Northwest Power and Conservation Council

October 25, 2011

MEMORANDUM

TO: Council Members

FROM: Terry Morlan

SUBJECT: IEAB Presentation

The IEAB (Independent Economic Analysis Board) presentation to the Council will serve two purposes. The primary topic will be a report on the "Cost-Effectiveness of Improved Irrigation Efficiency and Water Transactions for In-Stream Flows for Fish." In addition, Dr. John Duffield, current Chair of the IEAB, will provide a summary of IEAB activities in 2011. The Council has requested the IEAB to report to the Council annually on their activities and to provide an opportunity for communication about the Council's interests in economic analysis related to the Council's Fish and Wildlife Program or power activities.

The irrigation efficiency and water transactions report reviews the ways that improved irrigation efficiency, farm-to-stream water transactions, and related agreements are used to increase stream flows to improve fish habitat and promote fish recovery in the Columbia River Basin. Location-specific factors that affect the success and cost-effectiveness of both irrigation efficiency and water transaction projects are discussed. In addition, implications of recent trends in irrigation efficiency for basin-wide electricity production and demand are discussed. The report includes case studies of eight basins including the Lemhi, Yakima, Salmon Creek, Upper Grande Ronde, Walla Walla, Deschutes, Hood, and Blackfoot River basins.

The IEAB is currently receiving outside reviews of the draft report from other experts in the fields of irrigation efficiency and water transactions. I have attached a copy of the draft Executive Summary of the report for your information. Depending on the extent and nature of comments received this week, the IEAB hopes to be able to send a copy of the full report to the Council before the Coeur d'Alene meeting.

Attachment

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Independent Economic Analysis B
Cost–Effectiveness of Improved Irrigation Efficiency and Water Transactions for Instream Flow for Fish

Draft Executive Summary

Irrigation is by far the largest consumptive use of diverted water in the Columbia Basin. Improved irrigation efficiency is often discussed as a way to conserve water to enhance instream flows and improve water quality for fish. The Council's Fish and Wildlife Program includes irrigation efficiency projects (e.g., piping projects, lining ditches, converting from surface to sprinkler application) with the objective of enhancing instream flows to benefit fish habitat and passage. Other water transactions projects aim to enhance fish habitat with payments to buy, lease or modify water rights, usually in the form of reduced diversions. Other projects combine water transactions and irrigation efficiency improvements. In some cases, instream flows are facilitated by reservoirs that allow water to be stored until needed by fish.

This report reviews the ways in which improved irrigation efficiency, farm-to-stream water transactions, and related agreements are used to increase instream flows to improve fish habitat and promote fish recovery in the Columbia River Basin. First, the semantics and hydrology of irrigation efficiency are discussed. Second, the report reviews general principles for how modifications in irrigation efficiency or diversions may improve instream flows for fish. Third, the report examines the experience with both water transactions projects and irrigation efficiency projects in recent years. In particular, eight subbasins are examined in detail as case studies to assess locational factors as they affect the roles and relative potential and cost-effectiveness of irrigation efficiency projects and water transactions projects. In addition, implications of improved irrigation efficiency for basin-wide electricity production and demand are discussed.

Irrigation efficiency, which is not related to economic efficiency, is defined as a ratio. For example, in the case of water conveyance, irrigation efficiency is the ratio of the amount of water delivered to a field divided by the amount of water initially diverted. In the case of irrigation application efficiency, it is the ratio of the amount of water used by the crop divided by the amount of water applied to the field. In some locations a portion of the water applied to a field but not used by the crop will return to a canal or stream and is re-used by other nearby irrigators. As a result, individual irrigation efficiency measures such as field or farm application efficiency may be significantly lower than overall irrigation efficiency at the district or watershed level.

Generally speaking, improved irrigation efficiency is achieved by the application of technology, information, capital, labor, or energy to reduce the amount of water that must be diverted or applied to accomplish a given purpose in terms of crop acreage and production. In some settings, increased irrigation efficiency may not increase streamflow because the amount of water consumed by the crop is unaffected and because the portion of diverted or applied water that is not consumed returns to the local hydrologic system as "return flows." Any reduction in water diverted because of irrigation efficiency may be diverted by someone else or offset by a reduction in the return flows. Indeed, the unconsumed share of diversion often provides important benefits for the local hydrologic system. Increasing irrigation efficiency can result in

reduced water supply for other uses such as wells, necessitating additional diversion. Increased irrigation efficiency in one location can adversely affect habitat at some other time and place. That said, the case studies reviewed for this report did not reveal any instances of substantial, unintended adverse consequences of irrigation efficiency projects.

There are many situations in which increasing irrigation efficiency can provide important fishery benefits. Irrigation efficiency can be used to reduce diversions just above a critical stream reach. Return flows downstream may be reduced, but often, not where or when needed by fish. Irrigation efficiency can improve water quality if return flows are degraded relative to the receiving water body; common problems associated with return flows include temperature, sediment, nutrients, metals, and pesticides. Finally, irrigation efficiency can help irrigators be more productive and economically efficient while at the same time improving local fish habitat conditions.

The potential for irrigation efficiency to increase instream flows is closely related to state laws and programs that:1) define conserved water and rights to its use, and 2) protect instream flows from other water users. Washington and Oregon have provisions for legally protecting instream water conserved by irrigation efficiency projects. In Oregon, the Allocation of Conserved Water Program requires some of the water saved by private efforts to be dedicated to instream flow, and all water saved using Fish and Wildlife Program (FWP) funds can be so dedicated. In Idaho, water users can place water made available by conservation into the Idaho Water Supply Bank, thereby protecting their right for future years. Measurement and protection of conserved water is now a milestone for BPA irrigation efficiency work elements in the FWP.

