Department of Ecology Office of Columbia River: The Last Ten Years

by

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Executive Summary

In 2006, the Washington Legislature tasked the Washington Department of Ecology (Ecology) to "**aggressively seek out new water supplies"** for both instream and out-of-stream uses (emphasis added*). RCW 90.90.005(2).* The same legislation set up the Columbia River Basin Development Account and authorized $200 million to fund it, much of which has been spent or committed according to OCR's 2015 Water Supply Inventory Report to the Legislature. Ecology created the Office of Columbia River (OCR) to use these funds to develop new water supplies using storage, conservation, and voluntary regional water management agreements.

In the required January 2016 report to the Washington State Legislature, the OCR reported that it had funded projects that have cumulatively developed about 396,000 acre-feet of water, with an additional 320,000 acre-feet or more in near-term development i.e. in the 2015-2019 period.

Our analysis of OCR provides a critical overview of OCR's expenditures since its creation. In light of our findings, summarized in the following conclusions and supported by the analysis contained in this report, we recommend that the Washington State Legislature not provide additional funding to OCR until a performance audit on OCR is prepared for the Legislature:

a. **A significant amount of the approximately 400,000 acre-feet of water that the Office of Columbia River (OCR) reports as having been "developed" during the first decade of OCR's operations is not from "new" water supply production.**

b. **The approximately 400,000 acre-feet of water that the Office of Columbia River (OCR) reports as having been "developed" during the first decade of OCR's operations is, for the most part, not water that currently has been put to productive use**.

c. **There are hundreds of millions of additional taxpayer investment dollars that would be required over the next decade or more before all of that OCR "developed" water can actually be put to productive use**.

d. **Listing water as "developed" when financing has not been arranged to put that water to use exaggerates OCR's accomplishments and understates the costly taxpayer investments that will be required to put that water to use.**

e. The OCR and BOR funded Yakima Plan is based on speculative fish production benefits to justify funding large and expensive surface water storage facilities.

f. Doing an aggregate benefit-cost analysis on the Yakima Plan, as the OCR and BOR chose to do, hides projects that generate major net costs among those that generate net benefits.

g. To economically justify large Yakima Basin surface storage projects, the enhanced instream flows facilitated by those surface water storage projects would have to be implausibly effective at increasing salmon production and/or the incremental salmon production would have to be assigned indefensibly high economic values.

h. In addition, within the Yakima Basin, it would be far less costly to provide the planned enhanced in-stream flows through the buying of water rights that divert water flows to out-of-stream uses, leaving the water in the rivers rather than building new or expanded large surface water storage facilities.

i. The proposed surface water storage projects OCR envisions being carried out in the Yakima Basin over the next three decades would be very expensive to Washington State and its citizens, costing Washington taxpayers as much as $2 billion.

j. The proposals to actively manipulate the level of many lakes in the Alpine Lakes Wilderness through the construction of new dams, modification of other dams, and installation of mechanical and motorized equipment within a well-known and spectacular National Wilderness Area need critical economic scrutiny.

k. OCR's 2105 Columbia Basin Water Supply Inventory Report begins with an explicit criticism of the efficacy of water conservation efforts and an argument in support of giving priority to investments in surface water storage, the most expensive elements of the OCR's plans. OCR's critique of the efficacy of water conservation compared to building surface water storage facilities is misleading in several ways.

i. OCR's critique equates water conservation with improvements in the efficiency with which water is applied to crops. There are many other important types of water conservation besides improving the efficiency of irrigating crops.
ii. Even in the context of efficiency in the amount of water applied to crops, that improved efficiency can moderate the impact of irrigation on in-stream flows at the points of diversion. It can also reduce the loss of water to evaporation, evapotranspiration, and deep water aquifers.
iii. Low in-stream flows due to irrigation withdrawals often lead to efforts to enhance the in-stream flows by building more surface storage to be used to maintain in-stream flows. For instance, about half of the planned surface water stored by the proposed Wymer Dam and Reservoir would be used to enhance in-stream flows rather than delivering water to out-of-stream uses like irrigation.

iv. OCR's own analysis of a broad range of water conservation projects demonstrates that water conservation can provide water for out-of-stream uses in a cost-effective manner.

I. Over the past 10 years, the OCR has wasted millions of dollars on new dam studies for projects that have been demonstrated to be uneconomical with substantial adverse environmental impacts.

Table of Contents

I. The Water Supply "*Developed"* by the Office of Columbia River 2006-2016

A. The 2015 Inventory of Accomplishments of the Office of Columbia River

In 2006, the Washington Legislature tasked the Washington Department of Ecology (Ecology) to "*aggressively seek out new water supplies*"[1] for both instream and out-of-stream uses (emphasis added). The same legislation set up the Columbia River Basin Development Account and authorized $200 million to fund it, much of which has been spent or committed according to OCR's 2015 Water Supply Inventory Report to the Legislature.[2] Ecology created the Office of Columbia River (OCR) to use these funds to develop new water supplies using storage, conservation, and voluntary regional water management agreements.[3]

OCR, in turn created a Columbia River Basin Water Management Program - Policy Advisory Group (PAG), which meets four times a year. The PAG is made up of 27 federal and state agencies, including the Bureau of Reclamation (BOR), tribal members, irrigation districts, cities and counties, and three "environmental" members, of which one seat is listed as open, and one member, the Washington Environmental Council, has a seat at the table, but according to meeting minutes, has not attended meetings in several years.[4]

In early 2016 the Washington Office of Columbia River (OCR) submitted the "2015 Columbia River Basin Water Supply Inventory Report" to the Washington Legislature.[5] That Report listed 38 projects categorized as "developed", "near-term development (2015-2019)", and "long-term development (2019+)." The 17 projects labeled "developed" between 2006 and 2015 were said to provide a total water supply of 395,700 acre-feet. A similar inventory in 2016 listed two additional projects as "developed" so that the total of "developed" water 2006-2016 was listed as 410,376 acre-feet.[6] Those totals of "developed" water included water for both out-of-stream uses (e.g. irrigation) and in-stream uses (e.g. river and fish habitat).

These OCR inventories of "developed" water supply projects included the "Lake Roosevelt Incremental Storage Releases" and the "Odessa Subarea Groundwater Replacement" projects. Each of these projects was very large compared to the other listed OCR developed projects. The Lake Roosevelt Incremental Storage Release was listed as providing 132,500 acre-feet and the Odessa Subarea Groundwater Replacement was listed as providing 164,000 acre-feet. Just those two projects together represented 296,500 acre-feet, *about three-quarters of the total water supply* reported by OCR as developed between 2006 and 2016.

With federal funds appropriated to stimulate the economy during the Great Depression, groundbreaking for a *low* Grand Coulee Dam on the Columbia River was held on July 16, 1933. Legal challenges to the construction of the dam without specific authorization from Congress led to formal congressional authorization of the Grand Coulee Dam in 1935. What was authorized was a multi-purpose dam that not only would generate electricity but would also, among other things, store water for delivery to irrigate ("reclaim") public lands. That required a much larger

[1] RCW 90.90.005(2).
[2] Ecology Publication Number 15-12-006, January 6, 2016, p. 13. Required under RCW 90.90.040.
[3] http://www.ecy.wa.gov/programs/wr/cwp/cr_overview.html
[4] http://www.ecy.wa.gov/programs/wr/cwp/cr_pag.html
[5] https://fortress.wa.gov/ecy/publications/SummaryPages/1512006.html
[6] http://www.ecy.wa.gov/programs/wr/cwp/images/pdf/waterdev.pdf

and higher dam that created Lake Roosevelt as a large storage reservoir. The dam was completed by the end of 1941and the larger project of which the Grand Coulee Dam was to be a central part, the Columbia Basin Project, was approved by Congress in 1943.[7] In addition to the construction of the dam, the larger project required a series of large pumps that could move water out of Lake Roosevelt up into Banks Lake and a system of canals, pipelines, siphons, and pumps to distribute that water throughout the Columbia River Basin, primarily to benefit and promote small farming operations. The full BOR Columbia Basin Project has never been completed due to costs of doing so.[8]

Both the Lake Roosevelt Incremental Storage Releases and the Odessa Subarea Groundwater Replacement Projects seek to extend the delivery of water from Lake Roosevelt to some areas not previously reached by the Columbia Basin Project.

For this additional Lake Roosevelt water to reach all of the planned locations in the Odessa Subarea, canals, siphons, pumps, and pipelines will have to be upgraded or newly built at considerable cost. This is especially true of the Odessa Subarea Groundwater Replacement Project that would deliver 164,000 acre-feet of surface water to irrigate 70,000 acres currently served by deep groundwater pumps. The Washington OCR and U.S. Bureau of Reclamation (BOR) estimated that the Odessa Subarea project would cost $828 million or about $11,800 per acre served to actually deliver this surface water to those acres were the groundwater would be replaced.[9]

Table 1 summarizes these OCR/BOR projects aimed at bringing Lake Roosevelt surface water to the Odessa Subarea.

B. OCR's Meaning of "Developed Water"

The inclusion of a project in the OCR list of developed projects does **not** mean that the project is actively delivering all or any of the listed water to irrigators and municipalities, which are actually using that listed water supply. "Water development," to OCR, simply means that a certain amount of water at a particular geographic location is physically and legally available for transportation and deployment, **if** someone is able to fund the necessary infrastructure to get the water to potential users and fund the necessary equipment so that that water can be put to use.[10]

"OCR's development of water supply" means that OCR through the Department of Ecology has provided the "permitting, environmental review, funding, or other partnership" to which Ecology had committed. "For instance, once OCR has issued a new water right under one of [its] permitting programs, the impetus for continuing the project then falls on the permittee to provide

[7] For Columbia Basin Project history see "The Columbia Basin Project," Wm. Joe Simonds, Bureau of Reclamation, 1998, http://www.usbr.gov/pn/grandcoulee/pubs/cbhistory.pdf . For a history of Grand Coulee see *Grand Coulee: Harnessing a Dream*, Paul C. Pitzer, Washington State University Press, 1994.
[8] http://www.usbr.gov/pn/grandcoulee/pubs/cbhistory.pdf
[9] Odessa Subarea Special Study, Columbia Basin Project, Washington, Final Environmental Impact Statement, prepared by Office of Columbia River, Washing Department of Ecology and the U.S. Bureau of Reclamation, August 2012, Table 2-11, p. 133.
[10] "…after water has been developed, OCR has encountered delays in users' ability to deliver the water for its intended purpose. This encompasses many factors, including financial delays, infrastructure and construction delays, permitting by other agencies, or other user induced delays." p. 3 of "2015 Columbia River Basin Water Supply Inventory Report," submitted to the Washington State Legislature, Ecology Publication Number 15-12-006.

the necessary infrastructure to deliver water for their intended use…Delays may occur at this stage outside of OCR's control." [11] Given that OCR typically funds only a limited part of the required water delivery infrastructure, a "developed" project may not actually put the water to use for a considerable period of time because of the lack of funding.

Table 1.

Bureau of Reclamation and Office of Columbia River Projects to Delliver Irrigation Water to the Odessa Subarea

Project	Approval Date	Planned Water Delivery (acre-feet)	Actual Water Delivery (acre-feet)	Comment
Columbia Basin Project	1943	6,500,000	3,500,000	For all of the Columbia Basin. Odessa Subarea was originally included but not served.
Lake Roosevelt Incremental Storage Releases Project	2009	30,000 to Odessa Subarea	Delivery systems not in place	132,000 ac.ft. total during drought years. 30,000 ac.ft. to go to Odessa Subarea.
Odessa Subarea Groundwater Replacement Project	2012	164,000	Infrastructure unfinished; delivery systems not in place.	Upgrade in infrastructure proceeding as funding is available.

Sources: "Water to the Promised Land," Tim Steury, *Washington State Magazine* Fall 2013.
Final Supplemental EIS for the Lake Roosevelt Incremental Storage Release Project, Office of Columbia River,
August 2008; Bureau of Reclamation Evnironmental Analysis and Finding of No Significant Impact, June 2009;
Joint OCR-BOR FEIS Odessa Subarea Special Study, August 2012.

OCR lists the Odessa Subarea Groundwater Replacement project as one of the projects for which it has "developed" 164,000 acre-feet of irrigation water in the Odessa Subarea, where that newly developed water will replace existing but failing groundwater-based irrigation. The Bureau of Reclamation's Columbia Basin Project (CBP) was authorized over 70 years ago, in 1943.[12] According to the BOR, the delivery of Grand Coulee surface water to the Odessa Subarea is part of that original authorized project. [13] But the infrastructure to reach that area with water from Lake Roosevelt behind Grand Coulee Dam was long delayed, and farms in the

[11] Ibid.
[12] "The Columbia Basin Project," Wm. Joe Simonds, Bureau of Reclamation History Program, 1998. http://www.usbr.gov/pn/grandcoulee/pubs/cbhistory.pdf , p. 12.
[13] Lake Roosevelt Incremental Storage Release Project, Bureau of Reclamation Finding of No Significant Impact and Final Environmental Assessment, June 2009, p. 5.

Odessa Subarea were given "temporary" permits to pump groundwater to irrigate their lands while they waited for more of the "developed water" in Lake Roosevelt to be delivered to the Odessa Subarea.[14]

Over past decades, the pumps to move water from Lake Roosevelt up to Banks Lake so that it could then flow, largely by gravity, to farms in the Columbia Basin, including some of the farms in the general Odessa area, were built and a system of canals was constructed that delivered water to irrigate about 670,000 acres of farmland in the Columbia River Basin. This represents about 65 percent of the total of just over a million acres authorized to receive CBP water.[15] The actual water delivery to the Columbia Basin was only about half of the 6,500,000 acre-feet for which the CBP was designed and authorized.

