Identification of Potential Economic Benefits of Production and Use of Reclaimed Water

WORKING DRAFT

Updated November 2009

King County

Department of
Natural Resources and Parks
Wastewater Treatment Division

For comments or questions, contact:
Mark Buscher
King County Wastewater Treatment Division
201 South Jackson Street
KSC-NR-0512
Seattle, WA 98104-3856
206-684-1242
Mark.Buscher@kingcounty.gov

This information is available in alternative formats on request at 206-684-1280 (voice) or 711 (TTY).

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Prepared for:

Environmental and Community Services Section
Wastewater Treatment Division
Department of Natural Resources and Parks

Prepared by:

ECONorthwest

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1.0. INTRODUCTION

This report was prepared to support the development of a Reclaimed Water Comprehensive Plan for King County's Wastewater Treatment Division (WTD). The purpose of the Reclaimed Water Comprehensive Plan is to determine if, how, when, where, and by what funding mechanism over the next 30 years the county's existing reclaimed water program should expand.

The report synthesizes available information regarding the potential economic benefits—both financial and societal—that might arise from producing and using reclaimed water in the county's reclaimed water planning area (Figure 1). This synthesis is part of the first step in an economic analysis that King County is conducting for the Reclaimed Water Comprehensive Plan. The other part, which identifies the potential costs of producing and using reclaimed water, is documented in a companion report.[1] The information in both reports is preliminary and will serve as a basis for subsequent steps in the economic analysis.

1.1 Steps in the Economic Analysis

The economic analysis to be conducted for the Reclaimed Water Comprehensive Plan consists of a benefit-cost analysis of different strategies for producing and distributing reclaimed water that could serve identified potential uses throughout the region. To conduct the benefit-cost analysis, the county is using as a general guide an economic framework developed by the WateReuse Foundation.[2] The economic framework is a tool that can be used to organize, document, and communicate benefit-cost information in a transparent manner so that it can help guide public involvement and policy making.

King County will be adapting the framework to the planning process for the Reclaimed Water Comprehensive Plan.[3] The planning process is designed to incorporate involvement of interested parties in each of the anticipated major steps of the economic analysis, described below:

- **Identification of the benefits and costs associated with the production and use of reclaimed water.** This step includes developing a list of all potential benefits and costs that may accrue from production and use of reclaimed water. A broad suite of benefit and cost categories are considered. The benefits and costs are then screened to determine which can be analyzed quantitatively, which should be described only qualitatively, and which are insignificant and can be eliminated from further analysis. This report and the companion report on potential costs have been prepared to complete this step.
- **Establishing a baseline to define the outcomes associated with the "no action" alternative.** The baseline serves as the "status quo" scenario and defines what conditions would be like without development of the Reclaimed Water Comprehensive Plan. The

[1] King County. 2009. *Identification of Potential Economic Costs of Production and Use of Reclaimed Water.* Working Draft. http://your.kingcounty.gov/dnrp/library/wastewater/rw/CompPlan/0911_IDEconomicCost.pdf.

[2] Raucher, R., K. Darr, J. Henderson, R. Linsky, J. Rice, B. Sheikh, and C. Wagner. 2006. *An Economic Framework for Evaluating the Benefits and Costs of Water Reuse.* Alexandria, VA: WateReuse Foundation.

[3] King County. 2009. Reclaimed Water Comprehensive Plan – Planning Process. http://your.kingcounty.gov/dnrp/library/wastewater/rw/CompPlan/090722_AttachmentA_Motion.pdf.

baseline is not static and does not represent a single point in time; it must define likely conditions through 2040 to reflect the 30-year planning period being considered.

- **Identification of alternatives to reclaimed water that may achieve similar benefits.** In this step, alternatives to the production and use of reclaimed water will be identified. A brief example of an alternative to reclaimed water are new stormwater management practices that could hold water for irrigation or to improve baseflow conditions in a stream basin. An evaluation of the technical feasibility, benefits, and costs of these alternatives could occur during or after the planning process is completed but prior to making project-specific recommendations about expanding any portion of the existing regional reclaimed water system.
- **Assign and estimate values for benefits and costs to comprehensive plan reclaimed water strategies.** Benefits and costs that have been identified will be assigned to reclaimed water strategies. For those that can be quantified, a total value expressed in dollars will be estimated. For those where it is not feasible to express a quantitative value, the benefits and costs will be described qualitatively. The relative importance of each cost will be described in terms of importance and/or value. The importance and/or value will be scored on a qualitative ranking system so that all qualitative costs are compared on the same scale. The WateReuse Foundation framework suggests a five-point scale, ranging from -2 to +2, where +2 signifies a very high relative benefit, -2 represents a large relative negative cost, and -1 and +1 represent the intermediate outcomes of relatively smaller benefits and costs. A similar scale will be used in the economic analysis done as part of the Reclaimed Water Comprehensive Plan. The county will seek input from interested parties when assigning and estimating values for benefits and costs.
- **Conduct benefit-cost analysis.** The benefits and costs for each reclaimed water strategy will be summarized and discounted to present value at an appropriate discount rate. This summary will include monetized benefits and costs and a limited qualitative assessment of the non-quantified benefits and costs. The benefits and costs of each reclaimed water strategy will be compared to determine if the strategy has a net benefit or cost. Once the net benefit or cost for each individual strategy is completed, all the strategies can be compared to one another and the baseline.
- **Conduct sensitivity analysis.** A sensitivity analysis will be conducted on key variables of benefit and cost estimates to explore and communicate the impact of assumptions, uncertainty, or natural variability.

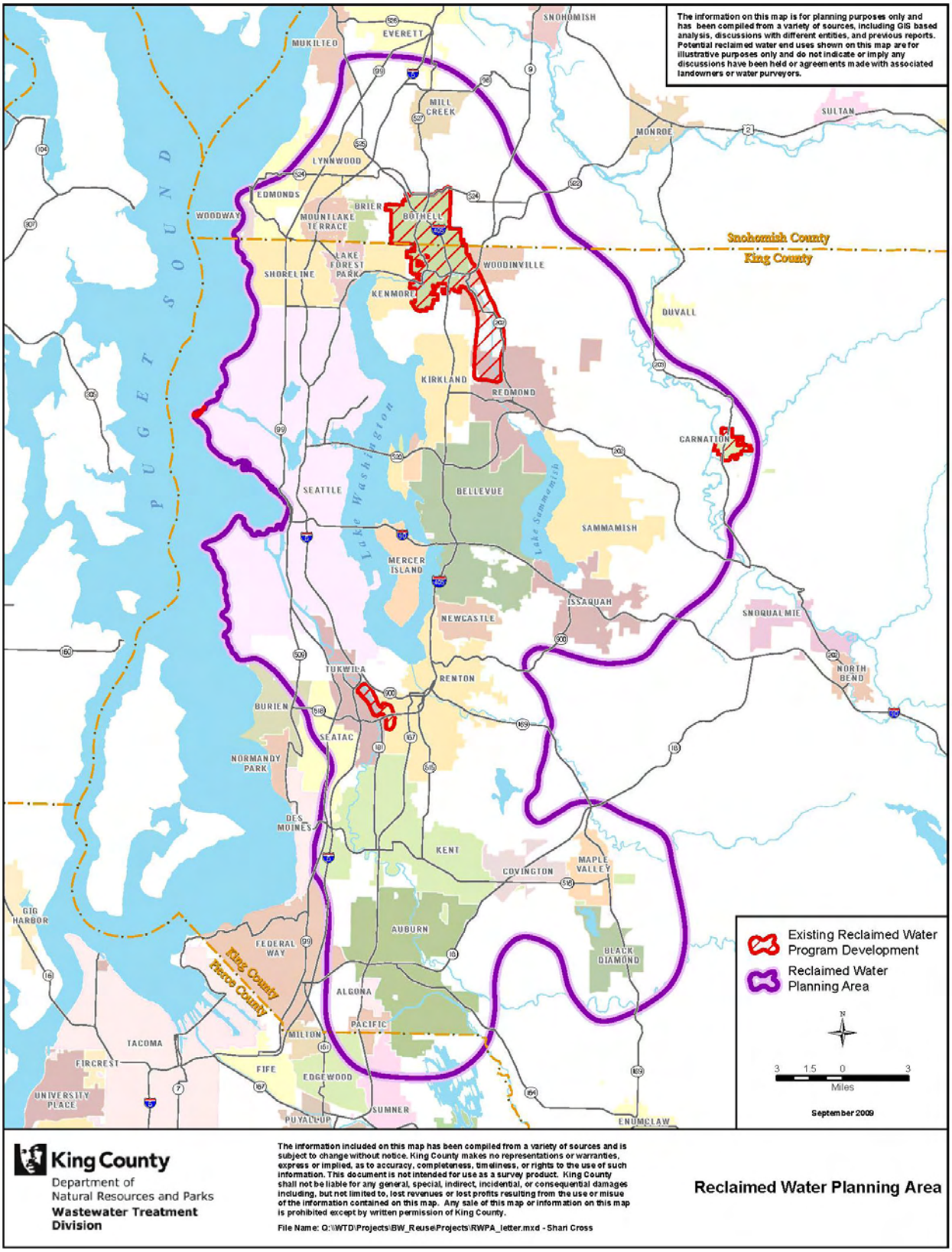

Figure 1. King County Reclaimed Water Planning Area

1.2 Approach to Identifying Potential Benefits

The approach to identifying both potential benefits and costs relies on the WateReuse Foundation's economic framework to conduct a "full social cost accounting" of benefits and costs of reclaimed water projects. Full social cost accounting tries to identify and account for all benefits and costs, regardless of who is impacted or whether the impact can be valued through market prices. The framework includes benefits, costs, and risks that are carried internally by water and wastewater agencies or their customers and those carried externally by others such as households, businesses, and special interest groups.