The eight case studies were chosen with a focus on evaluating the relative cost-effectiveness of irrigation efficiency projects compared to alternative approaches to improve instream flow to benefit fish populations. Details of each case study are included in the Appendix. Water transactions projects were observed in seven of the eight case studies (excluding Hood River). Documented irrigation efficiency projects have been completed in half of the basins (Yakima, Salmon Creek, Walla Walla, Deschutes, and Hood River). In general, most rivers have included multiple, complementary types of activities aimed at benefiting fish, including short- and long-term water rights leases, purchases of water rights, changes in point of diversions, stream restoration, improved fish passage, and diversion screening. Irrigation efficiency activities included on-farm changes in irrigation technology, but the majority of irrigation efficiency projects have involved piping to reduce seepage in water conveyance systems. Some projects combined irrigation efficiency with water transactions.

The characteristics and experiences in the eight basins studied vary enormously. For example:

- In the Hood River, irrigation efficiency improvements have been completed over the past 25 years by irrigation districts that saw financial gains from them; in the other basins most recorded irrigation efficiency projects involved Fish and Wildlife Program funding.
- In most water transactions projects, contracts stipulate a stated reduction in the amount of water diverted. On the Lemhi River, water transactions projects stipulated

a minimum instream flow. Irrigators maintain the base flows throughout the season by monitoring stream gauges and reducing diversions when flows are low.

- Some case studies involved small tributaries (Rock Creek, a tributary to the Blackfoot River), others focused on larger main stems (Deschutes River).
- In the Deschutes River, the value of irrigation efficiency projects was enhanced by the relatively large distance between the river and irrigated areas.
- The number of irrigation efficiency projects over the past 10 years ranged from zero to thirty across case studies.
- The number of water transaction projects over the past 10 years ranged from zero to twenty-five.

Improved irrigation efficiency is certainly not a general or complete solution to habitat water supply problems, but it can help. To benefit fish cost-effectively, both irrigation efficiency and water transactions projects must achieve three things: first, diversions of instream flows are reduced; second, the resulting increased flows must remain instream over the desired river reach; and third, those increased flows must enhance fish populations. To increase stream flows from irrigation efficiency projects there must be an identified quantity of "conserved water" that reduces diversion and increases instream flow. Water transactions that stipulate reduced diversions do not require monitoring or assurances regarding the quantity or fate of saved water.

The case studies reveal that both irrigation efficiency projects and water transaction projects have been used successfully to achieve an increase in instream flow at times and in locations where the fish habitat is impaired. Costs for these improvements range widely among the projects sampled; many irrigation efficiency and water transactions projects undertaken in the past decade have achieved these instream-flow increases at costs below $50/AF.

Evidence from the case studies suggests, however, that under current conditions the potential for additional, low-cost irrigation efficiency projects may be limited. In those case study basins where hydrologic and other conditions make irrigation efficiency projects attractive (Hood River, Deschutes River, Walla Walla River), most of the opportunities for low-cost irrigation efficiency projects have already been undertaken, leaving limited scope for additional cost-effective improvements. Indeed, in the Deschutes River Basin where many irrigation efficiency projects have been completed, the cost per acre-foot of conserved water has been rising over the past decade. The costs of leases and purchases of water rights can also be expected to rise after the lowest cost opportunities have been exhausted.

Overall the evidence suggests that water transactions projects offer greater potential than irrigation efficiency projects. Water transactions contracts can be designed to assure conditions that will protect fish whereas irrigation efficiency alone may not be enough to protect fish in dry years. Water transactions generally allow water users to decide how to meet their contractual obligation at least cost. This decision may include irrigation efficiency, crop idling, deficit irrigation, internal water transfers, and other management to minimize net revenue losses. The locations where a water transactions contract may be possible, and where it will correspond to the need for improved fish habitat, appear to be less restricted than in the case of irrigation efficiency projects. However, one drawback of water transactions projects should be noted. Water transactions projects generally involve a reduction in crop production with corresponding

local economic effects, and this has led to resistance to water transactions projects in small rural communities that are reliant on a healthy farm economy.

The analysis herein finds that targeted irrigation efficiency improvements to protect fish are unlikely to have much effect on regional power supply or demand, but other general trends may have more noticeable effects. The region continues to see changes in the types of irrigation technology being used. In recent years most of the change has involved conversion from gravity irrigation to pressurized sprinklers which increases the use of electricity for irrigation. In the future, higher energy costs could encourage conversions from high-pressure to low-pressure systems such as drip or trickle irrigation.

Increased competition for water will encourage a closer look at the details of improved irrigation efficiency. While most of the unconsumed water returns to the local hydrologic system, some of it is also removed from the local water basin. Such removals may include canal evaporation, ditch seepage transpired by undesirable plants, loss of sprinkler droplets evaporated or blown onto non-productive land, or percolation to degraded or unusable groundwater. If these losses can be reduced, they provide real gains in available water at the local level.

The Pacific Northwest has warmed about 1.0° C since 1900. Future warming is uncertain, but is projected to be 0.1-0.6° C/decade (ISAB 2007a). Warmer temperatures are expected to cause more precipitation to fall as rain rather than snow, shift the timing of snowmelt from f summer to spring, increase evapotranspiration, and increase water temperatures (ISAB 2007a). At the same time, demand for water for residential, irrigation, waste water assimilation, recreational, commercial, and industrial uses are all projected to increase with population growth in the Columbia River Basin (ISAB 2007b). Thus, future increases in the demand for water combined with a decline in supply will result in greater water scarcity. This trend should increase interest in irrigation efficiency and higher water prices may induce more water rights holders to participate in water transactionss. Whether these trends will facilitate increases in instream flow is uncertain, and outcomes will likely differ by state due to differences in state laws for water transfers, conserved water and instream flow protection.