Because of the cost of the required infrastructure and reluctance of some farms to embrace Bureau of Reclamation deliveries of water, the "developed" water associated with Grand Coulee Dam, its pumping system into Banks Lake, and the canal system moving the water into the Columbia Basin never reached parts of the Odessa Subarea. As a result, the "temporary" groundwater pumping for irrigation there continues to the present time, seriously depleting that groundwater aquifer.

Clearly authorizing and "developing" water does not automatically allow additional water to be used. The cost of delivering the water for actual use also has to be funded in one way or another. Those funding delays, as shown in the Odessa Subarea, can last many, many, decades despite the "availability" of the water in Lake Roosevelt.

For instance, the Lake Roosevelt Incremental Storage Releases Project approved in 2009 could not move water to the part of the Odessa Subarea most in need of groundwater replacement because:[16]

> After securing a new source of water from the Lake Roosevelt Storage Releases Project, OCR faced a new challenge: There was no way to deliver it to the southern part of the Columbia Basin. Interstate 90 was the problem. There was only one point, the Weber Siphon Complex, where water from the Columbia Basin Project passed under I-90, and it wasn't large enough to handle the additional flow. A second siphon would be required...OCR contributed $800,000 for the design and worked with Reclamation and Washington's congressional delegation to get stimulus funding for construction.

[14] It should be pointed out that over-pumping groundwater so that other groundwater users' wells were depleted was not "authorized." Washington law (WAC 173-130A) forbids such damaging over-pumping of ground water but was never enforced. In addition, many irrigators in the Odessa area lie outside of the Columbia River Basin and never were "promised" Columbia surface water. OCR's current efforts will not provide surface water to these irrigators either.

[15] Record of Decision for the Odessa Subarea Special Study Final Environmental Impact Statement, Columbia Basin Project, Washington, Bureau of Reclamation, April 2, 2013, p. 3.

[16] "The area south of I-90 has experienced the greatest declines in ground water levels and there is a high demand for replacement water supplies." Final Supplemental Environmental Impact Statement for the Lake Roosevelt Incremental Storage Releases Program, August 29, 2008, Ecology Publication #08-11-034, p. 2-18. "Weber Siphon Project," Washington Department of Ecology. http://www.ecy.wa.gov/programs/wr/cwp/weber.html

If it had not been for the "Great Recession" and the federal stimulus spending on "shovel-ready" construction projects, this federal money to help move this "developed" water south of I-90 might not have been made available.

The 2012 Record of Decision prepared by the Bureau of Reclamation for the Odessa Subarea groundwater replacement project made clear that in implementing the decision to support the project the Bureau of Reclamation or federal government generally were not expecting to finance the project: [17]

> The State [of Washington] and the irrigators anticipate moving forward with non-Federal funding for the [Odessa Subarea groundwater replacement] project. The expected scenario would consist of the State funding construction of conveyance infrastructure (such as widening canals, siphons, and appurtenant structures) and irrigators funding distribution systems from the canal to the farm through local improvement districts, loans, or other funding mechanisms…Currently, no Federal funding is committed or expected for implementing this [Odessa Subarea Groundwater Replacement] project. It is possible that no Federal funding will be needed or available for full implementation of all phases of [the Preferred] Alternative 4A.

Thus, if this project is to move beyond OCR's theoretical "development" level to actual delivery and the use of that Columbia River surface water to replace ground water in the Odessa Subarea, the estimated $828 million cost of the Odessa groundwater replacement project will have to be obtained from Washington taxpayers and/or the Odessa Subarea irrigators who get the benefit of a surface water supply replacing their deteriorating groundwater supply. This irrigation water supply is not in any practical sense "developed" at this point in time.

As mentioned above, some investments in the infrastructure necessary to move replacement water from Lake Roosevelt to Odessa Subarea groundwater irrigators *have* already taken place, funded by the 2009 American Recovery and Reinvestment Act that sought to stimulate the economy during the Great Recession.[18] In addition, OCR partially funded the upgrades of the Lind Coulee Siphon and some of the expansion in the capacity of the East Low Canal. But considerably more infrastructure has to be put in place to put the 164,000 acre-feet of water to use. The funding for that additional infrastructure at this point is unknown. As the Columbia Basin Development League's Mike Schwisow was quoted as saying after part of the Lind Coulee Siphon Project was completed and additional Columbia River water was being delivered to the Odessa Subarea: "[T]hat does not mean the Odessa Groundwater Replacement Project is completed…Expansion of the East Low Canal is the key piece; we need to have the back bone of the facility in place in order to make deliveries to all seven anticipated distribution

[17] Record of Decision for the Odessa Subarea Special Study FEIS, April 2, 2013, p. 24.

[18] The upgrades of the Weber Siphon complex that removed a bottleneck in moving Columbia River water south of I-90 was funded by the American Recovery and Reinvestment Act, as was the Potholes Reservoir Supplemental Feed Route Project that reduced congestion on the East Low Canal. OCR provided funding for the Lind Siphon and part of the funding for the expansion of the capacity of the East Low Canal. Absent another near catastrophic national economic crisis, such additional federal funding for this project seems unlikely since the project is not likely to be able to pass the benefit-cost tests required of Bureau of Reclamation projects. See "Review of Odessa Subarea Special Study" and memo to Washington State Legislators from Norman Whittlesey and Walter Butcher, March 5, 2013, re: Irrigation Development in Washington State. http://www.celp.org/archive/pdf/Odessa_Economics_Whittlesey-Butcher_Report_3-2013.pdf and http://www.celp.org/archive/pdf/Odessa_Economics_Whittlesey-Butcher_Letter_3-5-2013.pdf .

systems….[We] still need to identify funding to move forward. Now [we] need to identify the funds so they can wrap up the work."[19]

In addition, seven separate pumping platforms and pipeline system to move the water from the Low East Canal to the farmland now served by groundwater have to be designed, financed, and built. Some combination of the irrigation districts, the individual irrigators, and the state of Washington will be responsible for that part of the delivery system. The East Columbia Irrigation District is planning to sell municipal bonds to fund this and other parts of the water delivery system. Even with funding available for those distribution systems, it is expected to take ten years of phased development for the water to replace all of the targeted groundwater irrigation pumping. Clearly the 30,000 acre-feet Roosevelt Incremental Storage Releases to the Odessa Subarea and the Odessa Subarea Groundwater Replacement project are not actually "developed" at this point in time.

At the same time, Odessa area irrigators have not all been in agreement with BOR on how to deliver surface water to replace groundwater pumping. For example, in May 2015, Odessa Subarea Irrigators and the Columbia-Snake River Irrigators Association (CSRIA) filed a lawsuit against the BOR in the United States District Court for the Eastern District of Washington, stressing that BOR has arbitrarily delayed and blocked the approval of a new water service contract for the irrigators' Privately Funded Project to bring surface water from the BOR's East Low Canal.[20]

In mid-July of 2016 OCR's Tom Tebb noted the huge gap between the 90,000 acres in the Odessa subarea that are intended ultimately to be switched off of deep groundwater and what has actually been accomplished. He was quoted at the July 13, 2016, opening of the Lind Coulee Siphon as saying "Here we are in 2016, we have only about 2,000-3,000 acres [that] have been taken off deep wells and are actually on the Columbia River [surface] water system…[OCR] will work with… [irrigation districts]…to improve their current distribution, ensuring farmers are able to receive water when the time is right…." [21]. Table 2 below contrasts OCR's claims about the water it has "developed" with what groundwater had actually been displaced in the Odessa Subarea in mid-July 2016.

It is important to realize that OCR's "developed" new water supplies are not the same thing as having additional water available for use by farms, municipalities, and businesses. OCR's inventory of its "developed" water supplies seriously exaggerates the amount of incremental water that has actually been put to use. In addition, by not discussing the yet-to-be-incurred costs, OCR is seriously understating the economic challenges in putting this "developed" water to productive use. Most of the costs of actually putting incremental water to productive uses are not associated with the planning, permitting, and organizing of incremental claims to additional water. The vast majority of the costs are associated with the storage, transporting, and then delivery of that "developed water" to where it can be used productively. It is those costs that have to be carefully and accurately analyzed. Then the responsibility for covering those costs has to be directly analyzed and compared to the distribution of the benefits so that the feasibility and equity of the project can be evaluated. Simply knowing that there is "developed water" available at a particular location tells us nothing about the economic rationality, feasibility, and

[19] Washington AG Network, "Lind Coulee Siphons Completed On Time, Under Budget, posted by Glenn Vaagen, May 11, 2016. http://washingtonagnetwork.com/2016/05/11/coulee-siphons-completed-time-budget/ .
[20] http://www.prnewswire.com/news-releases/odessa-aquifer-irrigators-and-csria-file-lawsuit-against-us-bureau-of-reclamation-300075879.html and https://drive.google.com/file/d/0B-xN73ylnN7jUE9Fb3dFTE05d0E/view
[21] *Washington Ag Network*, Glenn Vaagen, July 15, 2016.

equity of investing in the storage, transportation, and delivery of that water to specific water users.

Table 2.

OCR Success in Replacing Odessa Subarea Groundwater with Columbia River Surface Water			
Project	**OCR "Developed" Surface Water for Replacement of Odessa Subarea Ground Water (acre-feet)**	**Odessa Subarea Acres to Be Converted to Columbia River Surface Water (acres)**	**Odessa Subarea Acreage Actually Switched to Columbia River Surface Water July 13, 2016 (acres)**
Lake Roosevelt Incremental Releases (for Odessa Subarea Ground Water Replacement)	**30,000**	**10,000**	
Odessa Subarea Groundwater Replacement Project	**164,000**	**70,000**	
Total Columbia River Surface Water Replacing Odessa Groundwater	**194,000**	**80,000**	**2,000a-3,000a 2.5% to 3.8%**
Source: WA Department of Ecology news release, July 13, 2016. OCR Tom Tebb quoted in the Washington Ag Netwoor, Glenn Vaagenon, July 15, 2016.			

C. The Cost of OCR's Studies of New Dam Storage Projects

Two-thirds of OCR's $200 million account in 2006 was designated to support development of new storage facilities.[22] As set out in OCR's 2007 Columbia River Basin Water Supply Inventory Report: [23]

> Well before the 2006 Columbia River Bill was passed, Ecology and Federal partners were considering opportunities for storage in the Columbia River Basin. Based on Congressional direction provided in 2003, Ecology and the Bureau have been jointly considering a range of proposals to increase water availability in the Yakima River Basin, including the feasibility of the proposed Black Rock Reservoir with a capacity of 1.3 million acre-feet. In 2004, Ecology signed agreements with the Colville Confederated Tribes, the Bureau, and Columbia River Basin irrigation districts to study new incremental storage releases at Lake Roosevelt and the feasibility of Columbia River mainstem water storage. The 2006 Columbia River legislation authorized further work on evaluating the feasibility of storage in the Columbia River Basin. Two-thirds of the $200 million authorized is intended to support the development of new storage facilities (RCW 90.90.010).

[22] *RCW 90.90.010(2)(b)*
[23] https://fortress.wa.gov/ecy/publications/documents/0711022.pdf , p. 4-2

New Columbia River Basin Projects

Columbia River Basin

Because the Columbia River system already has 61 dams on the river or its tributaries,[24] Ecology and BOR turned to looking at off-channel dam sites to which to pump water from the Columbia. In December 2004, the State of Washington, the BOR and the Columbia Basin Project (CBP) irrigation districts (the South Columbia Basin Irrigation District, the East Columbia Basin Irrigation District, and the Quincy-Columbia Basin Irrigation District) entered into a Memorandum of Understanding (MOU). The MOU describes roles and expectations of those parties in the then-anticipated Columbia River Initiative. Under provisions of the MOU, Ecology and BOR cooperated on a study to evaluate the potential for development of new large, off-channel storage sites in the Columbia River Basin.

A 2005 pre-appraisal report assessed a preliminary list of 21 potential off-channel storage sites before passage of the Columbia River Program:

1. Big Sheep Creek	8. Eagle Creek	15. Alder Creek
2. Ninemile Flat	9. Mission Creek	16. Rock Creek East
3. Hawk Creek	10. Moses Coulee	17. Rattlesnake Creek
4. Banker Canyon	11. Douglas Creek	18. Little White Salmon
5. Goose Lake	12. Sand Hollow	19. Panther Creek
6. Foster Creek	13. Crab Creek	20. Rock Creek West
7. Twisp River	14. Black Rock	21. Kalama River

The preliminary list of 21 sites was refined to 11 sites by evaluating size, dam safety issues, and compatibility with the Columbia Basin Project. In June 2007, The BOR and Ecology refined the list of 11 sites down to four sites. Sites that were structurally infeasible, had excessive leakage, or other conflicts were eliminated. Also, the Confederated Tribes of the Colville Reservation requested that two of the 11 potential reservoir sites located on their reservation not be further evaluated at this time.[25]

The BOR and Ecology evaluated the four remaining sites, all to be filled by pumping Columbia River water, in a 2007 appraisal study in preparation for a more comprehensive feasibility study and Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA). Those sites include:

Hawk Creek - A site in northern Lincoln County tributary to Lake Roosevelt with potential active reservoir capacity of 1,000,000 - 3,000,000 acre-feet, approaching the 5.2 million acre-feet active capacity of Grand Coulee Dam,[26] with a capital cost of up to $8.1 billion.

Foster Coulee - A site in northern Douglas County tributary to Lake Pateros with potential active reservoir capacity of 1,210,000 acre-feet. Foster Creek was eliminated from consideration because of significant geotechnical concerns in combination with a high downstream hazard condition.

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[24] http://columbia-institute.org/hawkcreek/dam/media_center/Entries/2006/10/2_New_dams_would_rival_Grand_Coulee.html

[25] Ibid., p. 3-10.