The process to identify potential economic benefits considered the following:

- Potential benefits associated with goods and services that are traded in markets and for which market prices provide a reliable estimate of value
- Potential benefits associated with goods and services that are not traded in markets but whose monetary value can be estimated using non-market techniques
- Potential benefits associated with goods and services that can be quantified in non-monetary terms
- Potential benefits associated with goods and services that cannot be quantified

In only a few instances do there exist reliable market-based data sufficient to determine the monetary unit price of a potential benefit. Prices commercial customers pay per thousand gallons of water to irrigate green space, for example, can indicate the value of increases in the supply of reclaimed water for such uses. For most of the potential benefits identified, however, there exist no market prices. This does not mean the value is zero. Instead, it means that the relationship between these potential benefits and the economy is not conducive to the establishment of market prices. As a consequence, families and businesses need to express the value they place on these benefits through means other than buying and selling them through a market, and economists must use techniques other than market analysis to describe the values.

For some of the benefits with no market prices, economists have developed techniques that yield substitutes for market prices as indicators of monetary value. Sometimes there might be indirect market indicators of value. For example, if reclaimed water were integrated into a project that would create new open spaces for picnicking, playing soccer, bicycling, and other activities, the additional amount households would be willing to pay for houses nearby would indicate the value people place on the amenities they would derive from the open space, a portion of which would be attributable to the availability of reclaimed water to sustain the amenities.[4]

In other situations, economists might be able to use sophisticated surveying techniques to elicit information about the value people place on a good or service. These techniques have been used in the past, for example, to estimate the value Washingtonians place on efforts that improve habitat for and increase the population of salmon.[5]

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[4] See, for example, Lutzenhiser, M., and N.R. Netusil. 2001. "The Effect of Open Spaces on a Home's Sale Price." *Contemporary Economic Policy* 19 (3): 291-298.

[5] Layton, D.F., G.M. Brown, and M.L. Plummer. 1999. *Valuing Multiple Programs to Improve Fish Popu*lations. April. Retrieved January 24, 2009, from http://www.econ.washington.edu/user/gbrown/valmultiprog.pdf.

For other benefits, valuation techniques have not yet been developed. Moreover, monetary values are inappropriate indicators of value for some of the potential benefits that could accrue from production and use of reclaimed water, such as the intangible value some residents of King County might place on contributions that reclaimed water would make to improving ecosystem health. Again, the absence of a monetary value does not mean the value is zero. In this instance, it means that members of the public need to weigh these values using their own personal non-monetary sense of importance.

The benefits identified are those that based on available information, could possibly occur. Further information about benefits that might actually occur will be forthcoming as the steps and tasks necessary to develop the Reclaimed Water Comprehensive Plan are completed. The benefits that do materialize will depend not just on the elements of the plan but also on how the county's ecological, social, and economic environment evolves. The factors that will shape this evolution—population and economic growth, changes in the health of the Puget Sound ecosystem, public preferences, and many more—almost certainly will cause the economic importance of some potential benefits to rise or fall relative to others. This report does not attempt to anticipate this evolution but, instead, reflects conditions of the past leading to the present, as represented by analysis of historical data.

2.0. OVERVIEW OF POTENTIAL BENEFITS

In keeping with *An Economic Framework for Evaluating the Benefits and Costs of Water Reuse* developed by the WateReuse Foundation,[6] several types of potential benefits from production and use of reclaimed water were considered. Economic benefits are defined somewhat broadly to embrace three distinct categories of economic effects:

- **Improvements in the welfare of the county's residents.** Such improvements typically materialize through improvements in the efficiency of the county's economy, which entails reducing the cost of producing a good or service or increasing the supply of a good or service available for a given cost. They also can occur when consumers change their preferences, placing a higher value on a given good or service. Economists typically apply the term "economic benefit" only to these types of improvements in welfare.
- **Increases in the county's economic growth, measured by increases in jobs, incomes, and related variables**. Economists typically apply the term "economic impact" to this type of effect, recognizing that it is not the same as an improvement in efficiency, and the two often move in different directions. Improving the efficiency of producing reclaimed water may, for example, involve reducing jobs and labor costs.
- **Improvements in financial status for WTD, other agencies, or their customers.** When such an improvement involves reducing the expenditures required to produce a good or service or increasing revenues from outside sources, it also represents an improvement in economic well-being for the agency or its customers. When it involves increased payments by customers for the same good or service, the agency's increase in financial resources mirrors the customers' decrease.

The following sections describe in more detail the types of the potential benefits that might materialize from the production and use of reclaimed water. (For more information, see the WateReuse Foundation's framework guidance document.[7])

2.1 Efficiency and Productivity Gains

In general, comprehensive reclaimed water planning will yield economic benefits insofar as it enables WTD and others to identify and take advantage of long-run opportunities for improving the system's efficiency. Such benefits might emerge, for example, if the plan facilitates installation of pipes and other infrastructure in conjunction with other development activities, such as during the construction or reconstruction of roadways, and if installation costs are lower than they would be after those activities have been completed.

[6] Raucher et al.,. 2006.

[7] Raucher et al.,. 2006, pp. 13-14, 24-28.

2.2 Increased Value of Ecosystem Goods and Services

Production and use of reclaimed water would yield economic benefits if they increased the value of goods and services derived from the county's wastewater resources and its water-related ecosystem. Table 1 identifies ecosystem functions, goods, and services that might be affected.

The potential benefits might materialize via different pathways:

- Producing and using reclaimed water may end or reverse actions that diminish some goods and services. Benefits would materialize, for example, if use of reclaimed water diminished the adverse effects of water withdrawals on instream habitat or of the discharge of wastewater on environmental quality.
- Producing and using reclaimed water may increase the supply of some goods or services if, for example, reclaimed water were used for irrigating crops and open spaces, restoring wetlands, or improving instream habitat for salmon.

2.3 Reduced Uncertainty and Risk

A reclaimed water comprehensive plan may yield economic benefits by reducing uncertainty about how the reclaimed water system likely will evolve and by giving greater certainty to water providers, water users, and resource managers. Benefits may materialize, for example, if the plan identified opportunities to reduce the probability that WTD's operations would fail to meet regulatory requirements or opportunities to increase the probability that land required for the system would be secured at a lower price than if, absent the plan, the land were developed for a conflicting purpose. Additional benefits could materialize if planned increases in the supply of reclaimed water were to give a water provider and its customers a backup source of water and reduce the probability of a supply shortage.

2.4 Improvement in Perceived Fairness

Some people may derive benefits from production and use of reclaimed water if they perceive that the distribution of costs and benefits is fair, especially if they perceive that it is more fair than the distribution that would occur without the plan.

Table 1. Summary of Functions, Goods, and Services of Water-Related Ecosystems that Might Be Affected by the Production and Use of Reclaimed Water

Function	Examples of Goods and Services Produced
Production and regulation of water	Natural and human-built features of an ecosystem capture precipitation; filter, retain, and store water; regulate levels and timing of runoff and streamflows; and influence drainage.
Formation and retention of soil	Wetlands and biota accumulate organic matter and prevent erosion to help maintain productivity of soils.
Regulation of atmosphere and climate	Biota produce oxygen and help maintain good air quality and a favorable climate for human habitation, health, and cultivation.
Regulation of disturbances	Wetlands and reservoirs reduce economic flood damage by storing flood waters, reducing flood height, and slowing a flood's velocity.
Regulation of nutrients and pollution	Wetlands and riparian vegetation improve water quality by trapping pollutants before they reach streams and aquifers; natural processes improve water quality by removing pollutants from streams.
Provision of habitat	Wetlands, riparian vegetation, streams, and reservoirs provide habitat for economically important fish and wildlife.
Food production	Biota convert solar energy into plants and animals edible by humans.
Production of raw materials	Streams and biota generate materials for construction, fuel, and fodder; streams possess energy convertible to electricity.
Pollination	Insects facilitate pollination of economically important wild plants and agricultural crops.
Biological control	Water-related birds and microorganisms control pests and diseases.
Production of genetic and medicinal resources	Genetic material in wild plants and animals provides potential basis for drugs and pharmaceuticals.
Production of ornamental resources	Products from water-related plants and animals provide materials for handicraft, jewelry, worship, decoration, and souvenirs.
Production of aesthetic resources	Wetlands, riparian vegetation, streams, and reservoirs provide basis for enjoyment of scenery from roads, housing, parks, trails, etc.
Production of recreational resources	Streams, reservoirs, riparian vegetation, fish, waterfowl, and other wildlife provide basis for outdoor sports, ecotourism, etc.
Production of spiritual, historic, cultural, and artistic resources	Wetlands, riparian vegetation, streams, and reservoirs serve as basis for spiritual renewal, focus of folklore, symbols of group identity, motif for advertising, etc.
Production of scientific and educational resources	Wetlands, riparian vegetation, streams, and reservoirs provide inputs for research and focus for on-site education.

Source: Adapted by ECONorthwest from De Groot, R., M. Wilson, and R. Boumans. 2002. "A Typology for the Classification, Description and Valuation of Ecosystem Functions, Goods and Services." *Ecological Economics* 41: 393-408; Kusler, J. 2003. *Assessing Functions and Values.* Institute for Wetland Science and Public Policy and the Association of Wetland Managers, Inc.; and Postel, S., and S. Carpenter. 1997. "Freshwater Ecosystem Services." in *Nature's Services: Societal Dependence on Natural Ecosystems*. Edited by G.C. Daily. Washington, D.C.: Island Press, pp. 195-214.

