WASHINGTON STATE
RECREATION AND CONSERVATION OFFICE
Salmon Recovery
Funding Board

Watershed Restoration and Enhancement Plan Review Report

Executive Summary

The 2018 streamflow restoration law required planning groups in fifteen watersheds, or Water Resource Inventory Areas (WRIAs), to develop watershed plans that offset impacts from new domestic permit-exempt wells and identify actions that will provide a net ecological benefit. Only plans that were approved by all members of the local committees could be adopted. The Department of Ecology adopted plans in nine WRIAs and completed rulemaking in a tenth. Five plans were not approved including WRIA 7 (Snohomish), WRIA 8 (Cedar-Sammamish), WRIA 13 (Deschutes), WRIA 14 (Kennedy-Goldsborough), and WRIA 15 (Kitsap). Pursuant to the law, if a committee failed to approve its plan, the Salmon Recovery Funding Board must provide a technical review of the plan. To meet this requirement, the Recreation and Conservation Office convened a science panel to review the five plans and provide recommendations.

Consumptive Use

Watershed plans must include a new consumptive water use estimate for each subbasin and the technical basis for each estimate. Consumptive use is the estimated water consumption from permit-exempt domestic groundwater withdrawals during the next twenty years. The methods used to estimate consumptive use across the five watersheds reviewed varied. For WRIAs 7, 8, 13, and 15, data from their respective counties were used based upon patterns in development in basins with permit-exempt wells, although each county's method was different. In contrast, WRIA 14 relied upon data provided from the state Office of Financial Management. These estimates then were multiplied by an estimate provided by the Department of Ecology of the average consumption (acre-feet/well) of indoor and outdoor permit-exempt wells in the WRIAs. This resulted in an estimate of the total number of acre-feet of water consumed by permit-exempt wells in each WRIA from 2018-2038 (Table 1). In each of the five watersheds, the methods used to estimate consumptive use were technically sound.

Water Offsets

Once consumptive use was calculated, the five WRIAs identified projects to offset the impacts of permit-exempt wells on aquifers and streams. Each identified a large number of projects and asserted they would offset the consumptive use. Generally, the projects appeared to be overly optimistic about the offset value. Particularly, some project types, such as water right purchases, roof runoff, and low-impact development, used assumptions that likely were overestimated. A more conservative estimate for these project types is warranted, particularly in WRIAs 13, 14, and 15. For WRIAs 7 and 8, it appeared that many of the projects had relatively low feasibility and the water offsets would occur outside the basins with high or moderate water consumption.

Net Ecological Benefit

Once consumptive use was calculated and offsets accounted for, the plans needed to provide additional actions to benefit in-stream resources beyond those necessary to offset the consumptive water use in the WRIA. Each WRIA identified a large number of projects to provide those benefits. While the projects appear to be beneficial for aquatic resources, the certainty that the projects will be completed was lacking. It would be helpful to include information showing the stage of the project, its certainty and feasibility, funding source, technical reviews, prioritization, private or public land, and identified project sponsors. We believe this would help provide the certainty that these projects will occur.

Conclusions

A great deal of work went into these plans. Each plan has important information to document consumption, offsets, and additional benefits. While important progress has been made and many details provided, there are still key areas for improvement, which have been identified in the report below.

Introduction and Purpose

In January 2018, the Washington State Legislature passed the streamflow restoration law (Revised Code of Washington 90.94) to help support robust, healthy, and sustainable salmon populations while ensuring rural communities have access to water. The law directs the Department of Ecology to develop watershed restoration and enhancement plans for fifteen WRIAs that identify projects to offset potential consumptive impacts of new permit-exempt domestic groundwater withdrawals on in-stream flows during twenty years (2018–2038) and which provide a net ecological benefit to the watershed. Following the provisions of the law, Ecology collaborated with a committee composed

of cities, counties, special interest groups, state agencies, and tribes in each WRIA to prepare a draft plan. The law requires all committee members to approve the plan before Ecology considers plan adoption. Ecology adopted nine plans and completed rulemaking for a tenth.

Five watershed plans were not approved unanimously by their committees including watershed plans for WRIA 7 (Snohomish), WRIA 8 (Cedar-Sammamish), WRIA 13 (Deschutes), WRIA 14 (Kennedy-Goldsborough), and WRIA 15 (Kitsap). For these unapproved plans, the streamflow restoration law requires Ecology to submit the draft plan for each WRIA to the Salmon Recovery Funding Board (SRFB) in the Recreation and Conservation Office for technical review. The SRFB review is designed to provide recommendations to Ecology about whether to amend the draft plan to ensure that actions identified in the plan, after accounting for new projected uses of water during the subsequent twenty years, will result in a net ecological benefit to in-stream resources in the WRIA. The law further states that the director of Ecology must consider the recommendations, may amend the plan before adoption, and must initiate rulemaking for the plan after adoption.

To meet this requirement, a science panel of six regional experts reviewed the five unapproved plans. Panel members Hans Berge, Annika Fain, and Adam Hill reviewed plans for WRIA 7 (Snohomish) and WRIA 8 (Cedar-Sammamish); panel members Bob Montgomery, Bill Norris, and Phil Roni reviewed plans for WRIA 13 (Deschutes), WRIA 14 (Kennedy-Goldsborough), and WRIA 15 (Kitsap). The panel was supported by Recreation and Conservation Office staff members Kat Moore, senior outdoor grants manager, and Lauren Burnes, special assistant to the director. The full panel is providing this report to the SRFB to summarize its review and recommendations. Our review and recommendations are limited to the technical aspects of the watershed plans, including the following:

- **Consumptive Use**: *Estimated water consumption from permit-exempt domestic groundwater withdrawals in the next twenty years.* Are the projections technically sound? Was the methodology applied consistently?

- **Water Offsets:** *Actions that put water back into aquifers and streams that offset new consumptive water use*. Will the planned projects and actions (if implemented), at a minimum, offset the total projected impacts to in-stream flows from new consumptive water use in all the subbasins in the WRIA?

- **Net Ecological Benefit**: *Actions in the plan provide additional benefits to aquifers and streams beyond the minimum to offset projected consumptive use*. Does the plan identify projects and actions that provide additional benefits to in-stream resources beyond

those necessary to minimally offset the impacts from new consumptive water use in the WRIA?