[26] http://www.usbr.gov/projects/Facility.jsp?fac_Name=Grand%20Coulee%20Dam

Sand Hollow - A site in western Grant County tributary to Lake Wanapum with potential active storage capacity of 1,000,000 acre-feet, with a capital cost of up to $3.5 billion

Crab Creek - A site in western Grant County tributary to Priest Rapids Lake with potential active storage capacity of 1,000,000 - 3,000,000 acre-feet, with a capital cost of up to $2.4 billion [27]

The BOR and Ecology's 2007 appraisal study failed to disclose that the section of Hawk Creek between the Lake Roosevelt area and the potential dam site contains threatened bull trout,[28] or that a Lower Crab Creek dam would flood tens of thousands of acres of wetlands, streams, lakes and shrub steppe habitat, much of which is owned and managed by the Columbia National Wildlife Refuge and Washington State Columbia Wildlife Area. In addition, the new dam would flood between 5,000 and 8,600 acres of existing irrigated farmland.[29]

Prior to conducting a feasibility study on any of the above projects, the Bureau must receive a Congressional study authorization. In addition, expenditures from the Columbia River Basin Water Supply Development Account (Account) needed for the state share of the feasibility study and EIS requires Legislative authorization.[30]

By the end of 2007, OCR reported to the State Legislature that is was considering five new large storage facilities:
• Columbia River Mainstem Off-Channel storage (Crab Creek, Hawk Creek, Sand Hollow)
• Yakima River Water Basin water storage (Black Rock)
• Similkameen River storage (Shanker's Bend)[31]
and one "small" storage facility:
• Wymer Dam in the Yakima Basin.[32]

As of December 2007, OCR had not awarded funding for construction of storage (or conservation) projects, although many projects were being evaluated at different levels of study (e.g. pre-appraisal, appraisal, feasibility).[33]

The 2007 report also identified the following water storage projects:
• Little Klickitat Basin Surface Water Storage - Potential surface storage projects in Dry Creek and Idlewild Creek are described in section 4.3.3 of Appendix B Multipurpose Water Storage Screening Assessment Report of the WRIA 30 Watershed Plan. Dry Creek and Idlewild Creek are headwater tributaries of the Little Klickitat River. Dry Creek has an extensive drainage area and appears to convey considerable winter/spring flows from snowmelt, with little groundwater base flow to sustain flows past June. The initial estimate of winter/spring discharge is 3,900 acre feet.

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[27] Ibid., p. 3-11. See also: http://www.csria.org/wp-content/uploads/2016/01/es-rp-590/CRMSO_Exec-Summary_reduced.pdf
[28] http://columbia-institute.org/hawkcreek/dam/Fisheries.html
[29] http://www.waterplanet.ws/crabcreek/ccrhome/Home.html
[30] https://fortress.wa.gov/ecy/publications/documents/0711022.pdf, p. 3-11.
[31] "Similkameen Appraisal Study. The Okanogan Public Utility District (PUD) is studying the potential for a storage facility/dam at Shanker's Bend on the Similkameen River, a site that has been considered for construction of a dam since the 1940s. The proposed site is located a short distance upstream from the existing Enloe Dam. The largest facility option (Elev. 1289) would inundate Canadian lands as well as lands adjacent to Palmer Lake in Washington. In 2007, Ecology provided $300,000 for the PUD to conduct an appraisal level review of the site, due in 2008. *Ibid*, p. 3-12.
[32] https://fortress.wa.gov/ecy/publications/documents/0711022.pdf , p. 4-3 .
[33] https://fortress.wa.gov/ecy/publications/documents/0711022.pdf , p. 3-2 .

• Idlewild Creek, in its lower reach, is incised into a relatively deep, narrow bedrock valley that would be amenable to construction of an in-channel storage reservoir. The valley is east-west oriented, with a steep southern wall that may help shade and maintain lower water temperatures. The estimated winter/spring discharge from the creek is approximately 1,600 acre feet.
• Horse Heaven Hills Water Storage[34] - Concepts for large-scale (3,000 to 9,000 acre-foot) surface and ASR water storage projects with planning-level cost estimates are provided in the report/memorandum Preliminary Water Storage Assessment Glade-Fourmile Subbasin, WRIA 31, which was produced for the WRIA 31 Planning Unit. The projects would involve diverting water from the Columbia River with conveyance to ASR wells or surface impoundments located north of the River in areas currently supported by groundwater supply from the Wanapum Basalt Aquifers.[35]

To date, *none* of the above "new water storage projects" have been constructed.

In addition, OCR has also issued temporary "term" water right permits in the Walla Walla River Basin; authorized withdrawals from Sullivan Lake in NE Washington,[36] and has funded studies and projects in the Methow River Basin.[37]

Yakima River Basin

In December 2004, the BOR released its Appraisal Assessment of the Black Rock Alternative. This report summarized and added to numerous technical reports on the potential to build a new large storage facility called Black Rock Reservoir in eastern Yakima County. Black Rock could hold between 800,000 acre-feet to 1,300,000 acre-feet of water. This volume is greater than all five of the existing Yakima River Basin storage reservoirs combined. The proposed reservoir would be filled with water pumped from Priest Rapids Lake on the Columbia River when water is available in excess of current Columbia River flow targets. Participating Yakima basin irrigation districts would use water from the Black Rock Reservoir in exchange for water they currently divert from the Yakima River. The 2004 report estimated the cost of building Black Rock at approximately $4 billion.

In the 2006 appraisal study, BOR considered three other Yakima River basin storage alternatives: a new Bumping Lake Dam and enlarged reservoir, Wymer dam and reservoir, and Keechelus-to-Kachess pipeline. In the 2006 appraisal, the BOR concluded that while the Bumping Lake enlargement and Keechelus-to-Kachess pipelines did not meet study objectives, the Wymer reservoir should be investigated further. In December 2006, the BOR published a Notice of Intent to prepare a combined planning report and EIS for the Yakima River Basin Water Storage Feasibility Study. At the same time, Ecology published a corresponding SEPA Determination of Significance (DS), requesting comments on the scope of the proposed EIS. The scope of the EIS and feasibility study includes the following state & federally funded projects:
• Black Rock Reservoir with a capacity of 800,000 to 1.3 million acre-feet
• Wymer Reservoir with a capacity of 174,000 acre-feet
• Wymer Plus Pump Exchange 9 with a capacity of 574,000 acre-feet[38]

[34] http://www.aspectconsulting.com/water-resources-projects/2014/7/9/horse-heaven-hills-water-storage-appraisal-assessment
[35] https://fortress.wa.gov/ecy/publications/documents/0711022.pdf p. 4-4.
[36] http://www.ecy.wa.gov/programs/wr/cwp/cr_sullivan.html
[37] https://fortress.wa.gov/ecy/publications/documents/1512006.pdf
[38] https://fortress.wa.gov/ecy/publications/documents/0711022.pdf p. 3-14

Through June 30, 2007, Ecology spent approximately $5.35 million in State cost share to study the feasibility of Yakima River Basin storage. Of that $1.35 million came from the Columbia River Account.[39]

The BOR released its Final Planning Report/EIS on December 29, 2008. It explained why a new Bumping Lake dam did not warrant further study because of environmental impacts on endangered species, flooding 1,900 acres of ancient forests ("old growth") adjacent to the William O. Douglas Wilderness, and because a larger-capacity reservoir would not fill on a regular basis and would not be a reliable source of water.[40,41]

In addition, the BOR report calculated a benefit/cost ratio of 0.13 for a new Black Rock Reservoir; a benefit/cost ratio of 0.31 for a Wymer Dam and Reservoir; and a benefit/cost ratio of 0.07 of a Wymer Dam plus Yakima River Pump Exchange.[42]

Subsequently, through the Yakima Workgroup, OCR and BOR reviewed and rejected 30 additional new Yakima Basin storage projects:

Bakeoven. Tieton River, South Fork
Casland, Teanaway River, North Fork
Cle Elum Lake Enlargement
Cooper Lake, Cooper River
Cowiche, Cowiche Creek, South Fork
Dog Lake, Clear Creek
East Selah, Yakima River
Forks, Teanaway River
Hole in the Wall, Dry Creek
Horseshoe Bend, Naches River
Hyas Lake, Cle Elum River
Little Rattler, Rattlesnake Creek
Lost Meadow, Little Naches River
Lower Canyon, Yakima River
Manastash, Manastash Creek
Mile Four, Rattlesnake Creek
Minnie Meadows, Tieton River, South Fork
Naneum, Naneum Creek
Pleasant Valley, American River
Rattlesnake, Naches River
Rimrock Lake Enlargement, Tieton River
Satus, Satus Creek
Simcoe, Simcoe Creek-Toppenish Creek
Soda Springs, Bumping River
Swauk, Swauk Creek
Tampico, Ahtanum Creek
Toppenish, Toppenish Creek
Upper Canyon, Yakima River
Wapatox, Naches River
Waptus Lake, Waptus River[43]

Despite eight years of Yakima Workgroup search for new storage sites (see above), in October 2016 the Yakima-Tieton Irrigation District announced a proposal for a new dam west of Tieton, at a cost of over $100 million. OCR had provided the irrigation district $117,000 in December 2015 to further study options.[44] After ten years of Ecology/OCR efforts, the Department of Ecology's 2015 Implementation Status Report on the Yakima River Basin Integrated Water, Resource Management Plan (July 2016) does not list **any** delivered new water from any Yakima Plan surface storage project element.[45]

[39] https://fortress.wa.gov/ecy/publications/documents/0711022.pdf , p. 3-15
[40] Bureau of Reclamation, *Final Planning Report/EIS, Yakima River Basin Water Storage Feasibility Study*, p. 2-128 to 2-131. http://www.usbr.gov/pn/studies/yakimastoragestudy/reports/eis/final/volume1.pdf
[41] The Department of Ecology withdrew from this report and prepared a SEPA Supplemental Draft and Final EIS in order to resurrect storage projects, such as a new Bumping Lake dam that the BOR refused to evaluate.
[42] Ibid., pp. 2-125 to 2-127.
[43] Yakima River Basin Integrated Water Resource Management Plan FPEIS (March 2012), Table 2-1, pp. 2-43 to 2-44.
[44] Living on borrowed time: Canal is more than 100 years old, but replacement won't be cheap, by Kate Prengaman, Yakima Herald, Oct. 26, 2016
[45] https://fortress.wa.gov/ecy/publications/documents/1612002.pdf , pp. 15-17.

II. OCR's Projected Future Water Supply Development: Yakima and Wenatchee River Basin Projects

A. Focusing on the Largest and Most Costly of the OCR Proposed Future Projects

The OCR projects proposed, with projected completion dates between 2016 and 2019, tend to be dominated by projects in the Yakima River Basin. OCR's 2015 Columbia River Basin Water Supply Inventory Report to the Washington Legislature estimates that "near-term development (2015-2019)" is expected to produce 320,132 acre-feet of water from eleven different projects. "Long-Term Development (2019+)" projects were projected to be served by at least ten different projects. Those long-term projects far enough along in the planning process to have estimated water development targets are projected to produce about 477,000 acre-feet of water.

Ninety-six percent of the water to be developed in the near-term projects (2015-2019) would develop water in the Yakima Basin and close to half (47 percent) of the long-term water development projects (beyond 2019) would be developed in the Yakima Basin.[46] For that reason, it is important to understand the status, costs, and benefits associated with the various projects included in the Yakima Plan.

B. The Yakima River Basin

In the Yakima River Basin, a total of 464,000 acres of farmland are irrigated using 2.5 million acre-feet of irrigation water rights.[47] Only 30 percent of the average annual runoff is stored in the storage system.[48]

In the 1900s, privately-constructed crib dams on the four natural glacial lakes (Cle Elum, Kachess, Keechelus, and Bumping) contributed to the extirpation of sockeye salmon. Construction of the BOR's five major storage dams, the previously four named dams plus Rimrock (Tieton Dam), eliminated access to previously productive spawning and rearing habitat for sockeye, spring Chinook, coho, and steelhead salmon above the new reservoirs.[49] Because the BOR dams flooded natural lakes, this report will refer to Cle Elum Lake, Kachess Lake (which consisted of upper and lower lakes), Keechelus Lake, and Bumping Lake, rather than "reservoirs." These five major dams have a total capacity of about 1,065,400 acre-feet. Clear Lake, is located above Rimrock Lake and has a capacity of 5,300 acre-feet, and is used primarily for recreational purposes. The five major dams —Bumping, Kachess, Keechelus, Rimrock (Tieton Dam), and Cle Elum store and release water to meet irrigation demands, flood control needs, and instream flow requirements. [50] Occasional droughts over the last several decades have led to curtailments in water delivery. The Roza Irrigation District and Kittitas Reclamation District "are proratable districts with water rights that are subject to curtailment during droughts. A small portion of the Kennewick Irrigation District and Sunnyside Division are also subject to curtailment. "Senior" water right holders are entitled to their full water allotment

[46] Op. cit. OCR 2015 Columbia River Basin Water Supply Inventory Report to the Washington Legislature, page 12.
[47] "Benefit-Cost Analysis of the Yakima Basin Integrated Plan Projects," Jonathan Yoder et al. Report to the Washington State Legislature by the Washington Water Research Center, December 15, 2014, p. 5.
[48] See: http://www.usbr.gov/pn/programs/yrbwep/reports/FPEIS/fpeis.pdf , p. 1-11,
[49] http://www.usbr.gov/pn/programs/yrbwep/reports/FPEIS/fpeis.pdf , p. 1-2.
[50] http://www.usbr.gov/pn/programs/yrbwep/reports/FPEIS/fpeis.pdf , pp. 1-16 and 1-17.

during a drought. Irrigation districts with a majority of "senior" water rights include approximately 75 percent of the Yakima-Tieton Irrigation District, approximately 65 percent of the Sunnyside Division, and approximately half the Wapato Irrigation Project.[51] For irrigation districts with mostly "senior" water rights, there is little incentive to embark on water conservation, water banking, or water efficiency measures.