Presentation by John Duffield, Chair of IEAB

Part I: Task 176 Irrigation Efficiency and Water Transactions Report

Part II: Annual IEAB Report

Coeur d' Alene, ID
November 8, 2011

Part I: Task 176 Irrigation Efficiency and Water Transactions Report

Independent Economic Analysis Board of the Northwest Power and Conservation Council

IEAB

John Duffield, Chair
Joel Hamilton, Vice-Chair
Susan Hanna
Daniel Huppert
William Jaeger
Roger Mann
Noelwah Netusil
JunJie Wu

Review/Comments by

Richard Cuenca
Chris Furey
Terry Morlan
Andrew Purkey
Jim Ruff

Irrigation Task - Outline

- Principles: Hydrology, State Law, Power Implications
- BPA Irrigation Efficiency Projects
- Columbia Basin Water Transactions
- Case Studies
- Implications and Conclusions

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Questions

- Region's experience with irrigation efficiency and altering streamflows?
- Region's experience with water transactions?
- What is their relative cost-effectiveness?
- How do these affect power generation and demand?

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Challenges

- To benefit fish, irrigation efficiency and water transactions need to do three things: 1) reduce diversion, 2) increase streamflows in the desired reach, and 3) benefit fish.
- Data on effectiveness for fish is limited.
- Focus is on change in acre feet per year.

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Approach

- Reviewed principles of hydrology and state laws for conserved water and instream flows.
- Reviewed aggregate CBWTP statistics, BPA irrigation infrastructure statistics, and irrigated acreage data.
- Case studies of 8 basins:
  - Lemhi, Yakima, Salmon Creek, Upper Grand Ronde, Walla Walla, Deschutes, Hood River, Blackfoot

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Summary Findings-1

- Aggregate expenditures by BPA on pipeline and sprinkler infrastructure was $13.8 million in 2004-2011
- Aggregate expenditures by CBWTP on water transactions in 2003-2011 was $27.2 million
- Expenditures for both programs were concentrated in a handful of basins [not equally distributed across basins]

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Summary Findings-2

- Water provided by CBWTP expenditures through 2011 cost on average $19/AF/year (2010 dollars), close to the opportunity cost in terms of foregone agricultural production.
- FWP funding for the CBWTP was highly leveraged with the average CBWTP cost share at 43%
- Other funding sources that support CBWTP transactions include landowners, states, Tribes, NGOs, electric utilities, the Pacific Coast Salmon Recovery Fund, and other federal funds

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Comparison of $/AF/YR Cost of Irrigation Efficiency and Water Transactions in Three Basins

	Irrigation Efficiency Projects		Water Transactions Projects	
	Cost/af/year ($2010)		Cost/af/year ($2010)	
Location	**Median**	**Range**	**Median**	**Range**
Yakima River, WA	$82	$46 - 118	$39	$9 - 72
Walla Walla Basin, OR	$23	$5 - 37	$27	$10 - 37
Deschutes River, OR	$41	$6 - 159	$25	$7 - 52

Note: Costs are total costs including BPA and all other outside sources.

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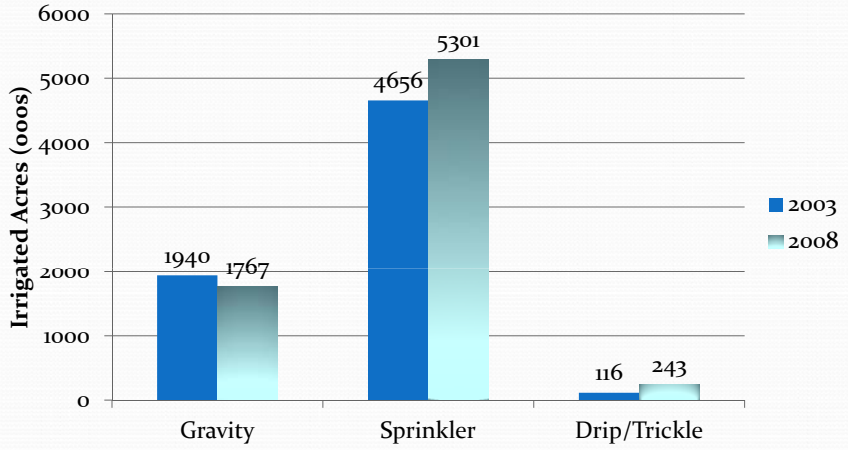
PNW Irrigated Acres by Methods of Water Distribution: 2003 and 2008



