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HYDROPOWER & FISH

NORTHWEST CHALLENGE: KEEPING FISH *AND* CLEAN HYDRO

by F. Lorraine Bodi and Dulcy Mahar, Bonneville Power Administration

INTRODUCTION

` The Pacific Northwest is known for two iconic images. One is the cheap, clean renewable hydropower that helps fuel the region's economy. The other icon is the fish, particularly salmon — with their still mysterious life cycle. Salmon are born in freshwater rivers, migrate to the ocean to spend much of their adult lives, then return to their natal streams to spawn. Even today, the effects of river and ocean conditions on various stages of this life cycle are not fully understood.

This arduous migration, which in the Columbia River Basin includes traversing a number of multi-purpose dams, inevitably pits fish against the dams. For over a quarter of a century, the Pacific Northwest has been struggling to balance hydropower production with the safety of its fish. The stakes are high both because of the importance of the fish and the importance of hydropower, a clean renewable resource that has taken on increasing value as concerns over climate change grow. It is, in some aspects, an environment versus environment issue.

BPA's Role in Fish Protection

To put the role of hydropower in the Northwest in perspective, one must realize that hydropower supplies about half of the region's electricity and 60 percent of its peaking needs. The Bonneville Power Administration (BPA), a federal power marketing agency under the US Department of Energy, markets wholesale power at cost from the 31 dams that make up the Federal Columbia River Power System (FCRPS). Two other federal agencies — the US Army Corps of Engineers (Corps) and the Bureau of Reclamation (Reclamation) — constructed these dams beginning in the early 1900s, finishing the last of the dams in the 1970s.

BPA, Corps and Reclamation are collectively referred to as the "action agencies" for FCRPS. It is BPA, however, that funds the bulk of efforts to protect and recover fish and wildlife affected by Columbia River Basin hydropower development. This funding runs to approximately $300 million per year in direct costs and includes: repayment of debt for fish ladders and passage systems; hatchery funding; research and monitoring; habitat improvements; and predator management — as well as interest expense and amortization. (This amount increases to over $700 million a year if one includes foregone revenues and replacement power costs.) BPA receives no tax appropriations and covers its costs through sales of its services to the region's public utilities, municipalities, coops, investor-owned utilities and a few large industries.

Please Note: The views expressed in this article are those of the authors and not necessarily of the Bonneville Power Administration.

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Expanding Mitigation

Expanding Mandates

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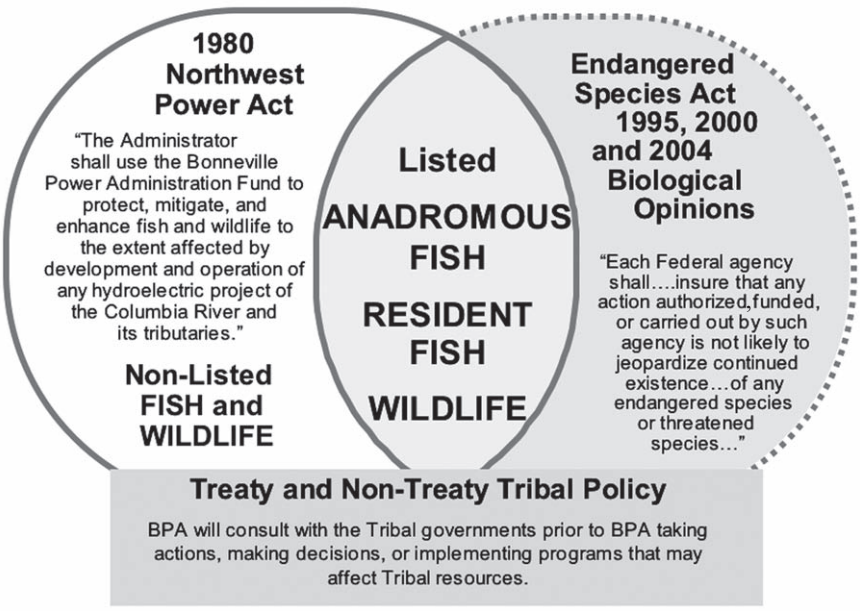
Since the early 1990s, when the first Northwest fish were listed as endangered under the federal Endangered Species Act (ESA), BPA has been working with its fellow federal and state agencies, Northwest tribes, public interest groups and others to make the Columbia Basin's rivers and habitat far safer for fish. One result of these listings has been a total overhaul of the hydroelectric system.

Mitigation efforts, however, did not begin in the 1990s. BPA funded mitigation long before species in the Columbia Basin were listed under the ESA. By the late 1970s, BPA had already spent over $200 million on such efforts. Then, in 1980, Congress passed the Pacific Northwest Electric Power and Conservation Act. This Act, among other things, called on BPA and other agencies that manage the regional hydro system to "protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, affected by such projects...in a manner that provides equitable treatment for fish and wildlife with the other purposes for which such system and facilities are managed and operated." This mandate applied to any affected species, not just those threatened or endangered.



BPA Mandates: ESA and NW Power & Conservation Act

BPA has fish and wildlife responsibilities under both the Endangered Species Act and the Northwest Power Act. BPA also consults with tribal governments before taking actions that would affect tribal resources. These responsibilities intersect and can in many cases be met in the same set of actions.

The Northwest Power Act also authorized formation of the Northwest Power and Conservation Council, an interstate oversight agency. It directed this Council to develop a *Columbia Basin Fish and Wildlife Program* (Program) to guide BPA and others' actions in meeting their responsibilities for fish and wildlife. BPA has used the Program as its mitigation road map. This Program has become one of the largest efforts in the world to address the natural resources of a region. Its cost is measured in billions, not millions, of dollars. The Columbia Basin includes an area approximately the size of France — encompassing two nations, four states, 14 tribes and numerous counties and towns.

ESA Listings: A Change in Focus

If the Northwest Power Act was a defining moment for BPA's fish and wildlife effort, a second defining moment occurred in the early 1990s. In 1991, the National Marine Fisheries Service (part of the National Oceanic and Atmospheric Administration and sometimes known as "NOAA Fisheries") listed Snake River sockeye salmon from Redfish Lake in Idaho's Stanley Basin as endangered under the ESA. Listings followed for Snake River spring, summer and fall chinook as threatened in 1992. Chinook were moved to the endangered list in 1995. Eventually 13 fish stocks would be listed. Of those, four stocks are in the Snake River. [For descriptions of these listings, see NOAA Fisheries' website: www.nwr.noaa.gov/ESA-Salmon-Listings/Index.cfm]

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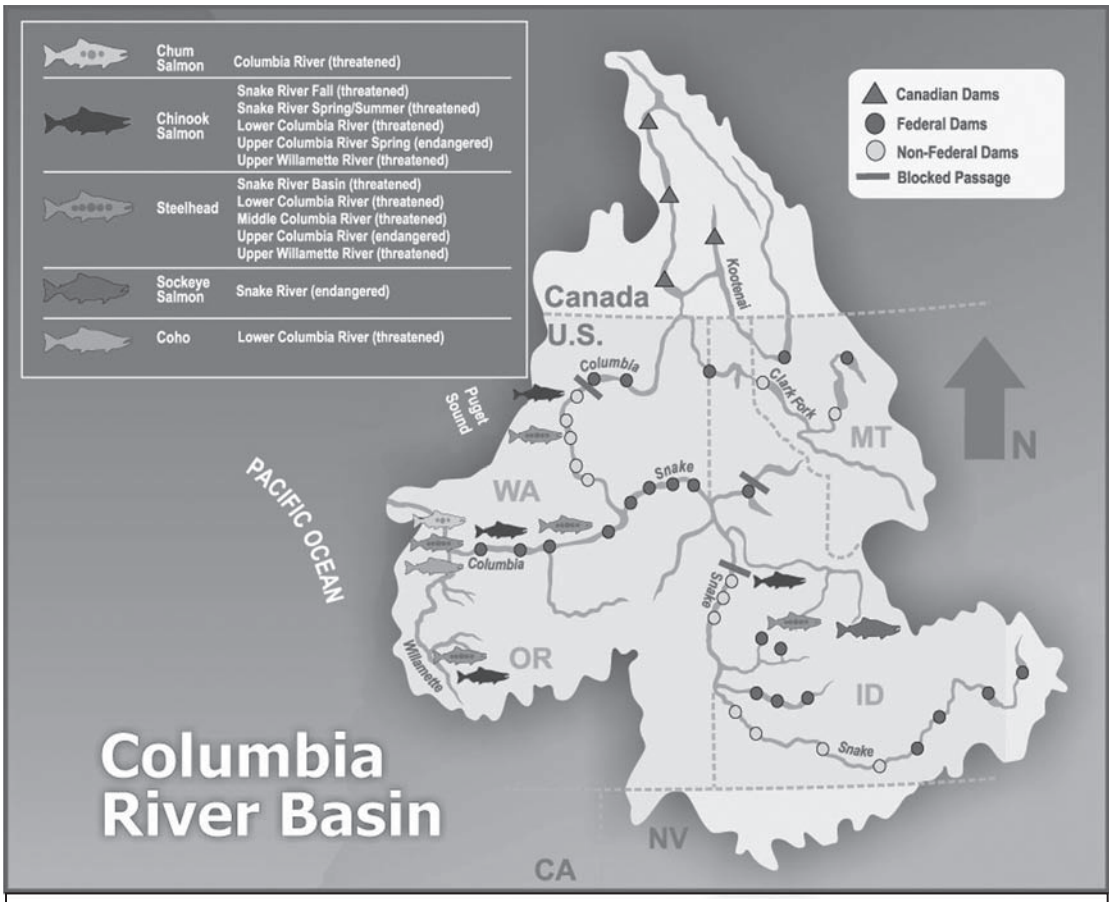
ESA-Listed Species



Columbia Basin ESA-Listed Species
Thirteen species of listed salmon and steelhead are affected by operations of the federal dams on the Columbia and Snake Rivers. The needs of these fish are considered in the action agencies' 2007 proposal for FCRPS operations.

Shifting Emphasis

One immediate result of the ESA listings was a renewed focus on wild fish, as opposed to hatchery fish. While increasing the overall number of fish returning to the river had been the aim of efforts in the 1980s, with ESA listings the emphasis explicitly shifted to preserving genetic diversity. ESA actions also called for stronger system-wide coordination to balance the demands of hydro generation and fish passage, native and anadromous fish and the many other needs and uses for the water in the Columbia and Snake rivers. Each ESA-mandated Biological Opinion (BiOp) — detailing NOAA Fisheries' assessment of how action agency proposals for operating the hydrosystem are expected to affect the survival and recovery of an ESA-listed species or its critical habitat — built incrementally on previous opinions, adding actions to those already in place.

PROTECTION & RECOVERY
A Three-Pronged Approach

BPA and its fellow action agencies (the Corps and Reclamation) have taken a three-pronged approach to fish protection and recovery.

Priorities

First, they have reprioritized FCRPS hydro operations. Formerly, after flood control, the priorities for FCRPS operations were power production and then fish. Today, operations for fish are second only to flood control in FCRPS operational decisions.

Fish Passage

Second, the agencies have been conducting an overhaul of the physical facilities in the system to facilitate fish passage at the dams. In the last 15 years, the hydro system has been retrofitted in ways that its original designers and builders could not have envisioned in order to promote good fish survival at dams and in reservoirs.

Expanded Focus

Third, efforts have expanded beyond a hydro focus to address impacts on fish from habitat, hatcheries and harvest. This makes sense since anadromous fish spend only a small portion of their life-cycle migrating up or downstream.

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Survival Standards

Water Releases

Storage Reservoirs in the Columbia Basin

The FCRPS is a storage-limited system. Generation is largely driven by the need to move water for non-power purposes, including fish and flood control.

Mitigation Flows

Stored Water

I: Reprioritized Hydro Operations to Enhance Fish Survival

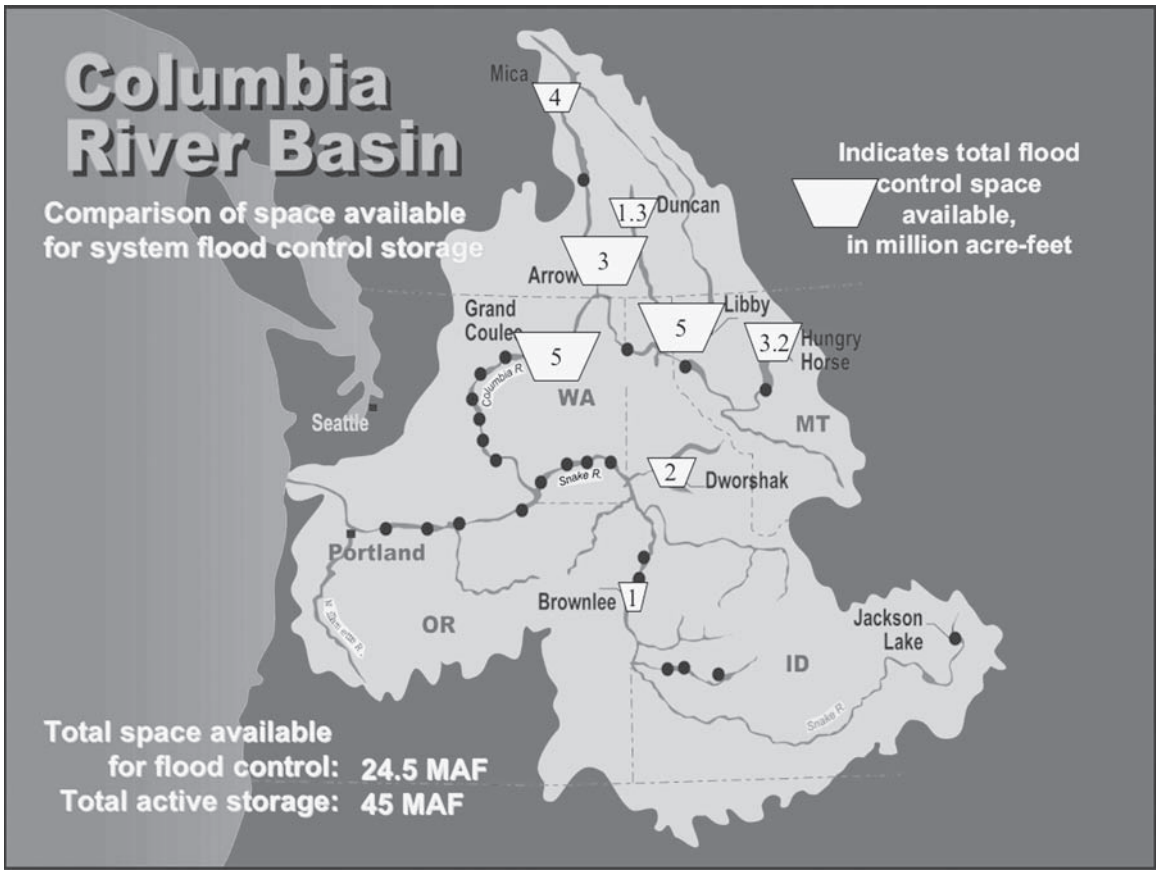
A key feature in the effort to make the Columbia Basin more fish friendly are three hydro operations regimes known as "flow augmentation," "spill," and "transportation."

The objective of all of these actions is to improve the survival of juvenile fish as they migrate through FCRPS dams on the Columbia and Snake River on their way to the ocean. NOAA Fisheries' new draft BiOp for FCRPS (discussed below) specifies new, higher performance standards for juvenile survival. The standards are 96 percent survival through all passage routes, including spill, for spring migrants and 93 percent for summer migrants. Survival is measured by detecting fish as they pass from the forebay above the dam to the tailwater below the dam.

These new and higher performance standards are an important element in the new draft BiOp. Currently, not all of the Columbia and lower Snake River federal dams are achieving this level of survival. Depending on real time conditions and further research, the agencies will further refine spill and transportation strategies to meet performance standards and increase overall fish survival.