C. The Yakima Plan

The Yakima Plan began as a BOR WaterSMART program authorized by the SECURE Water Act in Public Law 111-11, which in Fiscal Year 2009 also funded basin studies in the Colorado River Basin and the St. Mary and Milk River Basins in Montana and Canada. Under the WaterSMART program, BOR now has 12 studies of major river basins underway in the west. All of these major Basin Studies include *structural* (i.e., dams) and non-structural options to supply adequate water in the future, as well as consideration of potential new surface storage needs, as directed in the Act at Section 9503(b)(4)(e).[52]

In 2009, OCR and BOR convened a select Yakima Workgroup, which included five irrigation districts, federal and state agency representatives, the Yakama Indian Nation, city and county representatives, one conservation group representative (American Rivers), as well as a local organization advocating for surface storage structures (Yakima Basin Storage Alliance).[53] The Yakima Workgroup included both OCR and BOR as voting members and was not chartered under the Federal Advisory Committee Act.[54] The main objective of the Yakima Plan is to provide proratable irrigation districts with 70 percent of their water allotment during drought years by increasing the amount of surface water stored in the Yakima Basin. That Yakima Plan proposes to add about another half-million acre-feet of surface water storage, increasing the total surface water storage by about 50 percent to 1.5 million acre-feet.[55] This would have the effect of turning the proratable irrigation districts into near-Senior districts without modifying water rights in the basin.

The BOR and OCR commissioned a group of economic consulting firms to carry out a benefit-cost analysis of the Yakima Plan that became the BOR's "Framework for Implementation Report" for the Yakima Plan (i.e., the Four-Accounts Analysis).[56]

That BOR-sponsored economic analysis of the Yakima Plan focused on the *entire* complex set of projects included in the Plan. That Plan divided projects into seven categories or "elements":

i. Fish Passage (six projects).
ii. Structural and Operational Changes. (six projects)
iii. Surface Water Storage. (five projects)

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[51] http://www.usbr.gov/pn/programs/yrbwep/reports/FPEIS/fpeis.pdf, Table 3-1.
[52] http://www.doi.gov/ocl/hearings/112/WaterSurfaceStorage_020712.cfm
[53] A list of the Yakima Workgroup members (not updated) is located at: http://www.ecy.wa.gov/programs/wr/cwp/YBIP.html Several of the Yakima Workgroup members are also members of the OCR Policy Advisory Group. Compare: http://www.ecy.wa.gov/programs/wr/cwp/cr_pag.html
[54] See: http://www.usbr.gov/pn/programs/yrbwep/reports/FPEIS/fpeis.pdf and http://ucrsierraclub.org/pdf/Yakima_Water-Report_Response_%202-15-2013.pdf
[55] Op. cit, Benefit-Cost Analysis of the Yakima Basin Integrated Plan Projects, p. 6.
[56] "Yakima River Basin Integrated Water Resource Management Plan: Four Accounts Analysis of the Integrated Plan," U.S. Bureau of Reclamation Contract No. 08CA10677A ID/IQ, prepared by ECONorthwest, Natural Resources Economics and ESA, October 2012. The BOR "Framework for Implementation Report has the same date and contract number but lists the authors beginning with HDR Engineering instead of ECONorthwest. The author list of the Implementation Report was HDR Engineering, Anchor QEA, ECONorthwest, Natural Resource Economics, and ESA.

iv. Groundwater Storage. (Multiple projects)
v. Habitat/Watershed Protection and Enhancement. (Multiple projects)
vi. Enhanced Water Conservation. (Multiple projects)
vii. Market Driven Reallocation (Multiple projects).[57]

In each of the categories or elements listed above there are a half-dozen to dozens of separate projects, including projects that do not meet the goal of providing proratable irrigation districts with additional water supplies. The BOR-OCR sponsored benefit-cost study combined *all* of these individual projects into a single conceptual aggregation, namely the whole of the Yakima Plan. The economic analysis then proceeded to estimate the benefits and cost of each and every individual project and summed those benefits and costs up, trying to take into account interactions among the individual projects and avoid double-counting or under-counting. The No Action Alternative was simply that none of the Yakima Plan projects would be pursued, even though the Yakima Plan FPEIS listed dozens of on-going programs in the Yakima Basin. This allowed the comparison of the total costs and total benefits, appropriately discounted, to determine the net benefits or net costs associated with the *whole* of the Yakima Plan.

The conclusion from this OCR-BOR-commissioned benefit-cost analysis was that even under the worst-case scenario considered, economic benefits were 40 percent higher than the economic costs, resulting in discounted net benefits over the next hundred years of $1.8 billion.[58]

From an economic point of view, this is not a productive way to use benefit-cost analysis because it does not test the economic rationality of individual projects within the Yakima Plan. It is possible that a few elements of the Plan that are relatively inexpensive are the source of most of the benefits while other, much more costly projects with almost no benefits, offset many of the benefits flowing from the more economically productive projects, reducing the net benefits from the Yakima Plan. Uneconomic projects could be added as long as the whole set of projects still had positive net benefits suggesting that *all* of projects included in the aggregate were economically rational when they were not. From an economic point of view, the economic rationality of *each* project within the larger "plan" should be analyzed and rejected if its costs are higher than its benefits. What is needed for an overall plan with many individual projects is just what the Washington Legislature called for in 2013: "separate benefit-cost analyses for each of the projects proposed in the 2012 Yakima River basin water resource plan (IP)."[59]

The Washington State Legislature recognized the inadequacy of combining many different projects into just one big project and only calculating the benefits and costs for that artificial aggregate project rather than also analyzing the incremental benefits and costs of each individual project.

In 2013 Washington State Legislature mandated that the State of Washington Water Research Center (WRC) at Washington State University "prepare separate benefit-cost analyses for each

[57] Ibid. Table 1.
[58] This was the conclusion of the "national accounts" that focus on the benefits and costs as seen from the perspective of the nation as a whole, regardless of where, geographically, the economic costs and benefits are experienced. Other analyses looked at local or regional impacts outside of a benefit-cost framework. Op. cit. ECONorthwest et al. October 2012, Table 2, page 7.
[59] Section 5057 of the State of Washington Capital Budget for 2013, cited in WRC "Benefit-Cost Analysis of the Yakima Basin Integrated Plan Projects," Jonathan Yoder et al. Report to the Washington State Legislature, December 15, 2014, p. 2.

of the projects proposed in the 2012 Yakima River Basin Water Resource Management Plan."[60] In response to that mandate, the WRC issued a report at the end of 2014 to the Washington State Legislature.[61] *RCW 90.38.110.*

That report pointed out that, as calculated by WRC, *about 90 percent* of the estimated benefits of the overall Yakima Plan were associated with the *enhanced fisheries,* not irrigated agriculture or municipal water. Benefits to irrigated agriculture represented *only 5 to 10 percent* of the total benefits. Improved municipal water supplies were the source of *2 to 3 percent* of the benefits. Just the fish passage projects alone on Yakima Basin dams provided 75 to 80 percent of the estimated benefits of the Yakima Plan even though they were responsible for only a small percentage of the aggregate costs of the Yakima Plan. On the other hand, 66 percent of the costs were associated with out-of-stream and instream uses that produced only a small fraction of the overall benefits.[62] This clearly indicates that some of the costliest proposed projects generate very few benefits to justify the costs. The net losses associated with those uneconomic proposed projects are "covered" by the fish-production benefits associated with building fish passages at existing Yakima dams. In that sense the fish passage projects were being used to "indirectly fund" economically indefensible surface water storage projects even though the fish passage projects were largely unrelated to the surface water storage projects.

In addition, the "Four-Accounts Analysis" fish-production benefits were calculated using the "contingent valuation" methodology by estimating what economic value all of the households in the entire states of Washington and Oregon would place on increased salmon returns in the Yakima Basin.[63] Salmon production benefits are also based on artificial, untried, and highly engineered projects such as a giant "helix" downstream fish passage project at the existing Cle Elum dam and a "Whooshh" tube to shoot returning salmon over existing Yakima dams.[64] Projected fish-production benefits are also suspect because they fail to factor in the dire impacts of hot summer temperatures in the Lower Columbia River. n 2015, of the hundreds of thousands of sockeye returning to the Columbia Basin, only 300 made it up the Yakima River due to unprecedented warm water.[65]

D. The Cost of the Yakima Plan

The Yakima Plan is a 30-year plan that would be implemented in three 10-year stages. The Initial Development Phase is to run from 2013 to 2023. In the 2013-2015 biennium Washington State funding amounted to a $143 million share of the $234 million total project costs.[66] For the 2015 to 2017 biennium the Washington Legislature has appropriated an additional $30 million for continued implementation of the Yakima Plan. OCR projects that to fully fund the State's share of the Initial Development Phase, the state will have to invest $100 to $110 million in *each*

[60] Ibid. Quote from page ii.
[61] Ibid.
[62] Ibid. pp. iii-v.
[63] The analysis considered using only Washington households. The result was fish values about 40 percent below what was obtained using both Washington and Oregon households. Stated slightly differently, by combining the two states, fish values were boosted over 60 percent. See page 8 of http://www.usbr.gov/pn/programs/yrbwep/2011integratedplan/2012meetings/2012-09-26/4presentation.pdf
[64] See: http://www.usbr.gov/pn/programs/eis/cle-elum/index.html
[65] See: http://www.yakimaherald.com/news/local/drought-was-rough-on-sockeye-and-future-could-be-an/article_c3574d1e-68cf-11e5-92de-8f6fa08e7611.html
[66] The state's share was so high because of the state's purchase of the Teanaway Community Forest at a cost of almost $100 million.

of the next three biennia, ending in 2023.[67] The total cost of the ten-year Initial Development Phase of the Yakima Plan (2013-2023) is projected by OCR to be about $882 million of which the State would be responsible for about $407 million.[68]

This Initial Development Phase of the Yakima Plan on which the State of Washington is currently working is the *least expensive* of the three 10-year phases. The 2023-2033 Intermediate Phase is projected to cost 75 percent more than the Initial Phase, a decade total of almost *$1.6 billion*. The Final Development Phase (2000-2043) would be slightly less costly: about an additional *$1.5 billion*. The "Full Development Costs" over the three decades would be just over $4 billion.[69] The Washington Legislature has mandated that the State of Washington is to pay, at most, half of the total costs of the Yakima Plan (not specific elements). Federal, private, and other non-state sources, including a significant contribution of funding from local project beneficiaries of the Yakima Plan (e.g. proratable irrigation districts that would receive additional water) are expected to pay at least half of the plan costs.[70]

Below we review the economic rationality of the major surface water supply projects included in the OCR's future development plans, all of which are part of the Yakima Plan.

E. OCR Near-Term Water Supply Developments: The Kachess Drought Relief Pumping Plant and the Keechelus-to-Kachess Conveyance

OCR lists one major surface water storage project among its "near-term (2016-2020)" water developments: The Kachess Drought Relief Pumping Plant that during drought years would access the water that lies below that lake's current gravity flow outlet facilities, i.e. the "inactive" storage, in Kachess Lake. That single project would provide almost two-thirds, 200,000 acre-feet, of OCR's 2015 estimated total near-term water development of 320,000 acre-feet.[71] This Kachess Drought Relief Pumping Plant (KDRPP)s also listed as part of the Initial Development decade of the Yakima Plan and was scheduled in December 2014 to be completed by 2018.[72] A closely related project, the Keechelus to Kachess Conveyance (KKC), that is also part of the "Initial Development" decade of the Yakima Plan would allow the movement of Keechelus Lake water via a tunnel to Kachess Lake to facilitate the refilling of that lake after its inactive storage has been drawn down during drought periods by the drought relief pumping plant. In a December 2014 report to the Legislature on the projected costs of pursuing the Yakima Plan, OCR stated that "subsequent evaluations determined that the Kachess Reservoir Drought Relief Pumping Plant Project is unlikely to be viable without the inclusion of the [Keechelus to

[67] Implementation Status Report: Yakima River Basin Integrated Water Resource Management Plan, July 2016, Ecology Publication Number 16-12-002, p. 2.
[68] Ibid. p. 25. The total cost of the Initial Development Phase was estimated as $896.9 million in the December 2014 "Cost Estimate and Financing Plan-Legislative Report," Department of Ecology and Office of the Treasurer," Figure 4.
[69] Ibid. Cost Estimate and Financing Plant, December 2014, Figure 4.
[70] 2SSB 5367, Sec. 11(1)(a); RCW 38.120(1)(a). The State's obligation is to pay for at least half of the entire Yakima Plan, but could fund 100 percent of any specific element of the Yakima Plan, as it did when the State paid $97 million for the Teanaway Community Forest. See: http://www.dnr.wa.gov/news/teanaway-land-purchase-clears-way-washington%E2%80%99s-first-community-forest
[71] The OCR 2016 "Water Supply Development" (Rev. 08.19.16) also lists this facility as part of the Near-Term Development.
[72] "Yakima River Basin Integrated Water Resource Management Plan-Cost Estimate and Financing Plan-Legislative Report," OCR and the Office of State Treasurer, December 15, 2014, Figure 5

Kachess] conveyance system as a project component."[73] This significantly increased the cost associated with a feasible Kachess Drought Relief Pumping plant since now the costs associated with the water conveyance facilities have to be considered costs of the drought relief pumping project. The KDRPP and KKC Draft EIS published in January 2015 provided estimates of the total costs of each project. Adding the costs of the KKC to the KDRPP would increase the cost of the drought relief pumping project by 58 percent.[74]

Three months later in March 2015 the BOR released the "Feasibility Design Reports-Draft" for the Kachess Drought Relief Pumping Plant and, separately, for the Keechelus-to-Kachess Conveyance.[75] Those documents provided another estimate of the *field costs* of each of these components of the Kachess drought relief pumping project. As the earlier Kachess DEIS made clear, to such *field costs* must be added a variety of other very real costs to obtain the *total cost* of these projects. In the Kachess DEIS this led to estimated *total* project costs that were 53 percent higher than the *field costs* for the Kachess Drought Relief Pumping Plant element and 46 percent for the Keechelus-to-Kachess Conveyance element. When these additional costs are included, the BOR feasibility design report costs for the overall Kachess Drought Relief project increases by $205 million or about a third to $850 million compared to the January 2015 DEIS estimated *total costs*. See Table 3 below.