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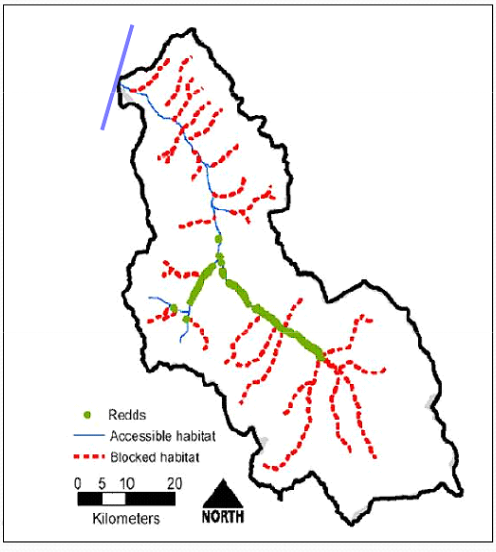
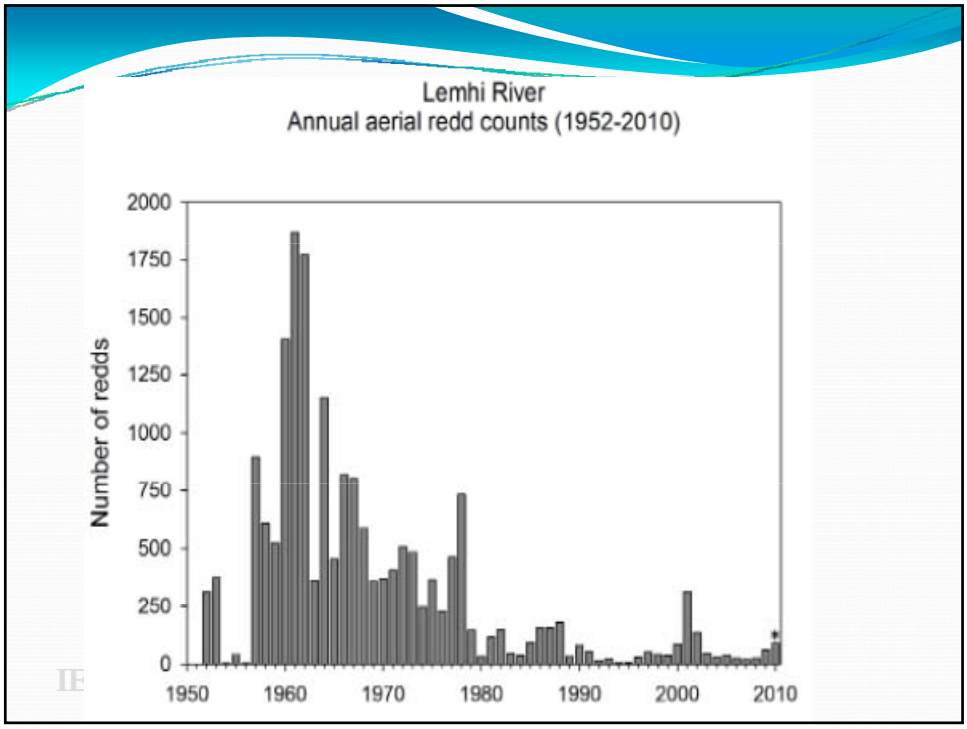
Case Study Example: Lemhi

- Salmon runs began to collapse in 1960s and 1970s
- By mid-1990s 37,000 irrigated acres
- 80% flood, efficiency from 25% to 30%
- Streambeds often completely dry in late summer
- Salmon redds in single digits in the 1990s

Map of Lemhi River Basin





Lemhi-Upper Salmon Program

- 2004-2011 BPA spent $414,000 on 8 pipeline programs and $2,329,000 on 18 sprinklers in the Upper Salmon
- CBWTP cooperated with Idaho Water Board and Idaho Legislature in creation of Lemhi Water Bank
- 2004-2008 series of annual leases
- In 2009 permanent transfers to achieve 35 cfs 80% of the time and 25 cfs 20% of time
- Funding was 72% Pacific Coast Salmon Recovery Fund and 28% BPA Fish Accords at $23 af/yr

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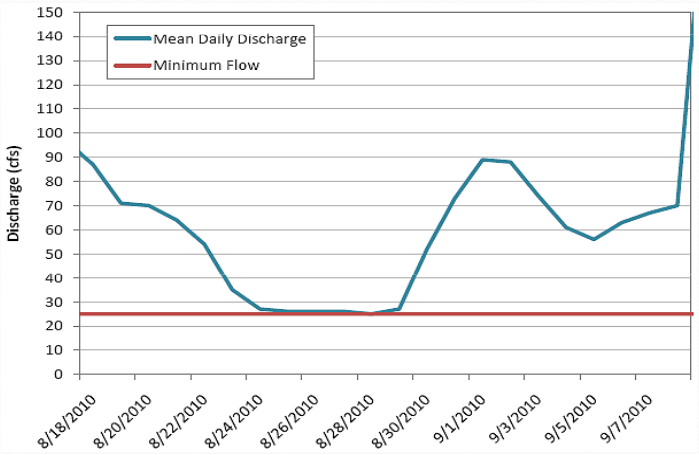
Lemhi River mean daily flow at L5, August 18 to September 8, 2010 during the second period of regulation.



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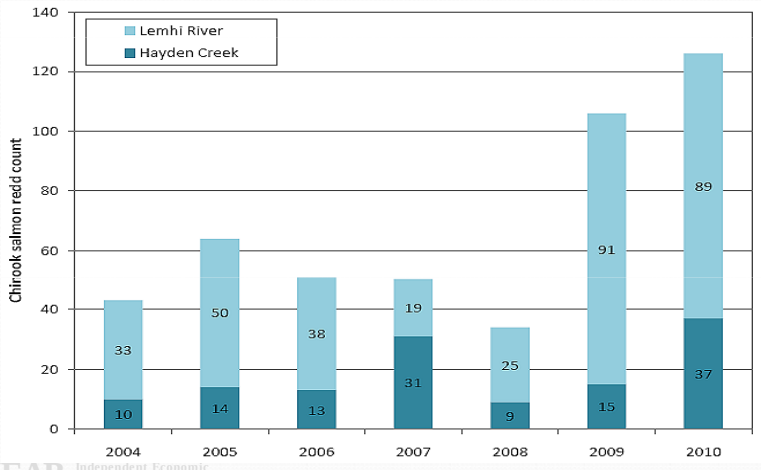
Lemhi River and Hayden Creek Chinook Salmon Redds 2004-2010



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Conclusions: 1

- Case studies show both irrigation efficiency and water transactions programs have been used successfully to increase streamflow at costs below $50/af/yr.
- Costs for IE and WT have been similar, but funding for CBWTP is highly leveraged. FWP average cost share is only 43%
- Characteristics and expenses in the eight basins vary widely.
- There are important variations in conserved water and instream flow protection laws among the states.

