IEAB Independent Economic Analysis Board

Economic Review of Instream Water Supply Components of the Salmon Creek Project

Independent Economic Analysis Board
Northwest Power Planning Council

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Conclusions

The Okanogan Irrigation District (OID) and the Colville Confederated Tribes (CCT) have collaborated on a project to restore anadromous fish to Salmon Creek, a tributary of the Okanogan River in the Okanogan subbasin of the Columbia Cascade Province. Part of the Proposed Project would be paid for with Bonneville funds (Fish and Wildlife Funds) managed by the Northwest Power Planning Council's Fish and Wildlife Program. As part of the Council's responsibility to ensure the cost effectiveness of the projects it funds, it has requested the Independent Economic Analysis Board (IEAB) to review the Salmon Creek project. The IEAB review has focused on the aspects of the Proposed Project that are intended to increase in-stream flows in Salmon Creek.

The IEAB's review has been facilitated by a well-documented screening level analysis of many options that were considered in developing the Proposed Project. The Okanogan Irrigation District and the Colville Confederated Tribes should be commended for their initiative and investment to develop a viable project to restore flows in Salmon Creek.

The Proposed Project was developed within the context of the OID/CCT project mission: to restore anadromous fish to Salmon Creek while maintaining the ability of the irrigation district to continue water delivery to its users. The Proposed Project includes (1) improved water control, (2) on-farm efficiency to reduce irrigation water use, (3) a new pump station on the Okanogan River, (4) increased storage capacity in an upstream reservoir, and (5) temporary utilization of a water bank until the other project elements can be implemented. Most of the water needed to replace Salmon Creek supplies would be provided by the new pump station on the Okanogan River.

The Proposed Project would improve local water supply reliability and have other benefits in addition to restoring Salmon Creek flows. In recognition of these multiple benefits, joint funding by Bonneville and state and federal government agencies has been proposed. The proposed Bonneville share of the funding is about half, which seems to be roughly appropriate given the local economic benefits stemming from the proposal and the roles of other funding organizations.

The IEAB finds that the Proposed Project is reasonably cost effective within the stated project goals. However, within a broader economic context, the cost effectiveness of increasing in-stream flows would likely be improved by inclusion of a permanent water bank or other methods for leasing or purchasing water. Using markets to obtain voluntary reductions in water delivered to irrigators would reduce the need to pump water from the Okanogan River, increase downstream flows and power production, and benefit landowners who are experiencing low economic returns from irrigated agriculture. Purchase or lease of water to reduce costs of pumping would be most cost effective when electricity prices are high. Further, reduced pumping in dry years would improve Okanogan River flows and quality. A water market approach to stream flow enhancement could be tailored to respond to contingencies such as electricity price surges and unusually dry weather. Inclusion of such a system, if politically feasible, would be innovative and challenging, but it would, in our view, increase the overall cost effectiveness of the proposal.

Because the Proposed Project has the potential of increasing water supplies to the irrigation district, the Council should request assurances from the irrigation district that increased water supplies and water saved through improved efficiency will not be used to increase irrigated acreage. Also, a more detailed operations plan for Salmon Creek storage facilities should be developed and approved by OID, CCT and the Council. There will be years in which there is simply not enough water available in the Salmon Creek watershed to meet recommended flows. Salmon Creek operations should be clearly defined for years when supplies are insufficient.

Executive Summary

The Okanogan Irrigation District (OID) and the Colville Confederated Tribes (CCT) have agreed on a project (the Proposed Project) to increase instream flows for anadromous fish in Salmon Creek, while preserving local irrigated agriculture. Salmon Creek is a tributary of the Okanogan River in the Columbia Cascade Province of north central Washington. Part of the Proposed Project would be paid for with power system users funds managed by the Northwest Power Planning Council (Council). This evaluation addresses the issue of whether the Proposed Project is a reasonably cost-effective package for providing instream flows in Salmon Creek.

The Proposed Project includes these elements:

- *District Wide Agricultural Water Conservation* would reduce Salmon Creek diversions by automating District water deliveries (installing devices and structures to improve district-wide flow control.).
- *Okanogan River Water Exchange #2, 80 cubic feet per second (cfs) pipeline* would pump water supply from the Okanogan River for irrigation, thereby making more Salmon Creek water available for instream use.
- *On-Farm Water Management* would implement on-farm irrigation management practices to reduce Salmon Creek diversion.
- *Interim OID Water Bank* provides water by leasing from willing sellers. The Water Bank, operated successfully for two years, would continue only until the remaining project elements are built to completion.
- *Raise Salmon Lake Dam and Replace the Salmon Lake Feeder Canal* would raise the dam 2 feet to increase Salmon Lake storage by 660 acre-feet (AF, about 325,800 gallons). This storage could enable the OID to capture more of the OID's full water right on the North Fork of Salmon Creek, which in turn provides a source of water for increasing instream flows.

The IEAB is impressed with the effort invested by the OID and the CCT to develop a viable restoration program for Salmon Creek. The documentation included in the *Joint Study on Salmon Creek Final Report* (Final Report, 1999) is a good example of the types of information needed to improve the cost-effectiveness of the overall fish and wildlife program. The Final Report explains the problem and provides measurable goals (flow targets), examines several alternatives and provides most of the necessary information about costs, effects on instream flows, and effects on OID water supplies. Most of the quantitative information is preliminary but appropriate for a screening-level analysis. The elements selected for the Proposed Project have been investigated in detail in a Phase II study conducted during 2000. Unfortunately, the Draft Phase II report is not yet available.

We have reviewed the available information, including the Final Report and information provided by CCT Fish and Wildlife Department staff and other sources, and we have referenced the IEAB report ***Economics of Water Acquisition Projects****.* Also, we have developed additional analysis described below. Based on the information available now,

The IEAB finds that the Proposed Project is a reasonably cost-effective package for increasing Salmon Creek flows, but with the following important qualifications:

1) The cost effectiveness of increasing in-stream flows would likely be improved by inclusion of a permanent water bank.

The interim OID Water Bank has already proved its worth as an inexpensive source of water for instream flows. The Washington Water Trust has negotiated the lease price with the OID. In 2000 and 2001, 966 and 1,719 AF were leased at a cost of $45 to $48 per AF per year. This price is about the same as $1,000 on a Present Value (PV) basis. That is, a one-time payment of $1,000 now should be enough to finance the $45 to $48 cost per acre for 50 years. This cost is considerably less than the average cost of water in the Proposed Project. The unit cost may increase if more water is acquired or if agricultural market conditions change.

Future electricity prices may be higher and more variable than they were in the recent past. The Proposed Project exposes the Fish and Wildlife Fund to significant risk of unreasonable pumping costs caused by high electricity prices. The OID Water Bank or other methods of reducing Okanogan River pumping would reduce power user's exposure to unreasonable pumping costs when power prices are high. The Water Bank could be structured to offer different prices from year to year based on economic and hydrologic conditions. High market prices for electricity would trigger payments to farmers for voluntary reductions in water use. Payments per unit of reduced water use would be higher when electricity prices are higher. The Water Bank could also be structured to reduce irrigation water use in dry years when Okanogan flows have more environmental and hydropower value.

2. With qualification 1, the share of costs proposed to be covered by the Fish and Wildlife Fund seems reasonable.

Power system users are being asked to pay roughly half of the costs of the Proposed Project. Cost sharing is appropriate, because the Proposed Project would benefit the local area and others in several ways. These benefits may include:

1) Reduced costs of Shellrock pumping in dry years;
2) Increased water supply reliability for irrigation in dry years;
3) Increased spills into Duck Lake, increasing water supply and groundwater recharge;
4) More stable water levels at Conconully Reservoir. This would be an economic benefit to recreationists, landowners around the lake, and related businesses in the area.
5) Restored anadromous fish runs will increase tourism and local recreational opportunities.

Given these ancillary benefits, there is not a definitive answer as to what share of costs should be covered by power system users, but the proposed cost share seems reasonable as long as pumping can be reduced when power prices are high.

3. Other methods for water lease or purchase may be cost-effective. However, permanent water acquisition is viewed unfavorably by some local interests because some local area costs are not compensated. More study and development is needed.

