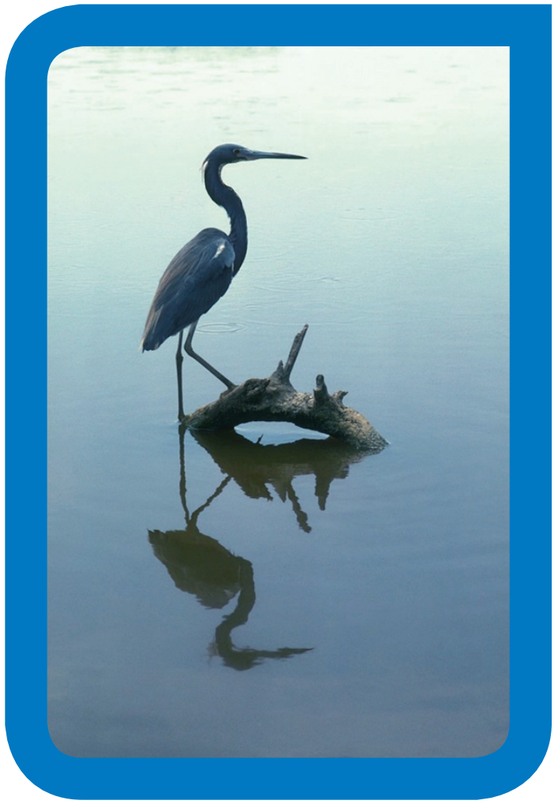
Conclusion

Virginia's current regulatory framework is insufficient to fully evaluate proposed reuse projects on a case-by-case basis.

New legislation is needed to ensure:

1) **thorough evaluation** of consumptive water reuse projects to determine their **impact on downstream water supplies**;
2) **mitigation is provided** where a new project will **impact downstream water supplies**; and
3) **meaningful and timely public notice** and comment periods are provided on proposals to reuse wastewater effluent.

Evaluating
Water Reclamation and Reuse Projects



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Fairfax Water

"If there is magic on this planet, it is contained in water."

Loren Eiseley, The Immense Journey

Evaluating Water Reclamation and Reuse Projects

Among the many environmental issues being discussed today, water reclamation and reuse are popular topics. Water reclamation and reuse are seen as environmentally friendly, allowing water to be "saved" for other uses or providing a new water source. Although reuse can be beneficial, it is important to understand the impact it can have on our current water sources and the likely infrastructure costs necessary to make it viable.

In Virginia, there have been suggestions of using water reuse as a means of complying with Chesapeake Bay nutrient reduction regulations. Water reuse is not always a sound solution to managing complex water resources related issues that face the Commonwealth and its localities. This brochure discusses the limitations that must be considered as Virginia implements solutions to restore the Chesapeake Bay and its tributaries now and in the future. It provides in-depth information necessary to evaluate, on a case-by-case basis, the costs and benefits of water reclamation and reuse projects.

The information will help to determine the following critical elements of any reuse project:

- Is the water reuse proposed in this project environmentally sound?
- Will this project impact the quality or quantity of the downstream water supply?
- Are there other proposed or existing reuse projects in this same watershed?
- Can the existing water utility provide additional potable water at a lower cost than the cost of the reclamation and reuse project?
- Have the costs of ongoing maintenance, such as pipeline replacement and renewal, been accounted for in the reuse economic model?

The current regulatory framework lacks a rigorous evaluation of reuse applications on downstream water supplies. This brochure provides recommendations for amending the Virginia Code to require water reclamation and reuse applicants to meet the same requirements as new water withdrawal applicants. It offers a real-life example of the potential impact of water reuse and provides specific questions to ask when evaluating water reclamation and reuse projects.

We hope this information is useful in preserving and protecting our most valuable natural resource.

Unfortunately, the regulations do not require new consumptive users to mitigate their impact on the state's water resources by providing storage to meet their needs and mitigate their consumptive demand. Changes needed in Virginia's Regulatory Framework include:

- New legislation to ensure that 1) applications for consumptive water reclamation and reuse projects are evaluated for their potential impact using the same criteria as a new water withdrawal application and 2) that mitigation is provided where a new project will impact downstream water supplies.
- Requirements for public notification and comment on proposals to reuse wastewater effluent.
- Detailed guidance to implement the proposed prohibition requirement and a careful consideration of factors when evaluating the impact of a particular reuse project.

What factors need to be considered when evaluating the appropriateness of a particular reuse project?

Water reuse needs to be evaluated on a case-by-case basis. The evaluation of water reuse needs to be considered in the context of a basin-wide approach. Some of the site specific considerations include:

- What is the impact to safe yield of downstream water supply? How does this translate to the equivalent cost of new water supplies ($/MGD)?
- Is the discharge being diverted from a freshwater watershed where the impact on potable water can be considerable, or from a tidal area where the impact to potable water may be less significant?
- Does this project provide service to new customers or will it replace an existing potable use?
- What is the long-term financial impact to the overall water and wastewater ratepayer?
- What are the increased expenses required to maintain dual distribution systems?
- Does the project provide groundwater re-charge?
- Are federal or state funds being used to promote or subsidize the project?
- Does the project have any water quality impacts on source water?