Table 1. Summary Information from Plans

	Snohomish WRIA 7	Cedar-Sammamish WRIA 8	Deschutes WRIA 13	Kennedy-Goldsborough WRIA 14	Kitsap WRIA 15
o Area (square miles)	o 1,856	o 692	o 270	o 381	o 676
o County	o King, Snohomish	o King, Snohomish	o Lewis, Thurston	o Mason, Thurston	o King, Kitsap, Pierce, Mason
o Major Streams	o Skykomish, Snohomish, Snoqualmie Rivers	o Cedar and Sammamish Rivers; Bear, Coal, Evans, Issaquah, Little Bear, May, North, and Swamp Creeks	o Deschutes River and Percival, Woodard, and Woodland, Creeks	o Alderbrook, Cranberry, Deer, Goldsborough, Kennedy, Johns, Mill, Perry, Sherwood, Shumocher, and Skookum Creeks	o Dewatto, Tahuya, and Union Rivers, and numerous smaller streams
o Subbasins	o 16	o 12	o 13	o 8	o 7
o Permit-Exempt Wells	o 3,389	o 967	o 2,616	o 4,294	o 5,215
o Acre-Feet Per Year	o 797	o 425	o 434	o 760	o 718

	Snohomish WRIA 7	Cedar-Sammamish WRIA 8	Deschutes WRIA 13	Kennedy-Goldsborough WRIA 14	Kitsap WRIA 15
o Offset Acre-Feet Per Year	o 1,444	o 1,805	o 1,801	o 1,725	o 2,873
o Net Acre-Feet Per Year	o 647	o 1,380	o 1,367	o 965	o 2,155
o Water Offset Projects	o 11	o 10	o 9	o 8	o 15
o Habitat Projects	o 26	o 23	o 19	o 25	o 31
o Consumptive Water Use Method	o Appendix A of *Final Guidance for Determining Net Ecological Benefit* (Ecology, 2019)				
o Indoor Consumptive Uses	o Appendix A (Ecology, 2019)				
o Outdoor o Consumptive Uses	o 393 randomly selected parcels from recent building permits	o 153 randomly selected parcels from recent building permits	o 80 randomly selected parcels	o 80 randomly selected parcels	o 80 randomly selected parcels
o Members voting to approve/not support	o 21/1 (Snoqualmie Indian Tribe)	o 15/1 (Snoqualmie Indian Tribe)	o 11/1 (Building Industry	o 7/4 (BIAW, Department of Fish and Wildlife, Skokomish Indian	o 12/6 (City of Gig Harbor Department of Fish and

	Snohomish WRIA 7	Cedar-Sammamish WRIA 8	Deschutes WRIA 13	Kennedy-Goldsborough WRIA 14	Kitsap WRIA 15
			Association of Washington)	Tribe, Squaxin Island Tribe)	Wildlife, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Squaxin Island Tribe, Suquamish Tribe)

WRIA 7

Introduction to the Watershed Plan

The Snohomish watershed, WRIA 7, is about 1,856 square miles and includes all the lands drained by the Skykomish, Snohomish, and Snoqualmie Rivers. It is divided into sixteen subbasins. The watershed is split about equally between King and Snohomish Counties. The WRIA includes the Snohomish River and its two main tributaries, the Skykomish and Snoqualmie Rivers. The watershed also contains the Tolt Reservoir and Spada Lake, which supply water to Seattle and Everett, respectively.

The WRIA watershed plan projects 3,389 new permit-exempt domestic well connections in the next twenty years, using 797 acre-feet per year or 1.1 cubic-feet per second. The watershed plan identifies eleven water offset projects that would provide an anticipated 1,444 acre-feet per year to benefit streamflows and enhance the watershed. The total offset yields a surplus offset of 647 acre-feet per year above the 797 acre-feet per year consumptive use estimate. The watershed plan identifies twenty-six habitat projects that could provide benefits to fish and other wildlife habitat through floodplain restoration, wetland reconnection, increased channel complexity, reduction of peak flow during storms, and increased groundwater levels and baseflow.

Technical Summary and Review Comments

Consumptive Use

Total offset is determined on an annual basis. King County consumptive use was based on 2000 to 2017 and Snohomish County was based on 2008 to 2018. The total consumptive use for the predicted 3,389 new wells is 797 acre-feet per year. Estimated consumptive use is shown in Table 2.

Table 2. Estimated Consumptive Use for WRIA 7

Wells and Consumptive Use	Quantity
o Projected number of permit-exempt wells in twenty-year planning horizon	o 3,389
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.0184
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.22
o Total estimated consumptive use from 2018-2038, acre-feet per year	o 797

Note: average indoor consumptive use in the plan is listed as 0.00184 (page 48), rather than 0.0184

The method used to project the number of new permit-exempt wells and consumptive use estimates in WRIA 7 is based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. The method to calculate consumptive use assumes 90 percent of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. About 20 percent of the outdoor water use returns to groundwater or surface water and also is not counted as a consumptive use.

A Geographic Information System analysis was used on 393 randomly selected parcels with recent building permits throughout the watershed to estimate outdoor irrigated area. The average irrigated area was estimated to be 0.20 acre.

Consumptive use is much higher in the summer than winter, but the calculations used are based upon an annual average. If the summer consumptive use was broken out separately it would help guide the implementation of future water offset projects at the time when resources are most limiting. Additionally, the methods used to calculate the number of permit-exempt wells in King and Snohomish Counties were different, which may result in minor differences in consumptive use estimates across basins. Despite these limitations, WRIA 7 followed the methodology prescribed by Ecology, used the most accurate data available for each basin, and applied the methods consistently.

Water Offsets

The WRIA 7 committee identified eleven water offset projects across seven subbasins, which if implemented, would provide a total water offset of 1,444 acre-feet per year (Table 3). The total offset yields a surplus offset of 647 acre-feet per year above the 797 acre-feet per year consumptive use estimate. There will be a water deficit in ten of the sixteen subbasins but habitat projects are proposed in all subbasins.

Table 3. Estimated Water Offsets for WRIA 7

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Lake Shoecraft Outlet Modification	o Water storage and retiming	o Tulalip	o 62.5

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Coho Creek Relocation and Streamflow Enhancement	o Streamflow augmentation and floodplain restoration	o Quilceda-Allen	o 362
o Lake Stevens Outlet Structure and Lake Level Management	o Water storage and retiming	o Little Pilchuck	o 500
o Lochaven Source Switch	o Water right acquisition	o Pilchuck	o 12.7
o Lower Pilchuck Number 1	o Water right acquisition	o Pilchuck	o 2.8
o Lower Pilchuck Number 11	o Water right acquisition	o Pilchuck	o 2.1
o Raging River Number 1	o Water right acquisition	o Snoqualmie South	o 126
o Patterson Number 1	o Water right acquisition	o Patterson	o 29.7
o Patterson Number 4	o Water right acquisition	o Patterson	o 71.6
o Managed aquifer recharge in Snoqualmie	o Water storage and retiming	o Snoqualmie North, Snoqualmie South, Upper Snoqualmie	o 198
o Snoqualmie River Watershed Surface Water Storage	o Water storage and retiming	o Cherry-Harris, Snoqualmie South, Upper Snoqualmie	o 77
o	o	o Total	o 1,444.4

The estimated cost for proposed water storage projects varies from $175,000 to $3.5 million. The water rights projects range from $5,000 to $324,000. The total cost for implementing all the water offset projects described in the plan is about $7 million. As of March 2022, three of the eleven planned water offset projects have secured initial feasibility funding. Project sponsors will further refine these cost estimates during their project scoping and development processes.