Water acquisition means the purchase or lease of irrigated land or water rights from willing sellers, not the involuntary use or reassignment of water rights. Water acquisition might be used to reduce costs of Salmon Creek restoration by reducing water use and allowing the saved water to remain in Salmon Creek.

The Proposed Project does not include any purchase or lease of water as a permanent means to increase instream flow. The Final Report did not include permanent water acquisition because the irrigation district did not wish to include permanent water acquisition as part of the scope of work. The mission statement of the study was to restore anadromous fish to Salmon Creek *while maintaining the ability of the irrigation district to continue water delivery to its users* (emphasis added).

The limitations that CCT/OID placed upon themselves and Dames & Moore do not apply to the IEAB, which has a charter to provide independent economic advice to the Council. Cost-effectiveness is a concept that requires comparisons among available alternatives. The IEAB believes that permanent water acquisition is a feasible alternative. Some water acquisition may be economical, and water acquisition should be considered as part of a diverse mix of water supply options that, taken together, may have a better overall result in terms of cost, flexibility, and reliability.

A cost-effectiveness comparison can be developed from the existing proposal for cost sharing (CCT, 2000b) and other information. This comparison suggests that leasing water or buying some land and ceasing irrigation, even temporarily, might be less expensive (from the regional and national perspectives) than the Salmon Lake dam raise or pumping Okanogan River water. However, results are close enough that a clear decision cannot be made confidently with existing economic information. The cost-effectiveness analysis is uncertain because future electricity prices, agricultural market conditions and discount rates are uncertain. The exact amount of cost savings from adding water acquisition to the Proposed Project is currently unknown. Also, water acquisition is not perfectly comparable to other project elements. It is the only element that significantly reduces agricultural production and consumptive use of water. To some extent, the cost-effectiveness comparisons are uncertain because different Proposed Project elements have different attributes.

Since water rights are closely tied to the land, a water acquisition program would probably buy irrigated land on the open market. However, leases and option contracts may also be possible. It is not currently clear what agency or body would act as the leaseholder or buyer. The IEAB assumes that the landowner would continue to pay all District assessments and local taxes in any case. As with the current OID Water Bank, the Washington Water Trust might act as the intermediary for transfer arrangements.

The IEAB understands that permanent water acquisition would require a vote of approval by OID landowners, and this vote must be allowed by a vote of the OID Board of Directors. There are about 400 landowners in the district. Absent this vote, water can not be purchased and dedicated to instream flow. Land could be purchased and retired, but the water rights would remain with OID, and OID could choose to reallocate the water to other lands in the District. If OID landowners maintain that water rights acquisition is not an option, then as a practical matter, it is not an option.

In comparison to the Proposed Project, some water acquisition would benefit landowners, because landowners would only participate if they expected to be better off by participating (i.e., selling their land). On the other hand, legitimate concerns have been raised about economic impacts of reduced agricultural production in the local area. Costs associated with lost business activity in the local area would not be compensated by purchase of land alone. These costs are largely lost net revenues or profits in linked markets.

It may be difficult to obtain a favorable vote without more general support from the local community. Therefore, the water acquisition program should include assurances and safeguards against local economic effects. These safeguards might include the following:

- A large share of the irrigated land in the region would not be fallowed in any year.

- Acquired water need not be used for instream flow in all years. For example, purchased land could be leased back to farmers when water is abundant or electricity prices for pumping Okanogan water are low. The IEAB recognizes that a lease-back program would result in some different cropping patterns relative to existing conditions. Permanent crops such as trees and vines and perennial hay crops would be largely precluded from the lease-back provision.

- Some of the District assessment covers the variable costs of delivering water. These variable costs would be avoided by not delivering water. By assumption, the acquired land would still pay the total assessment. Since some of the variable costs would be avoided, some of the income associated with continued payment of the assessment could be diverted and used to compensate for third party effects.

- The local area would benefit from restored anadromous fish populations, and other local economic benefits described below would provide compensation to the regional economy.

In summary, a long run strategy of improving efficiency of water use and increasing streamflow for fish might include a significant effort to relax the current restrictions on marketing of water within watersheds like Salmon Creek. We understand that the current rules do not facilitate private decision-making that would drive a functioning water market. Developing effective water markets that permit reasonable re-allocations of water among users and between offstream and instream use, while protecting against negative third-party effects, will be a substantial task. To develop a framework for such a market in Salmon Creek would undoubtedly require additional study and development, and it would require the full participation of all stakeholders.

We are not proposing that a radical change in water institutions be imposed on OID. Landowners are currently allowed to lease their water for instream flow through the OID Water Bank, so water acquisition could involve little more than a continuation of this structure and the recognition that landowners could permanently manage their land for its water as well as irrigated production.

4. Cost-effectiveness in this case is a function of the accounting perspective. The Proposed Project appears cost-effective relative to water acquisition, but only from the narrow perspective of the Fish and Wildlife Fund.

The cost-effectiveness of water acquisition depends on whose costs are counted. An *accounting perspective* defines whose costs are being counted. The recent cost-sharing proposal (CCT, 2000b) would spread costs among many different groups including local water users, power users, Washington taxpayers, and U.S. taxpayers.

Cost to the Fish and Wildlife Fund would be minimized by the Proposed Project as long as local, favorable power prices could be obtained for pumping Okanogan water. The Fish and Wildlife Fund would pay about $617 per AF PV of firm, permanent water supply for the Proposed Project as opposed to $1,000 to $1,600 for water acquisition. That is, the Proposed Project appears cost-effective compared with water acquisition in large part because other funding sources are available for much of the total Project costs.

From the somewhat broader perspective of power system users, opportunity costs of electricity consumed by pumping should be used, and water acquisition increases downstream power generation. Net costs of water acquisition ($750 to $1350 per AF) are similar to the Proposed Project ($854 per AF).

From the perspective of the Pacific Northwest region, capital costs of Okanogan River pumping facilities must be included because these would be paid by State of Washington taxpayers. Also, the cost of the OID assessment is not included as part of water acquisition costs. In this accounting perspective, some water acquisition ($250 to $750 per AF) appears quite economical compared to the Proposed Project ($1708 per AF).

The total cost of the Proposed Project ($2032 per AF) from the national perspective, which includes costs of Salmon Lake dam and feeder canal improvements paid by U.S. taxpayers, appears to exceed the national costs of water acquisition.

5. Significant cost savings might be achieved with a smaller Okanogan River diversion

The proposed Okanogan Diversion has been scaled to provide very reliable water supplies for OID. The new 80 cfs diversion could provide the district's entire maximum flow requirement of 36,230 gallons per minute (Final Report p. 2-4). With the OID Water Bank, water acquisition, district-wide conservation or on-farm water management, a smaller diversion capacity might suffice, yielding significant cost savings to the State of Washington. Estimates of the costs of a somewhat smaller diversion are not currently available. The Final Report suggests that "further modeling analyses of other pump capacities can be performed to find the optimum."

The IEAB has obtained the water system model used to evaluate water delivery from the Okanogan River diversion. The model allows the capacity of the Okanogan River diversion to be changed and the impact on water deliveries estimated. Results suggest that a reduction in capacity from 80 to 70 cfs would reduce average deliveries by less than 1 percent. Since methods are probably available to cope with these infrequent, small shortages, and costs would likely be reduced by much more than 1 percent, the size reduction is likely to be economical. The monthly model may not be able to represent peak demands appropriately, but it does suggest potential for cost savings from a smaller diversion. Additional study using a smaller (daily) time step to evaluate the entire Proposed Project would be helpful.

6. The Council should seek assurances that Salmon Creek facilities will be operated to achieve the greatest benefit for anadromous fish, that water will be made available in the amounts, timing, and locations indicated, and that additional land will not be irrigated

The Final Report outlines several instream flow schedules, or scenarios, that Salmon Creek facilities might be operated to meet.[1] Funding for Okanogan River pumping or any other component of the overall project should be contingent on a detailed operations plan, assurances that the selected flow schedule will be met to the extent possible, and contingencies in case of insufficient Salmon Creek water supply should be clear.

It is possible, though unlikely, that inexpensive Okanogan River water supplies might encourage expansion of irrigated acreage or increased water use on existing acreage. The Council should seek assurances that the existing place of use for irrigation in OID will be unchanged and enforced with the Proposed Project in place.