See Figure 1 for a proposed decision tree that outlines some of the important factors that must be considered in determining whether the impacts of a proposed reuse project are significant.

Considerations unique to Virginia's climatic and hydrologic patterns need to be evaluated as communities across Virginia consider the advantages and disadvantages of water reuse. While the development of dual-distribution reuse systems is more commonly practiced in the arid southwestern United States and groundwater-dependent areas of Florida, the drawbacks of seasonal storage requirements and the capital and operational costs associated with operating and maintaining dual distribution systems must be carefully considered before such a financial liability is undertaken.

Occoquan Reservoir Case Example

Virginia is home to one of the largest intentional indirect potable reuse projects in the world. The Occoquan system has been repeatedly cited, nationally and internationally, as a successful example of how to supplement the safe yield of a drinking water source. The Upper Occoquan Service Authority (UOSA) Water Reclamation Plant provides a valuable source of water into the Occoquan Reservoir, one of two sources of drinking water for more than 1.7 million people in Northern Virginia. Water quality in the Occoquan Reservoir dramatically improved after the UOSA Water Reclamation Plant came online in 1978. The high-quality water produced by UOSA must meet some of the most stringent discharge limits in the nation. Proposals to consumptively utilize UOSA discharge result not in a new reuse, but in a shift of water already being reused as a source of drinking water supply. In fact, during periods of drought, UOSA discharge water comprises the majority of inflow into the Occoquan Reservoir. The possibility of new industrial reuses using UOSA discharges consumptively poses a new risk to the Occoquan water supply source. There is also a serious potential to degrade water quality in the Occoquan Reservoir as flows from industrial reuse are returned to UOSA. These flows contain increased discharge concentrations of dissolved solids and associated parameters such as chloride and sodium. As you add more streams, current water treatment technology may not be sufficient to meet existing regulatory requirements, resulting in increased costs for Fairfax Water and its customers.

In essence, the water was already being reused by downstream entities. In some cases, such as use of reclaimed water as cooling water for thermoelectric power generation, the quality of the downstream water body may be affected by the concentrate of the industrial blow-down water that is conveyed to the wastewater discharge. This concentrate may contain higher concentrations of pollutants than the reclaimed water provided, reducing the potential benefits to a community or wastewater facility receiving the concentrate.

While these potential impacts are unique to each situation, it is important to recognize that reuse projects have the potential to significantly impact both the availability and quality of water in a particular watershed, particularly if there is a cumulative effect of multiple reuse projects within the same watershed.

Does reuse make economic sense?

Reclaimed water rates are commonly set as a percentage of potable water rates to make reuse attractive to potential users. Based on this approach it is unlikely the connection fees and commodity rates charged to reuse customers will allow for recovery of costs associated with construction, operation, and maintenance of a reclaimed water system. The economic evaluation of reuse should consider the water delivery systems that result in the overall lowest cost to the combined water and wastewater ratepayer.

In some instances in Virginia, the economic justification for reuse is based only on the wastewater perspective and federal or state monies are needed to recover project costs. Use of these funds competes with investments in existing water infrastructure, further burdening ratepayers and taxpayers as underground assets age. The use of grant funds may be tipping the economics of a particular reuse project such that monies are being invested in a new but unsustainable reclaimed water system.

Water reuse projects can increase the marginal cost of potable water to all users, a factor often lost in the evaluation of reuse projects. When evaluating overall reuse economics, the low marginal costs for additional potable water supply must be considered, particularly for large water systems.

In addition to the cost recovery of reuse infrastructure such as capital and operating costs, ongoing maintenance costs such as pipeline replacement and renewal are not typically accounted for in reuse economic models. The need to maintain dual distribution systems increases the total burden faced by water agencies that must operate and maintain water distribution systems with significantly decreased commodity sales, thereby further increasing commodity rates on water users. The economic evaluation of a reuse system must include not only the construction and operational costs for reclaimed water but also the financial impact to downstream water suppliers and their associated water system infrastructure investments.

As an example of how consumptive use potentially impacts water supply investments, consider that a cumulative consumptive diversion of 40 million gallons per day would require augmenting water supply storage by more than 4 billion gallons to meet the water supply needs over a three-to-four month drought similar to the 1930 drought of record. The Little Seneca Reservoir, located in the Potomac River basin and constructed in 1984, provides 4 billion gallons of water supply storage. The reservoir was paid for by Fairfax Water and utility counterparts on the Potomac River, the Washington Suburban Sanitary Commission (WSSC), and the Washington Aqueduct Division (WAD) of the Corps of Engineers. The construction cost of Little Seneca, updated to today's dollars, would be about $68 million. There is clearly a pressing need to consider cumulative consumptive use on a watershed-by-watershed basis.