The certainty of implementation of projects depends on many factors, such as identification and support of project sponsors, readiness to implement the project, and identification of potential barriers. Each of the water offset projects identified in the plan has a project sponsor ready to proceed with project development. One of the largest barriers to implementation is funding. Additionally, willingness of landowners to sell existing water rights is one very uncertain component of this plan. Other potential barriers include the willingness of landowners to sell or allow development of projects. Many of the water offset projects included in the plan have not yet secured landowner approval.

If implemented, the planned water offset projects and actions identified in the WRIA 7 plan will offset the total projected impacts to in-stream flows from the total new consumptive water use.

Net Ecological Benefit

The plan identifies twenty-six proposed habitat projects that provide additional benefits to in-stream resources beyond those necessary to minimally offset the impacts from new consumption water use in the WRIA. Ecological benefits associated with these projects include floodplain restoration, wetland reconnection, availability of off-channel habitat, reduction of peak flow during storms, increased groundwater levels and baseflow, and increased channel complexity. These habitat projects will contribute to addressing limiting factors for salmonids in WRIA 7.

The estimated cost for implementing individual habitat projects ranges from $20,000 (per lined storage pond) for the Snohomish Conservation District Small Farm Storage Initiative project to $15.5 million for the Raging River Bridge to Bridge Acquisitions and Floodplain Restoration project. As of March 2022, five of the twenty-six planned habitat projects have secured funding. Project sponsors will further refine these cost estimates during their project scoping and development processes.

Recommendations

Overall, there is room for improvement in the plan for WRIA 7 but it meets the stated intent for a watershed restoration and enhancement plan. The watershed plan would be

improved by a better distribution of projects to match the needs of individual subbasins, some improvements to reduce the uncertainty of the measurement of consumptive use, and implementation of projects to provide ecological benefit.

- The years used to calculate the King County consumptive use could be based on 2008 to 2018, the same as Snohomish County consumptive use.

- For projects focused on consumptive use or net ecological benefit, it would be helpful to identify feasibility and/or certainty of implementation. A matrix may be a helpful tool to use.

- The number of projects in Pilchuck and Patterson seem light, considering the needs. Additionally, we would have expected to see more projects in Cherry-Harris given consumptive use projections, even if estimates are low. We also suggest projects focused on irrigation and agriculture along the Skykomish and Snoqualmie Rivers, even if only modest offsets to projected consumption

WRIA 8

Introduction to the Watershed Plan

The Cedar-Sammamish watershed (WRIA 8) encompasses about 692 square miles and includes the lands that drain through the Ballard Locks as well as nearshore streams north of the Duwamish River to Mukilteo. The watershed has two major river basins, the Cedar and Sammamish, both of which empty into Lake Washington. The Cedar River has a mean annual flow of 679 cubic feet per second, over two times the discharge of the Sammamish River's 304 cubic feet per second. The upper Cedar River watershed provides water to Seattle. Other major tributaries include Bear Creek, Coal Creek, Evans Creek, Issaquah Creek, Little Bear Creek, May Creek, North Creek, and Swamp Creek. Fifty percent of the watershed is in a city or designated urban growth area. It is the most populated WRIA in Washington. About 85 percent of the watershed is in King County and the remaining 15 percent is in Snohomish County.

Technical Summary and Review Comments

Consumptive Use

A total of 967 new permit-exempt domestic wells are expected in WRIA 8 by 2038, with an estimated use of 425 acre-feet per year, with an estimated error of plus or minus six percent (Table 4). King County is projected to experience the most, with 740 wells, while

Snohomish County expects about 210. The remaining 17 are expected in cities and urban growth areas.

Table 4. Reported Estimated Consumptive Use for WRIA 8 and Assumptions used for Wells.

Wells and Consumptive Use	Quantity
o Projected number of permit-exempt wells in twenty-year planning horizon	o 967
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.0184
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.42
o Total estimated consumptive use from 2018-2038, acre-feet per year	425

The method used to project the number of new permit-exempt wells and consumptive use estimates in WRIA 8 are based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. The method to calculate consumptive use assumes 90 percent of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. About 20 percent of the outdoor water use is assumed to return to groundwater or surface water and also is not counted as a consumptive use. A Geographic Information System analysis was used on 153 randomly selected parcels throughout the watershed to estimate outdoor irrigated area. The average irrigated area was estimated to be 0.32 acre.

Consumptive use is much higher in the summer than winter, but the calculations are based on an annual average. If the summer consumptive use was separated, it would help guide the implementation of future water offset projects during the most water-limited time of the year. As noted previously, King and Snohomish Counties' methods of calculating the number of permit-exempt wells differ slightly and may result in subtle differences in consumptive use in basins in different counties. However, the slightly different projections would have little overall effect because they both use the same methods prescribed by Ecology in a consistent manner.

Water Offsets

The WRIA 8 committee identified ten water offset projects, across five subbasins, which if implemented would provide a total water offset of 1,805 acre-feet per year (Table 5). The total offset yields a surplus offset of 1,380 acre-feet per year above the 425 acre-feet per year consumptive use estimate, making any subtle differences in projections

negligible. There will be a water deficit in six of the twelve subbasins, but planned habitat restoration projects are identified in each subbasin intended to mitigate deficits.

Table 5. Estimated Water Offsets for WRIA 8 for Each Project Identified in the Plan by Project Type.

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Snohomish County Recycled Water Managed Aquifer Recharge	o Water storage and retiming	o Little Bear	o 181
o Wayne Golf Course Water Right Acquisition	o Water right acquisition	o Sammamish River Valley	o 3.54
o Sixty Acres Park Water Right Acquisition	o Water right acquisition	o Sammamish River Valley	o 126
o Water Right Acquisition Number 8	o Water right acquisition	o Sammamish River Valley	o 23.43
o Sammamish River Valley Irrigation Water Rights	o Water right acquisition	o Sammamish River Valley	o 551.83
o Sammamish River Valley Recycled Water Managed Aquifer Recharge	o Water storage and retiming	o Sammamish River Valley	o 181
o Number 1 Water Right Acquisition	o Water right acquisition	o Bear / Evans	o 346.8
o Number 4 Water Right Acquisition	o Water right acquisition	o Issaquah	o 286
o Riverbend Mobile Home Park Water Right Acquisition	o Water right acquisition	o Lower Cedar	o 20.1

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Number 5 Water Right Acquisition	o Water right acquisition	o Lower Cedar	o 85.4
o	o	o Total	o 1,805.1

Water offset projects include two water storage and retiming projects (or projects that change the timing of water withdrawal or addition from the river), and eight water right acquisitions. The total estimated cost for these projects is $4.4 million, with individual projects ranging from about $9,100 to $1.4 million. The certainty of implementation depends on support from landowners, funding, certainty of success, and feasibility. Each of these projects has project sponsors, but many do not have agreements in place with landowners or funding. It is difficult to imagine how budgets can be specific without concurrence on the project or the plan. If these impediments can be removed and the estimates provided by the committee are correct, the implementation of these projects would offset the total projected impacts to in-stream flows from the total new consumptive water use.