FLOW AUGMENTATION

Flow augmentation is the release of impounded water to create an artificial freshet that approximates a river's natural pre-dam flows. Water releases are timed with downstream fish migrations to help juvenile fish move to the ocean in a timely manner. The challenge is complicated by the fact that operators of the hydro system must deal with the variation of annual rain and snow. Because only about 20 percent of the annual runoff can be impounded for useful purposes, system operators cannot use stored water to transform a "dry" year into an average year. This substantially limits the Columbia system's flow flexibility, particularly in dry years.



Following the first ESA listing, the action agencies doubled the volume of water dedicated to helping fish migrate down the Snake River to 1.2 **m**illion **a**cre **f**eet (MAF). This involved changing the operation of the hydro system's storage reservoirs, including: Grand Coulee in Washington; Dworshak in Idaho; and Libby and Hungry Horse in Montana.

Today, Columbia Basin fish operations draw on eight MAF of stored water annually — about a quarter of the 30 MAF of storage in US reservoirs and treaty storage in Canada. Because much of the available storage is in Canada, its use downstream is governed by the Columbia River Treaty. Use of space in Canadian reservoirs not covered under the Treaty ("non-treaty storage") requires negotiation of additional agreements.

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Spill Operations

Transport Around Dams

Incorporating New Research

Facility Improvements

Surface Passage

Spill

Spill operations are a method of guiding juvenile salmon and steelhead through spillways rather than through a dam's turbines. Fish-laden water is released through a spillway so the fish avoid a dam's turbines.

Water that is spilled to pass fish does not generate power, so the more water spilled, the less hydropower is generated. Over time, spill and flow augmentation have reduced the federal power system capacity by about 1,200 average megawatts per year — by comparison, the city of Seattle consumes about 1,000 megawatts per year.

As a general rule, spill is a preferred passage route, but more spill does not always mean better survival for the fish. Improved ways to provide "surface passage" — changes which use less water and achieve better fish survival — are discussed below.

Transportation

Spill can be one of the safest ways to get fish past the dams. However, depending on circumstances and timing, transportation can provide a clear survival advantage compared with dam and in-river passage — yielding higher numbers of returning adult fish.

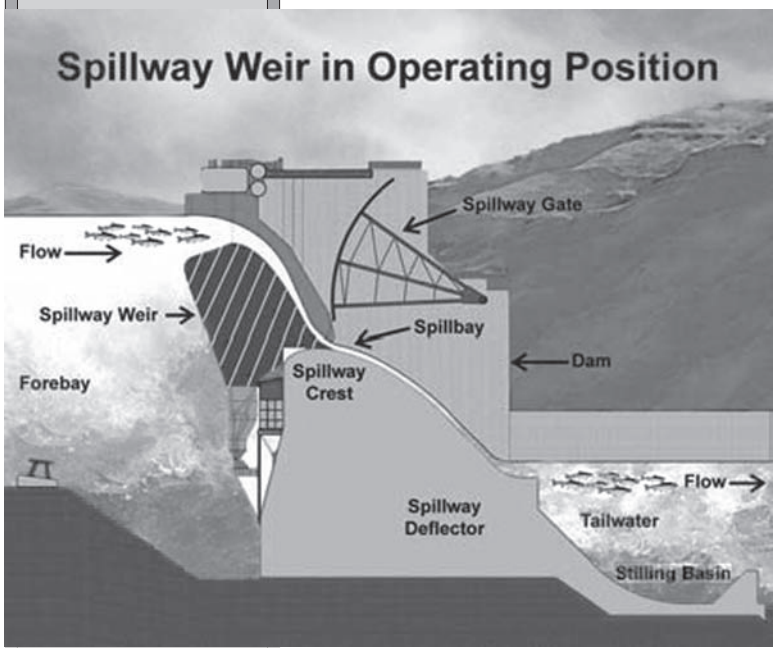
There is a critical balance between leaving juvenile fish to migrate in the river versus transporting them around the dams. During years when water conditions are poor, warm water and low flows in the river create hazardous conditions for fish migration in the river. Some stocks — such as chinook salmon — do better migrating in-river early in April. On the other hand, survival rates for Snake River steelhead are better with transport. Recent research also shows a strong correlation between how soon fish arrive in the estuary after their trip down the river and their ability to survive as they enter the ocean. (Source: NOAA Science Center, *Seasonal Differences in Migration Timing Lead to Changes in the Smolt-to-Adult Survival of Two Anadromous Salmonids*, Scheuerell, MD and RW Zabel, 2006. Draft in review.)

Early strategies addressed the many unknowns of transport by adopting a "spread the risk" approach — barging some fish and while leaving other fish to migrate in-river. The action agencies' most recent proposal makes use of the latest research results. Transport is balanced at certain times of the year for specific stocks based on what provides the best survival.

II: Overhauling the Dams

In 1994, Federal District Court Judge Malcolm Marsh remanded a BiOp to the federal agencies to reconsider the effects of FCRPS projects on fish. Judge Marsh added that "the situation literally cries out for a major overhaul" of the hydro system. *Idaho Dep't of Fish & Game v. Nat'l Marine Fisheries Serv.,* 850 F.Supp.886 (D.Or.1994).

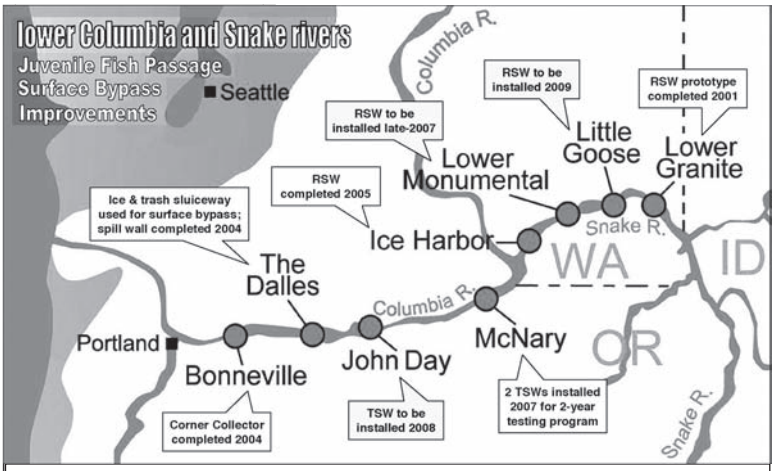
The action agencies responded by making major changes in dam configurations and operations. Over $1 billion has been invested since the mid-1990s in research, development and testing of prototype improvements and construction of new facilities and upgrades. The improvements in the physical facilities, along with improvements in the flow and spill programs, have delivered substantial improvements in both juvenile survival and adult returns.



The physical changes at the dams have focused on providing "surface passage" routes for juvenile fish at the dams. Juvenile fish naturally travel close to the water's surface as they migrate toward the ocean. To find and go through the passage routes at the lower Columbia and Snake river dams, they have had to dive to depths of 50 to 60 feet — down to where the original passage routes were located.

Surface passage routes, on the other hand, allow fish to go over the dams closer to the surface, providing an easier and gentler ride for the fish. These routes use spill but are considerably more efficient than traditional spill. More fish use surface passage per volume of flow, and more efficient spill generally reduces total dissolved gas in the river. (Dissolved gas created from the plunging water can be deadly to fish at high levels.) Surface passage routes also decrease the amount of time smolts spend in dam forebays, where they can be vulnerable to predators.

Federal engineers and biologists are developing new technologies to provide more surface-oriented passage for fish at each of the federal dams. These new technologies include spillway weirs installed at Lower Granite and Ice



SPILLWAY WEIR FAST FACTS

Advantages

- Safe – Removable Spillway Weirs (RSW) & Temporary Spillway Weirs (TSW) tests showed 98% survival
- Reduces reservoir delays – reduces passage delays
- Improved efficiency of passages – more fish with less flow
- If less flow, opportunity to improve water quality – lower total dissolved gases
- If less flow, improves the opportunity for power generation

Differences from Conventional Spill

- HOW water and fish are passed – surface "overflow"versus under deep gates
- HOW MUCH flow is required – less flow is required to pass comparable numbers of fish

Harbor dams and the corner collector at Bonneville Dam. Juvenile survival is 95-98 percent through the spillway weirs at Lower Granite and Ice Harbor dams and nearly 100 percent through the corner collector at Bonneville Dam.

The Corps expects to have surface passage installed at all eight dams on the Columbia and lower Snake Rivers by the year 2009. Other structural improvements for fish passage will include: juvenile bypass system improvements; spill deflectors to allow more spill; and state-of-the-art juvenile fish monitoring. The overall cost of all these dam improvements, scheduled to be completed in 2014, is expected to total between $1.55 billion and $1.65 billion.

As a result of efforts thus far, increased survival of Snake River fish through all eight FCRPS dams is now equivalent to what it was in the 1960s, when only four federal dams were in place on the Columbia and lower Snake rivers. Spring chinook survival in 2006 was the highest NOAA Fisheries has ever measured. [Source: *Survival Estimates for the Passage of Sprint Migrating Juvenile Salmonids through the Snake and Columbia River Dams and Reservoirs*, Northwest Fisheries Science Center, NOAA, 2006] Adult migration rate and travel time are similar to levels before the Snake River dams were completed (see graph below). [Source: US Army Corps of Engineers]

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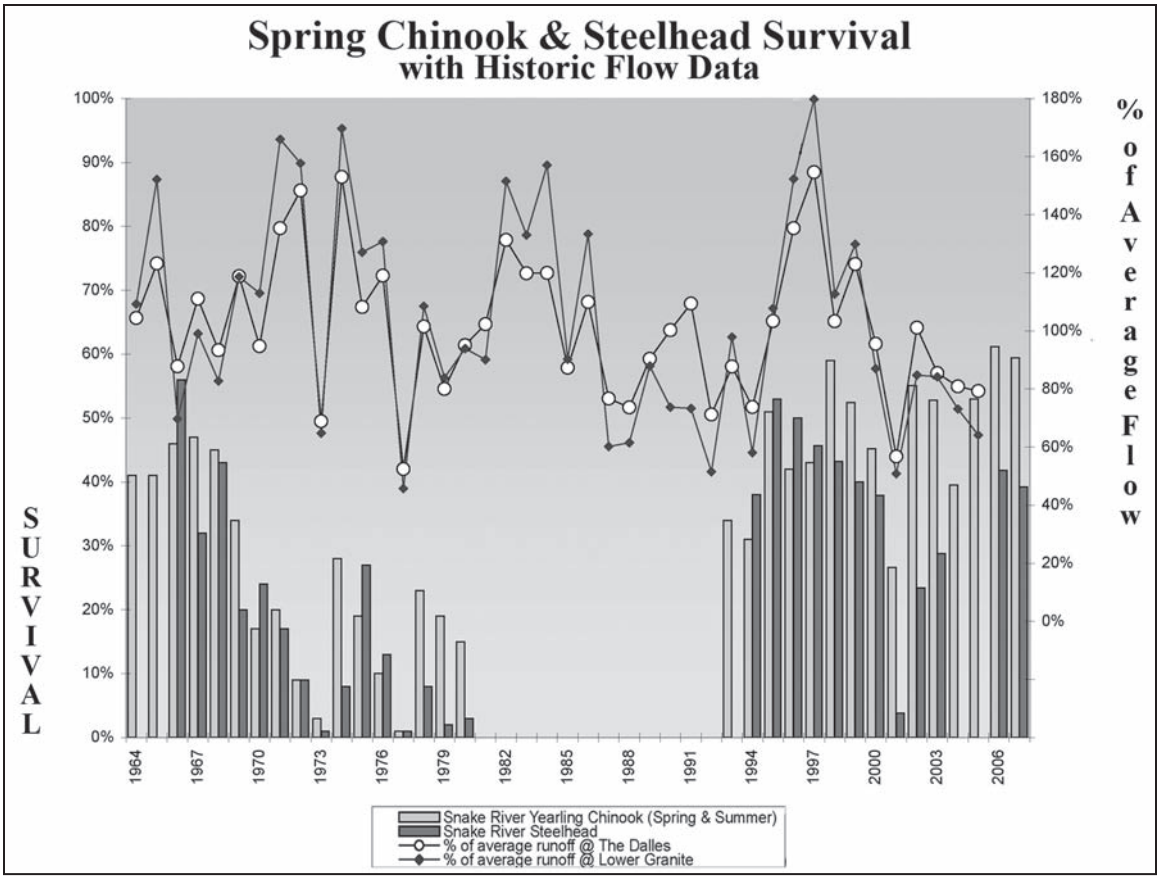
Spring Chinook and Steelhead Survival

Juvenile spring chinook survival through the eight dams on the Snake and Columbia Rivers is the highest it's been in recent years, according to NOAA Fisheries scientists – higher than when there were only four dams on the river in the late 1960s.



Hydropower & Fish

"All-H" Strategy

2007 Proposal

Hatchery Use

Hatchery BMPs

"Jump-Starting" Recovery

III: Looking Beyond Hydro Impacts

HABITAT, HATCHERIES & HARVEST

As the dams have been made increasingly safer for fish, the biological benefit from each incremental improvement is less and less. As we consider new actions, greater gains may be made by protecting and improving habitat, reforming and improving hatchery and harvest practices, and managing predators. This concept led to the "all-H Strategy" — which refers to habitat, hatcheries and harvest, as well as hydro operations. This strategy acknowledges the complex life cycle of ocean-migrating fish and the many other factors beyond hydropower operations that affect fish survival. Starting in 2001, the agencies increased their "off site mitigation" efforts — addressing impacts other than the dams.

There are many factors that have led to salmon's decline, and no one strategy will recover them. A comprehensive strategy must address limiting factors at all stages of the salmon lifecycle. With the 2007 proposed action, the federal agencies proposed a synergistic approach that combined a number of important elements.

THE 2007 PROPOSED ACTION INCLUDES:

ACHIEVING BETTER SURVIVAL AT THE DAMS — in the past with conventional bypass, now with surface passage routes discussed above

HABITAT RESTORATION — working with local communities to keep cattle out of streams, keep salmon out of irrigation diversions and improve tributary streamflows in ecologically sensitive and degraded areas

HATCHERY PRODUCTION — jump starting natural recovery by building supplementation hatcheries, such as the Cle Elum and the Nez Perce hatcheries, to accelerate the recovery of natural production of salmon

IMPROVED RIVER AND ESTUARY MIGRATION CONDITIONS — helping to remove invasive predators to salmon such as pikeminnow and terns. Also, helping fish avoid predators by managing river flows to keep them moving downriver quickly during the spring and summer

MANAGING FISH HARVEST CAREFULLY — to give fish harvesters the benefit of improving salmon populations while at the same time trying to minimize risk to ESA-listed fish

Improving Hatcheries

The contribution that hatchery fish make to recovery of listed fish has been the subject of much analysis, discussion and litigation in recent years. While ESA recovery targets are focused on wild fish, under certain circumstances hatchery fish can benefit the Evolutionarily Significant Unit (ESU) for certain listed stocks. This is an option only when biologists have determined that the genetic makeup of the hatchery fish is substantially similar to the wild fish in the same ESU.

Today, there are about 200 salmon hatchery programs in the Columbia River Basin, most of them funded by the action agencies as hydro mitigation. BPA alone spends over $60 million annually providing for the operation and maintenance of about 45 percent of the basin's hatcheries. BPA also funds research to evaluate the effectiveness of hatcheries.

With some exceptions, most of the salmon in the basin today originate in hatcheries. These hatchery fish provide the bulk of the harvest opportunity for the Columbia — both in-river and in the ocean. In the last three decades, the role of hatcheries has changed. It continues to change today. Hatchery evaluation and reforms are critical to ensuring that hatchery fish support — rather than impede — the recovery of natural fish.

NOAA Fisheries and other agencies are reviewing each hatchery operation to determine whether they are detrimental to natural stocks. Where problems are identified, state and federal agencies will be implementing reforms and "best management practices" to control risks that hatcheries might pose.