2.5 Economic Growth

It is not uncommon to hear people express their belief that economic growth is a good thing, which implies that production and use of reclaimed water would yield economic benefits insofar as it stimulates economic growth. Measuring such a benefit can be problematic, however, because growth can take different forms. Local business owners and mangers might focus on the importance of expanding the output of their firms and the net earnings for shareholders, for example, while workers may emphasize the importance of creating new jobs, especially those with higher wages, and community officials may be more concerned with robust growth in property values, retail sales, and other variables that underlie sources of revenue to support public services. Sometimes, one type of growth occurs at the expense of another; there might be a tradeoff between more jobs and higher wages for workers and higher earnings for business owners, for example. Even when a tradeoff exists, however, someone enjoys a benefit if they see growth in a variable important to them.

2.6 Financial Benefits

Production and use of reclaimed water may yield financial benefits, as well as additional economic benefits, for WTD, other agencies, or their customers if they lower the expenditures associated with a given level of service or increase revenues from outside sources. If, all else is equal, such production and use result only in an increase in revenues that an agency receives from ratepayers, they would generate a financial benefit for the receiving entity but not for those who pay the increased amounts.

3.0. POTENTIAL ECONOMIC BENEFITS

Potential economic benefits were identified through the following process:

- Developing an initial list of potential benefits
- Screening and further categorizing the potential benefits
- Describing and assigning unit values for benefits for which sufficient quantitative information is available
- Describing benefits for which insufficient information is available to support quantification

The benefits are presented in a series of tables in Appendix A, which correspond to the templates used in the guidance developed in the WateReuse Foundation's economic framework.[8]

3.1 Developing an Initial List of Potential Benefits

Table A-1 in Appendix A lists all the potential economic benefits identified to date. The benefits are listed in two broad categories: (1) direct benefits to water and wastewater utilities and their customers, and (2) indirect benefits accruing to society at large or stakeholders other than the water or wastewater agencies and their customers. The indirect benefits are divided further into four categories: (1) environmental benefits, (2) recreation benefits, (3) human health benefits, and (4) economic and social benefits. These categories come from the framework developed by the WateReuse Foundation.[9]

A broad approach was taken in identifying potential benefits so as to provide a comprehensive synthesis of studies and data that might prove relevant as analytical tasks conducted for the Reclaimed Water Comprehensive Plan are completed. Some refinement was done to reflect specific circumstances in the reclaimed water planning area, deleting some benefits the WateReuse Foundation lists and adding others through consultation with WTD staff.

This broad approach necessarily means that some of the identified potential benefits will not materialize. Completion of the plan should clarify which benefits are likely to materialize in association with specific facilities and operational practices that may be recommended to serve identified potential reclaimed water uses. The final determination of actual benefits should be made as the plan is implemented and in the context of specific actions.

Similar guidance applies insofar as some of the potential benefits that are identified as being distinct, based on how they have been reported in various studies, may, in actuality, prove to represent the same benefit. In such instances, it would be incorrect to maintain the distinction and risk counting the benefit more than once. As the comprehensive plan is completed and more details become known about its specific elements, the list of potential benefits should be revisited to appropriately characterize them in a manner that will avoid double counting. Final characterization of benefits should occur as recommended actions, if any, are taken to implement

[8] Raucher et al., 2006.

[9] Rauscher, et al., 2006, p. 24.

individual elements of the plan and should reflect the specific facility, site, water use, or other aspect of the action.

3.2 Screening and Further Categorizing the Potential Benefits

Table A-2 in Appendix A, which depicts the WateReuse Foundation's Template 4 – Summary Screening Process, summarizes the results of the screening and categorizing process. The process consisted of three steps:

- Some potential benefits were eliminated from further consideration because they appear likely to be too small to warrant further investigation.
- Other potential benefits were eliminated from consideration because they are already being captured by other programs in King County. For example, the county already is realizing benefits associated with capturing methane generated in the wastewater treatment process and is likely to continue to do so.
- The remaining potential benefits were separated into two subgroups: (1) those for which there appears to be sufficient information to support full or partial valuation in monetary terms, and (2) those for which it appears there is sufficient information to support qualitative assessment. Potential benefits were placed in the qualitative subgroup if it appears there will be insufficient information to quantify the extent of the benefit likely to be produced by production and use of reclaimed water or if there currently is insufficient information to describe the benefit's economic importance in quantitative terms.

3.3 Describing Potential Benefits for Which Sufficient Quantitative Information Is Available

Table A-3 in Appendix A, which corresponds with the WateReuse Foundation's Templates 5 and 6 – Detail on Benefit Value Derivation, gives information on the potential benefits for which it appears there will be sufficient information to describe in quantitative or monetary terms.[10]

The first three subheadings under each benefit in Table A-3 describe the benefit, identify the likely beneficiaries, and allow room to add the annual quantity of reclaimed water when specific project information becomes available.

The fourth subheading shows the unit value of each potential benefit, which has been extracted from the relevant data and literature.[11] The fifth subheading describes what the unit value represents, its source, and important information regarding its quality and applicability. These values are intended to represent starting points in an economic analysis. As specific reclaimed water facility options are developed, unit values will be further refined based on site-specific

[10] Raucher et al., 2006, p. 49.

[11] In some cases, the estimate shows a range of likely values. Where a range is not provided, the word "approximately" is used to emphasize that the exact value may be greater or less than the value presented.

factors and then multiplied by estimated annual quantities to produce an estimate of the total potential value of the benefit expected from the potential facility option.

3.3.1 Reviewing Available Literature to Estimate Unit Values

To develop data for the unit value for each potential benefit, information from peer-reviewed economic literature was reviewed. The databases shown in Table 2 were used to conduct a detailed search of the literature.

Table 2. Economic Databases Incorporated into the Estimates of Unit-Values

Database	Description
Econlit	American Economic Association's index of economic research, back to 1969.
Environmental Valuation Reference Inventory (EVRI)	Database of empirical studies conducted internationally on the economic values of ecosystem services.
National Ocean Economics Program (NOEP) Non-Market Values Database	Database of studies using non-market techniques to value ocean and coastal resources.
Beneficial Use Values Database (BUVD)	Database of studies that document values related to beneficial uses of water identified by the California State Water Resources Control Board.
ECOSystem Valuation Database	Internal database maintained by ECONorthwest that includes valuation studies of various ecosystem services, with an emphasis on studies completed in the Pacific Northwest.

Source: ECONorthwest.

3.3.2 Interpreting the Information

Two types of information and data on unit values were reviewed:

- **Market information**. Established markets exist for some of the potential benefits, such as avoided costs of electricity and energy usage that might be reduced through the use of reclaimed water and expected net revenues from commercial harvests of fish whose populations might increase through use of reclaimed water. In these cases, the market prices were interpreted as a measure of the potential economic benefit of actions that would prevent a decline or lead to an increase in the supply of the good or service. However, factors such as externalities (e.g., when prices do not include pollution impacts) and government intervention (e.g., when subsidies artificially reduce prices) can distort market prices.
- **Non-market information.** Other potential benefits are associated with goods and services not traded in markets, so studies were examined that employ non-market techniques to estimate their value. Economists have developed techniques that can

approximate the economic values of some of these benefits. These techniques have been tested and improved over the decades, with results and methods vetted through publication in academic journals and presentations at scholarly conferences.[12]

For some of the potential benefits, the unit values for these potential benefits will be estimated later because the unit value will depend on the specifics of different potential uses for reclaimed water and the conceptual facility configurations developed to serve these potential uses. For example, the potential benefit from using reclaimed water in a manner and location that would allow a utility to avoid capital costs will depend on the specifics of the proposal.

Where possible, the potential benefits drew on data and studies from the Puget Sound region. Often, however, appropriate information for this area is not available. In these cases, applying the results of relevant research conducted elsewhere was recommended. Economists often use the term "benefit transfer" to describe the process of applying to one setting the research results from another. Recommendations for benefit transfer in Table A-3 were based on this widely accepted methodology and on reliable sources of information about relevant research. This methodology is described below.

Ideally, data and studies would be available that quantify and value each benefit solely within the reclaimed water planning area, reflecting circumstances similar in scope and scale to the actions in the comprehensive plan. In practice this is not always the case. In some instances, a benefit, should it materialize, would accrue to residents in the planning area as well as to other residents of the Puget Sound region. An action that would improve salmon habitat in the planning area, for example, might result in larger salmon populations and more recreational fishing opportunities, but some of these opportunities would appear outside the county. In such instances, it may be appropriate to distinguish between the benefits that would accrue solely to residents of the planning area and those that would accrue to others.

In other instances, a study may measure benefit based on circumstances substantially different from those that would accompany actions specific to the reclaimed water planning area. For example, a plan-related action that would improve salmon habitat in King County may result in a change in salmon populations smaller than those that have been used in past studies to estimate the unit value of a change in salmon populations. In such instances, it might be appropriate to adjust the study's findings so that they better reflect the circumstances likely to accompany the plan-related actions. Table A-3 notes when such an adjustment might be appropriate for a particular potential benefit.

3.3.3 Applying the Benefit-Transfer Methodology

The benefit-transfer (BT) methodology measures the value of a particular benefit derived from the use or management of ecosystem resources at one site (referred to as the policy site) based on

10. For more information on the methods of measuring economic benefits that are not traded in markets, see National Research Council. 2004. *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*. Committee on Assessing and Valuing the Services of Aquatic and Related Terrestrial Ecosystems, National Research Council; Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being;* and Barbier, E.B., et al. 1997. *Economic Valuation of Wetlands.* Ramsar Convention Bureau, Department of Environmental Economics and Environmental Management, University of York, Institute of Hydrology, IUCN-The World Conservation Union.

the results of economic studies conducted elsewhere (referred to as the study site or sites).[13] For example, a BT analysis may calculate the values of water quality services of riparian areas in King County, based on studies conducted on riparian areas in Portland, Oregon. Where applicable, a BT analysis may save both time and money, but its applicability diminishes the greater the difference between the study site and the policy site. To the extent that the differences matter, values measured at the study site or sites may not accurately reflect values at the policy site. Given this constraint, the BT methodology is better suited to providing insights into the appropriate range of values for particular services rather than specific values.