Net Ecological Benefit

Twenty-three habitat projects are proposed in the plan to provide ecological benefits, including improvements to stormwater management and infiltration. There is a great deal of uncertainty as to how these habitat projects may offset consumptive use because stormwater projects are in built-out basins, and in these instances are largely retrofits of out-of-date infrastructure. The projects that include floodplain restoration, wetland reconnection, increased off-channel habitat, increased groundwater levels and baseflow, and improved channel complexity in salmon-bearing streams, will provide ecological benefits; few of them offer any offset benefits. The projects that do, are in the Sammamish River and will not address the most limiting factor of warm water temperature. Estimates of project costs where available are between $94,000 for beaver dam analogs to $7 million for a floodplain reconnection project on the Cedar River. While not prioritized, each of these project concepts are consistent with creating potentially measurable and meaningful ecological benefits for salmonids within WRIA 8.

Recommendations

The Watershed Restoration and Enhancement Plan for WRIA 8 is well written and clear in its intent. There are some areas where it could be improved. Three specific improvements are as follows:

- For consistency across basins, King County and Snohomish County should use the same assumptions for new permit-exempt wells, possibly using numbers from the state Office of Financial Management.

- For projects focused on consumptive use or net ecological benefit, it would be helpful to identify feasibility and/or certainty of implementation. A matrix may be a helpful tool to use.

- Ecological projects should be prioritized and effort should be made to include design elements that would increase cold water refugia in the Sammamish River and specifically address water offset directly as design elements in planned restoration projects.

- The Sammamish Basin, North Lake Washington Tributaries (Little Bear, North, and Swamp), and the Bear/Evans basins seem to have the most mitigating effects on water withdrawals and have a lot of pressure for new consumptive use. There should be more emphasis on ecological projects in those streams that are cooler, rather than relying upon relatively small improvements in the much larger Sammamish River.

WRIA 13

Introduction to the Watershed Plan

WRIA13, the Deschutes watershed, in Thurston and Lewis Counties, covers 270 square miles. The Deschutes River is the major hydrologic basin in WRIA 13, with a number of smaller independent tributaries that drain into four saltwater inlets: Budd, Eld, Henderson, and Nisqually Reach. Other principal streams include Woodard and Woodland Creeks, which drain into Henderson. WRIA 13 is divided into nine subbasins for the purposes of the watershed plan.

The WRIA 13 Watershed Restoration and Enhancement Plan projects 2,616 new permit-exempt domestic wells in the next twenty years with an estimated consumptive use of 434 acre-feet per year. A total of four water offset projects would provide an expected offset of 1,801 acre-feet per year to benefit streamflow. This is estimated to provide a total net surplus offset of 1367 acre-feet per year. The WRIA 13 watershed plan identifies nineteen habitat projects designed to increase stream complexity, reconnect floodplains, promote fish passage, enhance natural processes, and ultimately benefit salmonids and other aquatic species.

Technical Summary and Review Comments

Consumptive Use

A total of 2,616 new permit-exempt wells are expected in WRIA 13 by 2038, with an estimated 434 acre-feet per year (Table 6). Although WRIA 13 includes both Thurston and Lewis County, no new permit-exempt wells are expected to occur in Lewis County in the twenty-year planning horizon. The largest number of wells are in the Middle and Lower Deschutes subbasins and the three peninsulas.

Table 6. Estimated Consumptive Use for WRIA 13

Wells and Consumptive Use	Quantity
o Projected number of permit-exempt wells in the twenty-year planning horizon	o 2,616
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.017
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.15
o Total estimated consumptive use from 2018-2038, acre-feet per year	o 434

The method used to project the number of new permit-exempt wells in WRIA 13 is based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. Ecology used growth estimates and growth allocations that were prepared by individual counties to forecast the number of permit-exempt wells in the twenty-year planning horizon by subbasin.

The method assumed an average indoor use per person per day and used estimates of the average irrigated area (outdoor lawn and garden areas), amount of irrigation, and irrigation efficiency to derive the total water use per household with a permit-exempt well. A large portion (90 percent) of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. A small portion (20 percent) of the outdoor water use returns to groundwater or surface water and also is not counted as a consumptive use.

To estimate the average irrigated area for a new residence using a permit-exempt well, the lawn and garden areas of eighty parcels distributed throughout the WRIA and representative of a range of property values were analyzed. The average irrigated area was estimated to be 0.1 acre.

The methodology used to project the number of permit-exempt wells and consumptive use was consistent with WRIAs 14 and 15, the other watershed plans reviewed by our team. The indoor consumptive use per permit-exempt well estimated for WRIA 13 was

the same as for WRIAs 14 and 15. The outdoor consumptive use estimated for WRIA 13 was the same as for WRIA 14 and slightly more than for WRIA 15. The difference is caused by a larger average irrigated area in WRIAs 13 and 14 (0.1 acre) compared to WRIA 15 (0.08 acre).

The estimated outdoor consumptive use is much greater than the indoor consumptive use and comprises 90 percent of the total consumptive use. Ecology expects the outdoor water use will occur mainly in summer, but the consumptive use calculations present an average annual use, not the summer use. Showing the summer consumptive use would help guide implementation of future water offset projects as the largest streamflow deficits occur in summer. However, the projections follow the guidance used and appear to be technically sound.

Water Offsets

The WRIA 13 committee identified four water offset projects, across six subbasins, which if implemented would provide a total water offset of 1,801 acre-feet per year (Table 7). The total offset yields a surplus offset of 1,367 acre-feet per year above the 434 acre-feet per year consumptive use estimate.

Subbasins were delineated by Ecology and the Watershed Restoration Committee to describe the location of projected new consumptive water use and as a guide to developing projects that offset that use in the same general locations and that addressed habitat needs to provide net ecological benefit.

Table 7. Estimated Water Offsets for WRIA 13

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Schneider's Prairie Off-Channel Connection	o Off-channel reconnection and infiltration	o Lower Deschutes	o 681
o Hicks Lake Stormwater Retrofit	o Stormwater infiltration in series with existing stormwater treatment	o Woodland	o 296
o Donnelly Drive Infiltration	o Improve neighborhood stormwater infiltration, avoiding surcharge and runoff to Chambers ditch	o Lower Deschutes	o 14
o Deschutes/ Chambers Managed Aquifer Recharge	o Several candidate locations for managed aquifer recharge of diverted Deschutes River water from high flow periods, exceeding in-stream minimum flows or ecological flows	o Boston Harbor o Cooper Point o Lower Deschutes o Middle Deschutes o Upper Deschutes o Woodland	o 810
o	o	o Total	o 1,801

Managed aquifer recharge projects account for 45 percent of the total water offsets for permit-exempt wells. The projected offsets rely heavily on managed aquifer recharge facilities with benefits that appear overestimated. While managed aquifer recharge

facilities that accept stormwater or treated wastewater appear appropriate, managed aquifer recharge facilities that withdraw flow from streams rely on hydrologic manipulations of natural resources and natural processes that have questionable feasibility and benefits.