HATCHERY BEST MANAGEMENT PRACTICES MAY INCLUDE:

- Use of local brood stock in the hatchery program, rather than transferring stock between basins.
- Use of some fish of natural origin as brood stock, not just returning hatchery fish.
- Control of the number of hatchery fish on the spawning grounds. For example, trapping returning adult fish at a weir, sending the appropriate number of natural-origin and hatchery-origin fish on their way and harvesting the surplus hatchery fish.
- Mimicking natural rearing conditions in the hatchery. For example, raising fish at the temperature of the natural stream they'll be released in.

Hatchery fish also can help "jump-start" recovery of wild stocks. In recent years, fish biologists and hatchery managers have increased their use of "supplementation" — a strategy in which hatcheries are specifically designed to jump-start the natural restoration of decimated runs. Supplementation hatcheries raise fish under conditions that mimic conditions of natural streams. Juvenile fish typically are planted in ponds next to natural streams where they acclimate to the river well before they are ready to migrate

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downstream. Later, as adults, they return to the stream to spawn naturally. These programs have been successful in increasing the abundance of natural spawners in a number of locations. However, questions remain about whether these hatchery-origin fish degrade the genetic fitness of the wild fish with which they interbreed.

BIOLOGICAL OPINIONS & THE ROLE OF THE COURTS

Background

Litigation & Remanded BiOps

Since Judge Marsh's 1994 decision, NOAA Fisheries' BiOps to address ESA requirements for FCRPS have been the subject of much litigation. In lawsuits brought by environmentalists and fisher groups, Federal District Court Judge James Redden remanded the 2000 FCRPS BiOp, developed under the Clinton administration. *Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv.*, 254 F.Supp.2d 1196 (D. Or. 2003) In May 2005, Judge James Redden issued an opinion that the subsequent 2004 BiOp, developed by the Bush administration, was also legally flawed. *Nat'l Wildlife Federation v. Nat'l Marine Fisheries Serv.*, 2005 WL 1278878, No. CV 01-640-RE, CV 05-23-RE (D. Or. May 26, 2005).

Subsequently, in October 2005, Judge Redden invalidated the 2004 BiOp, but left it "in place" during a remand period. The Judge ordered the sovereign parties to collaborate during the remand process and try to find an approach that would have regional support. *Nat'l Wildlife Federation v. Nat'l Marine Fisheries Serv.,* 2005 WL 2488447, 35 Envtl. L. Rep. 20, 209, No. CV 01-640-RE, CV 05-23-RE (D. Or. Oct.7, 2005).

2007 Proposed Action

In May 2007, after extensive collaboration with tribes and states, BPA, the Corps and Reclamation sent their "Proposed Action" for operating FCRPS to NOAA Fisheries. This was followed in August with biological assessments that included the action agencies' proposed "reasonable and prudent alternative." These were accompanied by a Comprehensive Analysis that provided the scientific foundation for the biological assessments. These documents were designed to provide a foundation for NOAA Fisheries to develop a new FCRPS BiOp that would be responsive to Court orders. [Links to the biological assessments and additional information are available at the federal agencies salmon recovery website: www.salmonrecovery.gov/]

In October 2007, NOAA Fisheries issued a new draft BiOp. A public comment period closed January 4, 2008. The agency expects to issue a final opinion on March 18, 2008. [A link to the BiOp is on NOAA Fisheries' website: www.nwr.noaa.gov/Salmon-Hydropower/Columbia-Snake-Basin/Draft-BOs.cfm]

The New Draft Biological Opinion

Avoiding Extinction

Supporting Recovery

Lifecycle Stages

There are a number of significant changes in the actions included in the new draft BiOp. The overall rigor and scope of the scientific analysis that provided the foundation for the actions has also been improved. The goal of the actions for each listed stock was two-fold: 1) avoid extinction risk; and 2) support an adequate potential for recovery. To determine whether the actions would achieve these biological goals, the analysis assessed multiple metrics, including: the projected trends in abundance; productivity; population growth rate; and the 24-year extinction risk.

Each listed fish was scrutinized to determine its status. The analysis identified bottlenecks or limiting factors to recovery at each lifecycle stage for each distinct population. Specific actions were custom-tailored to address the unique needs of each listed Evolutionarily Significant Unit and speed the fish toward recovery. Actions are targeted to address key limiting factors to those populations most in need.

The new plan also reflects a 10-year program of major funding commitments for improvements to the dams, habitat and hatchery actions, predator control, and research, monitoring and evaluation.

New BiOp Funding Commitments

The new draft BiOp's funding commitments include:

- $70-80 million per year from the Corps' Columbia River program for dam modifications, survival evaluations, and predator management actions
- $45 million per year commitment from BPA for tributary and estuary habitat, with additional funds from the Corps and Reclamation
- Almost $35 million over the BiOp period to fund new hatchery facilities and another $5 million per year to fund new, hatchery–related expenses, support better steelhead productivity, and assess habitat potential for chum re-introduction below Bonneville Dam
- An increase from $3 million to $3.7 million per year to expand the Northern Pikeminnow Management Program and reduce predation of juvenile salmon
- An initial commitment of $75 million per year for research, monitoring and evaluation

Hydropower & Fish

On-Going Collaboration

"Sovereign" Review

Guided Implementation

Addressing Uncertainty

Collaboration Continued

In his October 2005 opinion, Judge Redden admonished the federal agencies to work with the region's states and tribes to "clarify policy issues and reach agreement or narrow the areas of disagreement on scientific and technical information. *Nat'l Wildlife Federation v. Nat'l Marine Fisheries Serv.,* 2005 WL 2488447, 35 Envtl. L. Rep. 20, 209. The agencies responded with an unprecedented effort.

The action agencies, along with hundreds of technical experts, planners and policy makers, worked over two years to complete this comprehensive analysis and set of proposed actions for listed species. The collaboration forged new areas of agreement and narrowed differences of opinion. The technical and scientific contributions of these entities led to a better understanding of what the fish need and helped the agencies fashion a comprehensive suite of actions and commitments to lay the foundation for the recovery effort for salmon and steelhead in the region.

The Proposed Action also institutionalizes the "Sovereigns" process to review implementation and recovery progress by the action agencies and others. The Proposed Action calls for continuation of the Policy Work Group, which includes high-level representatives of state and tribal governments, to guide implementation of the BiOp.

Accountability for Results and Addressing Uncertainty

Even with widely accepted population data and population metrics, as well as established and new analytic tools, evaluating the effects of the many limiting factors on every life stage of the fish is no simple matter. In addition, climate change and population growth could change current assumptions. A program of this complexity, with comprehensive actions on so many fronts, will entail a significant degree of uncertainty and risk. To address uncertainties and manage risks, the action agencies' proposal includes the following:

- New and higher performance standards for survival of fish passing through the dams (e.g. 96 percent per dam average for spring migrating fish), demonstrating a commitment to achieve results
- Research, monitoring and evaluation — a robust program addressing status of the fish, effectiveness of actions, and critical uncertainties
- Progress reports and contingencies, to ensure accountability for results over the BiOp term
- Adaptive management and continued collaboration and dialogue among sovereign governments to make timely adjustments where needed, based on the best available information

Fish Abundance (Geometric Mean)

ESU/DPS	Year Listed	Prelisting Hatchery + Natural Fish	Recent Hatchery + Natural Fish	Recent Natural Fish	TRT Minimum Recovery Abundance Thresholds	Abundance Trend (Natural Fish) w/ FCRPS Action
Snake River Spring/Summer Chinook	1992	21,836	89,823	25,957	26,000	Positive
Snake River Fall Chinook	1992	703	12,272	3,748	3,000	Positive
Snake River Steelhead	1997	70,345	189,271	37,784	22,000	Positive
Upper Columbia River Spring Chinook	1999	252	3,340	2,207	5,250	Positive
Upper Columbia River Steelhead	1997	3,376	15,349	3,643	4,250	Positive
Mid-Columbia Steelhead	1999	9,585	29,122	17,553	22,500	Positive

Fish Abundance

Comparing the recent abundance of adult fish returning to spawn with the NOAA minimum recovery abundance thresholds shows a positive trend with both natural stocks alone and hatchery and natural fish combined.

Hydropower & Fish

Dam Breaching Impacts

CONCLUSION

A WORD ABOUT THE FUTURE . . .

Given the magnitude of the salmon recovery task in the Columbia, and the many factors and interests in play, there are no quick fixes. Certainly no one entity and no single BiOp can do it alone. A comprehensive, science-based program that engages states, tribes, local landowners and federal agencies on all levels and actions is the surest way to preserve the region's priceless salmon for the future. However, given past experience, it won't be easy.

As for the region's valuable hydropower, similar challenges lie ahead. Emission-free hydropower is becoming more and more important as the region adopts ambitious carbon reduction goals. How these goals may play out in combination with hydro operations for salmon remains unclear. For example, if Snake River dams were breached, as some recommend, the Northwest Power and Conservation Council has estimated that removing the dams and replacing them with gas-fired generation would add 4.4 million tons of carbon dioxide to the air — the equivalent of almost 770,000 more cars on the road every year. Stay tuned on this one.

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Further Information in The Water Report

Editor's Note: In addition to an update you will find in this TWR's "Water Briefs" our prior coverage of the Columbia River BiOps process includes the following:

Columbia Basin Spills: Tribes Threaten Lawsuit Over BPA Proposal (TWR #3, Water Briefs: May 15, 2004)
Columbia River Discharges - Clean Water Act Citizen Suit (TWR #5, Water Briefs: July 15, 2004)
BPA Summer Spill Decision - Tribes Prepare Litigation Contesting (TWR #5, Water Briefs: July 15, 2004))
BPA Spill Controversy - 9th Circuit Compels Spill for Fishery (TWR #6, Water Briefs: Aug. 15, 2004)
NOAA Columbia-Snake Draft Strategy (TWR #7, Water Briefs: Sept. 15, 2004)
Water Quality Standards: 9th Circuit Holding on Dam Operations TWR #8 , Water Briefs)
NOAA BiOp - Columbia and Snake Rivers (TWR #10, Water Briefs: Dec. 15, 2004)
Bureau of Reclamation Decision Document for Columbia River (TWR #12, Water Briefs: Feb. 15, 2005)
Dams and Salmon: Judge Rejects BiOp by David C. Moon (TWR #16: June 15, 2005)
Columbia River BiOps Order and Upper Snake Case (TWR #20, Water Briefs: October 15, 2005)
Columbia River Water Management Plan: Emphasizing Water Storage and Conservation by David C. Moon (TWR #25: March 15, 2006)
Federal Plan Violates Endangered Species Act: Snake River BiOp Plan Flawed (TWR #28, Water Briefs, June 15, 2006)
BPA Closing of Fish Passage Center Rejected by 9th Circuit (TWR #36, Water Briefs: February 15, 2007)
Laws of the Rivers: Compendium for Major Interstate Rivers (TWR #37: March 15, 2007)
Columbia River Hydrosystem BiOp: 9th Circuit Upholds Rejection of 2004 BiOp by Mark L. Stermitz (TWR #40, June 15, 2007)

See: TWR's website at www.TheWaterReport.com, select "Columbia River Basin" under the Index of Articles. Electronic versions of prior TWR articles are available to TWR subscribers upon request, email: thewaterreport@hotmail.com

Wetlands

CLEAN WATER ACT JURISDICTION

ARMY CORPS JURISDICTIONAL WETLANDS DETERMINATIONS

by Douglas W. MacDougal, Schwabe, Williamson & Wyatt, P.C. (Portland, Oregon)

Rapanos & *Carabell*

Introduction

In June of 2007, the US Environmental Protection Agency (EPA) and US Army Corps of Engineers (Corps) released a memorandum providing guidance to EPA regions and Corps districts implementing the Supreme Court's decision in *Rapanos v. United States*, 547 U.S. 715, 125 S. Ct. 2208 (2006). *Rapanos* was decided together with *Carabell v. United States* and is collectively referred to herein as *Rapanos*. Those cases addressed Corps jurisdiction over waters of the United States under the federal Clean Water Act (CWA). 33 U.S.C.§1251 *et seq*. This article will examine some key facets of the guidance, which attempts to steer a clear path through the tangle of cases, regulations and interpretations that have made this issue confusing to all who encounter it. A visual approach to the different wetland settings is also provided in the form of a chart summarizing CWA jurisdiction to help comprehend the Supreme Court decision and Corps guidance.

Background: The *Rapanos* Case

CWA Goal

The CWA's goal is to protect the biological, chemical and physical functions of the waters of the United States. 33 U.S.C.§1251(a). The phrase "waters of the United States" usually includes: traditional navigable waters; interstate waters including interstate wetlands; and tributaries of these waters. It has also been interpreted to include adjacent wetlands. But, as we shall see, interpretations as to the extent of such tributaries and the meaning of adjacency have produced conflicting results. This article does not attempt to provide an exhaustive summary of Circuit or US Supreme Court decisions that preceded *Rapanos*. (RE: *Rapanos* issues see: Bicker, TWR #29; Walston, TWR #30; Water Briefs, TWRs #31 & #41) We will make note only of one case, because it represented the first true signal that the US Supreme Court (Court) was ready to reexamine the underlying premises of CWA jurisdiction. That is the case of *Solid Waste Agency of Northern Cook County (SWANCC) v. United States Army Corps of Engineers*, 531 U.S. 159 (2001). There, the Court held that the use of isolated nonnavigable interstate waters by migratory birds was not by itself a sufficient basis for the exercise of federal regulatory jurisdiction under the CWA. The Justices invalidated the so-called "Migratory Bird Rule," adopted by the Corps in 1986, whereby CWA jurisdiction was attained by the use of some isolated ponds as habitat by migratory birds. The *SWANCC* case was a warning shot to the Corps. The reasoning of that case made it clear that the Court intended the CWA to have more than a tenuous connection to navigability.

SWANCC Case

Finally, in 2006, the Justices were presented with two cases which gave the Court the opportunity to thoroughly examine the reach of CWA jurisdiction, as interpreted by the Corps. In *Rapanos*, the issue was whether wetlands having a surface hydrologic connection to a man-made ditch that drains into traditional navigable waters are waters of the US. The *Carabell* case presented the question of whether a wetland is "adjacent" if it is separated by a man-made berm from a tributary (a ditch in that case) to navigable waters. The Court's decision in *Rapanos* consists of five opinions, with no single opinion representing a majority of the Court. There were sufficient votes, however, to vacate and remand the judgments in both cases to the Sixth Circuit Court of Appeals.

Rapanos Issues

The plurality opinion, authored by Justice Scalia, concluded that the agency's regulatory authority should extend only to "relatively permanent, standing or continuously flowing bodies of water" connected to *traditional navigable waters*, and to "wetlands with a *continuous surface connection* to" such *relatively permanent waters* (emphasis added). *Rapanos*, 126 S. Ct. at 2227. We have emphasized the concepts of "relatively permanent waters," "traditional navigable waters," and "continuous surface connection" because these terms are critical to understanding CWA jurisdiction.

Scalia Opinion (Plurality)

The plurality saw the wetlands question solely as a matter of finding the boundaries of the waters of the US, made ambiguous by wetlands. *Id.* at 2225-26. It is important to focus-in on Justice Scalia's reasoning to appreciate how fundamentally different the plurality opinion is from what might be termed the everyday preexisting assumptions about the CWA. To the plurality, the CWA was not enacted to protect wetlands. *Id.* at 2228. It was enacted to protect the waters of the United States. Thus, the key issue for the plurality, and their *only* task as they saw it, is to find where the "water ends and the land begins." *See generally Id.* at 2216-17. For Justice Scalia, the Court should establish the limits of CWA jurisdiction, after which the statute should be applied according to its purpose. One should not use the purpose of the statute to define its jurisdiction. *Id.* at 2232.