A number of economists have examined the opportunities and limitations of BT analysis and have described the basic steps and the criteria to consider when selecting studies for such an analysis.[14] The major steps are follows:

- Identify the environmental good or service at issue.
- Identify interested parties.
- Review existing relevant studies.
- Assess the transferability of results from study to policy site, taking into account the affected good or service and interested parties.

The following are major factors or criteria to consider when assessing the transferability of results from study sites to the policy site:

- Evaluate the quality of the research conducted at the study sites.
- Seek similar environmental goods or services at the study and policy sites.
- Seek similar population and interested-party characteristics at the study and policy sites.
- Seek similar baseline measures and magnitude of changes of environmental goods or services at the study and policy sites.
- Account for different values calculated using different valuation methods.

Because of the challenges of measuring the full benefits of actions affecting goods and services derived from the county's ecosystem, there is some certainty that the unit values of the potential benefits identified in Table A-3 likely underestimate, perhaps significantly in some cases, the actual values that may materialize. When this is likely to be the case, it is noted in Table A-3 in the "omissions, biases, and uncertainty" section of the comments associated with each potential benefit.

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[13] King, D.M., and M. Mazzotta. 2000. "Methods, Section 8: Benefit Transfer Method." *Ecosystem Valuation.* Retrieved July 14, 2008, from http://www.ecosystemvaluation.org/benefit_transfer.htm.

[14] See, for example, Desvouges et al. 1992. "Benefit Transfer: Conceptual Problems in Estimating Water Quality Benefits Using Existing Studies." *Water Resources Research* 28 (3): 675-683; Boyle, K.J., and Bergstrom J.C. 1992. "Benefit Transfer Studies: Myths, Pragmatism, and Idealism." *Water Resources Research* 28 (3): 657-663; Brouwer, R. 2000. "Environmental Value Transfer: State of the Art and Future Prospects." *Ecological Economics* 32: 137-153; and U.S. Environmental Protection Agency, Office of the Administrator. 2000. *Guidelines for Preparing Economic Analyses*. Report No. EPA 240-R-00-003. Retrieved November 19, 2008, from http://yosemite.epa.gov/ee/epa/eermfile.nsf/vwAN/EE-0228C-07.pdf/$File/EE-0228C-07.pdf.

3.4 Describing Potential Benefits for Which Insufficient Information Is Available to Support Quantification

For many of the potential benefits of the reclaimed water comprehensive plan, insufficient information exists or is likely to exist to support reliable quantification. Hence, they are described in qualitative terms instead. These benefits are listed in Table A-4 in Appendix A, which corresponds to the WateReuse Foundation's Template 7 – Qualitative Benefits Description. The first subheading in this table describes the benefit, and the second subheading lists the anticipated key beneficiaries of each benefit. As reclaimed water facility options are developed, an assessment of the relative importance of these benefits will be completed using a qualitative ranking system. The benefits listed in Table A-4 are not necessarily less or more important than those whose values can be described in quantitative terms. To understand the overall potential economic benefits of the production and/or use of reclaimed water, the full set of potential benefits described in Tables A-3 and A-4 should be considered.

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APPENDIX A—BENEFITS TABLES

Table A-1. Initial List of Potential Economic Benefits of Production and Use of Reclaimed Water

General Notes: *This table identifies potential economic benefits that might materialize as a result of developing and implementing a reclaimed water program. It represents the first step in the process. Some of these benefits have been deleted from further consideration in later tables, because staff from King County's Wastewater Treatment Division (WTD) determined they would not be relevant to the particular circumstances that would arise from the development of the Reclaimed Water Comprehensive Plan. These benefits are included in this list, however, to document the efforts to consider all potential possibilities. Individual items were identified by applying the economic framework developed by the WateReuse Foundation (Raucher et al., 2006), consulting with WTD staff , and reviewing the relevant literature. A broad approach was taken in identifying potential benefits in order to provide a comprehensive synthesis of studies and data that might prove relevant as the comprehensive plan is completed and implemented. This approach necessarily means that some potential benefits may have been identified that will not materialize in actuality. It also means that some potential benefits may have been identified as being distinct (because that is how they are reported in different studies) when, in actuality, they may prove to be the same. Completion of the plan should facilitate clarification of which benefits are likely to materialize in association with specific facilities, operational practices, water uses, and so forth., and this clarification should avoid double-counting. The final determination of actual benefits should be made as the plan is implemented and in the context of specific actions.*

BENEFIT (potential increase in value or revenues, or decrease in costs or expenditures)
Direct benefits to an agency or customer
Increased flexibility regarding disposition of treated effluent
Reduced risk of incurring penalties from exceeding water quality mandated goals
Savings from using reclaimed water to avoid capital costs of wastewater treatment and disposal
Savings from using reclaimed water to avoid operation and maintenance costs of wastewater treatment and disposal
Reclaimed water sales revenues
Avoided increases in groundwater-pumping costs
Energy savings from avoided pumping costs for importing water
Increased supply reliability (customer perspective)
Savings from using reclaimed water to avoid costs of developing/purchasing potable water supply
Savings from using reclaimed water to avoid costs of developing/purchasing water supply to recharge an aquifer
Savings from using reclaimed water to avoid capital costs of water supply treatment
Savings from using reclaimed water to avoid operation and maintenance costs of water supply treatment
Savings from using reclaimed water to avoid capital, operation, and maintenance costs of water transmission
Savings from using reclaimed water to avoid capital, operation, and maintenance costs of water distribution
Increased water supply flexibility and reliability
Indirect benefits (societal)
Environment
Enhancement of downstream habitats
Reduced seawater intrusion into aquifers
Reduced risk of subsidence resulting from declining groundwater levels

Enhanced environmental restoration
Reduced risks to threatened or endangered species
Enhanced coastal ecosystems
Enhanced protection for utilities' source-water areas
Increased instream flows
Improvements in water quality (e.g., temperature, toxic substances, sediment)
Increased carbon sequestration and reduced greenhouse gas emissions
Reduced production of methane
Increased nutrient cycling
Recreation
Increased instream recreation
Increased near-stream recreation
Enhancement of green spaces for recreational use (e.g., golf courses, soccer fields, parks)
Expanded estuary-related recreation
Enhanced marine and coastal/beach-related recreation in Puget Sound
Increased wetland-related recreation
Human health
Reduced public health risk due to less contact with polluted water
Reduced public health risk as urban trees irrigated by reclaimed water remove pollutants from the air
Economic and social
Increased economic growth
Increased ability for water projects to leverage other community projects
Increased local control over water resources
Increased property values
Reinforced cultural/spiritual values
Reinforced cultural values associated with a conservation ethic
Enhanced aesthetic values
Lower treatment costs for downstream users
Increased agricultural production
Decreased capital and/or operation/maintenance costs for agricultural irrigation
Increased reliability of water supplies for agricultural irrigation
Savings in fertilizer usage
Commercial salmon harvest
Recreational salmon harvest
Flood protection
Reductions in risks associated with population and economic growth
Reductions in risk associated with climate change
Avoided energy costs to businesses and local industry
Increased public education
Reduced risk of enforcement/litigation costs associated with water rights

Table A-2. Potential Economic Benefits of Production and Use of Reclaimed Water (WateReuse Foundation Template 4, Summary Screening Analysis)

General Notes: *This table identifies potential economic benefits that might materialize as a result of developing and implementing the comprehensive plan. Individual items were identified by applying the economic framework developed by the WateReuse Foundation (Raucher et al., 2006), consulting with WTD staff , and reviewing the relevant literature. A broad approach was taken in identifying potential benefits in order to provide a comprehensive synthesis of studies and data that might prove relevant as the comprehensive plan is completed and implemented. This approach necessarily means that some potential benefits may have been identified that will not materialize in actuality. It also means that some potential benefits may have been identified as being distinct (because that is how they are reported in different studies) when, in actuality, they may prove to be the same. Completion of the plan should facilitate clarification of which benefits are likely to materialize in association with specific facilities, operational practices, water uses, and so forth., and this clarification should avoid double-counting. The final determination of actual benefits should be made as the plan is implemented and in the context of specific actions.*

Key: D = direct; E = environment; ES = economic/social; R = recreation; H – human health.

Potential Benefits for Which It Appears There is Sufficient Information to Support Quantitative Valuation[1]	
3.D.1	Savings from using reclaimed water to avoid costs of wastewater treatment and conveyance
3.D.2	Reclaimed water sales revenues
3.D.3	Avoided increases in groundwater pumping costs
3.D.4	Energy savings from avoided pumping costs for importing water
3.D.5	Increased supply reliability (customer perspective)
3.D.6	Savings from using reclaimed water to avoid costs of developing/purchasing potable water supply
3.D.7	Savings from using reclaimed water to avoid costs of developing/purchasing water supply to recharge an aquifer
3.D.8	Savings from using reclaimed water to avoid costs of water supply treatment and transmission
3.E.1	Enhancement of downstream habitats
3.E.2	Enhanced environmental restoration, wetland restoration
3.E.3	Reduced risks to threatened or endangered species
3.E.4	Reduced risks to threatened or endangered species (Pacific salmon)
3.E.5	Increased instream flows
3.E.6	Increased carbon sequestration and reduced greenhouse gas emissions
3.R.1	Increased instream recreation, near-stream, and wetland recreation
3.R.2	Enhancement of green spaces for recreational use (e.g., golf courses, soccer fields, parks)
3.H.1	Reduced public health risk as urban trees irrigated by reclaimed water remove pollutants from the air
3.ES.1	Increased property values (adjacent to suburban riparian greenways)
3.ES.2	Increased property values (adjacent to urban parks)
3.ES.3	Increased property values (adjacent to golf courses)