The plan segregates habitat projects from quantitative water offsets and fails to integrate natural stream processes into quantitative offset solutions. The plan provides the following quote, "Restoring floodplain connectivity and streamflow regimes, and re-aggrading incised channels are most likely to ameliorate streamflow and temperature changes and increase habitat diversity and population resilience" (Beechie et al. 2013) yet the plan fails to discuss degradation of streambed elevations as a root cause of reduced base flow volumes. Channel and streambed degradation is listed as a Habitat Limiting Factor Addressed for sixteen of the nineteen habitat projects listed in the plan. indicating root causes of reduced summer base flow. Channel degradation reduces water table elevations. Furthermore, the plan fails to sufficiently promote projects that specifically raise streambed and water table elevations.

Alteration of natural stream hydrology is a high-priority limiting factor in WRIA 13. Streamflow is important for supporting riparian vegetation and wetlands that provide shading, wildfire breaks, food web support, and flood and sediment attenuation functions. Yet the plan's water offsets seem to rely on further alterations of natural stream hydrology instead of seeking solutions that reverse such alterations to offset permit-exempt well withdrawals.

The narrative description for managed aquifer recharge projects mentions stormwater as a source for these projects. Yet, it is the only occurrence of the word "stormwater" in the entire description for managed aquifer recharge projects in WRIA 13. The plan should contain more details about how stormwater could be considered a source of water for managed aquifer recharge projects.

There appears to be no consideration of turbidity associated with high flows and its effect on operations and maintenance of managed aquifer recharge facilities. Consideration of turbidity with high flows likely will reduce the number of delivery days to offset operations and maintenance costs of managed aquifer recharge facilities.

The plan assumes that the groundwater recharge rate will be maintained through a program of periodic rehabilitation of the infiltration structure(s). However, rehabilitation could mean a number of things including excavating managed aquifer recharge facilities and screening out fines, which are not compatible with some of the natural areas identified as managed aquifer recharge locations.

There seems to be quite a bit of uncertainty around many offset projects. The offsets for this plan and others with high uncertainty should be revisited and removed as potential offsets.

Net Ecological Benefit

The plan estimates a surplus and net ecological benefit of 1,367 acre-feet per year. This includes a number of projects that we feel are uncertain or don't have project sponsors and thus should not be included. In other cases, there are projects that we felt overestimated the potential benefit. Given the larger surplus, if the authors of the plan were to provide more conservative estimates or remove projects, it still is likely there would be a net ecological benefit. The location and quantity of net ecological benefit shows a deficit in five subbasins and a surplus in four subbasins. This also is a concern though we are not sure if it is possible to identify additional projects to create a more spatially balanced offset across subbasins.

The plan also includes nineteen habitat projects. The plan states that the ecological and streamflow benefits from these projects are supplemental to the quantified water offset projects but will contribute to achieving net ecological benefit. There are a few habitat projects that appear to benefit marine or estuarine habitat and, while beneficial for salmon and other species, should not be considered contributing to net ecological benefit. In addition, most of the habitat projects do not have a project sponsor, which suggests that they are unlikely to be implemented. These should be flagged as conceptual only and not likely to provide a benefit.

Recommendations

Many of the offset projects are highly conceptual and feasibility analyses may find that the potential estimated offset in acre-feet per year is too high. More conservative estimates are needed for most of the managed aquifer recharge and water right acquisition projects. The estuarine and nearshore projects are good habitat projects for salmon and other fish but would not provide an offset to projected consumptive use and should be removed from the list of projects.

Consider solutions that address and enhance natural processes. Wood additions have the potential to accrete sediments and increase water table elevations. We recommend including a discussion of projects that raise water table elevations through raising streambed elevations. Aggradation of gravels in streams acts as filter media and helps to improve water quality. Wood additions coupled with riparian plantings can raise streambed elevations while limiting lateral stream migration. Riparian plantings improve water quality by shading streamflows and promoting deposition of fine sediments on

floodplains. Floodplain connectivity offsets can be evaluated with analyses similar to those identified in the WRIA 13 plan's Appendix I: Detailed Project Descriptions, pages I-26 and I-27.

We recommend developing strategies that recognize and reverse the root causes of reduced summer base flows. The plan should recognize impacts of increased stormwater flow and display a preference for intercepting stormwater to source managed aquifer recharge facilities. The plan should evaluate existing stormwater conveyance systems for managed aquifer recharge source water. The plan should make estimates of turbidity during high flows to consider turbid waters' plugging effect on recharge facilities and evaluate if turbid flows can be allowed or if they will increase operations and maintenance costs to such a level that the number of diversion days must be reduced.

The plan should use caution when replicating natural annual hydrographs through further manipulation of natural stream hydrography (i.e., stream withdrawals to source managed aquifer recharge projects). Instead, the plan should develop and evaluate projects that reduce alterations of natural stream hydrology and avoid further manipulation of natural stream processes.

We recommend the plan be revised to remove some of the less likely offset projects and consider other recommendations above.

WRIA 14

Introduction to the Watershed Plan

WRIA 14, the Kennedy Goldsborough watershed, is in Mason and Thurston Counties and covers 381 square miles and includes an extensive network of independent streams. Principal drainages include Alderbrook, Cranberry, Deer, Goldsborough, Johns, Kennedy, Mill, Perry, Sherwood, Shumocher, and Skookum Creeks. WRIA 14 is divided into eight subbasins.

The WRIA 14 Watershed Restoration and Enhancement Plan projects 4,294 new permit-exempt domestic wells in the next twenty years and an estimated consumptive use of 760 acre-feet per year. A total of eight water offset projects would provide an expected offset of 1,725 acre-feet per year to benefit streamflow. This is estimated to provide a total net surplus offset of 965 acre-feet per year. The WRIA 14 watershed plan identifies twenty-five habitat projects designed to increase stream complexity, reconnect floodplains, promote fish passage, enhance natural processes, and ultimately benefit salmonids and other aquatic species.

Technical Summary and Review Comments

Consumptive Use

A total of 4,294 permit-exempt wells are expected in WRIA 14 by 2038, with an estimated use of 760 acre-feet per year (Table 8). WRIA 14 includes both Mason and Thurston Counties, but the largest number of the wells are expected to be in Mason County in the Oakland Bay subbasin.

Table 8. Estimated Consumptive Use for WRIA 14

Wells and Consumptive Use	Quantity
o Projected number of permit exempt wells in twenty-year planning horizon	o 4,294
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.017
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.16
o Total estimated consumptive use from 2018-2038, acre-feet per year	o 760

The method used to project the number of new permit-exempt wells in WRIA 14 is based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. Ecology used growth estimates and growth allocations that were prepared by individual counties to forecast the number of permit-exempt wells in the twenty-year planning horizon. Ecology also forecasts the number of permit-exempt wells in the planning horizon by subbasin.

The method assumed an average indoor use per person per day and used estimates of the average irrigated area (outdoor lawn and garden areas), the amount of irrigation, and irrigation efficiency to derive the total water use per household with a permit-exempt well. A large portion (90 percent) of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. A small portion (20 percent) of the outdoor water use returns to groundwater or surface water and also is not counted as a consumptive use.