7. The IEAB has not considered the cost-effectiveness of Salmon Creek restoration relative to other restoration opportunities in the region.

Salmon Creek is one of many opportunities to provide new habitat for summer-run steelhead and spring-run chinook in the Upper Columbia. Our evaluation has not considered the economic merits of Salmon Creek restoration in comparison to other restoration opportunities in the region. We have only compared alternative methods for increasing flows in Salmon Creek. Thus, we have reached no conclusions regarding the cost-effectiveness of the Proposed Project relative to other potential uses of the Fish and Wildlife Fund. Past studies (NWPPC 1996, 1990) found that, based on biological and institutional factors, Salmon Creek compared favorably to other regional opportunities.

[1] Lyman (2001) stated that the OID and CCT are currently contemplating the continuous flow regime as described on page ES-6 of the Final Report, except that the statement "Reservoirs managed for fish only, possibly reducing damaging flood flows" would be modified to read "Reservoirs managed for fish and partial irrigation only, possibly reducing damaging flood flows." This modification is needed to accommodate Diversion 1. Diversion 1 serves about 360 acres and would still be served with Salmon Creek water in the Proposed Project

MAIN REPORT

1.0 Introduction

Salmon Creek is a tributary of the Okanogan River in Northern Washington. The Okanogan Irrigation District (OID) and the Colville Confederated Tribes (CCT) have joined to conduct a joint study of the feasibility of restoring anadromous fish runs to Salmon Creek while enabling OID to protect its water rights and ensure water delivery to its members. The Independent Economic Analysis Board (IEAB) of the Northwest Power Planning Council (Council) has been asked to consider whether the Proposed Project for increasing instream flows in Salmon Creek is a reasonably cost-effective set of solution to the instream flow problem.

1.1 Local Setting

Salmon Creek drains about 167 square miles on the eastern slopes of the North Cascade Range in Okanogan County. Conconully Reservoir and Salmon Lake, about 15 miles upstream of the Okanogan River, together provide 23,500 acre-feet of storage space (Final Report, 1999). Long-term historical average runoff above Conconully dam is estimated to be 21,700 acre-feet, ranging from 1,500 to 67,000 acre-feet (Final Report, p. 1-24). Controlled releases from Conconully Reservoir are diverted 4.3 miles above the Okanogan confluence for irrigation of about 5,000 acres within the Okanogan Irrigation District (OID). Primary crops are apples, pears, alfalfa, pasture, and urban yards and gardens (p 2-5). The towns of Okanogan and Omak depend on agriculture, timber, and tourism for their economic base.

1.2 Salmon Creek Project Goals and Benefits

Salmon Creek was an important spawning area for salmon and steelhead trout prior to construction of Salmon Creek irrigation works in about 1920 (USFWS 1949). Restoration has been discussed since at least 1990 (NWPPC 1990), and the potential quality of restored habitat is considered excellent. Restoration of "Salmon Creek is both biologically and institutionally feasible and should be strongly considered" (NWPPC, 1996). The target species are summer-run steelhead and spring-run chinook. Upper Columbia River Spring Chinook Salmon were listed as endangered under the Endangered Species Act in March, 1999, and Upper Columbia River Steelhead were listed as endangered in August 1997 (NMFS 2000).

Diversion of Salmon Creek into the OID irrigation system in the last 80 years has had the following detrimental results in the lower 4.3 miles of the Salmon Creek channel. The water tables have been reduced thus preventing the growth of riparian vegetation and causing the stream banks to fail. Collapsing stream banks have caused the channel to widen, making fish passage upstream more difficult. Streambank erosion has also left an alluvial fan that will require excavation at the mouth of the creek (OID, 2001).

The Salmon Creek Project would use streambed restoration and flow enhancement to make the lower reach passable, and would improve 11 miles of spawning and rearing habitat in the “middle reach” below Conconully Reservoir. Streambed restoration would be required for any restoration effort. Restoration work would include sediment removal, channel reconstruction, streambank protection and stabilization, and removal of obstacles.

The *Joint Study on Salmon Creek Final Report* (Final Report, 1999) described local hydrology, agricultural water use, past and potential fishery resources, potential for stream restoration, and water conservation and water supply elements. The Final Report estimated that 7,122 to 9,737 acre-feet of water in addition to what the watershed naturally provides would be required to meet the seasonal needs of irrigators and the year-round life cycles of steelhead and spring Chinook in the creek.

2.0 Estimated Costs of the Proposed Project

The Final Report describes numerous water conservation and supply options that would allow water to remain in Salmon Creek. Of the fifteen water conservation and supply options described in the executive summary, OID and the CCT agreed to pursue five for implementation. Water supplies and estimated costs for the five elements are shown in Table 1 below. These costs are preliminary and subject to revision. Currently, the IEAB is aware that additional work is being conducted on refining the cost estimates in the Phase II study.

2.1 Proposed Costs, and Updated Costs to the Fish and Wildlife Fund

Cost estimates were provided by the CCT (CCT, 2000b, 2001b) with some interpretations, and firm water supply estimates are taken from the Final Report. Table 1 shows that permanent components of the Proposed Project would provide 9,216 AF of permanent, firm water at a present value (PV) cost of $1,795 per AF. "Firm water" is water supply that could be provided during a year of a critical drought period. Average water supplies are more, and cost per AF of average supply would be less than shown in Table 1.[2]

At this point, issues regarding who pays and cost sharing must be introduced. The proposed cost-sharing approach must be taken into account when evaluating cost-effectiveness. The Fish and Wildlife Fund is not being asked to pay for the entire project. The proposed funding approach would have the Fish and Wildlife Fund pay for certain management costs and environmental documentation, temporary OID Water Bank purchases, and Okanogan River pumping (CCT 2000b). These payments would take place through revenues that BPA effectively puts into the Fish and Wildlife Fund. Washington taxpayers would pay for capital costs of the Okanogan River pump station, federal taxpayers would pay for Salmon Lake dam and feeder canal improvements, and other costs would be paid by a variety of federal and state programs.

In Table 1, the Fish and Wildlife Fund cost share for permanent supplies would be $5.69 million.[3] Most of the Fish and Wildlife Fund cost share, about $245,000 annually or $4.6 million

[2] Net present value (PV) is the one-time current payment equal to the sum of a discounted stream of future payments. For example, the PV of future principal and interest payments on a mortgage is the principal amount. The discount rate used in this report is 4 percent. PV analysis was not provided by the Final Report or any CCT sources. Some sensitivity analysis is provided below.

[3] Costs to the Fish and Wildlife Fund are $6.326 million with the Interim Water Bank. The Interim Bank is not included in calculations involving unit costs because supplies will only last for four years.

in Present Value (PV) terms, would be for Okanogan River pumping. The PV of Fish and Wildlife Fund costs per firm AF made available in OID would be $617.[4]

Two updates or corrections to the proposed costs appear necessary to the IEAB: the retail electricity price, and the amount of water that would be pumped. As is turns out, these corrections are almost exactly offsetting.

First, the electricity price used in the analysis ($0.0165/kwh) is the retail rate that would be charged the Council for the increased pumping costs (CCT, 2001b). This price correctly represented prices as recently as early 2001, but pumping costs were estimated prior to the current energy crisis. At the current time, wholesale prices are more than ten times the assumed level. Most observers now expect that long-run local electricity prices will be higher than prices experienced as recently as last summer.

The retail rate is expected to increase substantially on October 1, 2001 in response to higher wholesale power prices in the Northwest. Local power users expect that a BPA rate increase of 136 percent will be in effect until 2004. This rate increase is expected to increase local power costs by 45 percent. In 2004, if water conditions return to normal, BPA rates are expected to decline 20 percent, and another 20 percent decrease would occur in 2005 (CCT, 2001c). This information suggests that the long-run local retail rate will be about $0.02178 [45*((136-20-20)/136)*0.0165]. This long-run estimated retail rate should be used in the present value analysis, and represents the "best guess" for local, low-cost power and the liability to the Fish and Wildlife Fund.

