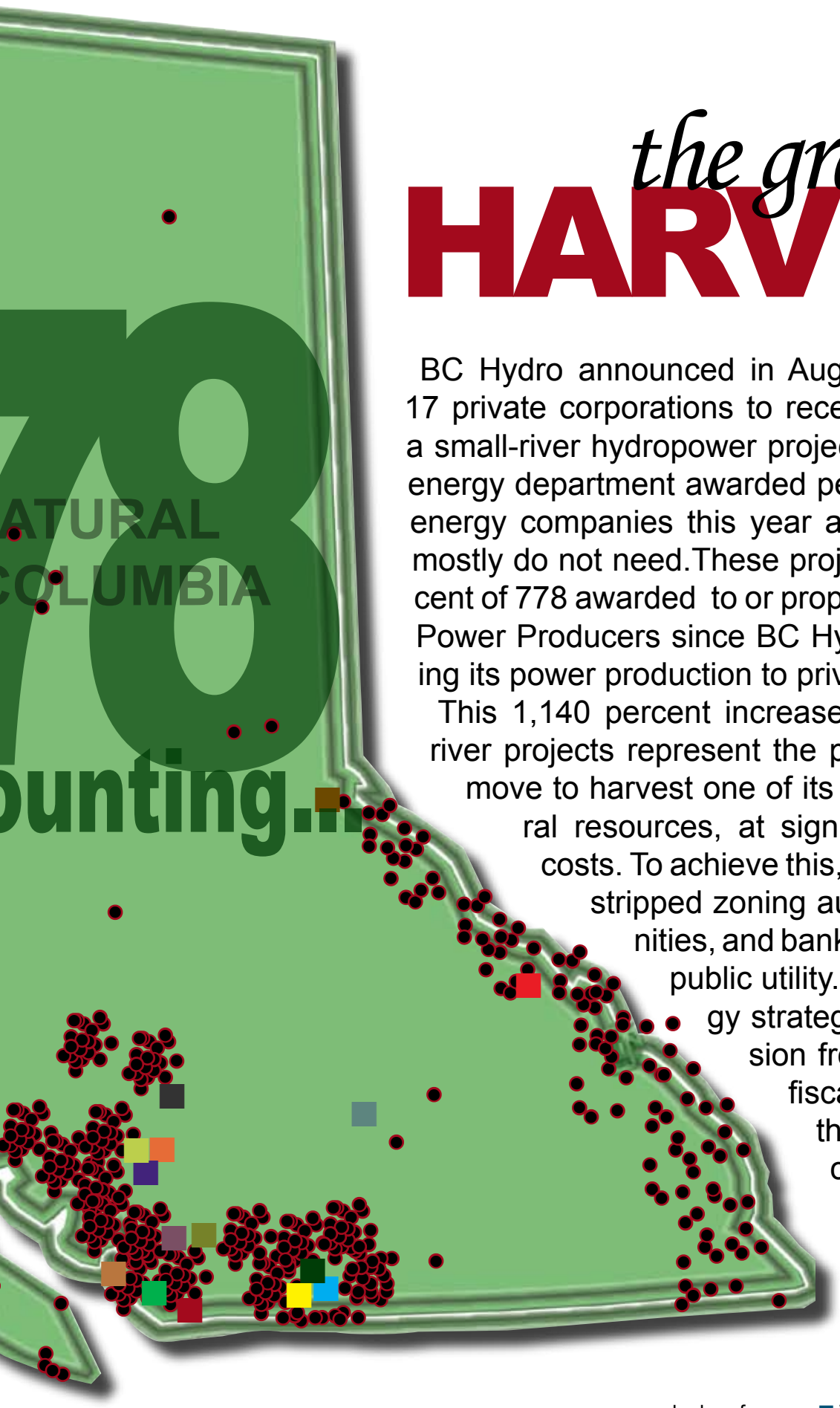
For the 4.4 million citizens of British Columbia, this is a huge loss, which they are already realizing in the form of escalating power charges.

To harvest its natural resources, the province has gutted its publicly-owned utility, BC Hydro, stripped communities of their authorities to zone land, and leaned heavily on run-of-river projects to build energy surpluses, which it is realizing, it can't sell.

And the 2010 awards go to ...