To estimate the average irrigated area for a new residence using a permit-exempt well, the lawn and garden areas of eighty parcels distributed throughout the WRIA and representative of a range of property values were analyzed. The average irrigated area was estimated to be 0.1 acre.

The methodology used to project the number of permit-exempt wells and estimate consumptive use in WRIA 14 was consistent with WRIAs 13 and 15, the other watershed plans reviewed by our team. The indoor consumptive use per permit-exempt well estimated for WRIA 14 was the same as WRIAs 13 and 15. The outdoor use consumptive use estimated for WRIA 14 was the same as WRIA 13 and slightly more than WRIA 15. The difference is caused by a larger average irrigated area in WRIAs 13 and 14 (0.1 acre) compared to WRIA 15 (0.08 acre).

The estimated outdoor consumptive use is much greater than the indoor consumptive use and comprises 90 percent of the total consumptive use. Ecology expects outdoor water use will occur mainly in summer but the consumptive use calculations present an average annual use, not the summer use. Showing the summer consumptive use would help guide implementation of future water offset projects as the largest streamflow deficits occur in summer. However, the projections follow the guidance used and appear to be technically sound.

Water Offsets

The WRIA 14 committee identified six water offset projects across seven subbasins, which if implemented would provide a total water offset of 1,725 acre-feet per year (Table 9). The total offset yields a surplus offset of 965 acre-feet per year above the 760 acre-feet per year consumptive use estimate.

Subbasins were delineated by Ecology and the Watershed Restoration Committee to describe the location of projected new consumptive water use and as a guide to developing projects that offset that use in the same general location and that addressed habitat needs to provide net ecological benefit.

Table 9. Estimated Water Offsets for WRIA 14

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Mason County Rooftop Runoff	o New county requirement for new rural residential building to install low-impact development best management practices that infiltrate more than 95 percent of rooftop runoff	o WRIA-wide	o 224

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o City of Shelton Reclaimed Water / Washington Correction Center Source Switch	o Redirect north Shelton wastewater to the Water Reclamation Plan and infiltrate Class A reclaimed water at existing spray field near the Washington Corrections Center.	o Goldsborough	o 459
o Evergreen Mobile Estates	o Water system consolidation and water right acquisition	o Oakland	o 7
o Managed Aquifer Recharge	o Install managed aquifer recharge facilities	o Case, Goldsborough, Kennedy, Mill, Oakland, Skookum	o 910
o Water Right Opportunities	o A focused WRIA-wide analysis on potential water right efficiencies and acquisition for future studies and implementation	o Goldsborough, Hood, Mill, Oakland	o 111
o Steamboat Middle	o Surface water retention and infiltration	o Kennedy	o 14
o	o	o Total	o 1,725

Note that the Schneider's Prairie Off-Channel Connection was included in Table 10 of the plan, but Schneider's Prairie is in WRIA 13. Schneider's Prairie Off-Channel Connection was not included in water offsets for WRIA 14.

Managed aquifer recharge projects account for 53 percent of the total water offsets for permit-exempt wells. The projected offsets rely heavily on managed aquifer recharge facilities with benefits that appear overestimated. While managed aquifer recharge facilities that accept stormwater or treated wastewater appear appropriate, managed aquifer recharge facilities that withdraw flow from streams rely on hydrologic manipulations of natural resources and natural processes that have questionable feasibility and benefits.

The plan cites the National Oceanic and Atmospheric Administration's Puget Sound Watershed Characterization Project, which is a tool used in Puget Sound by planners and resource managers to identify priorities for habitat protection and restoration. The characterization project directs planners to identify the root causes of watershed issues and develop appropriate solutions. The plan fails to identify stream degradation as a root cause of reduced base flows even though it is well understood that reduced streambed elevations directly impact water table elevations and base flow volumes. Channel and streambed degradation is listed as a habitat limiting factor addressed for nineteen of the twenty-three habitat projects listed in the plan's Table 12, indicating them as root causes of reduced summer base flow. Channel degradation reduces water table elevations. Furthermore, the plan fails to sufficiently promote projects that specifically raise streambed and water table elevations.

Alteration of natural stream hydrology is a high-priority limiting factor in WRIA 14. Streamflow is important for supporting riparian vegetation and wetlands that provide shade, wildfire breaks, food web support, and flood and sediment attenuation functions. Yet the plan seems to rely on further alterations of natural stream hydrology such as diverting streamflow to managed aquifer recharge facilities instead of seeking solutions that reverse those alterations, such as reversing channel degradation.

The Narrative Description for managed aquifer recharge projects identifies stormwater as a water source. Yet, it is the only occurrence of the word "stormwater" in the entire description for managed aquifer recharge projects. The plan should contain more details about how stormwater could be considered a source of water for managed aquifer recharge projects.

There appears to be no consideration of turbidity associated with high flows and turbidity's effect on operations and maintenance of managed aquifer recharge facilities. Consideration of turbidity with high flows likely will reduce the number of delivery days to offset operations and maintenance costs of managed aquifer recharge facilities.

The plan assumes that the groundwater recharge rate will be maintained through a program of periodic rehabilitation of the infiltration structure(s). However, rehabilitation

could mean a number of things including excavating managed aquifer recharge facilities and screening out fines, which are not compatible with some of the natural areas identified as managed aquifer recharge locations.

Net Ecological Benefit

The WRIA 14 watershed plan estimates a surplus and net ecological benefit of 965 acre-feet per year. This includes a number of projects that we feel either are uncertain or highly conceptual and thus should not be included. In addition, there are projects that we felt overestimated the potential benefit. Given the larger surplus, if the authors of the plan were to reduce or remove projects, it still is likely there would be a net ecological benefit. The location and quantity of net ecological benefit shows a deficit in three subbasins and a surplus in five subbasins. This is also a concern though we are not sure if it is possible to identify additional projects to create a more spatially balanced offset across subbasins.

The plan also identifies twenty-five habitat projects. The plan states that the ecological and streamflow benefits from these projects are supplemental to the quantified water offset projects but will contribute to achieving net ecological benefit. There are at least three habitat projects that appear to benefit marine or estuarine habitats and, while beneficial for salmon and other species, they should not be considered contributing to net ecological benefit. In addition, habitat projects without a project sponsor suggest a high likelihood that they will not be implemented. These should be flagged as conceptual only and not included.

Recommendations

The offset projects generally include many that are highly conceptual, and feasibility analyses may find that potential offsets in acre-feet per year are too high. We recommend providing more conservative estimates for most of the managed aquifer recharge, rooftop runoff/low-impact development, and water right acquisition projects while keeping the estimates for wastewater infiltration. Remove Schneider's Prairie Off-Channel Connection project from the plan as it is in WRIA 13.

The estuarine and nearshore projects are good habitat projects for salmon and other fish but would not provide an offset to projected consumptive use and should be removed from the list of projects. If habitat projects don't have a sponsor or landowners have not indicated some interest, then the project really is only conceptual and should not be included.