Second, the average annual amount of Okanogan River pumping, and the associated pumping cost, are also unclear from the available documentation. The Final Report presents results from a spreadsheet model of the Salmon Creek and OID water supply system for several alternatives. Model scenario WE-3-C1 estimates pumping under the assumption that pumping would be unrestricted by Okanogan River minimum flow requirements. Scenario WE-3-C2 estimates Okanogan River pumping under the assumption that 35 cfs of water right is transferred from the existing Shellrock pump station (see discussion of Shellrock below). Annual pumping in Scenarios WE-3-C1 and WE-3-C2 average 10,836 and 9,842 AF, respectively, significantly less than the 13,209 average AF assumed in Table 1.

[4] The cost per AF of increased flow in Salmon Creek might be more than the estimates presented here, because there is not a one-to-one correspondence between increased flow in Salmon Creek and water made available in OID. This occurs because some of the pumped water replaces water formerly pumped from the Okanogan at the Shellrock diversion, because some of the pumped water spills into Duck Lake and is not used for irrigation, and because there is sometimes no water stored in Salmon Creek reservoirs to use for instream flow even as pumping for irrigation continues.

Table 1.
Supplies and Costs of Water Supply Elements as Proposed (Okanogan Pumping at 13,209 AF and Electricity Price at $0.0165/kwh) [1]

	Supply [2.]	Dollar Costs			$/AF PV
Element	**Firm AF**	**2001 Capital**	**Annual**	**PV** [3.]	**Firm**
District-Wide Ag. Water Conservation	593	$425,000		$425,000	$717
Okanogan River Water Exchange	7,234	$6,825,000	$298,845	$12,415,515	$1,716
On-farm Water Management	1,153	$723,485		$723,485	$627
Interim OID Water Bank [4.]	1,585	$327,000	$202,000	$853,431	$2,814
Raise Salmon L. Dam & Feeder Canal	236	$2,980,251		$2,980,251	$12,628
TOTAL	10,801	$11,280,736	Varies	$17,397,683	
TOTAL, no interim OID Bank [5.]	9,216	$10,953,736	$298,845	$16,544,251	$1,795
Fish and Wildlife Fund cost share [6.]	9,216	$1,153,940	Varies	$5,690,638	$617
Fish and Wildlife Fund pump cost only	7,234		$244,885	$4,581,081	$633

1. Cost data are from CCT (2000b) except pumping cost data are from CCT (2001b). Pump costs are based on 13,209 AF of average water pumped, 675 feet of lift and 883 kwh per AF pumped. From CCT (2001b) the average retail cost of electricity with a demand charge of $7.49 per horsepower (CCT, 2001b) is $0.021 per kwh. It was assumed that capital required in 2001 and 2002 would be committed in 2001, and the present value of future costs was estimated using a real interest rate of 4 percent. Pumping costs beginning in 2004 were discounted for 50 years (2001-2050), and OID Water Bank costs were assumed to occur in 2001 through 2004.
2. When operative. See note 1. Supplies from Final Report except Pump Station from CCT 2001b. Firm supplies are defined as those available during the critical drought period such as 1928-1934.
3. Annual costs PV at 4 percent, 50 years, added to capital costs.
4. Cost of Interim Water Lease is $202,000 per year for 4 years (CCT, 2000b). Actual costs in 2000 and 2001 were $43,470 and $83,035, respectively. Landowner pays OID assessment. $/AF PV is calculated based on a 50 year life to make result comparable to other elements
5. Does not include Interim OID Water Bank.
6. Does not include Interim Water Bank. Power system users pay all variable pumping costs and environmental documentation costs.

Table 2 shows costs with average pumping reduced to 10,000 AF and the price of electricity increased to $0.02178 per kwh. The two changes have almost equal but offsetting effects on costs, so our estimate of actual costs to the Fish and Wildlife Fund is almost identical to the proposed costs.

Table 2.
Supplies and Costs of Water Supply Elements Adjusted
(Okanogan Pumping at 10,000 AF and Electricity Cost at $0.02178/kwh)

	Supply	Dollar Costs			$/AF PV
Strategy	**Firm AF**	**2001 Capital**	**Annual**	**PV**	**Firm**
District-Wide Ag. Water Conservation	593	$425,000		$425,000	$717
Okanogan River Water Exchange	7,234	$6,825,000	$298,714	$12,413,062	$1,716
On-farm Water Management	1,153	$723,485		$723,485	$627
Interim OID Water Bank	1,585	$327,000	$202,000	$853,431	$2,814
Raise Salmon L. Dam & Feeder Canal	236	$2,980,251		$2,980,251	$12,628
TOTAL	10,801	$11,280,736	Varies	$17,395,230	
TOTAL not including interim water	9,216	$10,953,736	$298,714	$16,541,798	$1,795
Fish and Wildlife Fund cost share	9,216	$1,153,940	Varies	$5,688,185	$617
Fish and Wildlife Fund, pumping cost only	7,234		$244,754	$4,578,628	$633

2.2 Costs to Power Users and the Region

The Fish and Wildlife Fund is not the only cost paid by power users. Most of the cost paid by power users is the cost of generating electricity. The electricity consumed by Okanogan River pumping would place a new demand on the regional power supply system, and power users must pay the total cost of meeting the new demand. The increase in consumption will lead BPA to incur additional purchased power expenses, which must be passed on through higher regional wholesale power rates, only some of which would be paid out of the Fish and Wildlife Fund.

The expense to the Fish and Wildlife Fund may be only $0.02178 per kwh, because power is sold to OID at a preferential rate, but the cost to power system users is the marginal or incremental cost of providing that electricity. At the margin, power system users might sell the electricity on the wholesale market instead of using it to pump Okanogan water, and price on the wholesale market is determined by costs of thermal generation, water conditions, and market forces. The retail rate of $0.02178 per kwh is substantially below the marginal cost of power production in the region. A marginal price of $0.035 per kwh is considered to be more accurate as a long-term measure of power costs. Power system users either forego $0.035 per kwh, or they must pay $0.035 for new replacement generation.[5]

[5] The Council's "Northwest Power Supply Adequacy/Reliability Study Phase 1 Report" (March 2000) provides long-term forecasts of price between $25 and $30 per megawatt-hour (MWH) in 1997 dollars, or $26 to $31 in 2000 dollars. Given recent trends, $35/MWH may be a reasonable assumption as a long-term price.

Table 3 presents a revised cost estimate assuming pumping costs for an average of 10,000 AF pumped and an electricity price of $0.035 per kwh.

Table 3.
Supplies and Costs of Water Supply Elements,
Okanogan Pumping at 10,000 AF and Electricity Price at $0.035/kwh [1.]

	Supply	**Dollar Costs**			**$/AF PV**
Element	**Firm AF**	**2001 Capital**	**Annual**	**PV [3.]**	**Firm**
District-Wide Ag. Water Conservation	593	$425,000		$425,000	$717
Okanogan River Water Exchange	7,234	$6,825,000	$415,450	$14,596,860	$2,018
On-farm Water Management	1,153	$723,485		$723,485	$627
Interim OID Water Bank ·	1,585	$327,000	$202,000	$853,431	$2,814
Raise Salmon L. Dam & Feeder Canal	236	$2,980,251		$2,980,251	$12,628
TOTAL	10,801	$11,280,736	Varies	$19,579,027	
TOTAL, no interim OID Bank	9,216	$10,953,736	$415,450	$18,725,596	$2,032
Cost to Pacific Northwest Residents	9,216	$7,973,485	$415,450	$15,745,345	$1,708
Power system user cost share	9,216	$1,153,940	$361,490	$7,871,983	$854
Power system user pump cost only	7,234		$361,490	$6,762,425	$935

1. See footnotes from Table 1. The average cost of electricity with a demand charge of $7.49 per horsepower is $0.041 per kwh.

Table 3 shows that total costs of the Proposed Project, not including the interim OID Water Bank are estimated to be about $2,032 per firm AF PV. Costs to power system users average $854 per permanent, firm AF PV, and variable costs of pumping are $935 per firm AF PV. These costs are somewhat more than the corrected Proposed Project costs in Table 2. [6]

Table 3 also shows costs to the Pacific Northwest region. This cost includes the Fish and Wildlife Fund costs, other costs to power users, and costs paid by State taxpayers. Under the proposal for cost sharing (CCT 2000b) the State of Washington would pay about $6.8 million for

[6] However, it should be noted that the use of $0.035/kwh is closely tied to the expected duration of the decision. That is, the estimated long-run equilibrium price of electricity should be used in the analysis of permanent, long-run changes in the use of water.

the cost of the new Okanogan River pumping station. This results in a regional cost share of $16.6 million or $15.7 million without the interim Water Bank. Costs to the nation include these costs, plus costs of the Salmon Lake dam and feeder canal to be paid by the Bureau of Reclamation. National costs are about $19.6 million or $18.7 million without the interim Water Bank. Average cost of firm, permanent water supply is about $2,032 per AF PV.