3.ES.4	Savings in fertilizer usage
3.ES.5	Commercial salmon harvest
3.ES.6	Recreational salmon harvest
3.ES.7	Flood protection
3.ES.8	Avoided energy costs to businesses and local industry (electricity)
3.ES.9	Avoided energy costs to businesses and local industry (natural gas)
Potential Benefits for Which It Appears there Is Sufficient Information to Support Qualitative Assessment	
4.D.1	Increased flexibility regarding disposition of treated effluent
4.D.2	Increased water-supply flexibility and reliability
4.E.1	Reduced risk of subsidence resulting from declining groundwater levels
4.E.2	Enhanced coastal ecosystems
4.E.3	Enhanced protection for utilities' source-water areas
4.E.4	Improvements in water quality (e.g., temperature, toxic substances, sediment)
4.ES.1	Increased economic growth
4.ES.2	Increased ability for water projects to leverage other community projects
4.ES.3	Improved management of water resources
4.ES.4	Reinforced cultural/spiritual values
4.ES.5	Reinforced cultural values associated with a conservation ethic
4.ES.6	Enhanced aesthetic values
4.ES.7	Increased agricultural production
4.ES.8	Increased reliability of water supplies for agricultural irrigation
4.ES.9	Reductions in risks associated with population and economic growth
4.ES.10	Reductions in risk associated with climate change
4.ES.11	Increased public education
4.ES.12	Reduced risk of enforcement/litigation costs associated with water rights

[1] The heading in WateReuse Foundation's Template 4, on which this table is based, reads "Potential Benefits for Which there Appears To Be Sufficient Information To Support Full or Partial Valuation." At this time, it is premature to determine which benefits may be valued in full and which may receive only partial valuation, given the current availability of relevant information.

Table A-3. Potential Economic Benefits of Production and Use of Reclaimed Water that Can Be Described Quantitatively (WateReuse Foundation Templates 5 & 6, Detail on Benefit Value Derivation)

General Notes: *The intent of this table is to provide a broad array of potential benefits that may arise from a reclaimed water program in King County. The types of benefits listed below reflect a "menu" of possible benefits, only a subset of which will likely be relevant to any specific application of reclaimed water. In some instances, the list shows alternative ways of describing a particular type or potential benefit, reflecting different analytical approaches applied in past studies, but this overlap does not mean that the benefit should be double-counted. The unit values listed for each benefit represent a starting point for analysis; the actual value will depend on site- and action-specific factors and may be greater or less than the value shown.*

All unit values in 2008 dollars.

Sources cited in the table are listed at the end of the table.

Key: D = direct; E = environment; ES = economic/social; R = recreation; H – human health.

Benefit: 3.D.1 Savings from using reclaimed water to avoid costs of wastewater treatment and conveyance	
Description	Increased production of reclaimed water would enable King County WTD to avoid the capital and operating costs associated with new or upgraded conventional wastewater conveyance and treatment capabilities.
Key Beneficiaries	King County WTD Customers/ratepayers
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Values to be provided by King County WTD.
Comments on Unit Values	It is expected that values will come directly from King County WTD's estimates of avoided capital costs for wastewater treatment and disposal using by using reclaimed water.
Benefit: 3.D.2 Reclaimed water sales revenues	
Description	Revenue would be generated by sales of reclaimed water to water utilities, or directly to agricultural, industrial, commercial, or residential customers.
Key Beneficiaries	Reclaimed water wholesaler[1] Customers/ratepayers
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	To be completed as values are determined during the planning process.
Comments on Unit Values	It is expected that values will be determined during the planning process.
Benefit: 3.D.3 Avoided increases in groundwater pumping costs	
Description	Reclaimed water may be used to recharge aquifers, raising the water table and reducing pumping costs. Pumping costs also can be avoided by substituting reclaimed water for non-potable water supplies obtained from groundwater.
Key Beneficiaries	Water utility using groundwater Self-supplied users of groundwater

Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $0.08 per kWh (or current relevant electricity rate)
Comments on Unit Values	**Description and Source:** Value based on the current (November 2008) average electricity rate for large and small demand general service in the reclaimed water planning area. Rates range from $0.06–$0.10 based on the timing and quantity of use (Puget Sound Energy, 2008a; Seattle City Light, 2008). **Quality of Estimate and Applicability:** It is anticipated that benefits will be estimated directly using the avoided cost method.
Benefit: 3.D.4 Energy savings from avoided pumping costs for importing water	
Description	Augmenting local non-potable water supply with reclaimed water will decrease demand for imported water, lowering costs of pumping imported water.
Key Beneficiaries	Water utility using imported water Customers/ratepayers of water utility
Annual Quantity	*To be completed when specific project information becomes available.*
Unit Value	Approximately $0.08 per kWh (or current relevant electricity rate)
Comments on Unit Values	**Description and Source:** Value based on the current (November 2008) average electricity rate for large and small demand general service in the reclaimed water planning area. Rates range from $0.06–$0.10 based on the timing and quantity of use (Puget Sound Energy, 2008a; Seattle City Light, 2008). **Quality of Estimate and Applicability:** It is anticipated that benefits will be estimated directly using the avoided cost method.
Benefit: 3.D.5 Increased supply reliability (customer perspective)	
Description	Reclaimed water adds an additional source of water supply that is highly reliable, potentially increasing system-wide reliability should other water supplies become unavailable.
Key Beneficiaries	Customers of water utility Customers of reclaimed water wholesaler
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	**Residential:** $120–$275 per household per year (see scaling issues below) **Commercial:** See comment below
Comments on Unit Values	**Description and Source:** Residential value represents the amount water customers are willing to pay to eliminate future shortages, based on contingent valuation studies that ask customers' willingness to pay to avoid different magnitudes and frequencies of water shortages. Willingness to pay increases as shortages become longer-lasting and more frequent. Studies generally show customers have a low threshold for shortages; customers are willing to pay to avoid even minor and infrequent shortages (e.g., a 10% reduction every 10 years) (Griffin and Mjelde, 2000; Barakat & Chamberlin, Inc., 1994). For commercial customers, short-run willingness to pay is proportional to short-run reductions in output, which are proportional to reductions in water supply (Chang, 2003). Long-run willingness to pay is likely to be smaller (Tierney, 1997.)

Quality of Estimate and Applicability: MEDIUM-HIGH
Residential studies conducted in Texas and California, which may not represent willingness to pay in Puget Sound region. Both studies are generally consistent at the low estimate, however.

Scaling Issues: Willingness to pay estimates are based on achieving 100 percent supply reliability. Values should be scaled to reflect the actual level of reliability enhanced by the reclaimed water program.

Benefit: 3.D.6 Savings from using reclaimed water to avoid costs of developing/purchasing potable water supply	
Description	Water utility would deliver reclaimed water to customers and uses that do not require potable water, allowing the utility to avoid costs of developing/purchasing more costly potable water and reducing rates for customers/ratepayers.
Key Beneficiaries	Water utility Customers/ratepayers
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Value determined based on options for a specific location.
Comments on Unit Values	Where appropriate, value would be determined based on supply needs and options for specific water utilities or self-supplied customers. See reclaimed water benefit 3.D.8 below if a water utility's planning provides for adequate supplies to meet its requirements over the next 30 to 50 years.
Benefit: 3.D.7 Savings from using reclaimed water to avoid costs of developing/purchasing water supply to recharge an aquifer	
Description	Water utility would use reclaimed water to recharge its aquifer, avoid the costs of using more costly potable water, and reduce rates for customers/ratepayers.
Key Beneficiaries	Water utility Customers/ratepayers
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Value determined based on options for a specific location.
Comments on Unit Values	Where appropriate, value would be determined based on supply needs and options for specific water utilities or self-supplied customers. See reclaimed water benefit 3.D.8 below if a water utility's planning provides for adequate supplies to meet its requirements over the next 30 to 50 years.
Benefit: 3.D.8 Savings from using reclaimed water to avoid costs of water supply treatment and transmission	
Description	Water utility would deliver reclaimed water to customers and uses that do not require potable water. Diminished demand for potable water would allow the utility to avoid capital costs to expand its water supply treatment and/or transmission capabilities and defer rate increases for customers/ratepayers.
Key Beneficiaries	Water utility Customers/ratepayers
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Value determined based on options for a specific location.

Comments on Unit Values	Where appropriate, value would be determined based on supply needs and options for specific water utilities or self-supplied customers. See reclaimed water benefit 3.D.8 below if a water utility's planning provides for adequate supplies to meet its requirements over the next 30 to 50 years.
Benefit: 3.E.1 Enhancement of downstream habitats	
Description	Instream flows augmented by reclaimed water, or because use of reclaimed water would displace withdrawals from streams and provide environmental benefits for the general public. Production of reclaimed water rather than lower-quality wastewater would reduce the risk of environmental harm downstream from future spills.
Key Beneficiaries	Water utility Customers/ratepayers General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $40 per acre-foot per year
Comments on Unit Values	**Description and Source:** The median value of water for environmental purposes from a meta-analysis of water transactions in Washington between 1990 and 2003. Range of market prices for water purchased for environmental purposes in Washington is $3–$300 per acre-foot per year. Median value was $37 (Brown, 2004). **Quality of Estimate and Applicability:** MEDIUM-LOW Represents recent transactions in Washington state, but not necessarily the Puget Sound region. Also, analysis is based on a small number of transactions, and study authors indicate a high level of uncertainty in drawing conclusions from these data. **Omissions, Biases, and Uncertainties:** Values reflect price of water under past conditions. As water demand increases and supply becomes more scarce the value of water is expected to increase in the future. Value may underestimate the total value of ecosystem goods and services produced by enhancing downstream habitats by increasing instream flows, perhaps considerably.
Benefit: 3.E.2 Enhanced environmental restoration, wetland restoration	
Description	Use of reclaimed water to augment instream flows and restore wetlands would increase the ecosystem's ability to produce fish habitat and other goods and services that are economically important to the general public. Production of reclaimed water rather than lower-quality wastewater would reduce the risk of environmental harm downstream from future spills.
Key Beneficiaries	General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	$100–$500 per acre per year
Comments on Unit Values	**Description and Source:** Values highly variable depending on the ecosystem restored and the degree of restoration. A meta-analysis of wetland valuation studies found that the value of most wetland ecosystem goods and services are in the range of $100–$500 per acre (Woodward and Wui, 2001). Depending on the type of ecosystem, its functions, location, and context within the larger environment, values in Puget Sound could be considerably higher or lower.