Plurality's Rationale

Wetlands

Kennedy's "Significant Nexus"

Justice Kennedy agreed with the plurality that the statutory term "waters of the United States" extends beyond waterbodies that are traditionally considered navigable, but came up with his own unique test — albeit one scorned by the plurality and ill-regarded by the dissenting justices. Justice Kennedy concluded that wetlands are waters of the United States "if the wetlands, either alone or in combination with similarly situated lands in the region, significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable.'" *Id.* at 2248. This test by Justice Kennedy is called the "significant nexus" test, a term he borrowed from the *Riverside Bayview* case, and it requires a case-by-case hydrologic and ecologic analysis. This method is poles apart from the plurality's view: the test requires looking at the *function* of the wetlands at issue before determining jurisdiction.

Dissenting Opinion

The dissent contended that the Corps' regulations are reasonable interpretations of the CWA. *Id.* at 2253. It strongly felt that the majority should step back and defer to the expertise of the Corps on such issues. *Id*. at 2259. Three entirely different perspectives of CWA jurisdiction thus emerged from the *Rapanos* case. Justice Scalia believed the "significant nexus" test came entirely from the mind of Justice Kennedy and not the statute. He called the test a "gimmick" whose standard was "perfectly opaque" and appeared to have far more respect for the deference argument of the dissent than Justice Kennedy's invention. *Id.* at 2234. To the plurality, there is no precedent for case-by-case analyses of ecological significance for each jurisdictional determination. *Id.* at 2233.

Dual Approach

Justice Stevens' dissent had little praise for the Kennedy view. However, it included a remark that the Corps, as will be seen, evidently took to heart. Stevens wrote that if a case arises where jurisdiction may be found *either* from the plurality test *or* the significant nexus test, then jurisdiction should attach. *Id.* at 2265. This approach may be meeting with acceptance with the courts. For example, after a searching analysis of what to do with these conflicting Supreme Court opinions, the First Circuit Court in *The United States v. Johnson*, 467 F.3d 56 (1st Cir. 2006), *cert. denied*, 128 S. Ct. 375 (2007), concluded that it was appropriate to apply the Justice Stevens approach. On the other hand, the court in *Northern California Riverwatch v. City of Healdsburg*, 496 F 3d 993 (9th Cir. 2007), went straight to the significant nexus test as the controlling principle, stating that "Justice Kennedy's concurrence provides the controlling rule of law for our case." *Id.* at 1029.

Corps' Response to Rapanos decision

Corps Guidance

It is perhaps no surprise that the interagency guidance on CWA jurisdiction following the *Rapanos* case adopted basically a triage approach.

The interagency guidance includes:

- Categorical *assertion* of CWA jurisdiction in some situations
- Categorical *rejection* of CWA in other situations
- Case-by-case *significant nexus* analysis as to situations not included in the first two categories

Guidebook

The Corps issued a regulatory guidance letter and a "*Jurisdictional Determination Form Instructional Guidebook*" (Guidebook) — which specify how determinations are to be carried out consistent with *Rapanos*. It also contains instructions to aid field staff in completing the "approved jurisdictional determination form" (JD form). It is intended to be used as the standard operating procedure for conducting a **j**urisdictional **d**etermination (JD), and emphasizes careful documentation practices that must be followed to support an approved JD. (See Corps website: www.usace.army.mil/cw/cecwo/reg/cwa_guide/cwa_guide.htm)

Elements of Corps' CWA Jurisdiction Under Its Guidance

Summary of Jurisdiction

The chart on the next page presents in shorthand form the author's summary of CWA wetlands jurisdiction. The abbreviations on the chart are those used in this article, and not necessarily those used by the Corps. The chart itself is the creation solely of the author for the purposes of explaining the confusing situation brought about by the multiple opinions in *Rapanos*, and has not been either reviewed or approved by the Corps. The chart provides a visual way of comprehending a wetlands' factual setting to determine when CWA jurisdiction exists (and therefore the CWA applies) in a particular case.

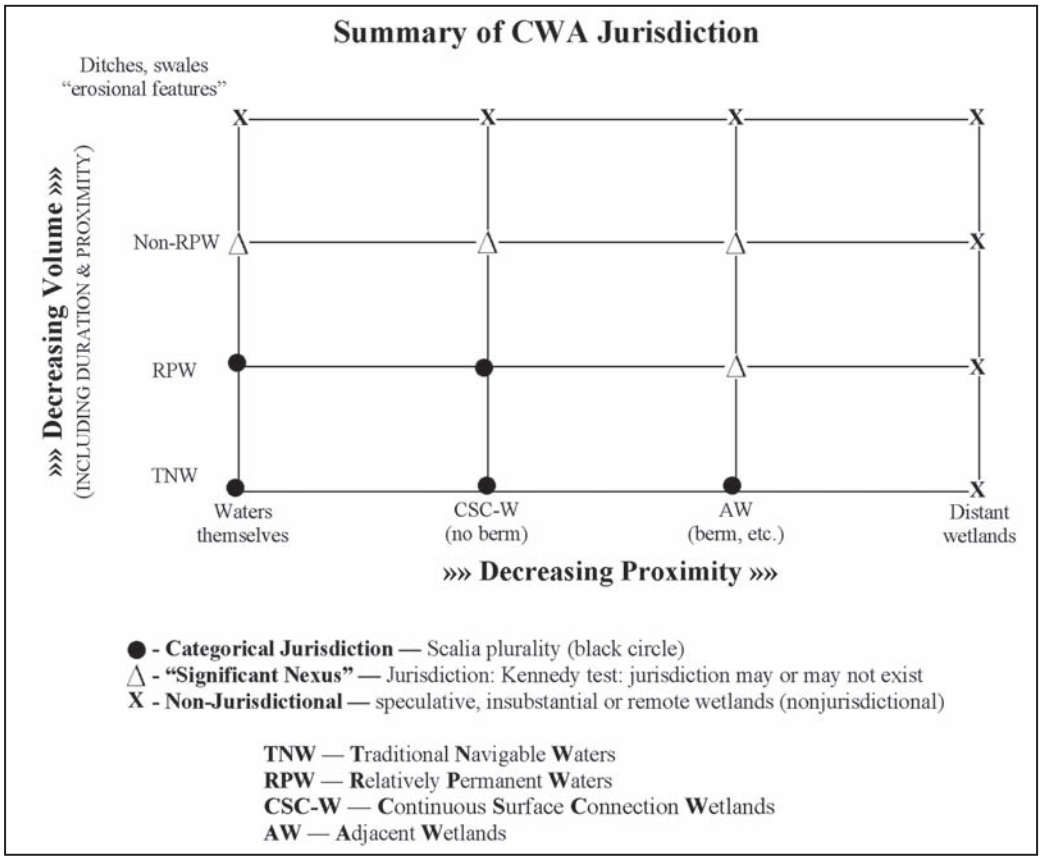
Volume & Proximity

The chart shows the two fundamental dimensions of the CWA jurisdiction issue: 1) volume of water (including duration and frequency) on the vertical, or y axis; and 2) proximity of wetlands along the horizontal, or x axis. The waters themselves are described along the y axis with the corresponding type of jurisdiction associated with the various features discussed in the guidance. "Categorical jurisdiction" — i.e. jurisdiction under Scalia's plurality opinion — is reflected on the chart as a black circle. "Significant nexus" jurisdiction — i.e. jurisdiction that may be applicable under Kennedy's test — is shown as a triangle.

CWA Jurisdiction

The first and easiest concept drawn from the Corps' guidance is that **t**raditional **n**avigable **w**aters (TNW) are well within the jurisdiction of the CWA (see lower left hand corner of the chart). Wetlands with a **c**ontinuous **s**urface **c**onnection ("CSC-W") to TNW have categorical jurisdiction.

Wetlands



RPW

Categorical jurisdiction also attaches to **r**elatively **p**ermanent **w**aters (RPW) — again, as shown with the black circle. These are interpreted by the Corps as tributaries that typically flow year-round or have continuous flow at least seasonally (for example, three months).

Adjacent Wetlands

Adjacent wetlands (AW) that are adjacent to TNW are also jurisdictional under the CWA. A word of caution is in order here. Wetlands are considered "adjacent" to the Corps even if separated from TNW or RPW by a berm or a dike or other feature. An AW determination thus implies a more remote connection than a CSC-W determination, as CSC-W wetlands have a continuous surface connection to TNW or RPW, uninterrupted by berm or dike. Along the x axis (horizontal), we see that categorical jurisdiction attaches both to CSC-W connected to TNW and to AW that are adjacent to TNW.

"Directly Abutting"

Wetlands "directly abutting" RPW that flow into TNW are categorically jurisdictional under the CWA — as reflected by the black circle on the chart where RPW and CSC-W intersect. [Note: The Corps at times refers to "wetlands directly abutting" RPW, while the chart uses the term "**c**ontinuous **s**urface **c**onnection" (CSC-W) for the same situation since that is the term used by Justice Scalia in his opinion].

AW adjacent to RPW are *not* categorically jurisdictional (i.e. wetlands that may be separated from the RPWs by a berm, a dike, or other features). That intersection between RPW and AW is indicated by a triangle, which signifies significant nexus jurisdiction. Thus, wetlands adjacent to, but not abutting RPW (that is, there being no continuous surface connection), that flow into TNW are jurisdictional under the CWA only where there is a "significant nexus" with a TNW.

Non-RPW

Now suppose we are no longer talking about either TNW or RPW but instead are considering intermittent or ephemeral waters. These are waters that do not have a year-round or seasonal continuous flow, as in the case of relatively permanent waters. As one might expect, non-RPWs are jurisdictional under the CWA *only* where there is a "significant nexus" with a TNW. These are represented on the chart by triangles along the x axis from the point labeled Non-RPW. Wetlands abutting *or* adjacent to non-RPWs that flow directly or indirectly into TNW are jurisdictional under the CWA only where there is a "significant nexus" with a TNW.

Ditches & Swales

At the outer limits of CWA jurisdiction, there are certain geographic features that generally do not carry jurisdictional waters: swales; erosional features (gullies, for example); and small washes characterized by low volume and infrequent, short-duration flows. These features might also include ditches used for draining uplands which do not carry relatively permanent flows and uplands themselves, which transport flows generated from precipitation. These limits of jurisdiction are marked with X's as being speculative, insubstantial or remote and therefore nonjurisdictional under *Rapanos* and Corps' guidance.

Wetlands

"Significant Nexus" Evaluation

Significant Case

Ability to Concede?

Comment Period Ongoing

CWA Jurisdiction and the Significant Nexus Test

According to the Corps, the significant nexus evaluation will include an assessment of the flow characteristics and functions of the tributary itself, in combination with the functions performed by any wetlands adjacent to the tributary, to determine if they have more than an insubstantial or speculative effect on the chemical, physical and/or biological integrity of traditional navigable waters. The evaluation will include considerations of hydrologic factors such as: flow volume, duration and frequency; proximity to traditional navigable waters; size of the watershed; average annual rainfall; and snowpack. The test will also include consideration of ecologic factors such as the ability of a tributary and its adjacent wetlands, if any, to carry pollutants and floodwaters to TNWs. It will include the ability of the drainage to provide adequate aquatic habitat that supports biota of a traditional navigable water. The evaluation will encompass the ability of adjacent wetlands to trap and filter pollutants or to store floodwaters. It will also involve the question of how well the system maintains water quality.

The significant nexus test was applied quite thoroughly in the *Healdsburg* case, where a basalt pond that was located next to the Russian River, in California, was determined to have significant nexus based on virtually all of the factors referred to above. It is an important Ninth Circuit opinion on the issue of CWA jurisdiction in the post-*Rapanos* era. See *Northern California Riverwatch v. City of Healdsburg*, 496 F 3d 993 (9th Cir. 2007).

Conclusion

It is noteworthy that the Corps relies so heavily on the significant nexus test, intending to employ it in virtually all jurisdictional situations that are not categorically obvious. This preponderant reliance on the significant nexus test — scorned so thoroughly by Justice Scalia in *Rapanos* and looked upon skeptically by the dissent — has become the virtual bedrock of the Corps' guidance.

Justice Stevens cautioned that case-by-case determinations "will inevitably increase the time and resources spent processing permit applications." *Id.* at 2265. There will undoubtedly be a time and paperwork challenge imposed by the Corps' reliance upon the significant nexus test. The Guidebook is approximately 85 pages long, complete with numerous flow charts and eight appendices. The approved JD form consists of eight pages of fine print. Most importantly, the appendices to the Guidebook contain detailed coordination procedures with EPA on all "significant nexus" evaluations. The Guidebook and the full library of related documents may be found online at the Corps website: http://www.usace.army.mil/cw/cecwo/reg/cwa_guide/cwa_guide.htm.

Comments already received by the Corps reveal a chorus of complaints on how much time will be required simply to establish whether or not jurisdiction attaches, much less to obtain a permit. Some have criticized multiple high-level reviews, and the inability to simply concede jurisdiction to the Corps and get on with business — they complain that the Corps insists upon going through all the steps in coordination with EPA to document its jurisdictional determination even when the applicant agrees that a project requires a Section 404 permit.

The initial six-month comment period for the guidance has been extended 45 days to January 21, 2008, to allow further public input (see www.usace.army.mil/cw/cecwo/reg/cwa_guide/fedreg_extcompd_rapanos.pdf). It would seem desirable for the Corps to provide some shortcut or fast-track procedures for those wishing to concede jurisdiction and perhaps also to streamline the significant nexus review process.

Given the divergent views of the justices in *Rapanos*, it will not be surprising if litigation continues nationwide on these difficult and complex issues. Litigation will undoubtedly occur not only to challenge individual significant nexus determinations (in the context of both permitting and enforcement) but also to force reconsideration of the jurisdictional premises themselves.

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TMDLs

TMDL CHALLENGES

CHALLENGES IN DEVELOPMENT & IMPLEMENTATION

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BACKGROUND

Increasing Impacts

Increasing Expectations

As communities have grown, environmental impacts have increased, as have the demands on watersheds to meet broad expectations for multiple use. Historically, single-issue planning has dominated watershed management, be it for flood control, water quality, habitat, or species recovery. Increasingly, there is a broader understanding of multi-faceted issues that involve consideration of both quality and quantity, resulting in the need for a comprehensive watershed management view to balance competing demands for a limited resource.

Today, managers are subject to multiple pressures of providing increased capacity to accommodate growth while at the same time adapting to new regulatory programs to protect water quality — such as the **t**otal **m**aximum **d**aily **l**oads (TMDLs) required under the federal Clean Water Act (CWA). Water quality limited receiving waters (CWA Section 303(d) lists), TMDLs, and the wasteload allocations established under this process are leading to new challenges for wastewater utilities, resource managers, and regulatory agencies.

TMDL Challenges

In many States, federal district court rulings on TMDL lawsuits in the 1990's resulted in requirements for State environmental agencies and the US Environmental Protection Agency (EPA) to accomplish TMDLs on all Section 303(d) listed water quality limited stream segments on accelerated schedules. TMDLs and wasteload allocations are leading to wastewater treatment plant discharge limitations. These limitations provide the basis for new discharge permits, which require upgrades for advanced treatment. The water quality studies required to develop TMDLs, the resulting requirements for upgrade of wastewater treatment plants to reduce point source discharges, and the implementation of "best management practices" to reduce nonpoint source loadings, all combine to add to the multiplicity of challenges facing managers and regulators. Maintaining a watershed management approach that integrates and balances competing demands in the water environment to meet existing needs and future expectations has become more difficult.

Multiple Aims

This article focuses on watershed management, water quality, and TMDLs. In particular, we examine certain Northwest watersheds where concurrent dissolved oxygen, nutrient, and temperature limitations present a complex operating arena that challenges all those who manage watersheds — from agencies to public works utility directors.