Future electricity prices are uncertain. Table 4 shows how the PV of the variable pumping cost changes with changes in the assumed regional cost of electricity. Unlike Tables 1 to 3, capital costs and annual O&M costs are not included. Pumping costs for the expected case of $0.035 per kwh are $676 per AF in PV terms. The PV of pumping costs varies substantially within a reasonable range of assumptions regarding electricity prices.

Table 4.
Present Value of the Cost of Pumping One Acre-foot from the Okanogan River 675 feet for Use in OID. [1.]

	Electricity Price, $/kwh				
	.015	**.025**	**.035**	**.045**	**.055**
PV of Pumping Costs, $/AF	$346	$511	*$676*	$841	$1,007

1. Period is 2001-2050. Pumping begins in 2004. $676 is the variable pump cost in Table 3

3.0 Water Acquisition Costs

Water acquisition, for purposes here, means the purchase or lease of irrigated land or water rights from willing sellers and the voluntary assignment of water rights for instream flows. The Proposed Project does not include permanent water acquisition. The element of permanent water acquisition was not evaluated as a part of the Proposed Project “because to the OID, it was not a viable one” (CCT, 2000). The Final Report only considered elements that would allow the District to protect its water rights and ensure water delivery to its members.

Water leasing would not be new to the district. The OID Water Bank, an interim measure used to acquire water in 2000 and 2001, is planned for use in 2002 and 2003. It would be phased out as other water supply measures are completed. The Joint Committee moved ahead with the Water Bank in parallel with the end of Phase I work. Irrigators were free to offer water from fallow, conservation, deficit irrigation, or any other legitimate source; they were not restricted to fallow only. Most if not all of the water came from land that was not irrigated.

The cost of leasing in 2000 turned out to be $135/acre and in 2001, $145/acre, and each acre provided three AF. In 2000 and 2001, 966 and 1,719 AF were leased from 322 and 573 acres, respectively. The Washington Water Trust, a non-profit organization dedicating to purchasing and/or leasing water for instream flows, is the intermediary. The Water Trust negotiates the lease price with the OID. The contract for the lease is between the Trust and OID. The tribes contract with the Trust for this service (CCT, 2001c).

The IEAB believes that a permanent OID Water Bank or other methods for leasing or purchasing water should be considered as part of the Proposed Project. IEAB's review of cost/effectiveness extends beyond the limited scope agreed to by OID/CCT, because we continue to find unrealized potential for the use of markets rather than regulations or new facilities to manage resources effectively. (Facilities are dams, other storage structures, or other water supply equipment.) Cost-effectiveness can only be judged by comparison of all feasible alternative strategies for increasing instream flow. The IEAB believes that water acquisition and a permanent OID Water Bank should be considered as potential feasible strategies to be evaluated like any other. These strategies can be implemented "while maintaining the ability of the irrigation district to continue water delivery to its users."

To acquire water, the Council or an intermediary would compensate farmers on a willing seller basis. We assume that water acquisition would be accomplished by voluntary fallow of irrigated land and the water would be released for flow into Salmon Creek. The existing OID Water Bank could be used, or water acquisition could be a long-term arrangement that would provide more certainty regarding the availability and price of water in future years. It is possible that water could also be made available by crop switching, deficit irrigation or extraordinary conservation. Those options have not been considered here.

The potential cost of water acquisition is estimated for two acquisition strategies: 1) annual leases, and 2) the purchase of irrigated land. Also, it turns out that cost-effectiveness depends on whose costs are counted. In Section 2, the costs of the Proposed Project depended on whose costs were counted. Water acquisition costs also vary depending on whose costs are counted.

"Economic accounting perspective" is a term that defines whose benefits or costs are being counted. There are at least five different accounting perspectives that can be identified for this analysis; the Fish and Wildlife Fund, power users, the local area, the Pacific Northwest Region, and the United States. Therefore, the two acquisition strategies are each compared to Proposed Project costs from five different accounting perspectives.

3.1 Annual Leases

The OID could continue the current Water Bank indefinitely. For this strategy, the cost of the OID Water Bank can be used to estimate the cost of acquiring water. The OID Water Bank leased water for $45 to $48 per AF per year. The PV of this cost is about $1,000 per AF. This would be the direct cost to the Fish and Wildlife Fund.

From the perspective of power users, there is an economic benefit that should be counted as an offset to the cost of water acquisition. By eliminating consumptive use of Okanogan River water, water acquisition has a downstream hydropower benefit. This benefit should be taken into account in the three broadest accounting perspectives: regional power users, the Northwest, and the nation. However, the Fish and Wildlife Fund has no ability to "capture" this benefit, so it is not included in the Fish and Wildlife Fund perspective.

The Okanogan confluence with the Columbia is above the Wells hydroelectric project. Each AF flowing through downstream turbines at Wells and several other downstream dams would generate about 572 kwh which, if valued at $0.035 per kwh, is worth about $20.04. Two adjustments are required: 1) each fallow acre eliminates about 2.5 feet of consumptive use. Therefore, for each AF made available for use in OID, only 0.83 AF (2.5/3.0) can be provided as downstream flow; and 2) Some Columbia River flow is spilled past turbines. Under spill levels targeted under the 2001 Bi-Op, we estimate that about 30 percent of power generation from Wells to the ocean is lost because of spill.[7]

Therefore, of the $20.04 of potential power produced at downstream turbines per AF of additional water, only about $11.62 is produced per AF of water rights devoted to instream flow at Salmon Creek (.833 times .7 times $20.04). The PV of $11.62 for 50 years beginning in 4 years at 4 percent real interest is $245. The direct cost of water acquisition by use of the OID Water Bank was about $1,000 PV, so net cost to power users, the region or the nation would be about $755 ($1,000-$245) per AF PV.[8]

3.2 Purchase of Irrigated Land

If irrigated land were purchased, the reliability of the acquired water would be improved relative to leasing water. For this analysis, it is assumed that irrigated land would be purchased and the land would be converted to dryland agriculture in most years. The value of water to the seller is the difference between irrigated land value and dry land value. Current irrigated land prices in the area are about $2000 or less per acre for orchard land, and about $3000 for hay land (Barber, 2001). Dry land value is assumed to be $500 per acre. We assume that each fallow acre could make 3.0 AF available. The cost of land acquisition net of dryland value should then be about $500 [i.e., ($2000 - $500)/3] to $833 [i.e., ($3000 – $500)/3] per AF in PV terms, depending on whether orchard or hay land is acquired.

For a purchase arrangement, we assume that the new landowner would be required to continue paying District assessments to OID. These fees were $95 per acre in 2001, and $105 two years ago. For this analysis, $100 per acre, or $33 ($100/3) per AF per year, is assumed. The PV of $33 for 50 years beginning in 4 years at 4 percent real interest is $694. In addition, mandatory safety improvements for Salmon Lake Dam will cost about $9 million (USBR PNR 1999). Water users are required to repay 15 percent. The increased debt burden is about $270 per acre ($9 million times .15 divided by 5,000). This cost would be $90 (90/3) per AF in PV terms. According to the district manager, repayment of $1,425,000, or $95 per acre, will begin in 2014 and payments will continue until 2026 (Sullivan, 2001). The cost of $95 per AF in 2014 is $55 in

[7] Approximate spill percentages for each facility were obtained from Council staff. Each percentage was multiplied by each facility's percentage of developed head from Wells to the ocean. For example, Priest Rapids spills about 60 percent of flows and represents about 11.7 percent of developed head from Wells to the ocean. Therefore, Priest Rapid spill results in a loss of 7 percent (60 times 11.7) of potential power generation from Wells to the ocean. These products were summed over all facilities to obtain a total loss of 30 percent.