Do current regulations adequately protect Virginia's water resources from the impact of consumptive reuse projects?

Although they may have similar impacts, water withdrawals and water reuse systems are regulated in different sections of the Virginia Code. Applications for new water withdrawals are evaluated by the VDEQ to determine their impact on downstream beneficial use and the state's water resource. In some cases, the applicant may be required to provide water storage, such as the construction of a water supply reservoir or use of a retired quarry to store water, to minimize the impact on the river during periods of low flow.

Unlike regulated water withdrawals, consumptive use associated with reuse does not currently require an evaluation of the impacts on downstream uses. For example, Virginia §62.1-44.15:5.02 requires non-municipal water withdrawals from the Potomac River to reduce or eliminate their withdrawal during periods when the Interstate Commission on the Potomac River Basin (ICPRB) Co-Operative Operating Rules are in effect. However, the existing regulatory framework for water reuse in the Virginia Code does not include an evaluation of consumptive reclaimed water use. Thus, the on-stream and off-stream users of water in Virginia are vulnerable to significant competition for surface water supply, without any requirement that new consumptive reclaimed water users provide water storage to meet their own need or contribute to the cost of new water supplies.

Under the current regulatory framework, downstream users may not be aware of new consumptive reuse projects upstream within a particular water basin. Virginia's Water Reclamation and Reuse Regulations allow VDEQ staff to administratively modify a permit to allow water to be diverted for a new reclaimed water system without the need for public notification and comment.

What changes to the regulations may be needed?

Proposed changes to Virginia's Water Reclamation and Reuse Regulation, as adopted by the State Water Control Board on August 4, 2011, include the addition of a prohibition section that requires VDEQ to evaluate whether a reuse project will cause significant impacts to downstream beneficial users. The prohibition language is a start at addressing the important issues related to consumptive use.

Understanding
Water Reclamation and Reuse Projects

What is reclamation? What is reuse of reclaimed water?

The Virginia Department of Environmental Quality (VDEQ) defines reclamation as the process of treating domestic, municipal, or industrial wastewater to produce reclaimed water for a water reuse that would not otherwise occur. Reuse is the use of reclaimed water for specific uses, which are defined and regulated by the VDEQ. Approved applications of reuse water are defined and regulated by the VDEQ. A regulatory framework for reuse of reclaimed water is provided in the Water Reclamation and Reuse Regulation 9 VAC25-740. The regulation can be found on the VDEQ Web site at *http://lis.virginia.gov/000/reg/TOC09025.HTM#C0740*.

How do reclaimed water discharges protect our water resources and help maintain base stream flow?

Historically, most reclaimed water has been returned to streams, lakes, or other water bodies in the form of wastewater discharges authorized under a Virginia Pollutant Discharge Elimination System (VPDES) permit. In fact, the historical return of reclaimed water to the environment has provided beneficial uses, including both off-stream uses such as public water supply, agricultural uses, and commercial and industrial uses, and on-stream uses such as the protection of fish and wildlife resources, habitat, recreation, and navigation.

What is consumptive reuse and why does it threaten our water resources?

Reclaimed water is increasingly being considered as a water source for new consumptive uses in Virginia. Consumptive use is that part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. The evaporative loss of water through a water-cooled system for thermoelectric power generation is an example of consumptive use. Cumulative consumptive use reduces water available to downstream users. The impact of cumulative consumptive use is specific to each water basin.

What is driving renewed interest in reuse of reclaimed water in Virginia?

A number of factors are driving consideration of new reuse systems in Virginia. Most importantly, there is a perception that reuse of reclaimed water can reduce wastewater discharges and associated nutrient loads to surface water. In many cases, this allows a community or wastewater facility to meet nutrient limits required by the Environmental Protection Agency's (EPA) Chesapeake Bay Total Maximum Daily Load (TMDL) program.

A complete cost analysis, however, needs to include the impact on downstream water resources. Reclaimed water diverted from a surface water discharge to a consumptive reuse reduces available surface water flow, potentially impacting the public water supply and other beneficial uses downstream. Over 90 percent of Virginia's public water supply relies on surface water. The continued availability of surface water sources to meet this need is critical to the sustained economic development of Virginia.

Other perceived benefits of reuse include diversification of a community's water supply portfolio, enhanced water supply reliability, and increased local control over water. These assertions fail to consider downstream users who may be dependent on wastewater return flows during low flow periods. Traditionally, water management decisions in Virginia have been made on a permit-by-permit basis. This approach overlooks the watershed-wide impact of consumptive water-use projects. It is vital that Virginia comprehensively evaluate downstream impacts of consumptive reuse without the narrow focus that may be considered by an individual jurisdiction or local authority.