ISSUES IN TMDL DEVELOPMENT

TMDL Process

EPA describes the TMDL process as a successive progression of steps that yield a TMDL as follows:

- Problem identification
- Identification of water quality indicators and targets
- Source assessment
- Linkage between water quality targets and sources
- Wasteload Allocations
- Follow-up monitoring and evaluation
- Assembling the TMDL

Practical Realities

This framework is to be completed concurrently, or iteratively, to produce a legally approvable TMDL with load calculations and allocations, which support the basis for review by EPA. However, in actual practice, the process is far from straightforward. Many waterbodies have been altered far beyond natural conditions. Assessing the complexities of watersheds and meeting the challenges in establishing appropriate target conditions to address water quality impairments is difficult. Incomplete water quality data compounds the challenge of formulating TMDLs, as it results in an incomplete understanding of all of the point and nonpoint source loadings that result in the impaired condition. Frequently, the TMDL process is undertaken without the key stakeholders responsible for the point and nonpoint source loadings having an adequate understanding of the potential impacts of the load allocations that may result from the process. This can lead to situations where the TMDL may be reviewed and approved by EPA, but cannot practically or economically be implemented.

TMDLs

Modeling

Point Source Data

Natural Background

Groundwater Impacts

Schedule Pressures

Implementation Planning

Stakeholder Involvement

Incomplete Water Quality Data

A frequent problem in TMDL development is the lack of complete water quality data to allow a full understanding of all of the loadings impacting a watershed. The pursuit of additional water quality data is often an initial step in the TMDL process. However, data collection and analysis is time consuming and expensive — conditions that are often inconsistent with the demands of the production schedule and the resources available. Even with additional monitoring, a full definition of all loadings in a watershed is difficult to attain.

Water quality modeling efforts designed to provide a complete understanding of watershed conditions are especially data intensive and time consuming. As a result, the most sophisticated modeling tools — those with the potential for providing the fullest understanding of watershed functions — are often reserved for only the highest priority watersheds. Even with the use of the most sophisticated models, adequate data and acceptable calibration is a challenge because watersheds are so complex.

Point source discharge loading data is often the most readily available pollutant loading data available. This occurs by virtue of the CWA's National Pollutant Discharge Elimination System (NPDES) permit reporting requirements. Monthly discharge monitoring reports must be submitted to regulatory agencies for all point source dischargers in every watershed. Unfortunately, for point source dischargers, the availability of this data has sometimes been interpreted as an indication that point sources are the only loadings that need to be controlled in TMDLs. This is certainly not the case in most watersheds — where most impairment is caused by either nonpoint sources, or a combination of point and nonpoint sources.

Some water quality monitoring data is generally available in TMDL watersheds since it is that data which provides the basis for the impairment designation. However, water quality data does not necessarily provide the information necessary to associate pollutant loadings with nonpoint sources such as agriculture, forestry, urban/suburban drainage, etc. Inappropriately estimating natural background loadings can be especially problematic in the resulting TMDL. If all unidentified loadings are characterized as natural background, potentially manageable nonpoint source loadings may not be quantified and designated for reduction. Conversely, if natural background loadings are underestimated, TMDL load reductions may exceed what is possible.

Groundwater is frequently an important component of overall watershed loadings. The lack of direct monitoring data, however, may disguise its importance. Land use activities such agriculture and forestry, as well as urban/suburban drainage and the use of on-site septic systems, all may result in pollutant loadings to groundwater that is then tributary to surface waters. The groundwater/surface water interactions are typically complex and difficult to understand. However, in many important watersheds, groundwater delivery of nonpoint source pollutant loadings is very prevalent. Understanding this interconnection can lead to substantially different management activities in the watershed to comply with TMDL requirements.

Schedule & Resource Limitations

The time and resources necessary to develop a complete and scientifically well-founded TMDL can be substantial. Rarely are the time and resources adequate to satisfy those charged with the responsibility to prepare the TMDL. Court ordered TMDL schedules compound the challenges by adding the pressure of mandated deadlines for completion.

This can be quite frustrating to TMDL leaders seeking a complete scientific understanding of the watershed. While budgets and time may be limited, the scrutiny with which the TMDL will be reviewed is not. The potential for critical review to contest the water quality analysis and resulting loading allocations is real.

Since budget and time are limited, reducing the workload required to prepare a TMDL is attractive. Often, consideration of TMDL implementation is abbreviated because it is not a mandatory component of an acceptable TMDL. This is unfortunate, since implementation planning presents an opportunity to engage both point and nonpoint stakeholders and reveal potentially impractical aspects of the TMDL. Implementation planning calls for the examination of water quality requirements and the TMDL process in a way that translates more directly to the actions that will be required for compliance. Concurrent TMDL development and implementation planning can result in more practical watershed management plans with greater stakeholder support.

Engagement & Communication with Key Stakeholders

Many TMDLs are developed without key stakeholders having the understanding necessary to accept the results of the TMDL and embrace the activities that may be required for watershed restoration. This seems to be an especially difficult problem to overcome and the misunderstandings that arise can compromise the efforts to improve water quality.

TMDLs

Regulated Community Inclusion

The TMDL process itself is complex enough that often only those preparing the water quality analysis understand who may be impacted and in what way. Often the State regulatory agency is leading the development of the TMDL and has the combined burden of conducting the analysis and communicating with the regulated community about the implications. Most in the regulated community are fully consumed with the core demands of their primary responsibilities and unfamiliar with the TMDL process. This disconnect can result in the development of technically impractical and unaffordable TMDLs.

Point source stakeholders and nonpoint source resource managers are generally the most skilled and experienced with managing the loadings from their sources. Wastewater utilities have the knowledge, skill and experience to understand the limits of treatment technology. However, if these stakeholders are not engaged in the TMDL process, they may be confronted with wasteload allocations that cannot be attained.

Nonpoint Challenges

Similarly, for the nonpoint sources, load allocations may be formulated that call for reductions exceeding what can be accomplished with **b**est **m**anagement **p**ractices (BMPs) with reasonable assurance. Since BMP effectiveness is less deterministic than point source controls, meeting reasonable assurance requirements in a robust way can be challenging.

Engagement Options

Without complete engagement of the point and nonpoint source stakeholders to provide a well-founded understanding of the effectiveness of pollutant reduction efforts, the potential application of some of the most innovative and economical watershed management approaches may be inadvertently limited. Water quality trading and loading offsets between point and nonpoint sources holds the promise of providing optimal watershed management plans. However, incomplete loading analysis, limitations of time, and the lack of complete engagement of both point and nonpoint source stakeholders limits the potential for these types of approaches to provide economical water quality improvements.

NUTRIENT TMDLs

Nutrient Impacts

Nuisance aquatic growth driven by nutrient loadings can impair a waterbody's designated beneficial uses in a number of ways, including: interfering with recreational activities; creating aesthetic issues (odors, filamentous algal growth); covering substrate that provides habitat for aquatic organisms and fish reproduction; consuming dissolved oxygen as a result of decay; shifting pH and dissolved oxygen by algal respiration; and degrading water supplies (e.g. taste and odor impacts). The challenge in developing nutrient TMDLs is in selecting the targeted water quality conditions for receiving waters and the nitrogen and phosphorus concentrations associated with those conditions.

Narrative Standards

Narrative standards are currently the most common criteria for nutrients, because several factors in addition to nutrient concentrations determine the impact of nutrients on receiving water quality. The additional factors that influence the extent of algal growth include: light penetration; stream velocity and scour; frequency and intensity of flood events; substrate stability; grazing; and temperature. For these reasons, nutrient concentrations that drive enriched conditions in one stream may not impair the beneficial uses in another.

Algal Impacts

Simplification Push

Conducting the studies necessary to support nutrient TMDLs and select appropriate target water quality conditions can be time consuming and expensive. Where states face many impairment listings on many waterbodies, schedule demands and resource limitations constrain the effort to conduct detailed individual analysis to support nutrient TMDLs. Consequently, there has been great interest in simplifying the process for assessing nutrient impairments and developing TMDLs.

Clark Fork River Voluntary Program Example

Stakeholder Collaboration

For the Clark Fork River Voluntary Nutrient Reduction Program (VNRP), complaints from recreational users about large quantities of periphyton (attached algae) indicated that nuisance conditions existed. Stream monitoring was conducted to assess instream algal biomass levels. Laboratory tile studies were conducted to explore the link between threshold concentrations of nitrogen and phosphorus and the resulting algal biomass. Literature on enriched conditions was reviewed for background on the basis for selecting appropriate target conditions for the Clark Fork River. In a collaborative process (see below), a group of stakeholders discussed conditions in the Clark Fork River and selected the instream targets for nutrient concentrations and algal biomass. To control Cladophora (a green algae) growth upstream of the City of Missoula, the VNRP established instream targets for total nitrogen and total phosphorus at 300 micrograms per liter (µg/L) and 20 µg/L, respectively. From Missoula downstream, diatom algae dominates and the total phosphorus target was established at 39 µg/L. The targeted algal biomass for the Clark Fork River was set at 100 milligrams per square meter (mg/m^2) chlorophyll a (i.e. green, as opposed to red chlorophyll b) under average summer conditions and 150 mg/m^2 chlorophyll a under peak conditions.

TMDLs

EPA Memorandum

Cited Advantages

Target Levels

Natural Conditions Concerns

Phosphorus Forms

Indicating Sources

Removal Processes

Bioavailability

Nutrient Pollution and Numeric Water Quality Standards

In an important new development from EPA on nutrient control and the national numeric nutrient criteria effort, Ben Grumbles, EPA Assistant Administrator, issued a May 25, 2007 memorandum on "Nutrient Pollution and Numeric Water Quality Standards" to State and Tribal water program directors. The memo calls for "EPA and its partners to take bold steps..."

Highlights of this EPA nutrient pollution memorandum include:

- High nitrogen and phosphorus loadings, or nutrient pollution, result in harmful algal blooms, reduced spawning grounds and nursery habitats, fish kills, oxygen-starved hypoxic or "dead" zones, and public health concerns related to impaired drinking water sources and increased exposure to toxic microbes such as cyanobacteria.
- The most widely known examples of significant nutrient impacts include the Gulf of Mexico and Chesapeake Bay. For these two areas alone, there are 35 States that contribute the nutrient loadings.
- Virtually every State and Territory is impacted by nutrient-related degradation of our waterways.

EPA cites advantages for adopting numeric nutrient criteria as follows:

- Easier and faster development of TMDLs
- Easier to write protective NPDES permits

EPA plans to provide direct assistance to States in adopting numeric criteria from a science-based foundation for developing new criteria for estuaries, wetlands, and large rivers. EPA goals include clearly and effectively communicating the dangers of nutrient pollution and the merits of numeric nutrient criteria to States, nutrient sources, and the public.

Potential Implications of Instream Numeric Nutrient Criteria

Numeric nutrient criteria are target levels for certain instream nutrients, which may be set at very low concentrations based on a reference watershed or condition. This process may result in new water quality impairment listings for streams, challenging targets for TMDLs, and restrictive effluent discharge permits. Typical instream phosphorus concentrations targets for rivers in the Rocky Mountains are in the range of 20 µg/L to 50 µg/L. Typical instream nitrogen concentrations targets are in the range of 300 µg/L to 600 µg/L.

Because instream numeric nutrient criteria based on natural conditions can be very low, a number of concerns arise. There are concentration levels that are lower than wastewater treatment technologies are capable of achieving if they were to be applied "end-of-pipe." This is a concern to wastewater utilities that rely on surface waters for effluent management, especially those discharging to small streams with limited potential for effluent dilution.

Phosphorus Speciation

Phosphorus speciation refers to the different forms of this nutrient that exist in a waterbody. Nutrients can be categorized many ways. When considering TMDLs for rivers, lakes, and reservoirs, the common forms of phosphorus assessed include: inorganic (such as orthophosphate) and organic phosphorus.

Phosphorus speciation has become an increasingly important consideration in the management of nutrient loadings in sensitive watersheds. This includes the Spokane River, which has a very low instream target concentration of 10 µg/L total phosphorus. Nonpoint source dominated watersheds such as the Florida Everglades also face similar challenges of very low phosphorus concentration targets. Phosphorus speciation (total, particulate, soluble reactive or ortho-phosphate, and soluble organic or non-reactive) may be indicative of the sources of loadings within the watershed and aid in nonpoint source loading analysis and source tracing. Phosphorus speciation also provides an indication of how bioavailable the nutrients loads may be to drive the enrichment that leads to dissolved oxygen depression.

Phosphorus speciation may be a key to the potential for removal in wastewater treatment facilities and in nonpoint source best management practices. Pilot testing of wastewater treatment technologies for point source discharges to the Spokane River have shown phosphorus speciation to be fundamentally important in the actual removal mechanisms that are effective in reducing loadings (particulate filtration, coagulation of reactive phosphorus and filtration, adsorption). Advanced nutrient treatment processes are limited in their ability to remove soluble, **r**efractory **d**issolved **o**rganic **p**hosphorus (RDOP). Residual levels of RDOP in the effluent from the most advanced wastewater treatment processes are on the same order as the instream total phosphorus targets.

Nitrogen Speciation

The importance of nitrogen speciation has become apparent in key watersheds of concern, such as Chesapeake Bay. Current scientific investigations are underway to attempt to understand the potential bioavailability of dissolved organic nitrogen in the marine environment. Exposure to salinity and sunlight may result in dissolved organic nitrogen becoming available as a nutrient source with time.

TMDLs

For point sources, effective treatment is available for removal of inorganic nitrogen (ammonia, nitrate, nitrite). However, advanced nutrient treatment processes are limited in ability to remove soluble, **r**efractory **d**issolved **o**rganic **n**itrogen (RDON). Residual levels of RDON in the effluent from the most advanced wastewater treatment processes exceed the general levels of instream total nitrogen targets by several times.

Collaboration: The Clark Fork River Voluntary Nutrient Reduction Program (VNRP)

The Clark Fork River is one of the longest rivers in the Northern Rockies. The River begins near Butte, Montana, and flows approximately 320 miles northwest to Pend Oreille Lake in northern Idaho. The River's watershed is approximately 25,000 square miles with flows ranging from nearly 0 to 7,000 **c**ubic **f**eet per **s**econd (cfs) of water.

Collaborative Process

The Voluntary Nutrient Reduction Program (VNRP) for the River is an excellent example of a collaborative process for developing a nitrogen and phosphorus TMDL. In February 1994, the Tri-State Water Quality Council (Council) established a committee to address nutrient concerns, driven by CWA 303(d) requirements and the need to develop a TMDL. Key stakeholders included point source dischargers (the Cites of Missoula, Butte, and Deer Lodge; and Smurfit Stone Container Corporation), University of Montana scientists, the Clark Fork Coalition, and the Council. Participants in the nutrient subcommittee worked for about two years to craft the VNRP. The VNRP was completed in August 1998 and officially approved by EPA Region 8 in October 1998.

Target Discussions

Substantial efforts were made to study and discuss appropriate nutrient target setting and establish instream goals for nitrogen and phosphorus. The instream target for nitrogen is 300 µg/L and the target for phosphorus is 20 µg/L upstream of the City of Missoula and 39 µg/L downstream.

Modeling

A fate and transport water quality model (QUAL2E) was used to predict dissolved and total nitrogen and phosphorus concentrations within a 200-mile reach of the River between Butte and the confluence with the Flathead River. The model accounted for flow input and nutrient inflow from tributaries and point source discharges, as well as nonpoint inputs directly to the mainstem of the river. The nutrient target subcommittee considered multiple wasteload allocations scenarios in establishing the VNRP.

Allocations

Reductions

The VNRP effort has been successful in reducing nitrogen and phosphorus loadings to the Clark Fork River. The City of Missoula made a substantial capital investment in upgrading wastewater treatment facilities for improved effluent quality of 10 milligrams per liter (mg/L) total nitrogen and 1 mg/L phosphorus. Further, the City of Missoula and Missoula County have extended sewer service to large urbanized areas previously served by onsite septic systems. This has eliminated nonpoint source nitrogen and phosphorus loadings from septic systems tributary to groundwater and the Clark Fork River.