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Conclusions: 2

- Potential going forward for water transactions appears greater than for irrigation efficiency.
  - In case study basins, most opportunities for low-cost irrigation efficiency appear to have already been undertaken
  - Water transfers are more flexible and allow water users to decide how to meet contracted obligations at least cost: irrigation efficiency, crop idling, deficit irrigation, inter-temporal water transactions, etc.
- Oregon excepted, irrigation efficiency improvements alone do not necessarily protect conserved water instream.
- Targeted irrigation efficiency improvements unlikely to have much effect on regional power supply or demand, but general trend from gravity to sprinkler increases power demand. Further transition to drip/trickle could be motivated by higher power prices.

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Part II: Annual Report Fiscal Year 2011

Independent Economic Analysis Board of the Northwest Power and Conservation Council

IEAB

John Duffield, Chair	University of Montana; Bioeconomics
Joel Hamilton, Vice-Chair	University of Idaho
Susan Hanna	Oregon State University
Daniel Huppert	University of Washington
William Jaeger	Oregon State University
Roger Mann	RMann Economics
Noelwah Netusil	Reed College
JunJie Wu	Oregon State University

New IEAB Board Members

- William Jaeger

Professor of Agricultural and Resource Economics, Oregon State University

- JunJie Wu

Emery N. Castle Professor of Resource and Rural Economics, Oregon State University

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Main Tasks in FY 2011

- Presentations (Task 159) Zebra-Quagga mussel
  - Roger Mann – Lake Roosevelt Forum, Nov. 2011, Spokane
  - John Duffield – Crown Managers Forum, March 2011, Polson
- Task 171. Scoping Review of Hatchery EIS [Report: IEAB 2011-1]
- Task 172. Economic Implications of MERR and Categorical Review (led to Task 181)
- Task 176. Implications of Changes in Irrigation Management for Fish and Power [approved Feb. 2011]
- Task 181. Cost Efficiency of Fish and Wildlife Program [approved May 2011]

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Possible Future Tasks

- The adoption of fish friendly and more efficient hydropower turbines
- Cost analysis of alternative operations to benefit migrating juvenile fish
- Cost of renewable energy generation and integration
- Update on economic risk assessment of the potential establishment of Zebra and Quagga mussels
- Develop coordination process with other advisory boards

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Supplemental Slides

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Aggregate Expenditures BPA Pipelines & Sprinklers and CBWTP Water Transfers

		Number of Projects	Average acre feet	Budget
BPA 2004-2011	Pipelines	78		$10,028,768
	Sprinklers	59		$3,771,508
	Total	--		$13,800,276
CBWTP (2003-2011)	2003-2007		68,555	
	2008-2011		85,900	
	2003-2011 ($2010)		76,264	$27,179,000
Source: derived Pisces (2010), CBWTP				

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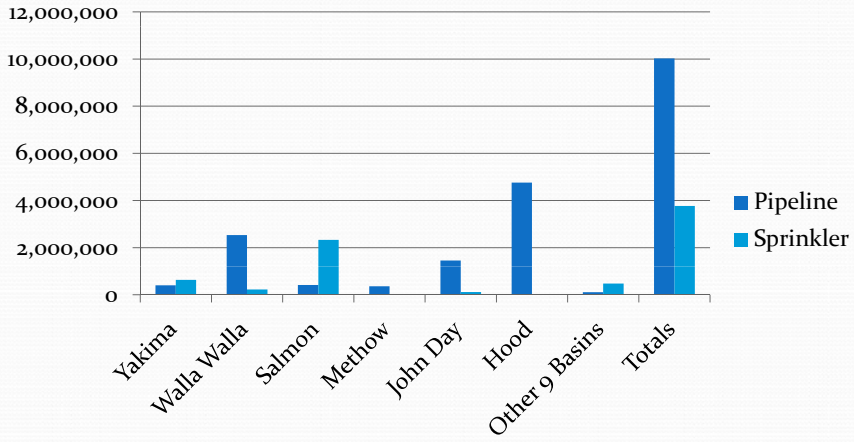
BPA Spending on Pipelines and Sprinklers 10/1/2004 to 2/15/2011, Nominal Dollars: Total and Basins > $200,000

	Install Pipeline		Install Sprinklers	
	Number of Projects	Work Element Budget	Number of Projects	Work Element Budget
Yakima	20	401,560	11	630,695
Walla Walla	9	2,531,373	9	229,500
Salmon	8	414,281	18	2,328,720
Methow	4	359,261		
John Day	23	1,451,932	2	115,000
Hood	5	4,757,027		
Other Basins	9	113,334	19	476,593
Totals	78	10,028,768	59	3,771,508

BPA Spending on Pipelines and Sprinklers 10/1/2004 to 2/15/2011, Nominal Dollars: Total and Basins > $200,000



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Water provided by CBWTP transactions, average 2003 through 2007 and 2008 through 2011, and total cost paid for water in 2010 dollars: Total and Basins > 50,000 AF

Subbasin	Average AF provided 2003-2007	Average AF provided 2008-2011	Total cost paid for water, million 2010 dollars
Yakima	4,630	8,901	$3.067
Willamette	8,909	8,995	$0.283
Salmon	4,152	8,938	$4.690
Deschutes	23,102	22,508	$10.344
Clark Fork	5,407	3,131	$0.377
Blackfoot	7,797	8,070	$0.483
Bitterroot	8,860	11,511	$1.816
Other Basins	5,698	--	--
TOTAL	68,555	85,900	$27.179

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Water provided by CBWTP expenditures through 2011, cost per AF in 2010 dollars, and CBWTP cost share: Total & Basins > 50,000 AF