	Quality of Estimate and Applicability: MEDIUM-LOW Values come from studies conducted across the country. Not specific to Puget Sound. Values represent wetland habitats, and may not apply to other kinds of habitats. **Omissions, Biases, and Uncertainties:** This value may be an overestimate or an underestimate of the actual value of environmental restoration. Studies show that values for natural ecosystems, including wetlands near urban areas, increase with population growth and growth in per capita gross domestic product (Brander et al., 2006), so it is expected that the per-unit value would increase over time.
Benefit: 3.E.3 Reduced risks to threatened or endangered species	
Description	Use of reclaimed water to augment instream flows and restore wetlands would increase the ecosystem's ability to produce habitat for at-risk species.
Key Beneficiaries	General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	$64–$138 per household per year (see scaling issues)
Comments on Unit Values	**Description and Source:** Value represents the willingness to pay by Washington and U.S. households to ensure the survival of the Northern spotted owl, from two contingent valuation studies (Rubin, 1991, and Hagen et al., 1992, in Richardson and Loomis, 2008). Research on the spotted owl provides an indication of the value of impacts on other at-risk species. **Quality of Estimate and Applicability:** MEDIUM-HIGH Lower value from study of households in Washington and higher value from a survey of all U.S. households; value is dated. **Scaling Issues:** Value represents households' willingness to pay to avoid a 100 percent loss of the species. It would need to be scaled to reflect the extent to which a particular reclaimed water application would improve the survival of the species. In most cases, applications would have a very small effect on species survival as a whole. Must also determine the appropriate geography of households to consider (e.g., Puget Sound, statewide, national). **Omissions, Biases, and Uncertainties:** Value may overestimate or underestimate the actual willingness to pay to ensure the continued survival of the species. Considerable uncertainty will surround the appropriate scaling factor of any project, leading to greater uncertainty in the total value of this benefit.
Benefit: 3.E.4 Reduced risks to threatened or endangered species (Pacific salmon)	
Description	Use of reclaimed water to augment instream flows and restore wetlands would increase the ecosystem's ability to produce habitat for at-risk fish and other species. Production of reclaimed water, rather than lower-quality wastewater would reduce the discharge of effluent potentially harmful to species near the outfall in Puget Sound and reduce the risk of harm to at-risk species from future spills.
Key Beneficiaries	General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	$156–$326 per household per year, depending on fish run (see scaling issues)

Comments on Unit Values	**Description and Source:** Value represents the willingness to pay by households in Washington for salmon recovery efforts that increase fish populations by 50 percent (Layton, Brown, and Plummer, 2001, in Richardson and Loomis, 2008). **Quality of Estimate and Applicability:** MEDIUM-HIGH Value from study of salmon recovery efforts in the Pacific Northwest, for Columbia basin and Puget Sound salmon runs. **Scaling Issues:** Value represents households' willingness to pay for species recovery. It would need to be scaled to reflect the extent to which a particular reclaimed water application would improve the survival of the species. In most cases, applications would have a very small effect on species survival as a whole. **Omissions, Biases, and Uncertainties:** Value may overestimate or underestimate the real willingness to pay to ensure the survival of the species. Considerable uncertainty will surround the appropriate scaling factor of any project, leading to greater uncertainty in the total value of this benefit.
Benefit: 3.E.5 Increased instream flows	
Description	Use of reclaimed water to augment streamflows or to displace the withdrawal of water from streams would enhance the ability of aquatic and streamside ecosystems to provide economically important goods and services, such as recreational opportunities, for the general public, and diminish the likelihood that a water utility would experience curtailment of its ability to withdraw water.
Key Beneficiaries	General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $40 per acre-foot per year
Comments on Unit Values	**Description and Source:** The median value of water for environmental purposes from a meta-analysis of water transactions in Washington between 1990 and 2003. Range of market prices for water purchased for environmental purposes in Washington is $3–$300 per acre-foot per year. Median value was $37 (Brown, 2004). **Quality of Estimate and Applicability:** MEDIUM-LOW Represents recent transactions in Washington state, but not necessarily the Puget Sound region. Also, analysis is based on a small number of transactions, and study authors indicate a high level of uncertainty in drawing conclusions from these data. **Omissions, Biases, and Uncertainties:** Values reflect price of water under past conditions. As water demand increases and supply becomes more scarce the value of water is expected to increase in the future. Value may underestimate the total value of ecosystem goods and services produced by enhancing downstream habitats by increasing instream flows, perhaps considerably.
Benefit: 3.E.6 Increased carbon sequestration and reduced greenhouse gas emissions	
Description	Use of reclaimed water to improve the health and functions of aquatic and streamside ecosystems would expand the ability of plants and trees to sequester carbon and dampen the anticipated adverse effects of climate change. Reduced energy use from pumping groundwater or imported water reduces the emissions of greenhouse gases.
Key Beneficiaries	General public

Annual Quantity	*To be completed when specific project information becomes available.*
Unit Value	$40 per ton of carbon dioxide or carbon dioxide equivalent
Comments on Unit Values	**Description and Source:** Median value based on a range ($10–$70) of the potential future price of carbon dioxide emissions, estimated by a consortium of Western electric utilities (Western Regional Transmission Expansion Partnership Economic Analysis Subcommittee, 2007). **Quality of Estimate and Applicability:** HIGH Represents a reasonable potential value of the price of carbon dioxide on national and global markets should carbon emissions become regulated. Similar prices are found in Europe, which is already regulating carbon emissions. **Omissions, Biases, and Uncertainty:** If current predictions of the impacts of climate change or the degree to which greenhouse gases must be controlled are underestimated, which seems likely (Adam, 2008), the price per ton of carbon dioxide could be substantially higher.
Benefit: 3.R.1 Increased instream, near-stream, and wetland recreation	
Description	Use of reclaimed water to increase streamflows and streamside ecosystems directly or indirectly would enhance instream recreational opportunities, especially during the summer when flows are low. Boaters and other recreationists would derive benefits from the increased recreational opportunities, businesses selling recreation-related goods or services would experience increased sales, and nearby property values would increase.
Key Beneficiaries	Consumers of instream, near-stream, and wetland recreation opportunities Businesses that support recreation Owners of property near enhanced recreational opportunities Beneficiaries of the increase in the property-tax base
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $36 per person per day
Comments on Unit Values	**Description and Source:** Represents the net economic value associated with general recreation activities in the Pacific Northwest per person per day from a meta-analysis of recreation valuation studies (Loomis, 2005). **Quality of Estimate and Applicability:** MEDIUM-HIGH Represents a general value for recreation in the Puget Sound region. Values for specific kinds of recreation are available and may be considerably higher or lower than this value. **Omissions, Biases, and Uncertainty:** Value may underestimate or overestimate the actual value of recreation at a specific location. Studies show that the value people place on recreational opportunities increases with per-capita gross domestic product, so this value could increase in the future.
Benefit: 3.R.2 Enhancement of green spaces for recreational use (e.g., golf courses, soccer fields, parks)	
Description	Use of reclaimed water for irrigation would facilitate the establishment of new green spaces and allow existing green spaces to be kept greener longer during the dry months. The additional amenities would benefit users, passers-by, and nearby residents. The (public or private) entities responsible for producing the green spaces would enjoy savings from lower irrigation costs.

	Businesses selling related goods and services (golf equipment, picnic baskets, etc.) would realize increased revenues from higher demand for their products.
Key Beneficiaries	Producers and consumers of goods and services of parks, golf courses, soccer fields, etc. Businesses selling goods and services associated with green spaces Owners of nearby properties
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $5 per person per day (see scaling issues) 2%–13% increase in property values (see scaling issues)
Comments on Unit Values	**Description and Source:** Represents the net economic value associated with recreation at a riparian-area urban park in Portland, Oregon (David Evans and Associates, Inc., and ECONorthwest, 2004); Represents the increase in value of property within 1,500 feet of an urban park (low estimate) or golf course (high estimate), as measured in a hedonic[2] study conducted in Portland, Oregon (Lutzenhiser and Netusil, 2001). **Quality of Estimate and Applicability:** MEDIUM-HIGH Represents a recent valuation of specific recreation opportunities provided by enhanced green space in an urban setting in the Pacific Northwest. MEDIUM-HIGH Value based on empirical data on property values gathered in Portland, Oregon, a region with similar characteristics to Puget Sound. **Scaling Issues:** If a particular park already exists but is enhanced by the addition of reclaimed water, the change in recreational value or property value will likely be smaller than this estimate but may still be positive, assuming environmental quality is enhanced. **Omissions, Biases, and Uncertainty:** Value may underestimate or overestimate the actual value of recreation or increase in property values at a specific location. Specific recreation activities, such as golf, may have values considerably higher than this.
Benefit: 3.H.1 Reduced public health risk as urban trees irrigated by reclaimed water remove pollutants from the air	
Description	Use of reclaimed water to irrigate trees in urban areas would improve air quality insofar as the additional trees would filter toxins from the air.
Key Beneficiaries	General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $740 per ton of carbon monoxide (CO) Approximately $1,500 per ton of nitrogen oxide (NOx) Approximately $2,500 per ton of sulfur dioxide (SO2) Approximately $4,000 per ton of particulate matter less than 10 microns in diameter (PM10) Approximately $2,000 per ton of volatile organic compounds (VOC)
Comments on Unit Values	Description and Source: Represents median values from a meta-analysis of social damage estimates from air emissions, including the costs of health care associated with health impacts from pollutants (Matthews and Lave, 2000).