Continuing Effort

Montana DEQ, the Council, the City of Missoula and other stakeholders have sustained the water quality monitoring effort for the Clark Fork River and its tributaries. Continued modeling efforts have led to improved interpretation of water data, recommendations for the monitoring program, and the identification of key tributaries and nonpoint sources impacting water quality in the rivers.

DISSOLVED OXYGEN TMDLS

Oxygen Demands

Dissolved oxygen depletion can be driven by pollutant loadings and conditions within waterbodies that result in the exertion of oxygen demands. Typical pollutant parameters that reduce dissolved oxygen in waterbodies, include: **b**iochemical **o**xygen **d**emand (BOD); ammonia nitrogen; and excessive levels of algae. Reduced dissolved oxygen concentrations can stress fish and other aquatic organisms, and if low enough, lead to fish kills and the mortality of other aquatic life.

Numerical Standards

Agencies typically use numeric standards to regulate dissolved oxygen conditions, with a range of 6 to 9.5 mg/L dissolved oxygen criteria used to protect the aquatic life uses in high quality waterbodies systems. For example, Idaho water quality standards call for dissolved oxygen greater than 6 mg/L for cold waters and greater than 5 mg/l for warm waters. Washington State standards call for at least 9.5 mg/L for the protection of core summer salmon habitat.

Natural Conditions & Alterations

Numeric standards provide a reference point for assessing conditions that constitute an impairment and reduce the subjectivity involved with TMDLs when compared to the interpretation of narrative standards sometimes applied for nutrients. Nevertheless, applying dissolved oxygen standards and developing dissolved oxygen TMDL can be challenging because many waterbodies have been altered (impoundments, diversions, etc) and do not conform precisely with the definitions in standards. Further, natural conditions may exist that do not conform with standards. For example, natural conditions may result in warmer stream temperatures that reduce dissolved oxygen saturation and prevent the attainment of dissolved oxygen criteria. Also, the hydrodynamics of impoundments may deplete dissolved oxygen levels in the lower depths of reservoirs.

TMDLs

Loading Control

Agency Modeling

Interstate Requirements

Treatment & Offsets

TMDL Initiated

TMDL Limits

Collaborative Workgroups

Concept Document

Technology & Reduction Actions

Spokane River Dissolved Oxygen TMDL

PRIOR TMDL INADEQUATE

For the Spokane River, the Washington Department of Ecology (Ecology) has prepared a dissolved oxygen TMDL that was published as a draft in 2004 and revised in 2007. Algae blooms and depressed dissolved oxygen in Lake Spokane (also known as Long Lake) impair beneficial uses and result in violations of water quality standards. The focus of the dissolved oxygen TMDL has been on controlling phosphorus loadings. Stakeholders had used a prior TMDL for phosphorus for years to annually track and control point source loadings of phosphorus. This earlier TMDL was found to be inadequate in protecting water quality.

Ecology conducted water quality modeling to establish instream target concentrations necessary to meet dissolved oxygen water quality standards in Lake Spokane. For lakes in Washington, the standards require that human activities may not cause the dissolved oxygen to decrease more than 0.2 mg/L below natural conditions. Ecology established phosphorus, ammonia nitrogen, and carbonaceous BOD wasteload allocations for the point source dischargers along the Spokane River in Washington State. Load allocations for phosphorus and ammonia were developed for the main tributaries to the Spokane River in Washington. Point sources to the Spokane River in Idaho will be required to limit discharges of phosphorus, ammonia, and BOD. Since the dissolved oxygen TMDL is for Washington State, Idaho Spokane River dischargers must meet Washington water quality standards at the stateline and in Lake Spokane.

The primary focus of the dissolved oxygen TMDL has been on the control of phosphorus loadings to the river. Since the allowable 0.2 mg/L dissolved oxygen depression from natural conditions is very small, the allowable loadings for phosphorus and other oxygen demanding substances is very restrictive. A substantial collaborative effort was undertaken for the Spokane River TMDL to address these challenges that resulted in the development of the *Foundational Concepts for the Spokane River TMDL Managed Implementation Plan* (see below). Instream concentrations for total phosphorus must be approximately 10 µg/L during the summer season (April 1 – October 31). This results in the most restrictive effluent discharge conditions for point source dischargers at levels lower than the current limits of wastewater treatment technology. To meet these limits will require a combination of state-of-the-art wastewater treatment technology combined with other load reduction off-sets such as conservation, effluent reuse, groundwater recharge, wetlands restoration, nonpoint source load reductions, etc.

Dissolved Oxygen TMDL: The Spokane River Collaborative Model

PROCESS RESULTS IN LONG-TERM MANAGEMENT PLAN

The Spokane River drains an area of about 6,640 square miles from Lake Coeur d'Alene in Idaho to the Franklin D. Roosevelt Lake impoundment of the Columbia River in Washington. During the summer months, segments of the Spokane River and Lake Spokane exhibit low dissolved oxygen levels, and fail to meet State water quality standards for dissolved oxygen. In response, Ecology initiated a TMDL process to assess water quality problems, define the sources of pollutants that cause the problems and determine the amounts of pollutants that can be discharged to the river while meeting water quality standards.

Ecology published a *Draft Total Maximum Daily Load to Restore and Maintain Dissolved Oxygen in the Spokane River and Lake Spokane* in October 2004 and an updated draft in September 2007. Dissolved oxygen in this system is affected by nutrients; therefore, this TMDL establishes limits for ammonia (NH3), **t**otal **p**hosphorus (TP) and **c**arbonaceous **b**iochemical **o**xygen **d**emand (CBOD). Phosphorus is the nutrient that has the greatest affect on dissolved oxygen levels in this system. Instream concentrations for various reaches must be approximately 10 µg/L total phosphorus during the critical period (April 1 – October 31).

Following the publication of the Draft TMDL in 2004, a collaborative TMDL process was undertaken which culminated in the June 30, 2006 *Foundational Concepts for the Spokane River TMDL Managed Implementation Plan.* Diverse stakeholder groups worked through the collaborative process that included representatives of point source dischargers, environmental groups, tribes, and regulatory agencies. A steering group was formed, as well as workgroups to address: wastewater flows and loadings; treatment technology; reuse and conservation; nonpoint sources; and monitoring.

The *Foundational Concepts Document* is an aggressive, managed approach that removes phosphorous from a variety of sources through a variety of methods. The approaches were prioritized in a reasonable way to maximize the effectiveness of the investments in actions taken to improve the Spokane River. Ecology will monitor and assess the impacts on dissolved oxygen over the next 20 years. The *Foundational Concepts Document* targets reductions in phosphorous to raise the level of dissolved oxygen in the River and allows the NPDES permit holders that discharge to the River to achieve an effluent phosphorous target of 10 µg/L through a combination of wastewater treatment technologies and other load reduction actions (conservation, effluent reuse, nonpoint source reductions, etc.).

TMDLs

The *Foundational Concepts Document* calls for a thorough reassessment of the TMDL after the 10th year of the Managed Implementation Plan and anticipates that the second 10 years of the plan could include new actions, such as consideration of river oxygenation and/or reconsideration of water quality standards.

TEMPERATURE TMDLS

Temperature Impacts

Water temperature is important for supporting fish and other aquatic life. Elevated water temperatures harm fish by adversely affecting their development, migration, or other processes. High temperature is a common reason for impairment listing of many rivers. In addition to the CWA requirements for TMDLs, federal Endangered Species Act (ESA) listings of endangered and threatened fish species have focused attention on the importance of water temperature for recovery efforts.

ESA Concerns

Numeric Standards

Numeric standards are used to by agencies to regulate temperature in waterbodies. Temperature criteria between 12^0C and 18^0C are typically required to protect instream for high quality cold water systems. Criteria vary with the fish species present and the habitat required for spawning, rearing, and migration. Seasonal Bull Trout and Dolly Varden (Char) spawning and incubation are the most sensitive and require the lowest temperatures (~9^0 C). Higher temperatures are considered acceptable for salmon and trout migration (~17.5^0C) and warm water species (~20^0C). Water quality standards reference the natural condition temperatures when a river's temperatures exceed the numeric criteria. For example, in Washington State the temperature criterion includes the natural temperature of the waterbody plus an increase from human activities of 0.3ºC (0.54°F) when the measured temperatures exceed the numeric criteria and the exceedence is due to natural conditions.

Natural Conditions

Many streams and rivers have been shown to exceed numeric criteria under natural conditions. A temperature TMDL may be needed when a waterbody does not meet its assigned temperature criteria. The challenges in temperature TMDLs include determining exactly what are the "natural condition" temperatures for a river, the minimal allowable increase when the natural conditions temperatures are exceeded, and the limited management options available to reduce temperatures. The primary tool available to watershed managers to reduce stream temperatures is to increase riparian shading. The warming of water temperatures as a stream flows downstream is a natural process. However, the rate of heating and the increase in water temperature can be dramatically reduced when high levels of shade exist and heat flux from solar radiation is thereby minimized. Shading from riparian vegetation does not directly cool the river, but reduces the amount of solar radiation reaching the water.

TMDL Challenges

Shading

Point Source Limitations

Point source dischargers have limited ability from a practical standpoint, to reduce effluent temperatures. Infrequently, effluent cooling has been utilized in wastewater treatment plants and in some other situations, hyporheic discharges (river bed below channel waters and above groundwater). In other cases, point sources have off-set thermal loadings from wastewater discharges by planting riparian vegetation to increase shading.

Tucannon River Temperature

Nonpoint Impacts

Temperature conditions on the Tucannon River in eastern Washington present an interesting case study of analysis in a watershed dominated by nonpoint sources. The Tucannon River temperature study includes a case where modeling was used to demonstrate that natural condition temperatures exceed the numeric criteria. The TMDL for this river involves a pilot streamlined approach by the State's Department of Ecology.

Tucannon River Temperature Modeling

Modeling Heat Sources

The 60-mile Tucannon River is located in southeast Washington State and extends from the Blue Mountains within the Umatilla National Forest to the Snake River. Elevated temperatures in the river currently exceed water quality standards and are a primary water quality concern for the Middle-Snake (WRIA 35) Watershed Planning Unit members. The Asotin County PUD conducted a temperature modeling study of the Tucannon River to identify the sources of temperature (heat) to the river and determine the thermal potential of the river under natural riparian conditions. The water quality model was also used to assess the benefits of riparian improvement projects.

Field Studies

Field studies were conducted to assess current river temperature conditions and heat sources and to support the development of the temperature model. QUAL2K was selected as the water quality model because it could meet the temperature simulation objectives of the project and this model is used to develop temperature TMDL allocations by Ecology. Approaches for model development required extensive coordination with Ecology technical staff that conducts temperature TMDLs. The model was used to estimate river temperatures under low flow and thermal potential conditions. The result of the modeling were used to determine compliance with temperature standards that reference an incremental increase above natural conditions.

TMDLs

Helpful Groundrules

Ecology Streamlining Pilot Project

Proposal Features

Benefits

Monitoring Aims

RECOMMENDATIONS FOR IMPROVING TMDLS

Many regulatory agencies and watershed stakeholders are seeking improvements in the TMDL process as they navigate through the watershed planning process. A key objective is to assure a balanced framework for consideration of all loading sources.

Some recommendations for watershed stakeholders include:

- Actively participate in watershed management plans and TMDLs early in the process
- Do not wait for regulatory agencies to publish TMDLs for formal public comment periods, as these opportunities provide insufficient time for adequate engagement in complex issues
- Quantify all point source and nonpoint source loadings in the watershed analysis, and distinguish natural background loadings
- Support good science in all watershed and TMDL analyses
- Develop a balanced framework for point source and nonpoint source load allocations in TMDLs
- Formulate equitable load reductions for point and nonpoint sources to achieve water quality goals
- Seek cost-effective pollutant load reductions that avoid unnecessarily expensive reductions in loads from individual sources, when more economical solutions are available

Streamlining the TMDL Process

Streamlined approach for temperature TMDLs: Washington State proposal

In Washington State, Ecology conducts the technical analysis for TMDL studies, which includes monitoring design, field work, data analyses, modeling, and establishing load and wasteload allocations. This traditional TMDL process can take several years to complete and may be costly and resource intensive. The traditional TMDL approach is well-suited for large watersheds that have many point sources, diverse non-point sources, and complicated hydrology and water quality characteristics.

However, many watersheds in eastern Washington have few point sources, and relatively simple and predictable water quality characteristics. For these rural areas, a streamlined TMDL approach may be a better fit. Ecology is currently pilot testing a streamlined temperature TMDL approach for the Tucannon/ Pataha Rivers in southeast Washington. The primary purpose of this streamlined TMDL process is to address water quality impairments as simply and quickly as possible. The streamlined TMDL process is potentially compatible with many other temperature TMDLs in nonpoint dominant watersheds that typically establish load allocations in terms of shade levels.

Features of this proposed streamlined TMDL process include:

- Using *existing* data/information collected by the local watershed community and other agencies as much as possible
- Collecting only those additional data needed to fill the gaps
- Shifting focus to water quality management, by engaging in implementation work earlier

Potential benefits of the streamlined TMDL process include:

- Earlier and greater community involvement: The streamlined TMDL process includes a high level of cooperation and collaboration with the local community early on and throughout the TMDL process. This should generate a greater sense of ownership by the local community in the TMDL. This is important since the long term success of cleanup efforts in non-point source dominant watersheds relies heavily on continued community support and engagement.
- Faster water quality improvements: Implementing nonpoint TMDLs often involves the use of adaptive management over several years. The streamlined TMDL process should help implement restoration projects as early as possible, thus speeding up water quality improvements and enhancing the long-term success of these TMDLs.
- Reduced staff time and cost: The streamlined TMDL process takes advantage of existing data and reports, simplifying sampling and report writing, and reducing the time spent preparing the TMDL. This can free up valuable resources for more complex watersheds where the traditional TMDL process is more appropriate.

It should be stressed that streamlining is still in its infancy; however, progress so far is encouraging and could potentially lead to similar approaches in other watersheds with other pollution problems.

Monitoring, Reasonable Assurance, and Adaptive Management

There are two major dimensions to consider in planning a watershed monitoring program: watershed monitoring and BMP monitoring. Watershed monitoring measures the success of the management effort in accomplishing the overall TMDL goals. BMP monitoring measures the success of individual load reduction projects. This is especially important in terms of providing reasonable assurance to the regulatory agencies that nonpoint source load reductions have actually been accomplished.

TMDLs

Expanded Analysis

Watershed Monitoring

Typical monitoring efforts and the data that are generally available may need to be improved or expanded to be suitable for statistical analysis that is useful in tracking the water quality response to the TMDL and determining the effectiveness of the plan. A typical statistical analysis may include: annual statistical summary; spatial trend analysis; time series analysis; statistical comparison to water quality standards; and a periodic long-term trend analysis.

Adaptive Process

BMP Monitoring

The objective of individual project monitoring is to verify that BMPs are properly installed, maintained, and functioning as intended. Development of a monitoring plan to allow evaluation of efforts to reduce phosphorus loadings and allow future evaluation and corrective action is important. Feedback on pollutant reduction efforts and project/BMP effectiveness is needed to provide an adaptive management framework for improvement in efforts with time.

Planning Critical

Tracking TMDL Implementation Plans

Development of a TMDL is a significant undertaking in watershed management. However, development of wasteload allocations for point source dischargers and load allocations for nonpoint sources alone do not improve water quality. It is the implementation of point source controls and nonpoint source management plans that produce the actual pollutant reductions needed to improve water quality. Therefore, TMDL implementation planning is critical in accomplishing watershed management objectives.

Prioritization

Watershed managers face a broad group of challenges in orchestrating restoration projects with numerous stakeholders, overlapping regulatory authorities, multiple pollutants, and varied funding sources. Sustaining the effort over a multi-year period adds to these challenges. Prioritization of the most effective BMPs and restoration projects is essential for a successful, long-term effort. Decision support systems which aid managers in tracking the implementation of water quality projects and BMPs provides a foundation for long-term watershed management. These systems provide the watershed manager with tools to track progress and prioritize efforts on those actions that are found to be most effective in restoring water quality. Systematic tracking of water quality improvement efforts provides a means for overall program management.