Table 3.

Total Costs of the Kachess-Related Projects*					
Source of Cost Estimate	Date of	Type of Estimate	"Middle" or "Average" Cost		
BOR/OCR Documents	Estimate		KDRPP	KKC	Total: KDRPP&KKC
Costs of YIP HDR Engin. & Anchor QEA (1)	March 2011	Includes Non-Contract and O&M	$226,406,000	$192,950,000	$419,356,000
KDRPP and KKC Draft EIS (2)	January 2015	Full Cost	$407,550,000	$237,880,000	$645,430,000
KDRPP & KKC Feasibility Design Reports (3)	March 2015	Full Cost	$509,207,350	$340,994,364	$850,201,714
*Average or middle value used when multiple alternative estimates were provided.					
(1) Table 1, p. 3, non-contract costs were 30% of construction costs, annual O&M were capitalized using a 4% discount rate.					
(2) Tables 2.13 and 2.14 on pages 2.54 and 2.55.					
(3) These "Field Cost" estimates were adjusted to total costs using the markups developed in the KDRPP and KKC Draft EIS. See (2) above.					

A little more than a year later, in June 2016, OCR reported to the legislature that it could not provide a cost estimate for the Kachess Drought Relief Pumping Plant because the plans for that facility were in flux.[76] After issuing a Draft EIS for the Kachess pumping and conveyance projects in January 2015 and receiving public comments on these projects, OCR and BOR decided that they needed to collect additional scientific data to reevaluate these projects in a Supplemental Draft EIS scheduled to be released in late 2016 or early 2017. [77] Clearly the basic

[73] "Yakima River Basin Integrated Water Resource Management Plan-Cost Estimate and Financing Plan-Legislative Report," OCR and the Office of State Treasurer, December 15, 2014,Ibid. Figure 4, fn *, no pagination.
[74] Kachess Drought Relief Pumping Plant and Keechelus Reservoir-to Kachess Reservoir Conveyance, Draft EIS, U.S. Bureau of Reclamation and WA Department of Ecology, January 2015, Tables 2-13 and 2-14, pp. 2-54 and 2-55.
[75] U.S. Bureau of Reclamation, Contract No. R13PC1006 ID/IQ, prepared by HDR Engineering, Inc.
[76] "Unit Costs for Proposed Keechelus-to-Kachess Conveyance and Kachess Drought Relief Pumping Plant," Washington Department of Ecology. Ecology Publication Number 16-12-003, June 2016, p. 8.
[77] "Kachess Drought Relief Pumping Plant," U.S. Bureau of Reclamation, last updated 7/21/2016, http://www.usbr.gov/pn/programs/eis/kdrpp/ .

design and costs of this large "near-term" OCR project remain uncertain although the costs show a steep upward trend.

The 2014 Washington Water Research Center benefit-cost study of the individual elements of the Yakima Plan commissioned by the Legislature estimated that the economic costs would exceed the economic benefits for each of the Kachess Lake projects. The economic *loss* associated with the Kachess Drought Relief Pumping Plant was estimated to be $107 million and the economic *loss* associated with the Keechelus to Kachess Conveyance was estimated at $110 million for a total loss of $217 million.[78] The ratio of benefits to costs was estimated to be 0.46 for the Drought Relief Pumping Plant and 0.20 for the Keechelus to Kachess Conveyance.[79] With the higher more recent cost estimates associated with the Keechelus to Kachess Conveyance discussed above, the economic losses associated with these proposed projects would be even greater given that OCR has now concluded that the Keechelus to Kachess water conveyance project is necessary to the successful operation of the Drought Relief Pumping project, the costs and benefits of these different parts of a joint project should be combined. That will increase the cost of the project by 71 percent while adding only about 30 percent to the benefits, increasing the net loss associated with the combined project. While the drought relief pumping plant by itself has a benefit-cost ratio of 0.46, having to combine it with the water conveyance component reduces the benefit-cost ratio by about 40 percent to 0.29. The net loss associated with the combined project more than doubles. [80, 81]

As OCR and BOR have indicated by delaying the Final EIS and planning to produce a Supplemental Draft EIS,[82] there are many unanswered questions about the practicality and economic rationality of the Kachess surface water supply project. The actual costs of these two related projects appear to be unknown at this time, but on a steep upward trend line. In addition, it seems highly unlikely that this project should be classified as a near-term development that will be constructed in the 2015-2019 period.[83] OCR has had to repeatedly "go back to the drawing board" with these projects, redesigning them, and re-estimating their cost. This makes it nearly impossible for the Legislature and public to evaluate the likely "success" of the OCR's

[78] Ibid. page 63 (Table 7) and page iii. The WRC net costs reported here are the "middle" estimates among a range of net benefit estimates associated with different WRC scenarios that varied the intensity of the impact of climate change on the hydrology of the Yakima Basin and the effectiveness of water markets within the state of Washington to move water from lower valued used to higher valued uses. In addition, these "middle" estimates assume that the individual projects are analyzed on a "stand alone" basis rather than as part of the Yakima Plan. This boosts the benefits associated with the projects. Finally, only out-of-stream benefits are included. The fish benefits associated with fish passages at dams and improved instream flows are assumed to be pursued separately without the additional surface storage projects. These are the net-benefits or net-losses WRC reported in the Executive Summary of their report.

[79] Op. cit. WRC 2014, pp. iii and iv. The WRC adds that "Under the most adverse climate considered [in the scenarios run], these two projects together would have net benefits of $6 million and a B/C ratio of 1.02." p. iv.

[80] Ibid. Table 20, p. 87, least adverse future climate scenario.

[81] OCR, in its June 2016 report to the Legislature on the Keechelus to Kachess Conveyance, stated that the water supply benefits of this project "would be minimal" because there was already "unutilized storage capacity in Kachess Reservoir and limitations on when water could be transferred between these two reservoirs. For that reason, OCR noted that "…the quantity [of water] transferred does not mean that quantity would become available for water supply. As noted above, the water supply benefits from KKC are minimal and Ecology and Reclamation have concluded the water supply benefits do not provide a basis for project construction." The Conveyance between the two lakes, however, *would* provide water benefits during drought periods by accelerating the refilling of the inactive storage in Kachess Lake that would be drawn down by drought relief pumping. However, over its life time, those benefits would not justify the costs.

[82] http://www.usbr.gov/pn/programs/yrbwep/2011integratedplan/2016meetings/06-08-2016/02mtgnotes.pdf

[83] That was its status in the "2015 Columbia River Basin Water Supply Inventory Report" submitted to the Washington State Legislature, Ecology Publication Number 15-12-006, January 6, 2016, p. 12.

primary “near-term” water supply project, namely the Kachess Drought Relief Pumping Plant. Furthermore, the benefit-cost analysis of the individual components of the Yakima Plan that the Legislature asked WRC to carry out documented the sizeable economic loss associated with these Kachess projects that would likely block the use of federal funds to help finance them.

A further concern is that although the Yakima Plan has been characterized as one in which “farmers themselves have agreed to pay for investments that promise to enable their water needs to be met ”[84] when given an opportunity to make a major investment to secure additional water during drought conditions, the irrigators balked at the cost: In October, 2015, as a result of significantly low projected snowpack in the Yakima Basin, the Roza Irrigation District (RID) voted to pursue a Kachess Emergency Temporary Floating Pumping Plant Project (KETFPP).[85] The proposed KETFPP would have consisted of a temporary floating pump facility with the ability to access up to 50,000 acre-feet of water from Kachess Lake that otherwise would be inaccessible due to low water elevations. This water could then be pumped into the Yakima River system to supply RID with temporary emergency drought relief in 2016. Because this would have impacted the BOR existing Yakima Project, the BOR scheduled public workshops on December 7 and 8, 2015.[86] But when the cost of the project reached $58 million plus, many farmers in the irrigation district said that extra water was not worth the extra $85 per acre they would likely have to pay for 10 years and a full page newspaper ad by concerned Roza Growers, urged farmers to voice their opinions on the pumping plant.[87] By mid-December, the RID had withdrawn its support of the project and BOR cancelled review of the proposed project.[88]

F. The Large Yakima Basin Storage Reservoirs in OCR’s Long-Term Development (2020+)

OCR’s list of “Long-Term Development” projects that are part of the 2015 Report to the Legislature on Columbia River Basin Water Supply Inventory includes 226,000 acre-feet of water development within the Yakima Basin that would be developed *after* 2019.[89] This is part of the 450,000 acre-feet of additional surface storage that the Yakima Plan proposes to develop over 30 years.[90] As discussed above, the “near-term” Kachess Drought Relief Pumping Plant project would involve extracting up to 200,000 acre-feet of water from the inactive storage pool of Kachess Lake and accelerating its replacement with the Keechelus to Kachess Conveyance. This leaves another 250,000 acre-feet of surface storage associated with the Yakima Plan to be identified. The 226,000 acre-feet that the OCR lists for the Yakima Plan in its “long-term” projects (meaning developed after 2019) would provide most of that remaining planned surface storage development. Although the Yakima Plan calls for constructing both a new Bumping Lake dam and a Wymer Dam,[91] OCR now claims that this additional surface storage would

[84] http://www.yakimaforever.org/2016/10/26/innovative-water-solutions/#more-1775
[85] See: http://www.dailysunnews.com/news/2015/dec/08/frustrations-aired-kachess-pump-workshop/
[86] See: http://www.roza.org/images/Public%20Meeting%20Notice%20Kachess%20Emergency%20Temporary%20Floatiing%20Pumping%20Plant.pdf
[87] http://www.dailysunnews.com/news/2015/dec/08/frustrations-aired-kachess-pump-workshop/
[88] http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=51808
[89] Op. cit. OCR June 2016 report to the Legislature on the Keechelus to Kachess Conveyance. p. 12.
[90] Final Programmatic EIS, Yakima River Basins Integrated Water Resource Management Plan, March 2012, p 2-20.
[91] http://www.usbr.gov/pn/programs/yrbwep/2011integratedplan/2016meetings/06-08-2016/03slideupdate.pdf

come from one large storage reservoir that would be built in the second or third decade of the Yakima Plan, either the Wymer Dam and Reservoir (162,500 acre-feet) or a new Bumping Lake dam (156,300 acre-feet net increase).[92] The remainder of the envisioned water development would come from smaller projects.

OCR's projection of the costs of pursuing this additional surface water storage increases substantially as one moves from the first decade of the Yakima Plan to the second decade. In the first decade (2013-2023), the projected surface water storage costs are about $414 million. In the second decade, the surface water storage investment costs will rise to just over a billion dollars, a 140 percent increase. In the third decade, the capital investments in surface water storage will be approximated one billion dollars more. Over the three decades $2.4 billion will be spent on surface water storage by the Yakima Plan. If, as ORC projects, the state will cover about half of the costs of these projects,[93] this represents a very substantial future financial obligation for the State of Washington of at least $1.2 billion, just for surface water storage in the Yakima Basin and does not account for likely cost overruns.

Of course, surface storage of water is just one of the elements of the Yakima Plan. In the Initial Development Phase, the cost of surface water storage was about $414 million, the total cost of *all* of the elements of the Yakima Plan in that decade was projected to be $897 million, over twice as high. For the second and third decades, the total costs are 50 to 60 percent higher than the surface water storage investment costs alone. The whole of the "Initial Development Phase" of the Yakima Plan, the first decade, 2013-2023, on which ORC is currently working, is projected to cost almost $900 million, while the cost over thirty years would be $4 billion, up to half of which may be a state obligation.[94] See Table 4 below**.**

Table 4.

Estimated Costs of Implementing the Yakima Integrated Plan				
Integrated Plan Element	**Initial Development**	**Intermediate Development**	**Final Development**	**Full Development**
	Phase 2013-2023	**Phase 2023-2033**	**Phase 2033-2043**	**Costs 2013-2043**
Surface Water Storage	**$413,900,000**	**$1,003,600,000**	**$999,000,000**	**$2,416,500,000**
Total for All Elements	**$896,900,000**	**$1,572,050,000**	**$1,542,250,000**	**$4,011,200,000**

Source: "The Yakima River Basin Integrated Water Resource Management Plan-Cost Estimate and Financing Plan-Legislative Report," Office of Columbia River, and Office of the State Treasurer, December 15, 2014, Figure 4.

G. The Economic Evaluation of the Yakima Plan's Large Surface Storage Projects

A high priced element of the Yakima Plan is the addition of a large surface water storage facility during the second or third decade of the Plan. Two alternatives are currently getting the most scrutiny: A new Bumping Lake Dam and the building of the Wymer Dam.

[92] Op. cit. Implementation Status Report: Yakima River Basin IP, pp. 16-17 and Op. cit, Benefit-Cost Analysis of the Yakima Basin Integrated Plan Projects, p. 10.
[93] Op. cit. Implementation Status Report: Yakima River Basin IP, p. 25 and 26.
[94] Ibid. Figures 4 and 5 (not paginated).