[8] In the short-term, this additional generation might be worth ten times as much during the next 12-18 months, or $200/AF. If short-run power prices are used, the economic benefit might offset totally the cost of acquisition, making water acquisition a benefit to both fish and power system users.

PV terms. Therefore, the cost of water acquisition with OID assessments would be $1249 ($500 + $694 + $55) to $1582 ($833 + $694 + $55) per AF in PV terms. This is the cost that would be paid by the Fish and Wildlife Fund.

Adjustments are required to derive costs from the perspective of power users, the Pacific Northwest region, and the nation. First, all of these perspectives obtain the offsetting benefit of increased downstream hydropower production (see Section 3.1). This reduces the cost range to $1005 ($1249 - $245) to $1337 ($1582 - $245).

Finally, the OID assessment costs would be paid annually by the Fish and Wildlife Fund. However, these assessments are fixed costs from the broader Northwest and national perspectives, and so they drop out of the analysis at these higher levels. The Proposed Project, even with the modifications suggested here, does not affect these costs. Without the project, they are paid by landowners, and with the project, they are paid by power users, and both of these groups are included in the Pacific Northwest perspective. From the Northwest and national perspectives, the change in the responsibility to pay the fixed costs is irrelevant and immaterial. This reduces the costs of water acquisition by purchase of land to $255 ($1005 - $694 - $55) to $588 ($1337 - $694 - $55)

This cost is less than the cost of firm yield in the Proposed Project from the Pacific Northwest or national perspective ($1,708 or $2,032 per firm AF PV, respectively, Table 3). The yield of water acquisition should be perfectly reliable, so this should be a valid comparison. Water acquisition appears to be especially economical in comparison to two elements: the Salmon Lake Dam raise ($12,628 per firm AF PV), and the Okanogan River pump station ($2,018 per firm AF PV). It is recognized that these elements have larger average than firm water supplies, whereas water acquisition has an average supply equal to its firm supply. The yield of the Salmon Lake dam raise in normal years is about 1,026 AF per year (Final Report, page ES-24) so cost per AF of normal-year supply is $2,817 ($2,980,251/1,026). The average yield of the Okanogan pump station in Table 3 was assumed to be 10,000 AF, so the cost per average AF is $1,460 ($14,596,860/10,000), still more than the cost of water acquisition.

Therefore, we conclude that, from the perspective of the Pacific Northwest Region, some water acquisition may be a cost-effective method of increasing Salmon Creek flows.

Table 5 compares the total cost of water acquisition and the Proposed Project from four perspectives. Costs to the Fish and Wildlife Fund might be minimized by pumping water from the Okanogan because local, favorable power prices can be obtained for pumping. From the somewhat broader perspective of power system users, the incremental cost of additional generation was used to value electricity for pumping, and water acquisition costs are net of downstream hydropower benefits. Still, costs of water acquisition are about equal to the Proposed Project.

From the perspective of the Pacific Northwest region, including all costs and benefits of regional residents, capital costs of the Okanogan pumping facilities must be counted, but costs of the OID assessment are not counted as part of the cost of water acquisition. Some water acquisition appears more economical than the Proposed Project. Finally, U.S. taxpayers must pay for costs of the Salmon Lake dam raise and feeder canal improvements. With this additional project cost, water acquisition appears even more economical.

3.3 Local Area Perspective and Benefits of Irrigated Production

The local area perspective includes benefits and costs of only those persons who live or work in the local area, perhaps Okanogan County. Water acquisition would have adverse effects on the local agricultural economy. Adverse local economic effects would contribute to an economy already depressed by market, institutional and regulatory impacts (Hansen, 2000; Highland Associates, 2000). On the other hand, the local area would pay for a very small share of Fish and Wildlife Fund costs, power user costs, State of

Washington costs, or national costs. We have not provided a numerical estimate, but this may explain why water acquisition is viewed unfavorably by local interests.

Table 5.
Costs and Benefits of Salmon Creek Restoration Options from Four Accounting Perspectives

Accounting Perspective	Description of Benefits and Costs Included in Proposed Project	Proposed Project PV Cost		Water Lease Cost, $ per firm AF	Land Purchase PV Cost, $ per firm AF
		Total, in $1000 [1.]	$ per firm AF [2.]		
Fish and Wildlife Fund	Environmental documentation costs, pumping costs at local price	$5,688	$617	$1000	$1249-$1582
Power system users	Includes power system user opportunity cost of hydropower consumption/production	$7,872	$854	$755	$1005-$1337
Pacific Northwest Regional residents	Includes Okanogan R. diversion capital costs, all other costs except Salmon Lake dam raise.	$15,745	$1,708	$755	$255-$588
United States (U.S. Taxpayers)	All costs included. Most indirect surpluses captured by other U.S. industries: some captured by foreigners	$18,725	$2,032	$755	$255-$588

1. Cost estimates for the Proposed Project are from data provided to the Council (CCT, 2000b). Interim Water Bank not included.
2. Interim Water Bank not included. Firm water supply is average annual available during the critical period of the 1930's drought. Average supplies are larger, so cost per unit of average supplies would be less.

The extent to which local economic effects of water acquisition should be counted from the regional or national perspective is a legitimate issue. First, the cost of leasing or buying land should reflect the net revenue that the landowner expected to make, so the lost net revenue is fully compensated by the voluntary lease or sale by the landowner. However, any loss of secondary economic activity is not directly compensated. This loss is the net revenues in forward linked industries, such as apple storage and processing facilities, and backward linked industries such as nurseries and farm stores.

The local area adverse effects may not be economic costs from the perspective of the Pacific Northwest region. This is because the larger region may obtain an offsetting benefit from water acquisition in the Okanogan area. This benefit occurs if agricultural prices are increased by the reduced production, or if the production lost in the local area is shifted to another area within the Pacific Northwest region. The water acquisition analysis has implicitly assumed that either this shift occurs, or that local linked industries did not experience significant net revenues to start with. However, the improved prices or replacement production may benefit areas outside of the region or even outside of the United States. This situation would require additional analysis to determine how the cost-effectiveness of water acquisition from the perspective of the region or nation should be affected.

3.4 Uncertainties and Attributes

There are several uncertainties about future conditions and operations that will affect the cost-effectiveness of water acquisition.

Future electricity prices are uncertain. A lower electricity price would reduce pumping costs. On the other hand, continuation of the current, high short-run cost of electricity would justify even more expensive acquisition of water rights.

The current price for orchard land is far below recent prices and costs for developing orchards. Realtors say the asking price for an acre of prime orchard land has dropped from more than $7,000 to less than $2,000 in three years. "But there's no buyers regardless of price," said Realtor Gary Barber (Hansen, 2000). Land prices could increase if apple market conditions improve, and water acquisition would become less cost-effective.

The low cost and significant supply obtained by the OID Water Bank in 2000 and 2001 might be attributed, in part, to the current dismal conditions in agricultural markets. Some landowners were probably just happy to have earned some income to pay their District assessment. Prices might be higher, and supplies might be lower, in the future.

Some orchard acreage is available for $2,000, but the amount of acreage available in this price range is unknown. The $2,000 figure represents the cost of an acre of apple trees that is fully depreciated and offered on the market at a relatively low price. Depreciation occurs because trees are too old to produce economically, or because market preferences have shifted so that the existing type of trees is not economically viable. Apparently, market factors have decreased the value of red delicious apple trees. The trees may be viewed as a liability since a cost is required to remove them. Much orchard acreage is in more economical apple varieties, and trees are younger. This acreage would not be available at

$2,000 an acre. A developed acre of producing apples can cost up to $15,000. Also, market factors may increase land prices in the future, and prices might increase if a large buyer came on the market. For these reasons, the cost of future water acquisition over a large range of acquisition amounts cannot be determined.

Increased reliance on water acquisition would affect the selection, scope and costs of other elements included in a modified proposal. Clearly, costs devoted to some other proposed measures would decline but the actual cost savings are unknown. If the Salmon Lake dam raise could be avoided, then water acquisition of 236 acre-feet could save about $2.9 million or about $12,628 per acre-foot. These savings could be put to better use by adding water acquisition to the Proposed Project, or perhaps even by being diverted to some other project entirely. The next-most expensive element is Okanogan River pumping. An acre-foot of water acquisition would displace pumping and reduce the variable cost of pumping by $676 in PV terms (Table 4), but it is unclear how operating, maintenance or facility costs might be reduced. If these costs can not be reduced much by water acquisition then pumping might be more cost-effective than water acquisition.