Consider solutions that address root causes of reduced summer base flows and use natural stream processes to reverse root causes. Wood additions can be used to accrete

sediments to raise streambed and water table elevations. Include a discussion that recognizes that raised streambed elevations also raise water table elevations to address root causes of reduced summer base flows. Accreted sediments in streams also act as filter media to improve water quality. Wood placements that effectively raise streambed elevations can be coupled with riparian plantings to minimize lateral stream migration. Riparian plantings also improve water quality by shading streams and promoting fine sediment deposition on floodplains.

We recommend using stormwater for managed aquifer recharge source water rather than surface water. Many managed aquifer recharge projects use surface water for their sources, which does not appear to consider that stormwater discharges to streams increases turbidity. Intercepting stormwater before it enters natural streams avoids increases in erosion and turbidity. The plan should evaluate existing stormwater conveyance systems for managed aquifer recharge source water and consider if turbidity during high flows can be allowed or if increased turbidity effects operations and maintenance costs to such a level that the number of diversion days must be reduced.

The plan should use caution when replicating natural annual hydrographs through further manipulation of natural stream hydrography (i.e., stream withdrawals to source managed aquifer recharge projects). Instead, the plan should develop and evaluate projects that reduce alterations of natural stream hydrology and avoid further manipulation of natural stream processes.

We recommend the plans be revised to remove some of the less likely offset projects and consider other recommendations above.

WRIA 15

Introduction to the Watershed Plan

WRIA 15, the Kitsap watershed, encompasses the entire Kitsap Peninsula and surrounding islands. It covers 676 square miles including Kitsap County and portions of King, Mason, and Pierce Counties. Major drainages include Dewatto, Tahuya, and Union Rivers and dozens of independent streams. WRIA 15 is divided into seven subbasins.

The WRIA 15 watershed plan projects 5,215 new permit-exempt domestic wells in the twenty-year planning horizon with an estimated consumptive use of 718 acre-feet per year. A total of fifteen water offset projects would provide an expected offset of 2,873 acre-feet per year to benefit streamflow. This is estimated to provide a total net surplus

offset of 2,155 acre-feet per year. The plan identifies thirty-one habitat projects designed to provide a variety of ecological benefits.

Technical Summary and Review Comments

Consumptive Use

A total of 5,215 new permit-exempt wells are expected in WRIA 15 by 2038, with an estimated use of 718 acre-feet per year (Table 10). Kitsap County is projects to experience the most, with 2,568 new wells, followed by Mason County with 1,301 new wells, Pierce County with 978 new wells, and King County with 368 new wells.

Table 10. Estimated Consumptive Use for WRIA 15

Wells and Consumptive Use	Quantity
o Projected number of permit-exempt wells in the twenty-year planning horizon	o 5,215
o Indoor consumptive use, acre-feet per year/per well (average)	o 0.0168
o Outdoor consumptive use, acre-feet per year/per well (average)	o 0.121
o Total estimated consumptive use from 2018-2038, acre-feet per year	o 718

The method used to project the number of new permit-exempt wells in WRIA 15 is based on recommendations from Appendix A of Ecology's *Final Guidance for Determining Net Ecological Benefit*. Ecology used growth estimates and growth allocations that were prepared by individual counties to forecast the number of permit-exempt wells in the twenty-year planning horizon. Ecology also forecast the number of permit-exempt wells by subbasin.

The method assumed an average indoor use per person per day and used estimates of average irrigated area (outdoor lawn and garden areas), the amount of irrigation, and irrigation efficiency to derive the total water use per household with a permit-exempt well. A large portion (90 percent) of the indoor water use returns to groundwater via septic tanks and is not counted as a consumptive use. A small portion (20 percent) of the outdoor water use returns to groundwater or surface water and also is not counted as a consumptive use.

To estimate the average irrigated area for a new residence using a permit-exempt well, the lawn and garden areas of eighty parcels distributed throughout the WRIA and representative of a range of property values were analyzed. The average irrigated area was estimated to be 0.8 acre.

The methodology used to project the number of permit-exempt wells and estimate consumptive use in WRIA 15 was consistent with WRIAs 13 and 14, the other watershed plans reviewed by our team. The indoor consumptive use per permit-exempt well estimated for WRIA 15 was the same as for WRIAs 13 and 14. The outdoor consumptive use estimated for WRIA 15 was slightly lower than for WRIAs 13 and 14. The difference is caused by a larger average irrigated area used in WRIAs 13 and 14 (0.1 acre) compared to WRIA 15 (0.08 acre).

The estimated outdoor consumptive use is much greater than the indoor consumptive use and comprises 90 percent of the total consumptive use. Ecology expects the outdoor water use will occur mainly in summer, but the consumptive use calculations present an average annual use, not the summer use. Showing the summer consumptive use would help guide implementation of future water offset projects as the largest streamflow deficits occur in summer. However, the projections follow the guidance used and appear to be technically sound.

Water Offsets

The WRIA 15 committee identified fifteen water offset projects, across seven subbasins, which if implemented would provide a total water offset of 2,873 acre-feet per year (Table 11). The total offset yields a surplus offset of 2,155 acre-feet per year above the 718 acre-feet per year consumptive use estimate.

Subbasins were delineated by Ecology and the Watershed Restoration Committee to describe the location of projected new consumptive water use and as a guide to developing projects that offset that use in the same general location and that addressed habitat needs to provide net ecological benefits.

Table 11. Estimated Water Offsets for WRIA 15

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Kingston Wastewater Treatment Plan	o Reclaimed water to recharge groundwater	o North Hood Canal, West Sound	o 328
o Central Kitsap Water Treatment Plan	o Reclaimed water for stream augmentation	o North Hood Canal, West Sound	o 560
o Tahuya Managed Aquifer Recharge	o Managed aquifer recharge	o South Hood Canal	o 200
o South Hood Canal Lakes Managed Aquifer Recharge	o Surface water storage and aquifer recharge	o South Hood Canal	o 62

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Bainbridge Island Managed Aquifer Recharge Opportunities	o Managed aquifer recharge through diversion of flow and infiltration	o Bainbridge Island	o 64.2
o Belfair Wastewater Treatment Plant	o Reclaimed water for infiltration to recharge groundwater	o South Sound	o 70
o Rocky Creek Managed Aquifer Recharge	o Managed aquifer recharge through diversion of flow and infiltration	o South Sound	o 150
o M&E Farm Stormwater Infiltration	o Stormwater collection and infiltration to recharge groundwater	o Bainbridge Island	o 8
o Ridgetop Boulevard Stormwater	o Stormwater collection and infiltration to recharge groundwater	o West Sound	o 126.7
o Mason County Rooftop Runoff	o Recharge groundwater through infiltration at homes	o South Hood Canal, South Sound	o 71
o Beall Creek	o Flow improvements	o Vashon Maury	o 26