Subbasin	Total AF acquired and used through 2011	Total cost paid for water acquired and used through 2011, million 2010 dollars	Cost per AF acquired and used through 2011, 2010 dollars	CBWTP (FWP) cost share
Yakima	58,754	$1.138	$19.38	40.9%
Willamette	80,521	$0.138	$1.72	85.9%
Salmon	56,508	$1.758	$31.11	40.1%
Deschutes	205,541	$5.163	$25.12	30.0%
Blackfoot	71,267	$0.328	$4.60	45.3%
Bitterroot	90,341	$0.658	$7.28	50.2%
Other Basins	123,446	--	--	--
TOTAL	686,378	$12.941	$18.85	43.4%

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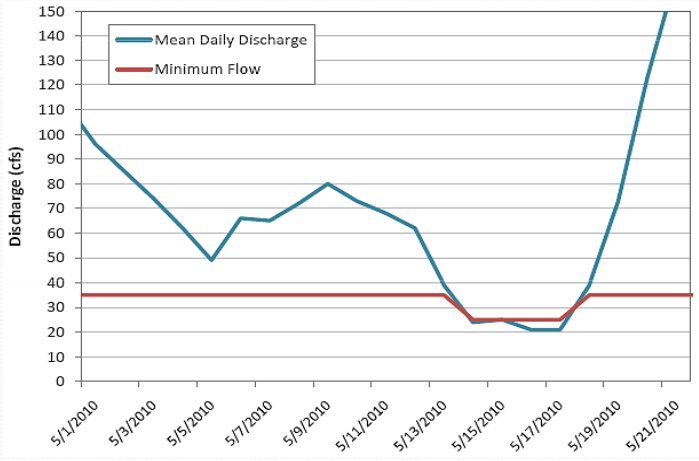
Lemhi mean daily flow at L5, May 1 – 21, 2010



IEAB Independent Economic Analysis Board

IEAB

Independent Economic Analysis Board
for the Northwest Power & Conservation Council
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Fiscal Year 2011 Annual Report

October 1, 2010 through September 30, 2011

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IEAB Fiscal Year 2010 Annual Report

Background

The Independent Economic Analysis Board (IEAB) is one of three advisory committees to the Northwest Power and Conservation Council (Council) that satisfy the Council's obligation under the Northwest Power Act (P.L. 96-501, 16 U.S.C. §839 et seq. (Act)). The Act requires the Council to develop a regional conservation and electric power plan and a fish and wildlife program (Program) to protect, mitigate and enhance fish and wildlife affected by the development and operation of the hydroelectric facilities on the Columbia River and its tributaries. In developing the Program, the Act requires (among other things) that the Council "utilize, where equally effective alternative means of achieving the same sound biological objective exist, the alternative with the minimum economic cost." The Act also directs the Council, as part of the project review process, to "determine whether the projects employ cost-effective measures to achieve program objectives."

The IEAB is a panel of eight economists whose expertise helps improve the cost-effectiveness of fish and wildlife recovery measures. The panel also provides economic advice or analysis of other fish, wildlife, and energy issues at the Council's request. The IEAB's primary objectives are to:

- provide the Council with increased analytical capability to bring economics to bear on issues within the Council's statutory responsibilities;
- advise the Council on appropriate methods of economic analysis for proposed fish and wildlife protection and mitigation measures and on the appropriate use of economic analysis to support policy decisions.

Almost all IEAB funding comes directly from the Council's Fish and Wildlife Division. The IEAB was established in November, 1996, and over the 15 years of its existence, the IEAB has focused on cost-effectiveness analysis (CEA), but has also provided economic advice on other fish, wildlife and energy issues at the Council's request. The IEAB has produced 29 reports and has engaged the region in discussion of economic issues related to the Program. IEAB reports are available at: www.nwcouncil.org/ieab/Default.htm. In addition, the IEAB presents its reports at various regional fora when requested.

IEAB members serve for four year terms, which are staggered to assure continuity. Candidates are solicited to submit applications for membership. The applications are evaluated by a panel of three regional economists, chosen from among the Directors of the Pacific Northwest Regional Economic Conference. The selection process is aided and facilitated by the Staff Coordinator (Terry Morlan has been the Staff Coordinator since the IEAB's inception.) Members are appointed by the Council from among the nominees presented by the evaluation panel.

In FY2011,Hans Radke completed his term and, after his many years of service to the IEAB, elected to not rejoin the panel. An additional vacant position had not been filled for several years. The nominating committee reviewed fourteen applications and provided four recommendations for appointments. The Council appointed Dr. William Jaeger, Professor of Agricultural and Resource

Economics, Oregon State University (OSU), and Dr. JunJie Wu, Emery Castle Professor of Resource and Rural Economics, OSU to fill the two positions.

The terms of four current board members will be completed on September 30, 2012, creating four openings for new appointments or reappointments. These will be selected following the process specified in the IEAB Charter to begin terms starting in October 2012.

Fiscal Year 2011 Activities

The main focus of the IEAB is on specific tasks conducted at the request of the Council. In FY2011, the IEAB considered five potential topics suggested by Council members and others:

- The adoption of fish friendly and more efficient hydropower turbines;
- Hatchery cost comparison focusing on cost benchmarking for BPA-funded projects;
- Contribution to the MERR and programmatic review process
- Costs of wind generation and integration from alternative accounting perspectives; and
- Relationships between irrigation efficiency, hydropower, and flows for fish.

During FY2011, three of these topics resulted in specific task orders. In addition there were several small task orders related to continued communication through regional fora of the findings from our project on the economic risk of a potential zebra-quagga mussel infestation in the Columbia River Basin (Task 159; FY2010).