With these many uncertainties, results are close enough so that we cannot say that water acquisition is definitely cost-effective, or that the Proposed Project is not cost-effective because water acquisition was not considered. However, we can say that water acquisition appears to be another element that might be used to reduce costs of Salmon Creek restoration.

It is also important that the different Proposed Project elements are not strictly comparable on a cost-effectiveness basis because they have different attributes. Cost-effectiveness analysis is unambiguous when alternative costs can be paid to obtain the same, identical good. In this case, however, the water acquired by water acquisition and the results of the Proposed Project elements are not identical. Each element provides water under different patterns at different times and places.

This difference is especially notable for the Salmon Lake dam raise and feeder canal improvements. The unit cost of this element compares poorly to other project elements, but it is the only element that can actually increase the usable supply for instream flow from the Salmon Creek system. In very dry years there is not enough yield in Salmon Creek to meet instream flow needs even if OID uses no Salmon Creek water, so the Salmon Creek improvements are unique in being able to meet this need. All other elements reduce use of Salmon Creek water within OID. Once OID use of Salmon Creek water is reduced to zero they cannot provide any more water to Salmon Creek.

Water acquisition is different from all other elements in several ways. It is the only approach that can substantially reduce consumptive use of water in the basin. Therefore, it is the only element that could increase Okanogan River flows. This is an important attribute in dry conditions. On the other hand, the adverse local economic effects of fallow land are also unique to water acquisition.

Many variations on water acquisition are possible, and each would have some different attributes. If land is purchased, some acquired land could be leased back for farming when conditions are favorable. It may also be possible to work out an option arrangement. The landowner would receive a fixed payment each year for a specified period in order to preserve an option to fallow land. An additional price would be paid in years when the water was actually used. The option arrangement may provide more certainty than the annual Water Bank, but less than water acquisition. Any of these programs could work through the Washington Water Trust as is currently practiced.

3.5 In conclusion, the OID Water Bank and/or some other method of acquiring water should be a permanent part of the Proposed Project. Price offered for water should be contingent on energy prices and hydrologic conditions.

The cost-effectiveness analysis of water acquisition above is limited by its ability to consider many factors that can not be known now, but will vary from time to time in the future. Water acquisition is a tool that might increase the overall cost efficiency of restoring Salmon Creek flows. It could reduce the efficiency of the Proposed Project if applied poorly. To work well, the amount of water acquisition and the price paid for it will vary from year to year. Landowners must face price signals each year that reflect the cost of other, marginal water supplies. At this price, there may be no takers, and this simply means that water acquisition is not economical that year.

Water acquisition and other project elements have different attributes that make cost comparisons difficult. These same attributes, however, are also a reason for including water acquisition in the Proposed Project. Water acquisition can contribute to a diverse portfolio of water supply options that can be drawn on as circumstances change. In particular, water acquisition should be more economical, and constitute more of the mix, when electricity prices are high, when hydrologic conditions are dry, when Okanogan flows are low, when agricultural market conditions are poor, or when irrigation is less profitable for other reasons.

4.0 Other Changes to the Proposed Project to Consider

There are other modifications to the Proposed Project that might increase its cost-effectiveness. Some modifications would avoid potentially unreasonable costs to power system users when electricity prices are high. Other elements not carried into Phase II may be less expensive than those in the Proposed

Project. Specifically, some options for water exchange from the Okanogan River are less expensive than the proposed 80 cfs diversion.

It should be noted that some elements carried into Phase II may be more expensive than estimated in Table 3. In particular, the water conservation options in Table 3 may be more expensive than shown because the conservation may have uncounted adverse effects on other water users and environmental values. The Phase II report may clarify some of these costs.

4.1 With water acquisition and/or other modified elements, the 80 cfs Okanogan River diversion may not be optimally sized

The 80 cfs Okanogan diversion, with water available from Salmon Creek above instream needs, and other supply sources, would allow OID to have a very reliable water supply. With water acquisition or leasing only in very dry years, some reduction in the size of the proposed diversion might be cost-effective. The Final Report (p 3-50) found that, with no flow restrictions on the Okanogan, "relatively little gain in instream flow benefits are made with the larger pump" in comparing a 40 and 80 cfs diversion. "Further modeling analyses of other pump capacities can be performed to find the optimum pump capacity."

Using the model Water System Operation #A12, with Shellrock removed, reducing capacity of the Okanogan diversion from 80 to 70 cfs has a very small effect (45 AF average) on water pumped. With the WAC restriction, the difference is even less (27 AF average). That is, a reduction in capacity of 12.5% results in an average pumping reduction of 0.4%. Even if cost savings from the 12.5% capacity reduction were small, these savings might be justified by the even smaller loss of water supply.

4.2 It may be cost effective to reduce Salmon Creek instream flows in some years

All of the cost-effectiveness analyses in the Final Report and this report do not consider how much cost might be avoided if Salmon Creek flow requirements could be reduced in very dry years. The 80 cfs Okanogan diversion alone can not meet all Salmon Creek instream flow regimes under all conditions (Final Report, p. 3-50). It is not clear what costs could be saved with little or no effect on Salmon Creek flows, or by how much flow might be affected, or how these flow reductions would affect anadromous fish. To answer these questions, a biological analysis of the value to the fish of increased flows in Salmon Creek during very dry years should be coupled with an economic analysis of the costs that could be saved by not ensuring that flows are sufficient in very dry years.

4.3 Groundwater pumping and conjunctive use has not been fully considered as a water supply option

Conjunctive use involves additional recharge of surface water to ground water in wet years with extraction of the recharged water in dry years. The Final Report examines a limited range of conjunctive use options. The Final Report considers water storage in the Salmon Creek watershed (p. 4-41) and recharge of Salmon Creek water (p. 3-56). With the Okanogan River diversion, conjunctive use of Okanogan River water might be possible using aquifers outside of the Salmon Creek watershed. It is not clear that this option has been fully explored.

4.4 The existing Shellrock diversion may be inadequate as a source of additional water from the Okanogan River, but the available public documentation suggests that it should be evaluated in more detail.

The Shellrock Point Pumping Plant was built on the Okanogan River in 1977-1978 to replace two smaller pumping plants. The Shellrock plant is used mostly in dry years when Salmon Creek supplies are inadequate. During the 1987 to 1998 period an average of 1,416 AF were pumped (Final Report p. 3-25; see also Figure 3-8, p. 3-30). The plant has four pumps, each with a capacity of 8.3 cfs. Lift is 620 feet. Each drive motor is rated at 800 horsepower. The Final

Report implies that the Shellrock station could provide more water at a reasonable cost. On page 3-26 “Shellrock pumping station can potentially pump up to 8,700 acre-feet during the irrigation season. Since the maximum annual quantity of pumping during 1987-1998 was only 4,679 acre-feet, the total supply capability of Shellrock is only partially used. . .” This implies that Shellrock could provide an additional 4,000 acre-feet annually. On page 4-19 “In our opinion, the station could be upgraded to take the full OID Okanogan River water rights (35 cfs). . .The new pipeline, intake screens with ancillary utilities, are estimated to cost about $0.43 M.”

This option appears to offer potential to increase cost-effectiveness of the Proposed Project, but it is never fully evaluated in the Final Report. The location of the pump station intake, in a back channel of the Okanogan River, may be prone to continuous siltation, and the pump not a reliable source of water when flows are low (CCT, 2001a). If this is true, it should be documented for the Council.

5.0 The Proposed Project would have multiple benefits that justify the partial cost share proposed for power system users

Power system users are being asked to pay about half of the cost of the Proposed Project, and this is appropriate, because the Proposed Project would have a variety of water supply and economic benefits for OID water users and others. The purposes of the project include water supply enhancement and more reliable water rights for OID, and the Proposed Project is also fulfilling these purposes. Economic benefits include:

1. Increased water supply reliability for irrigation in dry years

   Because of hydraulic problems, the Shellrock plant can currently use only 25 cfs of its capacity. The water supply model estimated that, at this capacity, water shortages would occur during extended drought as occurred during the 1930s. Some or all of this shortage would be eliminated by the Okanogan River diversion.