Financial Planning

Pursuit of Adequate Funding

For complex TMDLs which involve many projects and multi-year implementation, pursuit of project funding may be a significant challenge. Implementation plan tracking tools may provide financial planning information to support the systematic pursuit of funding support from diverse sources including local funds, grants, and cost-share programs. Watershed benefits beyond the basic pollutant reduction objectives of individual projects and BMPs may be important to define. These collateral benefits may include enhancements to habitat, fisheries, flood control, sustained instream flows, and so on. These features may provide important information for prioritization of projects, with higher priority given to projects with multiple benefits. Collateral benefits may also be important in pursuit of implementation funding and may help projects qualify for outside funding support.

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David Clark, Vice President, serves as National Director for Wastewater for HDR Engineering, Inc. He provides wastewater collection and treatment expertise, as well as an extensive background in water quality planning, nutrient management, and effluent discharge permit negotiations. Mr. Clark has participated in watershed planning, water quality analysis, and TMDLs for numerous rivers in the West. On the Clark Fork River, he participated in a multi-year effort to prepare the Voluntary Nutrient Reduction Program (VNRP), a stakeholder led effort to develop a nitrogen and phosphorus TMDL. For the Cascade Reservoir TMDL Implementation Plan, Mr. Clark co-authored a State-wide guidance document on preparation of TMDL Implementation Plans for Idaho DEQ. Mr. Clark is currently involved in water quality modeling of the Bitterroot and the Clark Fork rivers, and the development of a pollution off-set credit for nonpoint source loading reduction on the Spokane River. Mr. Clark is currently participating in the Water Environment Research Foundation (WERF) Nutrient Challenge, a national research project led by HDR to provide state-of-the-art nutrient removal technology information to wastewater utilities. Mr. Clark holds an MS in Civil Engineering (University of Washington, 1980) and a BS in Civil Engineering (University of Washington, Magna Cum Laude, 1978)

Jory Oppenheimer is a Senior Water Quality Specialist at HDR with 18 years of experience in surface water quality modeling and monitoring projects. He has conducted several technical water quality studies in rivers, lakes, and reservoirs that were used to establish TMDLs. Jory has conducted water quality assessments on large river systems, such as the Skagit, Puyallup, White, and Spokane Rivers, and many other large reservoirs and lakes. Mr. Oppenheimer also advises watershed groups, utilities, and other clients with TMDL projects and other issues related to water quality standards compliance. Mr. Oppenheimer holds an MS in Environmental Engineering and Science (University of Washington, 1988) and a BS in Environmental Science (Western Washington University, 1983).

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WATER BRIEFS

COLORADO RIVER ROD WEST

RECORD OF DECISION SIGNED

On December 13, 2007, US Secretary of the Interior Dirk Kempthorne signed an historic decision that will implement innovative strategies for management of the Colorado River. The consensus was reached among the seven Colorado River basin states about sharing water during the current drought and charting a water management course for the future. The Record of Decision (ROD) activates a legal agreement among the basin states and contains a provision in which they commit to address future controversies on the river through consultation and negotiation before initiating litigation.

The decision implements new, interim operational guidelines to meet the challenges of the current eight-year drought in the basin and low-water conditions caused by continued drought or other causes in the future. The rules will be in place through 2026. The ROD adopts four key elements of river management. First, the guidelines establish rules for shortages, specifying who will take reductions and when they take them. Second, the coordinated operational rules for Lake Powell and Lake Mead will be determined by specified reservoir conditions. Third, the new guidelines establish rules for surpluses, so that the Department of the Interior will have rules in place to distribute the extra water. Fourth, the new rules address the ongoing drought by encouraging new initiatives for water conservation.

Secretary Kempthorne noted that he was particularly impressed by the innovative approaches taken to conserve water. He highlighted the "Drop 2" project located in the Imperial Valley in southern California that is being paid for by Nevada. That project will create a reservoir to conserve additional water for Nevada's use over the next two decades. After that, the additional water will benefit all water users in the lower basin states. See Briefs, TWR #35. The project's originally estimated cost of $84 million, funded by Nevada, will give that state the right to withdraw a total of 280,000 **a**cre-**f**eet (AF) of water on an as-needed basis. Other conservation measures include an agreement allowing water users to obtain future credit for conserving water and leaving it in Lake Mead for use in later years ("Intentionally Created Surplus"). As part of the agreement, California — primarily the Metropolitan Water District of Southern California — has the option to store a maximum of 400,000 AF per year in Lake Mead for use in later years under certain conditions (up to a total of 1.5 million AF); Nevada may store a maximum of 125,000 AF/year (total of 300,000 AF); and Arizona a maximum of 100,000 AF/year (total of 300,000 AF). See "Extraordinary Conservation ICS" at ROD 38-41. The ROD also sets up a framework to allow cities to contract with willing farmers to temporarily fallow fields in dry years.

Specifics in the guidelines include the elevations in Lake Mead that would trigger a declaration of shortages in the Lower Basin. The guidelines also specify the conditions under which Lakes Powell and Mead will be operated, with the intent of operating the reservoirs to avoid the risk of water curtailments in the Upper Basin and minimize shortages in the Lower Basin. The guidelines provide a mechanism that encourages water conservation in Lake Mead in the Lower Basin to minimize the likelihood and severity of potential future shortages. They also modify and extend the Interim Surplus Guidelines, implemented in 2001, through 2026.

For info: Chris Paolino, Interior, 202/208-6416; Copy of the ROD is available at Reclamation's website: www.usbr.gov/lc/region/programs/strategies.html (under "New Info"); other TWR articles on the shortage agreement include: Fulp, et al, TWR #33; Hassencamp, TWR #39; and Water Briefs, TWR #42

DELTA SMELT ORDER CA

WATER SUPPLY IMPACTS

Federal district court Judge Wanger's "Interim Remedial Order" — issued on December 14 — curtails Delta pumping to protect the threatened Delta smelt from export pumping operations until new federal biological permits are obtained. Future water deliveries out of the Delta will depend on conditions in the new federal permits. "The Delta is indeed broken, both environmentally and as a source of water for most of California's people, businesses, industry and millions of acres of our most productive farmland," said California Department of Water Resources (DWR) Director Lester Snow.

The Interim Remedial Order requires the US Fish & Wildlife Service (USFWS) to issue a new Biological Opinion (BiOp) on the effects of the operation of the Central Valley Project (CVP) and State Water Project (SWP) upon the Delta smelt by September 15, 2008. Due to "imminent peril to the survival of the Delta Smelt and adverse affects on its critical habitat," the Order issued a preliminary injunction providing numerous interim remedial measures. Those measures include surveys and monitoring, increased sampling for Delta smelt that are entrained at the Jones Pumping Plant to a minimum of 25% of the time (diversion from the Delta-Mendota Canal), along with other triggers specified for the sampling. Flow restrictions were also included in the Order, including "Winter Pulse Flows," flows to protect pre-spawning adults, and flows for larval and juvenile Delta smelt. The injunction also included measures that the Federal Defendants may not take: for example, the US Bureau of Reclamation may not issue any new long-term water service contracts with CVP contractors until the new BiOp is completed, and will not increase exports from the south Delta and will operate Jones Pumping Plant within recent historical limits. Finally, USFWS was required to provide a status report on the progress of the BiOp on April 30, 2008.

In response to the ruling, the DWR completed its revised operational model to determine water supply impacts on December 24. The model provides a range of impacts on water exports, depending on Delta smelt migration patterns and precipitation. If 2008 is a dry year, State Water Project customers will receive seven to 22 percent less Delta water than would have been available without the court decision. If 2008 is an average water year, exports will be reduced 22 to 30 percent. The current State Water Project allocations of 25 percent of requested water supply are based on dry year conditions and already account for these reductions. Those allocations may increase depending on precipitation, but will not

WATER BRIEFS

increase as much as they have in past years due to the court ruling, according to DWR.

The order will primarily affect export pumping between January and June, when juvenile Delta smelt are at greatest risk of entrainment in pumps. The actual impact on water supply will depend on a number of factors including the locations where adult smelt spawn and offspring hatch, levels of precipitation for the year, and water temperatures affecting how quickly the fish migrate. The impacts on water supplies could be offset somewhat by water from the Environmental Water Account to the extent those water supplies are available this year. DWR delivers water through the Delta to 25 million Californians and 750,000 acres of irrigated farmland.

For info: Ted Thomas, DWR, 916/ 653-9712 or website: www.water.ca.gov/deltainit/; Judge Wanger's order available at: www.earthjustice.org/library/legal_docs/delta-smelt-final-remedy-order.pdf

WETLANDS RESTORATION CA

PURCHASED FOR DELTA SMELT

While the controversy over the Delta smelt continues and a federal district court order controls diversion of water to protect the ESA-listed species, Westlands Water District (Westlands) has acquired property in the northern Sacramento-San Joaquin Delta to restore natural tidal wetlands and upland habitat for the protection and conservation of listed species, including the smelt. "Saving the smelt is an issue of self-preservation for most of California," Thomas Birmingham, Westlands General Manager said. "Regulation of the state's water supply projects alone hasn't worked, and as a public agency with responsibility for providing water for more than 500,000 acres of farmland, the District's Board of Directors decided we need to act directly to help solve a critical problem."

The Delta property that Westlands acquired is in the area identified by state and federal fisheries experts as the prime location to create habitat for the smelt, according to Westlands' press release. The property consists of 3,450 acres and Westlands is buying the ranch south of Davis, California for $12 million. Lying at the southernmost tip of Yolo County, the property is currently used for farming. Westlands plans to convert portions of the property to create habitat for the smelt and maintain the rest in agriculture.

For info: Nicole Ratcliff, KP Public Affairs, 916/ 498-7733 or Westlands website: www.westlandswater.org/

STORMWATER SOLUTIONS OR

"*Stormwater Solutions: Turning Oregon's Rain Back into a Resource*" was released on December 11, 2007, by the Oregon Environmental Council (OEC). The report looks at water pollution and other side effects of mismanaged stormwater, providing more than 60 recommendations and policy suggestions that can protect human health, natural resources, and public infrastructure from the impacts of urban runoff. The report is available online at the website set out below.

OEC's press release noted that new, cost-effective technologies are available to address these problems, but are not commonly used outside of Oregon's largest cities. "You can find some excellent examples of improved stormwater management all around the state, but institutional barriers, old habits, and a lack of resources can prevent them from becoming common practice," said Teresa Huntsinger, program director at OEC. "Many Oregon cities lack information on best practices, have development codes that impede innovation, and need greater support from the state, including funding."

OEC and a team of 18 experts from around Oregon — dubbed the "Stormwater Solutions Team" — worked for over a year to develop a broad range of creative strategies for developers, builders, designers, state and local governments, and others to overcome existing barriers to successful stormwater management. The Team identified two major approaches to reducing impacts of stormwater runoff: first, improving the way stormwater is managed by promoting green infrastructure and other best management practices; and second, by reducing the sources of pollutants commonly found in stormwater. To seek broad input on solutions, the Team conducted a non-scientific survey of over 150 stormwater professionals from across Oregon. Those surveyed included developers, government employees, private firms, non-profits, and more. They helped identify the pollution sources most in need of additional attention, including oil and fluid leaks from vehicles, erosion from construction, waste dumped into storm drains, and urban use of fertilizers and pesticides.

For info: Teresa Huntsinger, OEC, 503/ 222-1963 x112, email: teresah@oeconline.org or website: www.oeconline.org/rivers

STORMWATER REPORT US

EPA has released a new report, "*Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*" — which contains 17 case studies that show the economic viability of LID practices. LID practices are innovative stormwater management practices to manage urban stormwater runoff at its source. The goal is to mimic the way water moved through an area before it was developed by using design techniques that infiltrate, evapotranspirate, and reuse runoff close to its source. Some common LID practices include rain gardens, grassed swales, cisterns, rain barrels, permeable pavements and green roofs.

The report highlights examples that, in most cases, reduce project costs while improving environmental performance. Total capital savings ranged from 15 to 80 percent, with a few exceptions in which LID project costs were higher than conventional stormwater management costs.

For info: Shakeba Carter-Jenkins, EPA, 202/ 564-4355, email: carter-jenkins.shakeba@epa.gov; Report available at EPA website: www.epa.gov/owow/nps/lid/costs07/

FERC HYDRO-LICENSING US

NEW ILP PROCESS

On December 17, 2007, the Federal Energy Regulatory Commission (FERC) issued its first license for a hydropower project using the Integrated Licensing Process (ILP), for the Mystic Lake Project on West Rose Bud Creek

in Montana (FERC # P-2301). The license was issued within one year of the application being filed with FERC, by delegation authority of the director of FERC's Office of Energy Projects. Adopted in 2003, ILP integrates the development of license application and environmental review, and coordinates FERC and other regulatory agencies that undertake such environmental review. In 2005, the ILP became the default process for relicensing within FERC.

The Mystic Lake Project, developed by PPL Montana, is an 11.25 megawatt (MW) project near Fishtail, Montana. The license requires the construction of public recreation facilities near the project as well as enhanced flows for whitewater boating. The license also requires the installation of new shutoff and minimum-flow valves to improve minimum flow reliability which would protect fish in the project's bypassed reach. Other requirements would protect, mitigate and enhance water quality, fisheries, wildlife and cultural resources at the project.

For info: Celeste Miller, FERC, 202/502-8680 or website: www.ferc.gov

COLUMBIA DRAFT BIOP NW

JUDGE EXPRESSES DOUBTS

A final biological opinion is due March 18, 2008, for the Federal Columbia River Power System (FCRPS), which is the subject of ongoing litigation in federal district court in Oregon (see Bodi/Mahar, this TWR). On December 7, 2007, in a letter sent to all the parties in the litigation regarding FCRPS and the upper Snake River Basin, Judge James Redden commended the Federal Defendants for their recent efforts but also expressed concerns that the draft BiOps "fail to satisfy the biological and legal requirements of the Endangered Species Act ('ESA'), its implementing regulations, and the relevant case law." Judge Redden noted that the BiOps are still in draft form and that the Federal Defendants have an opportunity to respond to the parties' comments. "I remain hopeful that they will produce final Biological Opinions that are scientifically and legally defensible," Redden stated.

Judge Redden's letter provided the parties with specific issues he wanted discussed at their December 12th status conference. Redden's letter implied that he is far from satisfied with the current draft and that he encouraged the Federal Defendants to "consider additional improvements to these draft opinions." One of the most interesting statements in his letter was his point that "Federal Defendants do not appear to be seriously considering any deviation from status quo operations in the upper Snake River." The judge also noted that the "Federal Defendants should address the Treaty Tribes' concern that the 'draft FCRPS BiOp for 2008-2017 fails to acknowledge and incorporate the Treaty fisheries (and the non-Indian fisheries) that will occur during this time period pursuant to United States v. Oregon.'"

Near the end of his letter, Judge Redden admonished the Federal Defendants regarding their position: "When I remanded the 2004 FCRPS BiOp, I instructed Federal Defendants to consider all mitigation measures necessary to avoid jeopardy, including removal of the four lower Snake River Dams, if all else failed. I also instructed Federal Defendants to ensure that any mitigation measures were reasonable (sic) certain to occur. Despite those instructions, the Draft FCRPS and upper Snake River BiOps again appear to rely heavily on mitigation actions that are neither reasonably certain to occur, nor certain to benefit listed species within a reasonable time. Moreover, Federal Defendants seem unwilling to seriously consider any significant changes to the *status quo* dam operations." (emphasis in original)

Judge Redden's letter ended with the warning to the Federal Defendants that if this FCRPS BiOp fails, it is not likely to be remanded again. Instead, Redden raised the specter of a "takings" issue when he stated, "If I decide not to remand the BiOp, but decide to simply vacate the opinion instead, would this not result in wrongful 'taking' by the Corp of Engineers, the Bonneville Power Administration, and the Bureau of Reclamation?" Judge Redden went on to point out that a failure to "get this right" could result in the court itself arriving at the measures that must be implemented: "Alternatively, a flawed biological opinion may result in a permanent injunction directing Federal Defendants to implement additional spill and flow augmentation measures, to obtain additional water from the upper Snake and Columbia Rivers, or to implement reservoir drawdowns to enhance in-river flows." The Judge closed by stating, "I remain hopeful that the parties will do what needs to be done." The collaboration process is continuing between the parties in the meantime.