Project	Short Description	Subbasins Benefiting	Estimated Offset Benefits (acre-feet per year)
o Stream Augmentation	o Discharge water indirectly into streams to augment streamflow	o Bainbridge Island (future), North Kitsap, South Sound, West Sound	o 632
o Forests for Streamflow	o Acquire forestland to preserve stands or emphasize longer harvest interval	o Bainbridge Island, North Hood Canal, South Hood Canal, South Sound, South Sound Islands, Vashon Maury, West Sound	o 241.2
o Raingardens and Low Impact Development	o Improve infiltration on impervious surfaces that generate stormwater	o Bainbridge Island, North Hood Canal, South Hood Canal, South Sound, Vashon Maury, West Sound	o 188
o Water Right Acquisitions	o Permanently protect water rights, habitat improvements	o Bainbridge Island, Vashon Maury	o 146
o	o	o Total	o 2,873

The plan lists primary limiting factors of channel and streambed degradation, increased peak flows, low streamflow, loss of upland forest cover, loss of riparian forest, and loss of floodplain connectivity and habitats. The limiting factors listed all speak to past land-use practices of removing wood from streams and draining wetlands that resulted in reduced streambed and water table elevations. These practices coincided with increases in stormwater and associated water quality and quantity impacts. This does not appear to be appropriately identified and many solutions rely on further manipulation of natural systems instead of restoration of natural processes.

The plan cites the National Oceanic and Atmospheric Administration's Puget Sound Watershed Characterization Project, which is a tool used in Puget Sound by planners and resource managers to identify priorities for habitat protection and restoration. The

characterization project directs planners to identify the root causes of watershed issues and develop appropriate solutions. The plan fails to identify stream degradation as a root cause of reduced base flows even though it is well understood that reduced streambed elevations directly impact water table elevations and base flow volumes. The plan's Table 14 lists channel and streambed degradation, degradation of wetland and shoreline habitats, or loss of floodplain connectivity and habitats, as a habitat limiting factor addressed for twenty-three of the thirty-one habitat projects. This is an indication of root causes of reduced summer base flow. Channel degradation reduces water table elevations. Furthermore, the plan fails to sufficiently promote projects that specifically raise streambed and water table elevations.

Stream augmentation from pumping groundwater twists a root cause problem into a solution. It will rely on electricity to pump water for streamflow augmentation. Electric supplies will become more at-risk during fire season as climate change worsens. Utilities may shut off power preemptively to avoid causing wildfires or electricity may be cut off due to wildfires. Providing generators as a solution to this concern does not address root causes of the problem.

Forest protection projects seem like a good idea, but there is uncertainty about the age of the stands. These also are largely protection projects and while protection is always cheaper than restoration or mitigation, the benefits seem theoretical and some revisit of the forestry offset should be considered.

It is unclear if forest protection projects–are considered an offset project by the Department of Ecology. It is clear from literature that mature forests provide better in-stream flows, but not clear if the parcels would become mature forest anyway.

Net Ecological Benefit

The watershed plan estimates a surplus and net ecological benefit of 2,155 acre-feet per year just by accounting for the offset projects. However, this includes a number of projects that we felt were uncertain and thus should not be included. In addition, there are projects that we felt overestimated the potential benefit. Given the larger surplus, if the authors of the plan were to reduce or remove unlikely projects, it still is likely there would be a net ecological benefit. The location and quantity of net ecological benefit shows that all subbasins have a surplus, though this may change when the offset is revisited to adjust for our suggestions.

The plan also identifies thirty-one habitat projects. The plan states that the ecological and streamflow benefits from these projects are supplemental to the quantified water offset projects but will contribute to achieving net ecological benefit. However, there are a few habitat projects that appear to benefit marine or estuarine habitats and, while

beneficial for salmon and other species, should not be considered contributing to net ecological benefit. In contrast to other WRIAs, all the habitat projects have sponsors and thus may be more likely to be implemented.

Recommendations

The offset projects generally include many that are highly conceptual, which suggests that the potential offset in acre-feet per year is too high. We recommend providing more conservative estimates for most of the managed aquifer recharge, rooftop runoff/low-impact development, and water right acquisition projects while keeping the estimates for wastewater infiltration. Projects that pump groundwater to augment surface water should not be considered as off-set projects.

The estuarine and nearshore projects are good habitat projects for salmon and other fish but would not provide an offset to projected consumptive use and should be removed from the list of projects.

Consider solutions that address and enhance natural processes. Wood additions can accrete sediments and increase water table elevations. Include discussion of projects that raise streambed elevations to raise water table elevations. Accreted gravels in streams act as filter media and improve water quality. If wood additions are coupled with riparian plantings, lateral stream migration can be arrested. Water quality is improved by shading streamflows and fine sediments tend to deposit on floodplains with intact riparian corridors.

Recognize root causes of reduced summer base flows and develop strategies for reversing root causes. Display a preference for intercepting stormwater before it enters natural streams and increases in erosion and turbidity. Develop and evaluate projects that reduce alterations of natural stream hydrology and avoid further manipulation of natural stream processes.

Evaluate existing stormwater conveyance systems for managed aquifer recharge source water. Consider the turbid waters' plugging effect on managed aquifer recharge facilities. Make estimates of turbidity during high flows. Evaluate if turbid flows can be allowed or if they will increase operations and maintenance costs to such a level that the number of diversion days must be reduced.

We recommend the plan be revised to remove some of the less likely offset projects and consider other recommendations above.

Conclusions

We reviewed the watershed plans for WRIAs 7, 8, 13, 14, and 15 to answer specific questions about consumptive use, water offsets and net ecological benefits.

Consumptive Use: *Estimated water consumption from permit-exempt domestic groundwater withdrawals in the next twenty years.* Are the projections technically sound? Was the methodology applied consistently?

- Across all five plans, the consumptive use estimates were technically sound and the methodology was applied consistently.

Water Offsets: *Actions that put water back into aquifers and streams that offset new consumptive water use.* Will the planned projects and actions (if implemented), at a minimum, offset the total projected impacts to in-stream flows from new consumptive water use in all the subbasins in the WRIA?

- Yes, all plans identify projects that offset projected consumptive use impacts, though in particular for WRIAs 13, 14, and 15, we feel that those offsets are too optimistic, and some projects should be removed. However, we believe that even after removal of more uncertain projects, there still will be adequate offsets.

Net Ecological Benefit: *Actions in the plans provide additional benefits to aquifers and streams beyond the minimum to offset projected consumptive use.* Do the plans identify projects and actions that provide additional benefits to in-stream resources beyond those necessary to minimally offset the impacts from new consumptive water use in the WRIA?

- Yes, though, as noted above, there are a number of water offset projects in WRIAs 13, 14, and 15 and some habitat projects that should not be included.

While we recommend some minor revisions for WRIAs 7 and 8, we felt that they meet the stated intent for watershed restoration and enhancement plans. For WRIAs 13, 14, and 15, we recommend revising or removing some water offset and habitat projects and addressing other minor comments.

References

Washington Department of Ecology (Ecology). 2019. Final Guidance for Determining Net Ecological Benefit. GUID-2094 Water Resource Program Guidance. Publication 19-11-079. Olympia, Washington. Published on July 31, 2019.