2. Increased spills into Duck Lake, increasing water supply and groundwater recharge from Duck Lake.

   The water supply model suggests that the Okanogan River diversion would increase spills into Duck Lake. These spills would become additional water supply by seepage and by Duck Lake pumping.

3. More stable water levels at Conconully Reservoir. This would be an economic benefit to recreationists and landowners around the lake.

   Conconully Reservoir is the smaller of the two reservoirs in the area; it has 5 miles of shoreline. Four roads provide good access. There are three campgrounds but the reservoir area is used predominantly by picnickers. The reservoir offers good fishing. Washington State Parks and Recreation Commission administers recreation at Conconully Reservoir.

Salmon Lake has 8 miles of shoreline and is served by one access road. There are two campgrounds on the lake, and two concessions provide lodging and rental boats. There is excellent trout fishing. Some of the upper reservoir area lies within the boundaries of the Okanogan National Forest which administers recreation for that portion. Recreation administration of the remaining reservoir area is by the Okanogan Irrigation District.

The water supply model suggests that water levels in these reservoirs would be more stable with the Okanogan River diversion. "If Conconully and Salmon Lake reservoirs are operated for instream flow supply only. . . .Reservoir elevations would average much higher compared to that under an operations for irrigation supply because storage drawdown would occur less frequently." (Final Report, p. 3-47, see also Figure 1D-1).

4. Restoration of local fisheries will provide recreational opportunities for residents and increased opportunities for tourism.

5. Reduced costs of Shellrock pumping in dry years.

   The water supply model estimates that, with the Shellrock plant able to pump 35 cfs, average pumping would amount to 2,147AF, while 1,416 AF were actually pumped on average during 1988 to 1989. Some or all of this pumping would be eliminated by the Okanogan River diversion. Shellrock pumping costs are usually paid by OID, and these costs would be avoided when the Shellrock plant is closed.

6.0 Summary of Considerations by Accounting Perspective

Cost-effectiveness is a measure that requires a determination of whose costs should be counted. Accounting perspective is an economic term that defines whose costs are being counted in an analysis. The choice of an accounting perspective is, in large part, a value judgment. If the Council chooses to count Fish and Wildlife Fund costs only, then only some of power system users' costs are counted, because power system users are also affected by regional hydropower production and its costs. If only power system users are counted, then the impacts on Pacific Northwest residents through general taxation, changes in business activity, employment, and recreational amenities are not considered. Power system users are also taxpayers, business owners, workers, and recreationists.

In the case of the Salmon Creek Project, the choice of an accounting perspective could be an important factor affecting the relative merits of alternative approaches. The "best" approach depends on whether we count just fish and wildlife program costs, or power system user costs, or costs to the Okanogan region, or State costs, or even national costs. Our analysis has shown that

- Costs to the Pacific Northwest Region might be minimized by water acquisition, but possible negative economic impacts from reduced agricultural production are of great concern in the local area, especially when compared to other approaches that increase net spending in the region;

- Costs to the Fish and Wildlife Fund may be minimized by the Proposed Project, but this approach does not include other important regional costs include hydropower opportunity costs and capital costs for Okanogan River pumping.

- The Proposed Project would provide economic benefits to the local area in terms of improved water supply reliability, spending for irrigation system improvements, and restored anadromous fisheries. Tourism and recreation have been a growing segment of the local economy. Fisheries restoration would likely have benefits for these activities. Benefits are obtained by locals and tourists, and the businesses who sell to them. Most of these benefits could be obtained with a project that includes some water acquisition.

7.0 Limitations on our conclusions

Our evaluation is somewhat limited. First, we have not compared cost-effectiveness of Salmon Creek restoration to restoration in other streams. Second, we have not compared cost-effectiveness of alternative management elements such as hatcheries. Third, we have not compared alternatives in terms of resulting numbers of fish. Finally, we did not evaluate the Salmon Creek plan for streambed and streambank modifications. These modifications must occur with any instream flow program. Our limited evaluation compares costs of different approaches for increasing Salmon Creek flows. The result, in terms of number of fish escapements or other population measures, cannot be forecast with the available data.

Ideally, the Council would compare the Salmon Creek approach for restoring the target species to approaches in other locations. Restoration could be targeted to other rivers in the Upper Columbia River, including the Okanogan, Methow, Similakameen, Entiat or Wenatchee. There is currently no basis for comparison of approaches across river basins because 1) costs in other basins are unknown, and 2) the effectiveness of the approaches in each basin, including Salmon Creek, in terms of increasing escapement are also unknown. Some cost data are probably available but escapement increases due to stream restoration are not.

8.0 Compliance with IEAB's standards in the water markets paper

The IEAB has previously addressed economic standards for the acquisition of water rights in its report titled ***Economics of Water Acquisition Projects***. In this section, we compare the Salmon Creek Project against those standards.

- Make use of existing expertise and existing markets in water acquisition.

The Salmon Creek Project has developed a temporary water marketing mechanism, the OID Water Bank. Water has been used for instream flows under existing laws using the Washington Water Trust. Under the Proposed Project, the OID Water Bank would be phased out. On this score, the Proposed Project shows only limited success, and thus the IEAB recommends that options for water acquisition be kept open.

- Require careful justification and documentation of proposed acquisitions.

The Final Report is an excellent start to justification and documentation of the Proposed Project. The OID Water Bank is adequately documented, but water acquisition is not considered. The Phase II report should provide even better documentation of proposed water supplies and their costs.

- Embed water acquisition in broader planning framework

Water acquisition was not fully considered in the analysis. Arguably, water acquisition was considered within a local decision-making process that considered impacts on the regional economy. The Phase I analysis did consider other water supply options together with habitat restoration needs, watershed planning, and regional water supplies. Streambed and streambank restoration has been considered, and passage and screening improvements required to protect the restoration investment have been planned or completed. The cost-effectiveness of this Proposed Project compared with other uses of the Fish and Wildlife Fund was not possible.

- Foster market competitiveness through transparency

Transparency refers to market structures that make prices, quantities and terms of sale readily visible to all potential participants. There is not a competitive market for water in the region. The way the Council, the OID and the CCT choose to implement the IEAB recommendations would determine, in part, the transparency of the process.

- Weigh the advantages and disadvantages of leasing versus buying

Acquisition of water rights or land was not considered as an option in the Final Report. Therefore, the relative merits of leasing versus buying were not considered.

This analysis suggests that permanent water acquisition costs are more than leasing costs. OID Water Bank water cost $45 to $48 per AF per year, or roughly $1000 in PV terms. The landowner continued to pay the OID assessment. This report estimated that land acquisition would cost $1249 to $1582 per AF PV before counting downstream hydropower values. The lower cost for water leasing from the OID Bank may be attributable to the fact that water from temporarily unproductive land was offered to the Bank. Purchase of land might cost more, but it would provide more certainty that water will be available in future years.

- Encourage development of contingent water markets

The Proposed Project includes the temporary Water Bank. No permanent contingent markets are being considered. The IEAB recommends that, with the Okanogan River diversion in place, the OID Water Bank should continue to lease water contingent on electricity prices, land values, and fisheries needs.

- Be willing to support infrastructure improvements

The Final Study considered a wide range of infrastructure and management improvements, and the IEAB recommends that some improvements (e.g., Okanogan diversion sizing and conjunctive use) continue to be investigated.

- Land value is an upper bound to the value of water for irrigation

Land value was not used as an upper bound to cost of water supplies in the Final Report because land acquisition was not considered to be a viable water supply element. The IEAB has used land value as a way to value water and provide an upper bound to show at what cost irrigated land should be acquired.

- Time the process to maximize avoided costs in irrigation

Farmers must pay some costs to remain in business in the long run. These costs can not be avoided by land fallow in the short run, but they can be avoided if the farmer stops farming entirely. Permanent water acquisition usually maximizes avoided costs, because land may be permanently fallow, so permanent acquisition tends to be less expensive than leasing in the long run. This report has found that water acquisition costs appear to be comparable to water leasing costs, but leasing costs may be temporarily depressed because of poor agricultural market conditions.

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