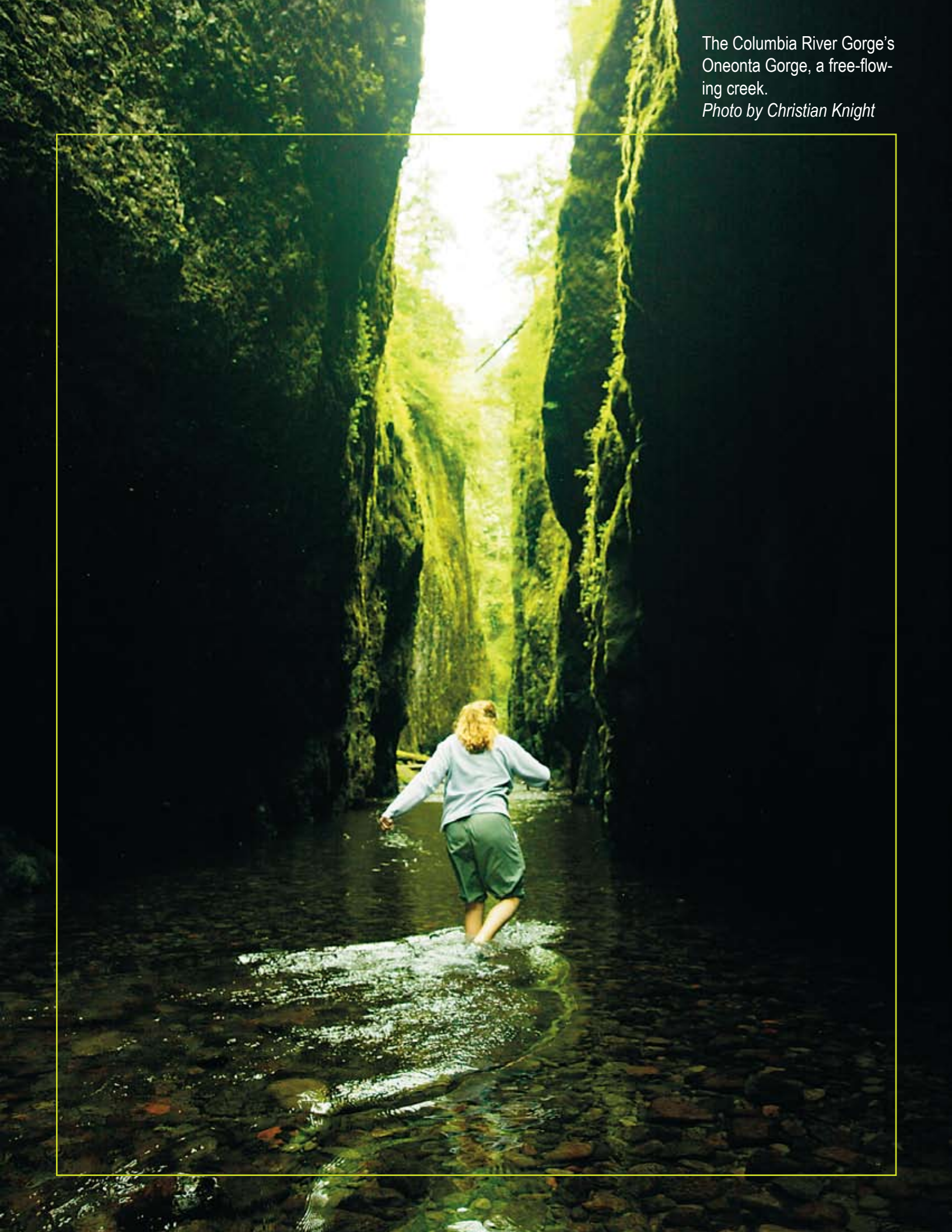
- Near Stewart; on Long Lake; 31 megawatts
- Near Port McNeill; on the Kokish River; 45 megawatts
- Near Golden; on the Beaver River; 19 megawatts
- Near Pemberton; on: North Creek; 16 megawatts
- Near Port Mellon; on Box Canyon; 15 megawatts
- Near Mission; on the Stave River; 18 megawatts
- Near Gold Bridge; on Jamie Creek; 19 megawatts
- Near McBride; on Benjamin Creek; 6 megawatts
- Near Squamish; on Culliton Creek; 15 megawatts
- Near Squamish; on Mamquam Creek; 25 megawatts
- Near Pemberton; on the Upper Lillooet River; 74 megawatts
- Near Harrison Hot Springs; on Bremner and Trio creeks; 45 megawatts
- Near Harrison Hot Springs; on Tretheway Creek; 21 megawatts
- Near Powell River; on the Upper Toba River; 124 megawatts
- Near Harrison Hot Springs; on Shovel Creek; 37 megawatts
- Near Terrace; on the Dasque-Middle River; 20 megawatts
- Near Sechelt; on Ramona 3, Chickwat and CC creeks; 45 megawatts
- Near Pemberton; on Boulder Creek; 23 megawatts
- Projects proposed or operating prior to 2010

*** 2010 project data compiled from *http://www.bchydro.com/planning_regulatory/acquiring_power/clean_power_call.html*. Other data compiled from *http://www.ippwatch.info/w/*. To see an interactive map with details of each of BC's proposed and operating run-of-river projects, visit: *http://www.ippwatch.info/w/***



the great creek HARVEST

BC Hydro announced in August 2010 the last of 17 private corporations to receive a permit to build a small-river hydropower project. British Columbia's energy department awarded permits to a total of 27 energy companies this year alone for energy they mostly do not need.These projects are the most recent of 778 awarded to or proposed by Independent Power Producers since BC Hydro began outsourcing its power production to private industry in 2002. This 1,140 percent increase in proposed run-of-river projects represent the province's aggressive move to harvest one of its most abundant natural resources, at significant environmental costs. To achieve this, British Columbia has stripped zoning authority from communities, and bankrupted its once proud public utility. The province's energy strategy has garnered derision from progressives and fiscal conservatives. And the prime minister's recent efforts to sell the province's surplus of premium energy to California has so far failed.



The Columbia River Gorge's Oneonta Gorge, a free-flowing creek.
Photo by Christian Knight