For info: Judge Redden's letter is available at: www.wildsalmon.org/library_files/2007/Redden%20letter1.pdf; for more information about the BiOps and related litigation go to: www.salmonrecovery.gov

WENATCHEE FLOWS WA

WATERSHED PLANNING

Washington Department of Ecology (Ecology) director Jay Manning signed a new rule on December 12 that will protect stream flows and make more water available for use in the Wenatchee River watershed over the next 20 years. The rule changes how water will be managed in the future, making additional water available for municipal, residential and stock uses, while at the same time improving protection of stream flows and existing water rights. The rule changes were drafted as part of the Wenatchee Watershed Planning process under the state's Watershed Planning Act. Chelan County commissioners adopted the plan in 2006.

In 1983, regulations were established governing how water would be managed on the Wenatchee River, Mission Creek and Icicle Creek. The rule was adopted to protect stream flows, fisheries and existing water rights, and it also closed new allocations of water on Peshastin Creek between June 15 and October 15. The amendments to that rule revise existing stream flow levels, set aside a reservation of four cubic feet per second for future use, and establish a maximum amount of water that may be allocated from the Wenatchee River and its tributaries. The rule changes will not affect people who have existing water rights.

For info: Ecology's website at: www.ecy.wa.gov/programs/wr/instream-flows/wenatchee.html; the final Wenatchee Watershed Management Plan is available at: www.co.chelan.wa.us/nr/nr_watershed_plan.htm

CALENDAR

January 15 CA
California State Water Resources Board Meeting, Sacramento. Cal/EPA Headqtrs Bldg, 1001 "I" Street, 10 am.. For info: Jeanine Townsend, SWRCB, 916/ 341-5600, email: jtownsend@waterboards.ca.gov or website: http://www.waterboards.ca.gov/wksmtgs/2008/schedule.html

January 15-16 MT
Montana Water Policy Interim Committee Meeting, Hamilton. For info: Krista Lee Evans, Lead Staff, 406/ 444-1640; Committee website: http://leg.mt.gov/css/lepo/2007_2008/water_policy/default.asp

January 16 CA
Implementing Sustainable Development Programs, Workshop, Irvine. RE: Achieving a Competitive Business Advantage Through Sustainable Approaches; Successful Programs Examined. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

January 16 WA
SEPA & NEPA Seminar, Seattle. Red Lion Hotel. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

January 17 CA
Landform Grading and Soil Ecology: Preserving Natural Hydrologic Functions in Watersheds Impacted by Development, Sacramento. California EPA Bldg.. Sponsored by the California State Water Resources Board. For info: Mary Tappel, SWRCB, 916/ 341-5491, email: mtappel@waterboards.ca.gov or website: www.waterboards.ca.gov/nps/index.html

January 21 AK
Permitting Strategies in Alaska, Anchorage. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 22-23 CO
Colorado Water Conservation Board Meeting, Denver. For info: CWBC website: www.cwcb.state.co.us/

January 23-25 CO
Colorado Water Congress 50th Annual Convention, Denver. Denver Hyatt Regency Tech Center. For info: CWC, 303/ 837-0812 or website: http://cowatercongress.org

January 24-25 WA
15th Annual Endangered Species Act Seminar, Seattle. State Convention & Trade Center. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 24-25 NM
Law of the Rio Grande SuperConference, Albuquerque. For info: CLE International, 800/ 873-7130 or website: www.cle.com

January 24-25 CA
Criminal Enforcement of Environmental Laws, Seminar, Los Angeles. Biltmore. For info: CLE International, 800/ 873-7130 or website: www.cle.com

January 27-29 NM
AWWA 2008 Inorganic Contaminants Workshop, Albuquerque. For info: AWWA website: www.awwa.org/conferences/inorganics

January 28-29 FL
Growth and Water Supply Conference, West Palm Beach. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=962&page=Growth_%26_Water_Supply

January 30-February 2 IL
Water Environment Federation Midyear Meeting, Chicago. Sheraton Chicago Hotel & Towers. RE: Knowledge and Technology Exchange within the Water and Wastewater Fields. For info: WEF website: www.weftec.org

January 31 OR
Groundwater Exploration Strategies & Technologies, Conference, Portland. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

January 31-February 1 WA
Introduction to Aquatic Toxicology: Understanding Impacts of Organic Chemicals and Metals on Aquatic Ecosystems, Training, Lacey. Lacey Community Center, 6729 Pacific Avenue SE. Course ID: ETOX - 410 (2 days); instructor: Ruth M. Harper, PhD. For info: Northwest Environmental Training Center: www.nwetc.org or register online: https://nwetc.websitesource.net/reg_etox-410_01-08_lacey/registration.htm

February 1 WA
Marine Shoreline Development & Permitting, Conference, Seattle. Washington State Convention & Trade Center. For info: Law Seminars Int'l, 800/854-8009, email: registrar@lawseminars.com or website: www.lawseminars.com/

February 1-2 OR
2008 Pacific Northwest Ground Water Exposition, Portland. Red Lion Hotel on the River at Jantzen Beach. RE: Cargo Securement, Driver Qualitification & Compliance, Emergency Planning, Drilling Cost Calculator, Pump Installation Cost Calculator & More. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

February 5-7 WA
Stream Restoration Symposium, Stevenson. Skamania Lodge. For info: Conference website: rrnw.org/symposium.htm

February 5 WA
Green Building: Benefits & Opportunities for Builders & Communities, Seminar, Seattle. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

February 6 CA
Strategic Plan Update: 2008-2012 Public Workshop, Sacramento. Cal/EPA Headqtrs Bldg, 1001 "I" Street, 9:30 am.. Informal workshop to receive comments on the State Water Resources Control Board draft Strategic Plan Update: 2008-2012. For info: Selica Potter, SWRCB, 916/ 327-8090 or email: spotter@waterboards.ca.gov; Agenda available at: www.waterboards.ca.gov/board_info/calendar/2008.html#february

February 7-8 ID
Creating Environmental Capital, Seminar, Boise. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net/seminar.lasso?seminar=08.WAMID

February 7-8 ID
Water Rights Transfers, Seminar, Boise. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net/seminar-request.lasso?seminar=08.WAMID

February 9 CO
An Evening About Colorado's Water Resources, Fort Collins. Morgan Library (Colorado State University). For info: CSU website: lib.colostate.edu/archives/water/

February 10 NV
2008 Sustainable Water Sources: Conservation & Resources Planning Conference & Exposition, Reno. Sponsored by American Water Works Association. For info: AWWA, 800/ 926-7337 or website: www.awwa.org/

February 11 CA
Long Range Planning & Water Policy in California, Conference, Ontario. Ontario Convention Center. For info: American Ground Water Trust, 800/ 423-7748 or website: www.agwt.org/workshops.htm

February 11-12 TX
Texas Wetlands Conference, Austin. Omni Downtown. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=965&page=Texas_Wetlands

February 13 OR
Fishing the Past to Feed the Future: Archaeology, Historical Ecology, and Restoration of Marine Ecosystems, Eugene. University of Oregon, Many Nations Longhouse. For info: Christina Davis, ENR, 541/ 346-1395, email: cdavis6@uoregonl.edu, or website: www.law.uoregon.edu/org/jell/climate.php

February 14 OR
Northwest Environmental Business Council Luncheon "Lessons in Stormwater Management-Technical Solutions", Portland. For info: NEBC website: www.nebc.org or Sue Moir, 503/ 227-6361, email: sue@nebc.org

February 19-21 NV
Power-Gen 2008, Conference & Trade Show, Las Vegas. The Rio Hotel and Casino. National trade show for the renewable energy industry. For info: Conference website: pgre08.events.pennnet.com/fl//index.cfm

February 19-21 OR
Northwest Hydroelectric Association Conference, Portland. Marriott Hotel. For info: NWHA, 541/ 610-3311 or website: www.nwhydro.org

February 19-20 MT
Montana Water Policy Interim Committee Meeting, TBA. For info: Krista Lee Evans, Lead Staff, 406/ 444-1640; Committee website: http://leg.mt.gov/css/lepo/2007_2008/water_policy/default.asp

February 20-22 CA
2008 Environmental Industry Summit, San Diego. Coronado Island Marriott Resort. For info: Summit website: www.ebiusa.com/Summit2007/

February 20-22 NM
Western Coalition of Arid States Winter Conference, Albuquerque. Embassy Suites. RE: Water Resrouces Planning for Climate Change in the Arid West. For info: WESTCAS, 202/ 966-2190 or website: www.westcas.org

February 21 CO
Clean Water Act and the National Pollutant Discharge Elimination System (NPDES) Workshop, Denver. RE: Clean Water Act, Scope of the NPDES Program, other water regulations (e.g., SPCC, Wetlands), case studies and more. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

February 21-22 CA
26th Annual Water Law Conference (American Bar Association), San Diego. For info: ABA website: www.abanet.org/environ/waterresources/home.html

February 21-22 GA
Southeast & Georgia Wetlands & Water Law Update, Seminar, Atlanta. Hyatt Regency. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

February 21-24 NM
13th Water Conservation/Xeriscape Conference and Expo, Albuquerque. Marriott Pyramid Hotel. For info: Scott Varner, Xeriscape Council of New Mexico, 505/ 468-1021, email: scott@xeriscapenm.com or website: www.xeriscapenm.com

February 25-26 DC
Ground Water Industry Legislative Conference, Washington D.C.. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

February 26-28 DC
2008 Association of California Water Agencies Washington DC Conference, Washington DC. Washington Court Hotel. For info: ACWA website: www.acwa.com//events/acwa_events.asp

February 27 OR
Environmental Entrepreneurship Symposium, Eugene. University of Oregon, Many Nations Longhouse. For info: Christina Davis, ENR, 541/ 346-1395, email: cdavis6@uoregonl.edu, or website: www.law.uoregon.edu/org/jell/climate.php

(continued from previous page)

February 28 OR
Aquifer Storage and Recovery and Artificial Recharge, Symposium, Corvallis. Oregon State University (LaSells Stewart Center). For info: Michael Campana, Institute for Water & Watersheds, 541/ 737-2413 or email: aquadoc@oregonstate.edu

February 28-29 NV
Family Farm Alliance 20th Annual Meeting & Conference, Las Vegas. Monte Carlo Resort & Casino. For info: Dan Keppen, FFA, 541/ 850-9007, email: DanKeppen@clearwire.net or website: www.familyfarmalliance.org

February 28-29 OR
Pacific Northwest Timberlands: A Changing Industry, Seminar, Portland. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

March 4-7 VA
Washington Roundtable: Water Policy Seminar and 156th Council Meeting, Arlington. Doubletree Hotel Crystal City. Sponsored by the Western States Water Council. For info: Cheryl Redding, WSWC, 801/ 561-5300 or email: credding@wswc.state.ut.us

March 6-7 CA
NEPA SuperConference, San Francisco. The Fairmount. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=967&page=NEPA_SuperConference

March 6-7 CA
Alternative Water Resources, Seminar, Sacramento. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net/seminar-request.lasso?seminar=08.PURCA

March 6-9 OR
Public Interest Environmental Law Conference, Eugene. University of Oregon. For info: PIELC website: www.pielc.org

March 7 AZ
NEPA & EIS Conference, Phoenix. For info: Law Seminars Int'l, 800/854-8009, email: registrar@lawseminars.com or website: www.lawseminars.com/seminars-topic.php#Environmental

March 12-14 Canada
GLOBE International Conference & Trade Fair on Business and the Environment, Vancouver, B.C.. Major international marketplace for innovative environmental technologies, products, and services.. For info: Conference website: www.globe2008.ca

March 12 TX
Implementing Sustainable Development Programs, Workshop, Houston. RE: How Companies Can Achieve Competitive Business Advantage Through Sustainable Business Approaches; Successful Programs Presented & Discussed. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

March 13 WA
Water Rights Transfers: Participating in the Water Market in Washington State, Seminar, Seattle. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net/seminar-request.lasso?seminar=08.WAMWA

March 13-14 CO
Colorado Water Law SuperConference, Denver. Athletic Club. For info: CLE International, 800/ 873-7130 or website: www.cle.com/product.php?proid=999&page=Colorado_Water_Law_SuperConference

March 13-15 OR
7th Biennial Conference on University Education in Natural Resources, Corvallis. Oregon State University. For info: Andrea Wirth, OSU 541/ 737-9903, email: andrea.wirth@oregonstate.edu, or website: http://uenr.forestry.oregonstate.edu/

March 13-16 CO
Environmental Law 37th Annual ABA Conference, Keystone. For info: ABA website: www.abanet.org/environ/calendar/

March 14 CA
Common Grounds, Common Waters: Towards a Water Ethic, Santa Clara Journal of International Law Symposium, Santa Clara. Santa Clara University, Benson Memorial Center. RE: Cooperation & Sound Management. For info: Monica Davis, SCJIL, email: monicaelisedavis@gmail.com or website: http://scjil.wordpress.com/program-description/

March 17-19 CA
American Water Resources Association "GIS & Water Resources V" Conference, San Mateo. Marriott Hotel. For info: AWRA website: www.awra.org/meetings/San_Mateo2008/

March 17-18 CA
NEPA SuperConference, Los Angeles. The Millenium Biltmore Hotel. For info: CLE International, 800/ 873-7130 or website: www.cle.com

March 25-28 CA
Joint 2008 NAEP/AEP Annual Conference: Changing Climates, San Diego. Omni Hotel. For info: Websites: www.califaep.org or www.naep.org

March 26 WA
Redevelopment of Contaminated Property Conference, Seattle. For info: Law Seminars Int'l, 800/854-8009, email: registrar@lawseminars.com or website: www.lawseminars.com

March 27 WA
Northwest Environmental Business Council Conference "Managing Stormwater in Washington: Solutions to New Compliance Regulations", Seattle. For info: NEBC website: www.nebc.org or Sue Moir, 503/ 227-6361, email: sue@nebc.org

March 27-28 NV
NEPA Seminar, Reno. Grand Sierra. For info: CLE International, 800/ 873-7130 or website: www.cle.com

March 30-April 2 MI
AWWA/WEF Information Management & Technology Conference, Detroit. Marriott Renaissance Center. For info: AWWA website: www.awwa.org

March 30-April 3 TN
Ground Water Summit, Memphis. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

April 1-4 WA
American Public Works Association (APWA) Spring Conference, Ocean Shores. Convention Center. RE: Practical Innovation in the Field of Public Works. For info: Mike Terrell, 206/ 684-3078 or email: michael.terrell@seattle.gov

April 6 PA
21st Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP 2008) Conference, Philadelphia. RE: Abandoned Mines, Future of Geophysical Technology, Unique Developments in Electrical Resistivity, Marine and Beach Geophysics, Special Challenges in Surface Wave Processing, more. For info: Conference website: www.eegs.org/sageep/index.html

April 10-11 AZ
Land Use Law Super Conference, Phoenix. For info: CLE International, 800/ 873-7130 or website: www.cle.com

April 10-11 WA
Washington Water Law Conference, Seattle. For info: Law Seminars Int'l, 800/854-8009, email: registrar@lawseminars.com or website: www.lawseminars.com

The Water Report
Water Rights, Water Quality & Water Solutions in the West
260 N. Polk Street • Eugene, OR 97402