The primary research and communication tasks undertaken during FY2011 were as follows:

1. Task 159: Presentations to regional fora on Zebra-Quagga Mussel Investigations: . Lake Roosevelt Forum in Spokane, WA (Roger Mann, November 2010); , Crown Managers' Forum in Polson, MT (John Duffield, March 2011.)
2. Task 171: Scoping Review of Hatchery EIS Economic Appendices.
3. Task 172: Economic Implication of MERR and Categorical Review.
4. Task 176: Implication of Changes in Irrigation Management for Fish and Power.
5. Task 181: Cost Effectiveness of Fish and Wildlife Program.

In addition the IEAB conducted eleven meetings, seven by phone and four in-person. .

Task 159: The requests for presentations by IEAB on our Zebra-Quagga Mussel study (Report 2010-1 Economic Risk Associated with the Potential Establishment of Zebra and Quagga Mussels in the Columbia River Basin) indicate a continued interest in this topic across the region. In addition to the presentations to the Lake Roosevelt Forum and Crown Managers' Forum by IEAB, Roger Mann had earlier presented to the 100th Meridian Initiative Columbia Basin Team meeting, June 10, 2010 and at the Invasive Species session of the Pacific Northwest Economic Region Summit meeting, July 17, 2010.

Task 171: The Hatchery EIS task entailed a brief review of the economic appendices and a consideration as to whether further work was warranted. The findings were reported in IEAB 2011-1. Scoping Task for Review of Hatchery EIS Economic Appendices. The recommendation was that at

this time additional work on this topic by IEAB did not appear warranted, but that after completion of the Mitchell Act EIS, this topic might be revisited.

Task 172: This task entailed a review of interim documents relating to the MERR and Categorical Review and communication/presentations to the IEAB by staff including Nancy Leonard, as the IEAB considered ways in which it might contribute to this programmatic review. The outcome of this task was a proposal to review the evolution and implementation of cost-effective measures throughout the Fish and Wildlife Program's history (the first program was established in 1983).This is Task 181, Cost Effectiveness of the Fish and Wildlife Program, discussed below.

Task 176: This task was approved by the Council in February 2011 and, along with Task 181, has been the primary focus of the IEAB in FY2011. A 31 page draft report (Cost-Effectiveness of Improved Irrigation Efficiency and Water Transactions for Instream Flow for Fish), along with a 57 page appendices was completed at the end of the fiscal year, and is presently in review. The Executive Summary was provided for the Council's November 8-9, 2011 meeting in Coeur d'Alene and it is expected the report will be finalized soon after those meetings. The substance of this report is summarized in a following section.

Task 181: This task was approved by the Council in May of 2011, and is (along with completion of Task 176) the main current focus of the IEAB at the start of FY2012. The task takes a retrospective look at the many ways the cost-effectiveness of the Council's Fish and Wildlife Program has been improved since the first program was established in 1983. This is timely given the on-going programmatic review, but also because it has now been 15 years since the Gorton amendments requiring cost-effective implementation in 1996 (and the associated establishment of both the science boards and IEAB in 1996). It is also timely in that the current Staff Coordinator, Terry Morlan, has considerable institutional knowledge and a unique perspective on how cost-effectiveness has been improved over time – not just from 1996, but also since 1983.

The IEAB has been involved in efforts to improve the cost-effectiveness of the Fish and Wildlife Program for nearly 15 years. Even though direct measurement of this progress is difficult, the IEAB believes that a number of initiatives have caused fish and wildlife projects to become more cost-effective over time. Important contributors include independent science review, improved project proposal forms, better project management, and the development of project cost data bases. Most of these efforts have focused on individual projects with some coordination within subbasins. Although program-level issues have been identified through the categorical reviews, there has been little progress in regional prioritization of projects to achieve overall program objectives and use available funds more effectively. The next step in improving the cost-effectiveness of the Council's Fish and Wildlife Program as a whole would be explicit comparisons among projects to eliminate duplication, improve coordination, share resources, better understand how multiple projects contribute to key program objectives and assign priorities based on program effects and costs.

The Council has begun to address program cost-effectiveness issues through subbasin plans, better definition of program objectives, and categorical reviews of projects addressing similar objectives. The Council's interest in expanded analysis of the program was illustrated in a July 15 letter from Council Chair Bruce Measure to ISRP Chair Eric Loudenslager. It provided a set of eleven questions to guide the 2010 categorical review. The questions represent key fish and wildlife policies and address a range of issues including the appropriateness of project scale, consistency with program

priorities, proportionality with biological risk, utility and availability of data and project results, and contribution to monitoring.

The IEAB is drafting a report focusing on two areas of cost-effectiveness. The first is a description of the changes that have contributed to improving the cost-effectiveness of individual fish and wildlife projects over the past 15 or so years. This will increase public and Council recognition of the progress over time. The second part of the report describes the potential for more comprehensive approaches to FWP decisions, as reflected in the MERR and comprehensive review, which could further improve the cost-effectiveness of the program. This report will likely be presented to Council in January or February 2012.

Meetings. The IEAB held 11 meetings in FY2011, including four in-person meetings in Portland at the Council offices and seven phone meetings. Much of the IEAB's work is accomplished in meeting preparation time and at the meetings themselves.

IEAB Reports FY 2011

The IEAB completed one report in FY 2011. This report was on Task 171 related to the hatchery EIS. The IEAB also developed two draft reports. One of these, Task 176 on irrigation efficiency has been reviewed and is being finalized as summarized below.

More complete descriptions are found in the report executive summaries.

1. **Scoping Task for Review of Hatchery EIS Economic Appendices (Task 171)** http://www.nwcouncil.org/library/report.asp?d=35

January 19, 2011 | document IEAB 2011-1 The MA-DEIS is an important document with respect to hatchery policy in the Columbia River Basin in the post-HSRG world. The potential policy changes considered in the MA-DEIS will affect the Council's FWP hatchery program. This EIS does specifically consider the potential impacts of policy on costs at non-Mitchell Act funded programs including the FWP hatcheries. Like the earlier work by IEAB (IEAB 2009-2), the hatchery cost estimates are incomplete and based on a number of important assumptions. However, it does appear that cost estimates specific to the FWP hatcheries as a group could be disaggregated from the "other hatchery" estimates reported and that this could be done across alternatives. A limitation of the IEAB's earlier work is that it simply assumes the HSRG hatchery level recommendations would be implemented.