New Bumping Lake Dam

Unsuccessful efforts to construct a new Bumping Lake dam downstream of and flooding the existing dam on the Bumping river, upstream from Goose Prairie, WA, date back over half a century. Bills to construct a new Bumping Lake dam were introduced in Congress in 1979, 1981, and 1985. All failed.[95] As described above, opposition to a new Bumping Lake dam and adverse environmental impacts caused the BOR to exclude this project from its 2008 Final Planning Report/EIS.[96] Only through the support of Washington Governor Christine Gregoire, who had been a major backer of a new Black Rock dam,[97] was a new Bumping Lake dam project brought back for consideration.[98]

Wymer Dam

Also, as described above, in its 2008 Final Planning Report/EIS the BOR evaluated two versions of a Wymer Dam in Lmuma Creek (an intermittent stream), approximately 8 miles upstream of Roza Diversion Dam,[99] off-channel of the Yakima River, between Ellensburg and Yakima. The BOR's report calculated that either project version had a benefit-cost ratio well below 1.0: For the Wymer Dam and Reservoir it was 0.31; and for the Wymer Dam plus Yakima River Pump Exchange it was 0.07.[100] Again, the Gregoire administration brought back the Wymer dam project.[101]

OCR plans to finance studies of these two proposals and possibly others that might be proposed during the end of the first decade and the beginning of the second decade of the Plan and make a decision on what surface water storage alternatives should be pursued.

In 2015, Senators Cantwell and Murray introduced S. 1694 in Congress, which authorizes continued federal funding for studies of water projects in the Yakima Basin, including presumably the new Bumping and Wymer dams. Reps. Reichert and Newhouse introduced a companion House bill. This legislation did not passed the 2016 session of Congress.

As discussed above, the Washington Legislature mandated that the Washington Water Resource Center (WRC) carry out benefit-cost analysis of each major project that was part of the Yakima Plan. That report was delivered to the Legislature in December 2014.[102] That WRC report concluded that a new Bumping Lake Dam would cost $371 million more than the benefits it provided over the next 100 years. The benefit-cost ratio would be 0.18. Five out of six of the dollars invested in it would not be justified by the benefits. For the Wymer Dam and Reservoir, the costs would exceed the benefits by $1.2 billion. The benefit-cost ratio would be 0.09. Ten out of eleven of the dollars invested in it would not be justified by the benefits.[103] The WRC confirmed the 2008 benefit/cost failure of the Wymer Dam calculated by the BOR.

As the WRC discussed at length in its report to the Legislature, the WRC estimated benefits do *not* include the value of the planned increase in-stream flows that these reservoirs are projected

[95] http://www.usbr.gov/pn/programs/yrbwep/reports/FPEIS/fpeis.pdf , pp. 1-23 and 1-24.
[96] Bureau of Reclamation, *Final Planning Report/EIS, Yakima River Basin Water Storage Feasibility Study*, p. 2-128 *to 2-131.* http://www.usbr.gov/pn/studies/yakimastoragestudy/reports/eis/final/volume1.pdf
[97] http://www.ucrsierraclub.org/ucr/yakima/media_2005-03-18.html
[98] https://fortress.wa.gov/ecy/publications/documents/0912009.pdf
[99] http://www.usbr.gov/pn/studies/yakimastoragestudy/reports/eis/final/volume1.pdf , p. 2-66.
[100] Ibid., pp. 2-125 to 2-127.
[101] https://fortress.wa.gov/ecy/publications/documents/0912009.pdf
[102] Op. cit. Benefit-Cost Analysis of the Yakima Basin Integrated Plan Projects, Jonathan Yoder et al.
[103] Ibid. pp. iii and iv.

to provide. Because these enhanced in-stream flows are intended to increase the population of salmon in the Yakima basin rivers and streams, the benefits of these proposed increased in-stream flows will depend on both the effectiveness of in-stream flow in boosting fish production and the value that is placed on the increased salmon populations.

The benefit-cost analysis commissioned by the OCR and BOR in support of the Yakima Plan calculated very high economic benefits from the in-stream flows. As a result, the OCR-BOR economic analysis found that fish benefits would be worth $5 to $7.4 billion while the agricultural benefits were only $0.8 billion, only one-sixth to one-ninth of the extremely high estimated fish-production benefits.

Municipal water benefits were only $0.4 billion. Put slightly differently, the OCR-BOR analysis finds that 80 to 90 percent of the benefits of the Yakima Plan are fish-production benefits derived primarily from proposed fish passage projects at existing dams. Agriculture, apparently, is a relatively minor beneficiary of the Yakima Plan, providing only about 10 percent of the benefits of the Plan.[104] The Yakima Plan is, according to the OCR-BOR economic analysis, primarily a multi-billion-dollar plan to increase salmon populations in the Yakima Basin.

There is no doubt that improving salmon habitat and river and stream ecosystems has economic value. Over the last half-century economists have developed the tools to estimate such non-market economic values. The question raised by the Washington Water Research Center was whether the ORC-BOR economic analysis accurately estimated those values.

For example, using the same Four-Accounts methodology, the WRC report estimates that the loss of 1,000 acres of ancient forest due to flooding from a new Bumping Lake dam *would exceed* $1.85 billion.[105] These costs were not incorporated in the OCR and BOR estimates of costs and benefits.

It is important to understand that the reliability of those fish economic values associated with in-stream flows was different than the reliability of the agricultural and municipal water benefits for several reasons:

i. It is difficult, if not impossible, to separate out the beneficial impacts on fish populations of investments in fish passages at Yakima Basin dams from fish-production impacts of habitat rehabilitation along streams and rivers and/or increased in-stream flows. Some of these are activities that complement other activities, boosting the overall impact on fish populations. But it is also likely that there are declining marginal benefits as additional improvements in salmon habitat and survival are made.
ii. The effectiveness of in-stream flows on fish survival is difficult to measure.
iii. The economic value of improved native fisheries is difficult to measure, especially in a setting where the number and mix of fish are uncertain and varying over time.
iv. The opportunity cost of providing instream flows by purchasing out-of-stream water rights (e.g. irrigation water rights) is only a fraction of what it costs to provide for instream flows by constructing additional water storage.[106]

[104] Ibid. p. iv.
[105] WRC "Benefit-Cost Analysis of the Yakima Basin Integrated Plan Projects," Jonathan Yoder et al. Report to the Washington State Legislature, December 15, 2014, p. 108.
[106] Ibid. Table 24, p. 91.

On the other hand, the value of water committed to agriculture or municipal water supplies can be more easily measured because:

i. There are market-based water transfers that take place in the region that can be analyzed,
ii. the alternative costs of obtaining the water from groundwater pumping, surface water treatment, or conservation measures is known, and
iii. because irrigation water is used to raise crops that are sold into commercial agricultural markets.

Because of this large difference in the precision of and confidence in the impacts of additional in-stream water flows on fish-production economic values versus agricultural and municipal water values, the WRC analyzed the out-of-stream (agricultural and municipal) benefits separately from the in-stream (fish-production) benefits. In order to objectively narrow the plausible range of values associated with in-stream flows the WRC established two reference points.[107]

The first reference point was tied solely to the irrigation and municipal (out-of-stream) water benefits. By calculating those accurately and comparing them to the cost of the storage projects, one can calculate how valuable the fish-production values would have to be in order to bring the total benefits (irrigation and municipal, as well as fish-production) up to the level of the surface water storage costs. That tells us how high the value of fish-passage, fish habitat rehabilitation, and in-stream flows for fish production taken together would have to be for the surface water storage project to produce net benefits that are positive or a benefit-cost ratio that is 1.0 or above. One can then ask if there is any evidence that fish-production benefits, especially those that are not directly associated with investing in fish passage at the Yakima Basin reservoirs, could be that high.

The second reference point for valuing instream flows is to ask what irrigation and municipal water benefits are lost if the instream flows are provided by reducing agricultural and municipal surface water uses. This, arguably, would be the lowest price that irrigators or municipal water users would accept in return for voluntarily reducing their surface water use. In that sense this would be the opportunity cost of providing in-stream flows by foregoing agricultural and municipal surface water benefits. This tells us what economic value is lost if in-stream flows are pursued by reducing irrigation and municipal uses. That cost can be compared with the cost of providing the instream flow by building surface water storage facilities to see if shifting water from irrigation and municipal use is a less costly way of providing in-stream flow fish-production benefits than building large surface water storage.

Pursuing enhanced in-stream flows and their associated benefits in terms of fish production by purchasing water rights from irrigators is already part of the Yakima Plan. That Plan had seven "elements" which included a "Market Driven Reallocation Element" that would "[c]reate conditions within which water banks can facilitate the sale or lease of water between willing parties on a temporary or permanent basis, to improve water supply and instream flow conditions in the Yakima basin."[108] Such transfers of water rights were projected to [i]ncrease

[107] The following two paragraphs are a paraphrasing of the WRC's explanation of how they approached the valuation of in-stream flow. Ibid. p. 20.
[108] Op. cit. OCR and Office of the State Treasurer, "Cost Estimate and Financing Plan-Legislative Report," December 15, 2014, un-paginated, PDF page 8.

the overall value of goods and services derived from the [Yakima] basin's water resources, by reallocating water from lower-value to higher-value uses."[109]

The WRC's report to the legislature on the benefits and costs of the individual projects within the Yakima Plan explored the implicit cost of providing instream flows by such market-based transfers of existing water. To do that, the WRC estimated the agricultural value of surface water being used for irrigation in the Yakima basin (the agricultural benefits gained or lost by increasing or decreasing the irrigation water available). WRC recognized that the cost of diverting water from irrigated agriculture to instream flows would be higher than the lost market value of the reduced agricultural production because of the use of less water. WRC therefor increased that agricultural market value by a third to cover transaction costs, other values farms might attach to that water and the agricultural activity it supported, risk and uncertainty, etc.[110]

WRC estimated that the annual agricultural benefit of an acre-foot of water would be about $84 a year if it were to be leased. Assuming a discount rate of 4 percent, the cost to purchase in-stream flows in perpetuity from an irrigator was estimated to be about $2,750 per acre foot. This assumed that only intra-irrigation-district water trading was possible and that historical climate conditions persisted. If full water rights trading were possible, the cost of purchasing the water for instream flows from irrigators would be lower. If climate change was much more adverse than historical climate conditions, the cost of purchasing the in-stream flows would be higher.

The WRC study commissioned by the legislature concluded that under moderately adverse climate change and intra-district water trading only, the cost of providing the in-stream flows by constructing additional surface water storage would be *16 times as high* as purchasing water rights to protect instream flows. If full water trading within the region were possible, providing for those instream flows by constructing addition surface water storage would be *25 times* what it would cost to purchase the water rights from irrigators. On the other hand, if no increase in water trading was possible and there was moderately adverse climate change, the construction of additional surface water storage would cost *nine times* what purchasing water rights to supplement instream flows would cost.[111]

The unavoidable conclusion is that the agricultural benefits associated with having more irrigation water due to the construction of additional surface water storage would justify only a tiny fraction of dam and reservoir construction costs, 4 to 10 percent of those costs. That is a serious problem for OCR and BOR since to get federal funding (and possibly state funding, too), the proposed water projects need to pass a benefit-cost test: showing positive net values when costs are subtracted from benefits or a benefit-cost ratio greater than 1.0.

The WRC economic analysis that was mandated by the Legislature also studied directly the value of the in-stream flow enhancements for fish-production values to see if those projected fish-production values could turn around the results of the economic analysis and show that the separate projects of the Yakima Plan water development projects made economic sense. The Yakima Plan investments for surface storage to support both in-stream *and* out-of-stream uses

[109] Op. cit. OCR and BOR, Yakima River Basin Integrated Water Resource Management Plan, Final Programmatic EIS, March 2012, p. 2-39.
[110] Op. cit. WRC Benefit-Costs of Yakima Integrated Project, December 2014, pp. 90-91.
[111] Ibid. p. 91. The text on p. 21 says that with intra-district water trade and the CGCM climate regime, the cost of pursuing in-stream flows via the Yakima Plan would be 25 times the cost of pursuing enhance in-stream flows by using water markets. That is incorrect. As pointed out here, the 25-fold increase in cost is associated with full water trading.

account for about 66 percent of the costs of the Yakima Plan.[112] We have already discussed the agricultural and municipal water benefits, the out-of-stream benefits. We now turn to the WRC's estimates of the benefits of the in-stream flows.

The WRC economic analysis estimates that the in-stream flows combined with fish habitat restoration would generate $48 to $294 million in fish-production benefits. Just the mainstem river habitat restoration of the Yakima Plan would cost $338 million. [113] Thus, even if the enhanced instream flows could be provided from new storage at no cost, the costs of improving fish habitat would exceed the benefits, generating net losses rather than net benefits. But, of course, the cost of creating the surface water storage reservoirs to support the proposed in-stream flows would not be zero. The capital costs of the Wymer Reservoir were estimated by the OCR and BOR in 2012 as $1.14 billion and the capital cost of a new Bumping Lake Dam was $517 million.[114] The Yakima Plan, as adopted, includes building *both* of these two large surface storage projects, but more recently OCR has backed away from that part of the Plan, stating, instead, that only one of the be built, at least in the near term. One of the primary stated purposes of these surface water storage reservoirs is to enhance in-stream flows and enhance fish populations. For instance, it is projected that "on average, around half of the storage capacity [of the Wymer Reservoir] would be used annually to improve instream flows upstream and downstream of the reservoir."[115] Clearly a substantial part of the costs associated with these surface water storage projects would have to be allocated to in-stream flows. That would make these efforts to improve fish habitat appear even more uneconomic, increasing the net losses associated with the projects. The estimated fish-production values associated with enhanced instream flows when added to the agricultural and municipal water values cannot not provide sufficient benefits to justify the costs of the proposed surface water storage projects of the Yakima Plan.