Is water reuse environmentally sound?

A common perception is that reuse of reclaimed water is environmentally friendly, allowing domestic potable water to be saved for other uses and in many cases this is true. In some cases, however, reuse of reclaimed water is proposed for new uses such as cooling water to offset evaporative losses. In projects where reclaimed water will be consumptively used, the discharge will not be returned to a water body and can significantly impact downstream, on-stream, and off-stream beneficial uses during droughts.

Considerations When Evaluating the Impact of Proposed Water Reuse Projects

1 DISCHARGE

Consumptive Use > 0.5 MGD?
- YES → Does the VPDES discharge to a freshwater source?
- NO → Does the VPDES discharge to a freshwater source?

Does the VPDES discharge to a freshwater source?
- YES → Is reuse proposed within the same water basin?
- NO → Are water supplies (reservoir or free-flowing source) located downstream?

Is reuse proposed within the same water basin?
- NO → Potential for Significant Impacts
- YES → Are water supplies (reservoir or free-flowing source) located downstream?

Are water supplies (reservoir or free-flowing source) located downstream?
- YES → Potential for Significant Impacts
- NO → WQ Impacts from concentrated discharge?

WQ Impacts from concentrated discharge?
- YES → Potential for Significant Impacts
- NO → Impacts to other beneficial uses?

Impacts to other beneficial uses?
- YES → Potential for Significant Impacts
- NO → Will a dual-distribution system be created?

Questions that need to be considered:

(1) What is the impact on Safe Yield and what is the cost to replace the consumptive use with a new supply source?

(2) What existing and future water supply infrastructure investments are impacted?

(3) What is the impact to other downstream beneficial uses?

(4) What measures are needed to mitigate any water quality impacts of the reuse?

2 DISTRIBUTION

Will a dual-distribution system be created?
- YES → New water uses or to replace existing potable?
- NO → Are all costs for capital, O&M, treatment, distribution, and seasonal storage accounted for?

New water uses or to replace existing potable?
- REPLACE → Users still connected to the water system as a back-up?
- NEW → Are all costs for capital, O&M, treatment, distribution, and seasonal storage accounted for?

Users still connected to the water system as a back-up?
- YES → Potential for Significant Impacts
- NO → Are all costs for capital, O&M, treatment, distribution, and seasonal storage accounted for?

3 ECONOMICS

Are all costs for capital, O&M, treatment, distribution, and seasonal storage accounted for?
- NO → Need a complete evaluation of all project related expenses and revenues
- YES → Are all benefits accounted for?

Need a complete evaluation of all project related expenses and revenues → Are all benefits accounted for?

Are all benefits accounted for?
- NO → Evaluate and monetize project benefits
- YES → Has an analysis been performed to evaluate the impact on the overall water and wastewater rate?

Evaluate and monetize project benefits → Has an analysis been performed to evaluate the impact on the overall water and wastewater rate?

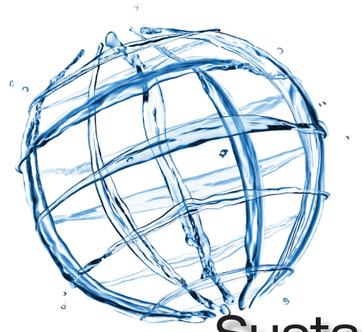
Has an analysis been performed to evaluate the impact on the overall water and wastewater rate?
- NO → Need a complete evaluation of all water and wastewater related expenses and revenues
- YES → Are grant monies needed to initiate the project?

Need a complete evaluation of all water and wastewater related expenses and revenues → Are grant monies needed to initiate the project?

Are grant monies needed to initiate the project?
- YES → Potential for an Unsustainable Reuse System
- NO → Will potable water customers be subsidizing this practice?

Will potable water customers be subsidizing this practice?
- YES → Potential for an Unsustainable Reuse System
- NO → Are there means to sustainably operate, maintain, and renew both the reuse and potable system at an acceptable level of service?

Are there means to sustainably operate, maintain, and renew both the reuse and potable system at an acceptable level of service?
- NO → Potential for an Unsustainable Reuse System
- YES → Sustainable



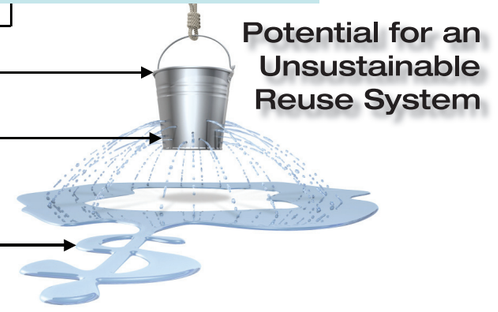


Figure 1