The advantages of reviewing the MA-DEIS in greater detail include: 1) an independent "second opinion" on likely cost impacts of the HSRG recommendations; 2) insights on cost parameters not included in the earlier analyses; 3) a perspective on how these costs will vary depending on how the HSRG recommendations are implemented; and 4) a perspective on the broader impacts of the policy, including harvest policy. (The MA-DEIS provides an initial pass at the future analysis of harvest-related impacts, something that was suggested as a second phase for IEAB 2009-2).

The IEAB recommends that, because the MA-DEIS does not include a "preferred alternative", we wait for the final document before considering development of a potential future task. The final EIS would also presumably be improved by comments. Any potential future review task would focus on

updating our earlier work on the FWP hatcheries and the implications of the MA-DEIS preferred alternative on costs for these hatcheries.

2. Cost-Effectiveness of Improved Irrigation Efficiency and Water Transactions for Instream Flow for Fish (review draft 9/23/2011).

Irrigation is by far the largest consumptive use of diverted water in the Columbia Basin. Improved irrigation efficiency is often discussed as a way to conserve water to enhance instream flows and improve water quality for fish. The Council's Fish and Wildlife Program includes irrigation efficiency projects (e.g., piping projects, lining ditches, converting from surface to sprinkler application) with the objective of enhancing instream flows to benefit fish habitat and passage. Other water transactions projects aim to enhance fish habitat with payments to buy, lease or modify water rights, usually in the form of reduced diversions. Other projects have combined water transactions and irrigation efficiency improvements.

This report reviews the ways that improved irrigation efficiency, farm-to-stream water transactions, and related agreements are used to increase streamflows to improve fish habitat and promote fish recovery in the Columbia River Basin. Location-specific factors that affect the success and cost-effectiveness of both irrigation efficiency and water transaction projects are discussed. In addition, implications of recent trends in irrigation efficiency for basin-wide electricity production and demand are discussed.

First, the semantics and hydrology of irrigation efficiency are discussed. Second, the report reviews general principles for how modifications in irrigation efficiency or the location of diversions may improve streamflows for fish. Third, the report examines the experience with both water transactions projects and irrigation efficiency projects in recent years. In particular, eight subbasins are examined in detail as case studies to assess the relative potential and cost-effectiveness of irrigation efficiency projects and water transactions projects, and to provide information on the role of irrigation efficiency and water transactions generally.

The case studies reveal that both irrigation efficiency projects and water transaction projects have been used successfully to achieve an increase in streamflow at times and in locations where the fish habitat is impaired. Costs for these improvements range widely among the projects sampled; many irrigation efficiency and water transactions projects undertaken in the past decade have achieved these streamflow increases at costs below $50/AF/year. Evidence from the case studies suggests, however, that under current conditions the potential for additional, low-cost irrigation efficiency projects may be limited. In those case study basins where hydrologic and other conditions make irrigation efficiency projects attractive (Hood River, Deschutes River, Walla Walla River), most of the opportunities in these basins for low-cost irrigation efficiency projects have already been undertaken, leaving limited scope for additional cost-effective improvements. Indeed, in the Deschutes River Basin where many irrigation efficiency projects have been completed, the cost per acre-foot of conserved water has been rising over the past decade, suggesting that few low cost opportunities remain. The costs of leases and purchases of water rights can also be expected to rise after the lowest cost opportunities have been exhausted.

Overall the evidence suggests that the potential scope going forward for water transactions projects appear to be greater than for irrigation efficiency projects. Water transactions projects can have

advantages over irrigation efficiency projects. Water transactions contracts can be designed to assure conditions that will protect fish. Irrigation efficiency alone may not be enough to protect fish in dry years. Water transactions generally allow water users to decide how to meet their contractual obligation at least cost. This decision may include irrigation efficiency, crop idling, deficit irrigation, internal water transfers, and other management to minimize net revenue losses. The locations where a water transactions contract may be possible, and where it will correspond to the need for improved fish habitat, appear to be less restricted than in the case of irrigation efficiency projects. One drawback of water transactions projects should be noted however. Water transactions projects generally involve a reduction in crop production which reduces aggregate agricultural output in the local economy, and this has led to resistance to water transactions projects in small rural communities that are reliant on a healthy farm economy.

The study finds that targeted irrigation efficiency improvements to protect fish are unlikely to have much effect on regional power supply or demand, but other general trends may have more noticeable effects. The region continues to see changes in the types of irrigation technology being used. In recent years most of the change has involved conversion from gravity irrigation to pressurized sprinklers, which increases the use of electricity for irrigation. In the future, higher energy costs could encourage conversions from high-pressure to low-pressure systems such as drip or trickle irrigation.

Potential Activities for FY 2012

In FY 2012 we will finalize Task 176 on irrigation efficiency and water transactions and present the report to the Council at its November 2011 meeting. We will also continue work on Task 181, on the cost-effectiveness of the Fish and Wildlife Program as earlier described. This section notes additional topics previously mentioned by Council that the IEAB could address in FY 2012.

In Fy2011, the IEAB reviewed a number of economic topics suggested by Council members and others. Several potential topics are as follows: the adoption of fish-friendly and more efficient hydropower turbines, cost analysis of alternative operations to benefit migrating juvenile fish, cost of renewable energy generation and integration, update on economic risk of the potential establishment of Zebra and Quagga mussels, and develop coordination process with other advisory boards.

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