H. Proposed Water Development Projects in the Alpine Lakes Wilderness

Despite the fact that all of the major proposed water storage projects in the Yakima Basin have costs that grossly exceed benefits, Yakima Plan supporters have called the Yakima Plan a "National Model."[116] OCR has applied that same "model" of "aggressive development of new water storage" to Washington's Alpine Lakes Wilderness. OCR's *2015 Columbia River Basin Water Supply Inventory Report* discusses this set of projects immediately after discussing the Yakima River Basin Plan.[117]

The Alpine Lakes Wilderness straddles the central Cascade Mountains crest and is one of the most popular National Wilderness Areas in the nation. The Wenatchee National Forest part of that wilderness contains the Enchantment Lakes that are part of the headwaters of the Wenatchee River. A tributary, Icicle Creek, is fed by some of those wilderness lakes. Given

[112] Ibid. p. iv-v.
[113] Ibid. p. 100.
[114] "Yakima River Basin Integrated Water Resource Management Plan: Framework for Implementation Report," prepared by HDR Engineering et al., October 2012, p. 17, Table 2.
[115] Washington Department of Ecology, "Building a Future for Water, Wildlife and Working Lands," http://www.ecy.wa.gov/programs/wr/cwp/images/pdf/8-YBIP-Wymer.10.03.13.pdf .
[116] http://krdistrict.org/EnergyBillNR.pdf
[117] Op. cit. WA Department of Ecology Publication Number 15-12-006.

current demands on Icicle Creek's water, that watershed has faced chronic water supply issues.[118]

In December 2012, OCR and Chelan County co-convened a small workgroup, the Icicle Work Group (IWG), to resolve water rights litigation, fish hatchery concerns, and water supply issues facing the Wenatchee River and its tributary Icicle Creek. The Icicle-Peshastin Irrigation District (IPID) had historic water rights and easements that allowed it to store and divert water from the Enchantment Lakes in the Alpine Lakes Wilderness. Potential IWG water supply enhancement projects include increases in the water diversions from seven lakes in the Enchantment Lakes region.[119] These proposals include the rebuilding of a collapsed dam on Eightmile Lake so that the lake level can be raised to store more water and, during drawdown, can be lowered below current levels. Another proposal would install a siphon or pump or blast a tunnel to allow the draining of Upper Klonaqua Lake into Lower Klonaqua Lake so that additional water could be stored and delivered to the IPID. The IWG is also considering installing remotely controlled equipment so that the levels of all seven of these wilderness lakes can be controlled by IPID from its offices, adjusting the quantities of water removed from the lakes to meet both consumptive use and instream flow requirements.

These and other possible manipulations of the level of these wilderness lakes are currently part of a State Environmental Policy Act EIS process.[120] Presumably there will also be a NEPA process, since the lakes are within a National Forest managed by the U.S. Forest Service. OCR is funding the work of the IWG through a $700,000 contract with the Chelan County Natural Resources Department. OCR also sought another $3.5 million to continue the IWG work into the 2015-2017 biennium.[121]

These proposals to actively manipulate the level of many lakes in the Alpine Lakes Wilderness through the construction of new dams, modification of other dams, and installation of mechanical and motorized equipment within a well-known and spectacular National Wilderness Area are certain to be controversial. It is not clear that the 2006 Washington legislation that established the OCR envisioned that a Washington state government agency would support this type of intrusion into one of the state's most valued natural areas. At the very least, the legislature should require a clear and convincing showing that *each* of these proposed activities within the Alpine Lakes Wilderness has benefits exceeding costs *and,* given the unavoidable environmental costs, that the problems of water supply in the Wenatchee River Basin cannot be solved by aggressive water conservation plans throughout that water basin and the expansion of regional water markets that encourage the selling and trading of water rights so that existing water can voluntarily move from lower to higher valued uses. New commercial intrusions into the Alpine Lakes Wilderness and the commercial manipulation of the water levels in these wilderness lakes are unlikely to be economically justifiable.

[118] Ibid, p.11.
[119] Colchuck, Eightmile, Upper and Lower Snow, Nada, Upper Klonaqua, and Square Lakes.
[120] https://fortress.wa.gov/ecy/publications/documents/1512006.pdf , p. 11.
[121] More information is posted at the Icicle Work Group website:

http://www.co.chelan.wa.us/natural-resources/pages/icicle-work-group

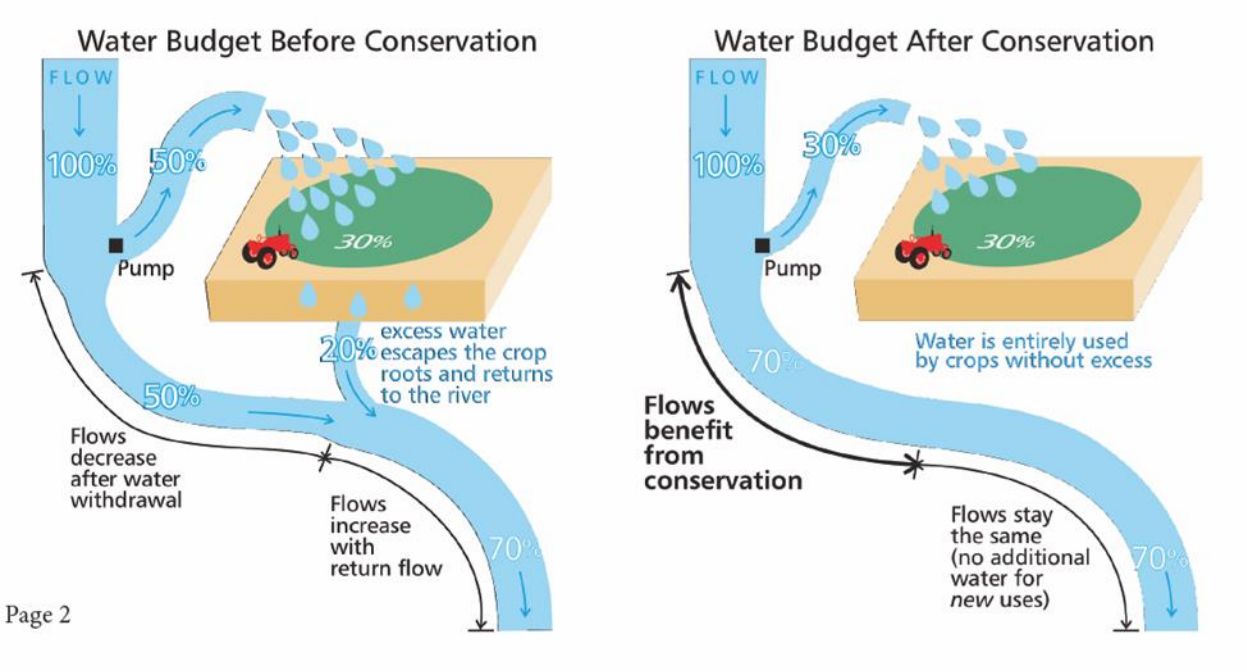
III. The Effectiveness of Water Conservation in Meeting Water Needs

In the first few pages of the 2015 "Columbia River Basin Water Supply Inventory Report" to the Washington Legislature, OCR presents water conservation as though it has no clear beneficial use. Although the report goes on to detail that there *are* clear, large, and real benefits from water conservation,[122] water conservation is initially presented as a lesson to which OCR has learned not to pay attention.

OCR begins its discussion of "lessons learned" "since OCR's inception" that now "shape the way [OCR] allocate[s] funds and prioritize[s] our efforts" with the assertion that "certain project types, such as water acquisition and storage…more efficiently and reliably provide additional water supply than conservation and efficiency improvements."

This is an important, if disturbing, assertion of bias in favor of those approaches to improving water supply that are the most expensive and pose the greatest likelihood of significant and permanent environmental damage: large reservoirs that capture and store water from natural waterways. Since OCR's 2015 report to the legislature on its success at developing water supply over the last decade and its projections of water supply it expects to develop in the near future heavily depends on reservoir storage, it is important to understand the misleading character of OCR's asserted "lesson learned" that water conservation is largely ineffective in improving the delivery of the services of water to agriculture, cities, and businesses.

Page 2 of the "2015 Columbia River Basin Water Supply Inventory Report" presents the following figure.



[122] Page 8 shows 10,000 AF of conservation savings from the Odessa Subarea Groundwater Replacement Program and page 12 shows 3,476 AF of Irrigation Efficiency conservation that has already taken place.

The figure above is presented by OCR to show that there are only very small benefits from water conservation when that conservation is associated with the more efficient application of water to crops. This figure is described by OCR in the following manner:

> Conservation projects, which are abundant on our project inventory lists, are often suggested as a way to make more water available for instream flow and other uses. Despite the presumed benefits, increasing irrigation efficiency does not readily translate to water supply made available for new allocation. While these projects can provide valuable benefits to streamflows supporting aquatic species and habitat, implementation of these projects generally does not yield enough benefits to achieve out-of-stream goals. The amount of water used consumptively by crops remains essentially constant throughout a range of application efficiencies. In some instances, enhanced water use efficiency results in higher consumptive use by crops and less water being available in stream.
>
> As depicted in the [illustration above], water conserved through increased efficiency generally would have returned to the water body as "return flow", and would not have been used consumptively by the crops. However, as OCR attempts to allocate new sources of water, we cannot use these return flow portions, because it will actually reduce streamflow in areas downstream from the historic return flow location. (Page 2.)

There are two very important pieces to this ORC argument about the ineffectiveness of water conservation in enhancing water supply that have to be critically analyzed:

i. A distinction must be made about different types of water conservation efforts. In this OCR description of the lessons it has learned, ORC used the phrase "water conservation" only to refer to applying the appropriate amount of water to crops. But, as OCR knows, this is just one type of water conservation. ORC's own water conservation projects have indeed been among the most important means by which the Columbia Basin has been able to allocate more water to new/current users. Water conservation includes, and has been highly effective in, lining irrigation ditches or replacing them with piping in the Columbia Basin.[123] Because of these projects that discourage seepage from the different canals and conduits, the Columbia Basin as a whole has far more water than otherwise would be available to irrigate crops. This is important because the OCR quote presented above seems to dismiss *all* forms water conservation using an example of *one* type of water conservation. Clearly OCR cannot mean *all* conservation projects are ineffective since conservation projects that reduce the loss of water in the transportation of water from large bodies of water (like the Columbia or numerous reservoirs) have been shown to be highly effective in providing additional supplies of water to the farmers who use the water.[124] OCR's "lesson learned" and its accompanying "teaching aid" are not about water conservation generally but about the efficiency with which water is applied to crops, avoiding wasteful over-watering of crops.

[123] Columbia Basin Project Coordinated Water Conservation Plan-Final Draft. Prepared by Anchor QEA, LLC. March 2010. P. 3.

[124] Both the volume of water conserved and the cost per acre foot make this clear in the Columbia Basin Project Coordinated Water Conservation Plan-Final Draft (2010). This is also made clear in the Columbia River Basin Water Supply Inventory Report where conservation is responsible for saving thousands of AF.

ii. OCR's discussion of the impact of improved irrigation efficiency is misleading. It ignores the instream benefit that is shown in the OCR figure, a benefit that should not be dismissed. Although keeping instream flows at levels sufficient to maintain healthy rivers and fish population may not directly provide more water for irrigation and other off-stream uses, in the situation depicted in the OCR figure, the instream benefits are clearly obtained without any loss in crop production. Assuming that the crops receive enough water, as they do in this figure, then the enhanced instream benefits at the point of diversion would certainly provide some justification for the water conservation measures as it is applied to the crops. Since the damage to riverine ecosystems caused by low stream flows due to the diversion of river water to irrigate crops often leads to the search for additional water sources to enhance instream flows, improved crop watering efficiency that reduces the decline in stream flows at diversion points can indirectly reduce the need to find other water sources to supplement the low stream flows. Efforts to supplement instream flows can reduce the water flows available for out-of-stream uses.

However, the OCR's figure depicting the impact of improved efficiency in applying water to crops is inaccurate. In the "Columbia Basin Project Coordinated Water Conservation Plan-Final Draft," 17 percent of the water not used by the plants that seeps into the ground is lost to "deep groundwater systems, evaporation, and evapotranspiration".[125] This loss of water due to over-watering that seeps into the ground or is absorbed into the air clearly shows that the OCR figure that is presented above is not representative of the actual hydrology. The right-hand figure (after conservation) would remain the same. But the left-hand figure (before conservation) would have 17 percent of the 20 percent return flow (3.4 percent) lost to deep groundwater systems, evaporation, and evapotranspiration. It is possible that some of the water that makes it into the deep groundwater systems could, at a cost, be returned through groundwater pumping, but the portion lost to evaporation and evapotranspiration would be gone forever. Even if the water can be pumped from the deep groundwater system, it is unclear who would benefit from this water. A careful understanding of where the water goes before it is in the deep groundwater system would need to be better understood. In addition, OCR has not used updated crop water requirements. The Washington Irrigation Guide (WIG) is the standard in Washington State for estimating crop water needs, but the guide has not been revised since 1997.[126]

Water conservation is a very real and reliable strategy that has been proven to provide more water to the Columbia Basin Water Inventory. Conservation should not be dismissed as ineffective. Discouraging water conservation, as the above figure and quoted language does, can only harm efforts to cost-effectively provide more water to the farmers of the Columbia Basin. Providing a simplistic figure and language that discourages conservation will lead to less water available for other farmers to use and less water available in the streams that are adjacent to each farm. Indeed, conservation, including improved application of water to plants, is important in developing water supply.