	Quality of Estimate and Applicability: It is anticipated that benefits will be estimated directly using the avoided-cost method. An assessment of reclaimed water uses incorporating this benefit would include the cost of a tree planting program. **Scaling Issues:** To the extent that trees in urban areas already exist, but are enhanced by the addition of reclaimed water, the improvement in air quality and public health will likely be smaller than this estimate, but positive. **Omissions, Biases, and Uncertainty:** Considerable uncertainty surrounds the underlying damage functions and chemical modeling used to calculate the social damage estimates for each of the studies included in the meta-analysis. These values may underestimate or overestimate the actual value of removing the pollutants.
Benefit: 3.ES.1 Increased property values (adjacent to suburban riparian greenways)	
Description	Use of reclaimed water to provide green space, improve instream water quality, or provide other environmental improvements would increase the value of nearby properties. Use of reclaimed water to increase the supply and/or reliability of water for municipal-industrial uses would stimulate economic growth and increase growth-related values of property in areas where tight supplies and/or restricted reliability would curtail growth.
Key Beneficiaries	General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	10%–15% increase in property value (see scaling issues)
Comments on Unit Values	**Description and Source:** Represents the increase in value of property adjacent to riparian suburban greenways, as measured in a hedonic[2] study conducted in British Columbia (Quayle and Hamilton, 1999). This is consistent with the findings of studies completed in the U.S. (Palone, 1997; Mason, 2001). **Quality of Estimate and Applicability:** MEDIUM-HIGH Value based on empirical data gathered in British Columbia, a region with similar characteristics to Puget Sound. **Scaling Issues:** If riparian greenways already exist, but are enhanced by the addition of reclaimed water, the change in property value will likely be smaller than this estimate but positive, assuming environmental quality is enhanced. **Omissions, Biases, and Uncertainty:** This may overestimate or underestimate the actual effect on values of any specific project using reclaimed water.
Benefit: 3.ES.2 Increased property values (adjacent to urban parks)	
Description	Use of reclaimed water to provide green space, improve instream water quality, or provide other environmental improvements would increase the value of nearby properties. Use of reclaimed water to increase the supply and/or reliability of water for municipal-industrial uses would stimulate economic growth and increase growth-related values of property in areas where tight supplies and/or restricted reliability would curtail growth.
Key Beneficiaries	Property owners adjacent to urban parks Consumers of public services dependent on growth-related tax revenue
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately 2% increase in property value (see scaling issues)

Comments on Unit Values	**Description and Source:** Represents the increase in value of property within 1,500 feet of an urban park, as measured in a hedonic[2] study conducted in Portland, Oregon. (Lutzenhiser and Netusil, 2001). **Quality of Estimate and Applicability:** MEDIUM-HIGH Value based on empirical data gathered in Portland, Oregon, a region with similar characteristics to Puget Sound. **Scaling Issues:** If a particular park already exists but is enhanced by the addition of reclaimed water, the change in property value will likely be smaller than this estimate but may still be positive, assuming environmental quality is enhanced. **Omissions, Biases, and Uncertainty:** This may overestimate or underestimate the actual effect on values of any specific project using reclaimed water.
Benefit: 3.ES.3 Increased property values (adjacent to golf courses)	
Description	Use of reclaimed water to provide green space, improve instream water quality, or provide other environmental improvements would increase the value of nearby properties. Use of reclaimed water to increase the supply and/or reliability of water for municipal-industrial uses would stimulate economic growth and increase growth-related values of property in areas where tight supplies and/or restricted reliability would curtail growth.
Key Beneficiaries	Property owners adjacent to golf courses Consumers of public services dependent on growth-related tax revenue
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately 13% increase in property value (see scaling issues)
Comments on Unit Values	**Description and Source:** Represents the increase in value of property within 1,500 feet of a golf course, as measured in a hedonic[2] study conducted in Portland, Oregon (Lutzenhiser and Netusil, 2001). **Quality of Estimate and Applicability:** MEDIUM-HIGH Value based on empirical data gathered in Portland, Oregon, a region with similar characteristics to Puget Sound. **Scaling Issues:** If a golf course already exists but is enhanced by the addition of reclaimed water, the change in property value will likely be smaller than this estimate but may still be positive, assuming environmental quality is enhanced. **Omissions, Biases, and Uncertainty:** This may overestimate or underestimate the actual effect on values of any specific project using reclaimed water.
Benefit: 3.ES.4 Savings in fertilizer usage	
Description	Residual nutrients in reclaimed water may fertilize land where used for irrigation, decreasing the amount and cost of additional fertilizer applications.
Key Beneficiaries	Agricultural producers Consumers of agricultural products General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $42 per acre-foot of water applied

Comments on Unit Values	**Description and Source:** Represents the value of offset fertilizer use per acre-foot of water applied in agricultural and landscaping purposes that would otherwise require other sources of fertilizer (King County WTD, 2008). **Quality of Estimate and Applicability:** It is anticipated that benefits will be estimated directly using the avoided cost method.
Benefit: 3.ES.5 Commercial salmon harvest	
Description	Production and use of reclaimed water would result in improved aquatic and marine habitat for salmon. Larger salmon populations would increase the catch available to the commercial salmon industry. The increased supply of wild salmon would lower prices for consumers; increased salmon consumption would have health benefits for consumers.
Key Beneficiaries	Commercial salmon industry Consumers of wild salmon
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $7 million per year (see scaling issues)
Comments on Unit Values	**Description and Source:** Value based on the average annual value of the commercial salmon harvest in Puget Sound (Industrial Economics, 2006). **Quality of Estimate and Applicability:** HIGH Value estimated recently in Puget Sound. **Scaling Issues:** Represents total value of the commercial salmon harvest each year. It would need to be scaled to reflect the extent to which a particular reclaimed water application would affect the value (e.g., total catch, per-unit price). In most cases, applications would have a very small effect. **Omissions, Biases, and Uncertainty:** Actual value of commercial salmon harvest may vary. sometimes considerably, from year to year.
Benefit: 3.ES.6 Recreational salmon harvest	
Description	Production and use of reclaimed water would result in improved aquatic and marine habitat for salmon. Larger salmon populations would increase the catch available to the salmon anglers, and generate additional demand for related businesses. The increased catch and consumption of salmon would have health benefits for consumers.
Key Beneficiaries	Salmon anglers Businesses in the recreational fishing industry Consumers of wild salmon
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $4 per additional fish caught
Comments on Unit Values	**Description and Source:** Represents the willingness to pay for catching an additional fish by recreational salmon anglers on the Willamette and Clackamas Rivers in Northwestern Oregon (Berrens, Berland, and Adams, 1993). **Quality of Estimate and Applicability:** MEDIUM Represents the value of catching an additional fish to salmon anglers in the Pacific Northwest. Conditions and characteristics of anglers, and hence the value they place on catching a fish, may be considerably different between the rivers in the study and the

	Puget Sound. Value is also somewhat dated. **Omissions, Biases, and Uncertainty:** Value may overestimate or underestimate the value of enhancing the recreational salmon harvest in Puget Sound. Value measured in a river environment, so may not accurately represent values for marine angling.
Benefit: 3.ES.7 Flood protection	
Description	Use of reclaimed water to expand existing wetlands and create new ones could expand their ability, under some conditions, to absorb water, retard water flows, and diminish downstream flooding.
Key Beneficiaries	General public
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $40,000 per acre (a one-time benefit)
Comments on Unit Values	**Description and Source:** Median value of flood protection provided by restored wetlands in Lynnwood and Renton, Washington. Study based on substitution costs of constructed flood storage for storage provided by existing wetlands (Leschine, 1997). **Quality of Estimate and Applicability:** MEDIUM Represents the value of flood storage provided by wetlands in two watersheds in Puget Sound for specific storm events. Transferring this value to other wetlands depends on the similarity of the flood storage provided by other wetlands, the relevant storm size, and potentially other factors. An assessment of reclaimed water uses incorporating this benefit would include the cost of creating the flood retention area or wetland. **Omissions, Biases, and Uncertainty:** Value may overestimate or underestimate the actual value of flood protection provided by wetlands.
Benefit: 3.ES.8 Avoided energy costs to businesses and local industry (electricity)	
Description	Use of reclaimed water to heat and/or cool buildings would lower energy costs.
Key Beneficiaries	Building owners Customers
Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $0.08 per kWh (or current relevant electricity rate)
Comments on Unit Values	**Description and Source:** Value based on the current (November 2008) average electricity rate for large and small demand general service in the reclaimed water planning area. Rates range from $0.06–$0.10 based on the timing and quantity of use (Puget Sound Energy, 2008a; Seattle City Light, 2008). **Quality of Estimate and Applicability:** It is anticipated that benefits will be estimated directly using the avoided cost method.
Benefit: 3.ES.9 Avoided energy costs to businesses and local industry (natural gas)	
Description	Use of reclaimed water to heat and/or cool buildings would lower energy costs.
Key Beneficiaries	Building owners Customers

Annual Quantity	To be completed when specific project information becomes available.
Unit Value	Approximately $1.20 per therm (or current relevant natural gas rate)
Comments on Unit Values	**Description and Source:** Value based on the current (November 2008) natural gas rate for commercial and industrial customers in the reclaimed water planning area (Puget Sound Energy, 2008b). **Quality of Estimate and Applicability:** It is anticipated that benefits will be estimated directly using the avoided cost method.

[1] The term "reclaimed water wholesaler" is used as a shorthand to facilitate reference to expected situations where King County WTD would deliver reclaimed water to a water utility, which would distribute it.

[2.] "Hedonic" refers to a pricing model that identifies price factors according to the premise that the price of a good is determined both by internal characteristics of the good and external factors affecting it. The most common example is in the housing market: The price of a property is determined by the characteristics of the house (size, appearance, features, condition) as well as the characteristics of the surrounding neighborhood (accessibility to schools and shopping, level of water and air pollution, value of other homes).

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Table A-4. Potential Economic Benefits of Production and Use of Reclaimed Water that Can Be Described Qualitatively (WateReuse Foundation Template 7, Qualitative Benefits Description)

General Notes: *The intent of this table is to describe potential benefits that may arise from King County's reclaimed water program. Only a subset of these benefits likely will be relevant to any specific action. In some instances, the table includes alternative descriptions of a potential benefit; these should not be used to double-count the benefit.*

Key: D = direct; E = environment; ES = economic/social; R = recreation; H – human health.

Benefit: 4.D.1 Increased flexibility regarding disposition of treated effluent	
Description	Ongoing environmental deterioration, population growth, climate change, and other factors are likely to put additional stress on water quality and quantity issues in Puget Sound. Production of reclaimed water would provide King County with another option for disposing of treated effluent. The level of benefit resulting from increased flexibility regarding disposition of treated effluent would be case-specific.
Key Beneficiaries	King County WTD Customers/ratepayers
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.D.2 Increased water supply flexibility and reliability	
Description	Reclaimed water would supplement other water supplies available to water utilities, giving them more options for meeting customers' demands at lower cost, increasing service reliability, and deferring rate increases. The level of benefit resulting from increased water-supply flexibility and reliability from using reclaimed water would be case-specific.
Key Beneficiaries	Water utility Customers/ratepayers Reclaimed water wholesaler[1]
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.E.1 Reduced risk of subsidence resulting from declining groundwater levels	
Description	Use of reclaimed water to recharge aquifers or substitute for water that otherwise would be pumped from aquifers would raise groundwater levels and reduce subsidence risk. The level of benefit resulting from reduced risk of subsidence from using reclaimed water would be case-specific.
Key Beneficiaries	General public, especially those affected by subsidence from declining groundwater levels
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.E.2 Enhanced coastal ecosystems	
Description	Production of reclaimed water would decrease wastewater discharges, reducing pollutants which degrade the health and functions of coastal ecosystems that

	provide valuable goods and services to the general public. The level of benefit resulting from enhanced coastal ecosystems from a particular application of reclaimed water would be case-specific.
Key Beneficiaries	General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.E.3 Enhanced protection for utilities' source water areas	
Description	Use of reclaimed water as a substitute for water from natural sources would protect levels of source water available for later use and decrease ecological disturbance of watersheds providing water for utilities and other purposes. Utilities and their customer/ratepayers would enjoy cost savings; the general public would enjoy environmental benefits.The level of benefit resulting from enhanced protection for utilities' source-water areas from using reclaimed water would be case-specific.
Key Beneficiaries	Water utility Customers/ratepayers General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.E.4 Improvements in water quality (e.g., temperature, toxic substances, sediment)	
Description	Production of reclaimed water would decrease discharge of wastewater pollutants in receiving water bodies. Direct or indirect use of reclaimed water to augment streamflows in impaired water bodies would dilute existing pollutants and improve water quality. The level of benefit resulting from improvements in water quality from a particular application of reclaimed water would be case-specific.
Key Beneficiaries	General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.1 Increased economic growth	
Description	Production and use of reclaimed water would stimulate economic activity in related businesses. Availability of reclaimed water would support general economic growth insofar as it would relax constraints associated with the quantity, reliability, and environmental impacts of municipal-industrial water systems. General economic growth would yield financial benefits for growth-related businesses, property owners, and public services. Increased economic growth related to a particular application of reclaimed water would be case-specific. Effects from increased economic growth may include changes in expenditures, changes in the supply of goods and services, changes in amenities and quality of life, and changes in the cost of doing business. Changes in jobs and incomes resulting from production of reclaimed water are not the same as the changes in the supply of goods and services resulting from the reclaimed water comprehensive plan. First-order effects would be offset, more or less, by second-order effects that would materialize if, for example, new jobs drew resources away from jobs elsewhere in the county. If net expenditures or employment

	increase, however, a project would provide a net stimulus.
Key Beneficiaries	Reclaimed water-related businesses Growth-related businesses Owners of property that experiences growth-related increases in value Consumers of public services dependent on growth-related tax revenues
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.2 Increased ability for water projects to leverage other community projects	
Description	Use of reclaimed water would enable the development of community projects that otherwise would not be possible due to water supply constraints, or a lack of an affordable, reliable supply of water in an appropriate location. The level of benefit resulting from leveraging other community projects with a particular application of reclaimed water would be case-specific.
Key Beneficiaries	Reclaimed water-related businesses Growth-related businesses Owners of property that experiences growth-related increases in value Consumers of public services dependent on growth-related tax revenues
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.3 Improved management of water resources	
Description	Use of reclaimed water, displacing the use of potable water for customers and uses that don't require it, would increase the supply of potable water for other customers and uses, and decrease the local water utility's exposure to the decisions of environmental regulators, non-local water suppliers, and other external entities. If a project decreases the likelihood that other water users with senior rights outside of King County's jurisdiction will capture flows that could be put to beneficial use by King County, the project provides a valuable benefit. Water utilities elsewhere that do not have primacy for their entire water supply have made major and costly capital investments in the form of pipelines, reservoirs, desalination plants, and water reuse purely to meet this benefit. These costs represent at a minimum, the benefit of local control. If King County is able to avoid such a situation with a project, the project will provide an equivalent benefit.
Key Beneficiaries	Water utilities Reclaimed water utilities General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.4 Reinforced cultural/spiritual values	
Description	Production and use of reclaimed water would enhance attributes of the environment having cultural/spiritual value. The level of benefit related to reinforced cultural/spiritual values resulting from a particular application of reclaimed water would be case-specific.
Key Beneficiaries	Individuals who derive cultural/spiritual value from environmental resources enhanced by the use of reclaimed water
Relative Importance	To be completed when specific project information becomes available.

Benefit: 4.ES.5 Reinforced cultural values associated with a conservation ethic	
Description	Production and use of reclaimed water would respond to preferences of some individuals, businesses, and groups for diminishing impacts on the environment. The level of benefit related to reinforced cultural values associated with a conservation ethic resulting from a particular application of reclaimed water would be case-specific.
Key Beneficiaries	Individuals who derive value from actions that promote natural-resource conservation
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.6 Enhanced aesthetic values	
Description	Use of reclaimed water would lead to improvements in green space, instream water quality, reduced discharge of effluent in Puget Sound, and other natural-resource amenities from which people derive aesthetic value. The increase in value would affect the value of nearby properties, the level of activity in real-estate, tourism/recreation, and other industries, and the revenue public entities derived from the increases to support the provision of public services. The level of benefit related to enhanced aesthetic values resulting from a particular application of reclaimed water would be case-specific.
Key Beneficiaries	Consumers of natural-resource amenities enhanced by reclaimed water Owners of properties near the enhanced amenities Businesses associated with the enhanced amenities Consumers of public services dependent on values and activities derived from the enhanced amenities
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.7 Increased agricultural production	
Description	Use of reclaimed water for irrigation at prices lower than alternative supplies (if available) would increase the supply of locally produced agricultural supplies available to consumers, increase farmers' net revenues, and reinforce efforts to prevent farmland from being converted to other uses. The level of benefit arising from increased agricultural production related to a particular application of reclaimed water would be case-specific.
Key Beneficiaries	Agricultural producers Consumers of agricultural products General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.8 Increased reliability of water supplies for agricultural irrigation	
Description	Access to reclaimed water for irrigation would induce farmers to undertake production of higher-value crops requiring a reliable source of irrigation water. The level of benefit arising from increased reliability of water supplies for agricultural production would be case-specific.

Key Beneficiaries	Agricultural producers Consumers of agricultural products General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.9 Reductions in risks associated with population and economic growth	
Description	Production and use of reclaimed water would provide an additional source of water to meet demands associated with population growth, resulting in less risk of water shortages and less cost associated with meeting new water-supply demands. The level of decreased risk associated with the potential impacts on water supply, ecosystem goods and services, and demand for water resources from increased population and economic growth in the region would be case-specific.
Key Beneficiaries	General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.10 Reductions in risk associated with climate change	
Description	Production and use of reclaimed water would provide an additional source of water to meet demand in the face of potential water shortages associated with anticipated increases in the incidence of low streamflows during summer months and increased interannual variation in streamflows. The level of decreased risk associated with reductions in impacts of climate change directly, such as changes in ecosystem functions, increased insect and disease outbreaks, and increased fire, drought, and other events, as well as changes in society's response to climate change, including implementation of regulation to control greenhouse gas emissions and other adaptation and mitigation measures, would be case-specific
Key Beneficiaries	General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.11 Increased public education	
Description	Production and use of reclaimed water would generate opportunities to provide the public with information on the benefits of water reuse and conservation.The level of benefit of public education resulting from a particular application of reclaimed water would be case-specific.
Key Beneficiaries	General public
Relative Importance	To be completed when specific project information becomes available.
Benefit: 4.ES.12 Reduced risk of enforcement/litigation costs associated with water rights	
Description	Use of reclaimed water, by displacing the use of water from a stream or aquifer, would allow a water utility or industrial water user to avoid bumping against the limits of its existing water rights and incurring costs to develop additional water rights. The state and interested third-parties would avoid costs associated with clarifying the boundaries of existing water rights or evaluating an application for new water rights. Enforcement/litigation costs avoided by the use of reclaimed water would be

	case-specific.
Key Beneficiaries	General public Water utility Customers/ratepayers Taxpayers
Relative Importance	To be completed when specific project information becomes available.

[1] The term "reclaimed water wholesaler" is used as a shorthand to facilitate reference to expected situations where King County WTD would deliver reclaimed water to a water utility, which would distribute it.