[125] Columbia Basin Project Coordinated Water Conservation Plan-Final Draft. Prepared by Anchor QEA, LLC. March 2010. P. 7.
[126] http://www.ecy.wa.gov/programs/wr/wig/wig.html

OCR has also supported the "Columbia Basin Project Coordinated Water Conservation Plan" which was developed by the three Columbia Basin Project irrigation districts. The goal of this project was to identify water conservation projects that would allow additional acreage to be served without disrupting the water supply of existing acreage while also not increasing the withdrawals of water from the Columbia River. The water saved by this coordinated water conservation effort "would be available as a replacement water supply for groundwater deliveries in the Odessa Subarea, environmental uses, and municipal and industrial water supply."[127]

Note ORC's direct assertions that these conservation efforts would make water supply available for out-of-stream uses such as crop irrigation and water supplies to municipalities and industrial operations. Also, note the recognition that low stream flows can require the diversion of water from out-of-stream use to instream flows.

OCR estimates that 18,267 acre-feet of water savings were generated by the Coordinated Water Conservation efforts between 2009 and 2012, "freeing up enough water to irrigate almost 6,100 acres of land." "The project allows OCR to begin replacing some groundwater water rights with surface water rights in the Odessa Subarea, immediately…" [128] The OCR list of developed water projects between 2006 and 2016, lists the Columbia Basin Irrigation District Piping of open water canals as resulting in the saving of 33,822 acre-feet of water for other uses.[129] That was the third largest of the OCR's list of developed water supply projects. Only the Odessa Subarea Groundwater Replacement Project (164,000 acre feet) and the Lake Roosevelt Incremental Storage Releases Project (132,500 acre feet) provided larger developed water supplies.

Given these OCR-documented water conservation programs' support for out-of-stream water uses, the OCR's report of the negative "lessons learned" about the effectiveness of water conservation in its 2015 Columbia River Basin Water Supply Inventory Report to the Legislature is incomprehensible.

IV. Conclusions on OCR's Last Ten Years

The above analysis of OCR provides a critical overview of OCR's expenditures since its creation. That critical overview raises serious concerns about the actual accomplishments of OCR and the economic rationality of the projects that OCR has supported with its expenditures. The overall conclusion from the above analysis is: <u>The Washington State Legislature should provide no additional funding to OCR until a performance audit on OCR is prepared for the Legislature.</u>

The more detailed conclusions drawn from the above analysis include the following:

[127] "Columbia Basin Project Coordinated Water Conservation Plan—Final Draft," prepared by Anchor QEA for the East, Quincy, and South Columbia Basin Irrigation Districts and the Washington State Department of Ecology, March 2010, page 1.
[128] http://www.ecy.wa.gov/programs/wr/cwp/CBID.html
[129] http://www.ecy.wa.gov/programs/wr/cwp/images/pdf/waterdev.pdf

a. **A significant amount of the approximately 400,000 acre-feet of water that the Office of Columbia River (OCR) reports as having been "developed" during the first decade of OCR's operations is not from "new" water supply production.** For example, as explained in OCR's 2008 Columbia River Basin Water Supply Inventory Report, "On March 20, 2008, Governor Chris Gregoire signed legislation that will provide for the release the largest delivery (132,500 acre-feet) of new water to towns and farms in the Columbia Basin, and for endangered salmon, in three decades. New withdrawals from Lake Roosevelt, behind Grand Coulee Dam, are expected to begin in 2009."[130] In other words, OCR merely arranged to withdraw more water from the existing Lake Roosevelt reservoir.

b. **The approximately 400,000 acre-feet of water that the Office of Columbia River (OCR) reports as having been "developed" during the first decade of OCR's operations is, for the most part, not water that currently has been put to productive use**. For instance, 194,000 acre feet of "developed" water currently stored in Lake Roosevelt behind Grand Coulee Dam has been authorized to be delivered to the Odessa Subarea to replace failing groundwater sources currently being used for irrigation. However, that Columbia River surface water cannot be delivered to those croplands until major additional investments are made in expanding the capacity of the East Low Canal and its associated facilities and to fund and build the delivery systems to carry the water from the canal to the croplands. As a result, as of mid-July, 2016, over 95 percent of the "developed" water that is supposed to be replacing groundwater pumping in the Odessa Subarea has not been delivered to those lands. According to the Bureau of Reclamation (BOR), the original Columbia Basin Project authorized delivery of Lake Roosevelt water to the Odessa Subarea in 1943. For much of that land, the cost of delivering that water has continued to prevent the use of Columbia River surface water to irrigate those lands. Of the 90,000 acres of Odessa Subarea land where Columbia River surface water is supposed to displace deep groundwater pumping, such displacement has taken place on only 2,000 to 3,000 acres of land as of mid-July 2016.

   And, despite OCR spending nearly $200 million of state funds, no new major storage projects have been constructed within the Yakima Basin to provide new water supplies.

c. **There are hundreds of millions of additional taxpayers' investment dollars that will have to be made over the next decade or more before all of that OCR "developed" water is actually put to productive use**. Some combination of funding from Washington State taxpayers, the irrigated farms and municipalities that are beneficiaries, and the federal government will have to be put together before this water is actually "developed" in the sense of being put to productive use. A funding plan for completing this first decade of OCR water "development" has not yet been developed.

[130] 2008 Columbia River Basin Water Supply Inventory Report, Office of Columbia River, p. 3. http://www.ecy.wa.gov/programs/wr/cwp/images/pdf/08legsrpt/expand-rpt.pdf

d. **Listing water as "developed" when financing has not been arranged to put that water to use exaggerates OCR's accomplishments and understates the costly taxpayer investments that will be required to put that water to use.**

e. **The OCR and BOR funded Yakima Plan is based on speculative fish production benefits to justify funding large and expensive surface water storage facilities.** Ninety-six percent of the water to be developed in the OCR "near-term" (2015-2019) water projects are located in the Yakima River Basin and 47 percent of the water from "long-term" development projects (2019+) are also located there. The Yakima Plan lays out a thirty-year vision to develop approximately 500,000 acre-feet of water. As the OCR and BOR calculate the benefits of this 30-year water development project, about 85-90 percent of the benefits of the Yakima Plan are dependent on projected enhanced salmon populations. Only 5 to 10 percent of the benefits are associated with irrigated agriculture. Improved municipal water supplies would be the source of 2 to 3 percent of the benefits.

f. **Doing an aggregate benefit-cost analysis on the Yakima Plan as the OCR and BOR chose to do hides projects that generate major net costs among those that generate net benefits.** The benefit-cost analysis paid for by OCR-BOR found that even under the worst-case scenario the benefits of all of the projects associated with the Yakima Plan generate net benefits of $1.8 billion with a benefit-cost ratio of 1.4. The Washington Legislature in 2013 was not satisfied with the OCR-BOR aggregate benefit-cost analysis and ordered the Washington State Water Research Center (WRC) to do a benefit-cost analysis of each of the component projects within the Yakima Plan. That is a more appropriate use of benefit-cost analysis since it prevents economically very productive projects with very high benefits and very low costs from being used to justify economically irrational projects that have low benefits and high costs.

g. **To economically justify large Yakima Basin surface storage projects, the enhanced instream flows facilitated by those surface water storage projects would have to be implausibly effective at increasing salmon production and/or the incremental salmon production would have to be assigned indefensibly high economic values.** The WRC benefit-cost analysis mandated by the Washington Legislature concluded that none of the OCR larger surface water storage projects in the Yakima Basin could be justified on the basis of the irrigated agriculture and municipal water supply benefits. This includes the combined Kachess Drought Relief Pumping Plant and the related Keechelus-to-Kachess Conveyance. That water conveyance project is needed to make the drought relief pumping from the Kachess Lake's inactive storage viable. The WRC benefit-cost analysis also concluded that neither the Wymer Dam and Reservoir nor a new Bumping Lake Dam could be economically justified on the basis of irrigation and municipal water benefits.

   The WRC estimated the fish-production value of those enhanced in-stream flows to be far too small when combined with irrigation and municipal water benefits to justify the cost of building of those surface water storage facilities.

h. **In addition, within the Yakima Basin, it would be far less costly to provide the planned enhanced in-stream flows by the buying water rights to divert water flows**

to out-of-stream uses and leaving the water in the rivers rather than building new or expanded large surface water storage facilities. Diverting water from out-of-stream uses to in-stream uses would cost a fraction, 4 to 33 percent, of the in-stream-flows' share of the costs of building the surface water storage facilities. Stated differently, in order to economically justify the overall Yakima Project, OCR-BOR had to assume the fish-production value of the water was so much higher than the agricultural and municipal water values (at least 3 to 25 times higher) that it does not make economic sense to use that water for agricultural and municipal uses. It should be devoted instead to fish production via in-stream flows. If that assumption is abandoned, then the Yakima Plan no longer is economically rational nor are most of its component parts.

i. **The proposed surface water storage projects OCR envisions being carried out in the Yakima Basin over the next three decades would be very expensive to Washington State and its citizens, costing Washington taxpayers as much as $2 billion.** OCR's projection of the costs of pursuing this additional surface water storage increases substantially as one moves from the first decade of the Yakima Plan to the second decade. In the first decade (2013-2023), the projected surface water storage costs are about $414 million. In the second decade, the surface water storage investment costs will rise to just over a billion dollars, a 140 percent increase. In the third decade the capital investments in surface water storage will be approximated one billion dollars more. Over the three decades $2.4 billion will be spent on surface water storage by the Yakima Plan. If, as the 2006 ORC legislation requires, the state will cover about half of the costs of the total plan, this represent very substantial future financial obligation for the State of Washington, including at least $1.2 billion, just for surface water storage.

   In addition, as the Yakima Plan is implemented, BOR and OCR intend to conduct appraisals and, potentially, feasibility-level studies on other water supply enhancements, including the potential for an inter-basin transfers from the Columbia River.[131] Pumping from the Columbia River into a new Wymer dam has been proposed.[132] A presentation was made to the Yakima Workgroup on November 8, 2009, on pumping Columbia River water into a new Selah Creek dam.[133] None of these proposals are included in the costs of the Yakima Plan.

   Of course, surface storage of water is just one of the elements of the Yakima Plan. In the Initial Development Phase, the cost of surface water storage was about $414 million. The total cost of all of the elements of the Yakima Plan in that decade was projected to be $897 million, over twice as high. For the second and third decades, the total costs are 50 to 60 percent higher than the surface water storage investment costs alone. The whole of the "Initial Development Phase" of the Yakima Plan, the first decade, 2013-2023, on which ORC is currently working, is projected to cost almost $900 million, while the cost over thirty years would be $4 billion, up to half of which may be a state obligation. See Table 5 below.

[131] Yakima River Basin Integrated Water Resource Management Plan, Final Programmatic Environmental Impact Statement, Benton, Kittitas, Klickitat, and Yakima Counties, p, 2-25
[132] http://www.usbr.gov/pn/programs/yrbwep/2009workgroup/meetings/2009-11-23/14wymerflex.pdf
[133] http://www.usbr.gov/pn/programs/yrbwep/2009workgroup/meetings/2009-11-09/10selahcreekpresentation.pdf

Table 5.

Estimated Costs of Implementing the Yakima Integrated Plan				
Integrated Plan Element	**Initial Development**	**Intermediate Development**	**Final Development**	**Full Development**
	Phase 2013-2023	**Phase 2023-2033**	**Phase 2033-2043**	**Costs 2013-2043**
Surface Water Storage	**$413,900,000**	**$1,003,600,000**	**$999,000,000**	**$2,416,500,000**
Total for All Elements	**$896,900,000**	**$1,572,050,000**	**$1,542,250,000**	**$4,011,200,000**

Source: "The Yakima River Basin Integrated Water Resource Management Plan-Cost Estimate and Financing Plan-Legislative Report," Office of Columbia River, and Office of the State Treasurer, December 15, 2014, Figure 4.

j. The proposals to actively manipulate the level of many lakes in the Alpine Lakes Wilderness through the construction of new dams, modification of other dams, and installation of mechanical and motorized equipment within a well-known and spectacular National Wilderness Area need critical economic scrutiny. At the very least, the legislature should require a clear and convincing showing that *each* of these proposed activities within the Alpine Lakes Wilderness has benefits exceeding costs *and,* given the unavoidable environmental costs, that the problems of water supply in the Wenatchee River Basin cannot be solved by aggressive water conservation plans throughout that water basin and the expansion of regional water markets that encourage the selling and trading of water rights so that existing water can voluntarily move from lower to higher valued uses. New commercial intrusions into the Alpine Lakes Wilderness and the commercial manipulation of the water levels in these wilderness lakes are unlikely to be economically justifiable.

k. OCR's 2105 Columbia Basin Water Supply Inventory Report begins with an explicit criticism of the efficacy of water conservation efforts and an argument in support of giving priority to investments in surface water storage, the most expensive elements of the OCR's plans. OCR's critique of the efficacy of water conservation compared to building surface water storage facilities is misleading in several ways.

i. OCR's critique equates water conservation with improvements in the efficiency with which water is applied to crops. There are many other important types of water conservation besides improving the efficiency of irrigating crops.

ii. Even in the context of efficiency in the amount of water applied to crops, that improved efficiency can moderate the impact of irrigation on in-stream flows at the points of diversion. It can also reduce the loss of water to evaporation, evapotranspiration, and deep water aquifers.

iii. Low in-stream flows due to irrigation withdrawals often lead to efforts to enhance the in-stream flows by building more surface storage to be used to maintain in-stream flows. For instance, about half of the planned surface water stored by the proposed Wymer Dam and Reservoir would be used to enhance in-stream flows rather than delivering water to out-of-stream uses like irrigation.

iv. OCR's own analysis of a broad range of water conservation projects demonstrates that water conservation can provide water of out-of-stream uses in a cost-effective manner.

I. Over the past 10 years, the OCR has wasted millions of dollars on new dam studies that are uneconomical with adverse environmental impacts.

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