Reclaimed Water Infiltration Study Summary

LOTT Clean Water Alliance
Lacey • Olympia • Tumwater • Thurston County

Study Summary

After nearly ten years of effort, LOTT has completed an extensive scientific study about reclaimed water infiltration. The study is intended to answer community questions and concerns about residual chemicals that may remain in reclaimed water, and what happens to them when reclaimed water is infiltrated into the ground and used to replenish groundwater.

The many household and personal care products people use every day, such as medicines, soaps, shampoos, cleaning supplies, lawn care products, and even some foods, contain a broad variety of chemicals. Some of these chemicals end up in wastewater that gets sent to a treatment plant for cleaning before it is released back to the environment. Most wastewater from the sewered areas of Lacey-Olympia-Tumwater is currently treated at LOTT's Budd Inlet Treatment Plant and discharged to Budd Inlet. Some is treated to Class A Reclaimed Water standards and reused in the community for irrigation, water features, or groundwater replenishment.

Class A Reclaimed Water meets high water quality standards and is approved by the State Departments of Health and Ecology for many uses, including groundwater replenishment. While reclaimed water has been used safely for this purpose in many areas of the country and the world, the community had questions about the safety of the practice here, in part because our climate differs from regions where much of the related research has been conducted.

This study was conducted as part of LOTT's commitment to:

- Be responsive to community concerns
- Ensure current practices are safe and responsible
- Inform long-term planning

Primary Study Question

The key question that the overall study effort was intended to answer is:

What are the risks from infiltrating reclaimed water into groundwater because of chemicals that may remain in the water from products people use every day, and what can be done to reduce those risks?

Key Findings

- Under current conditions, risks from infiltrating reclaimed water into groundwater are low and the water is safe.
  - Risk to human health is very low.
  - No risks to ecological health were identified.
- Because risks are low, there is no immediate need to change current practices or the level of treatment.
- Conditions are expected to change over time and study results will likely need to be revisited in the future.

Study Activities

The Reclaimed Water Infiltration Study began with an intensive scoping process that included active public engagement. A Community Advisory Group was formed in 2012, consisting of local residents with diverse backgrounds and interests. This group was heavily involved in the scoping process, and has provided feedback and insights throughout the study effort. Scoping was informed by public feedback gathered through stakeholder interviews, a phone survey, focus groups, and public workshops. Over 80 community questions about residual chemicals in reclaimed water were identified through these efforts. The questions fell into four main categories, which provided the framework for implementing the scientific study.

Task 1
Water Quality Characterization
What is the current quality of our local waters?

Task 2
Treatment Effectiveness Evaluation
What happens to reclaimed water that is infiltrated to groundwater?

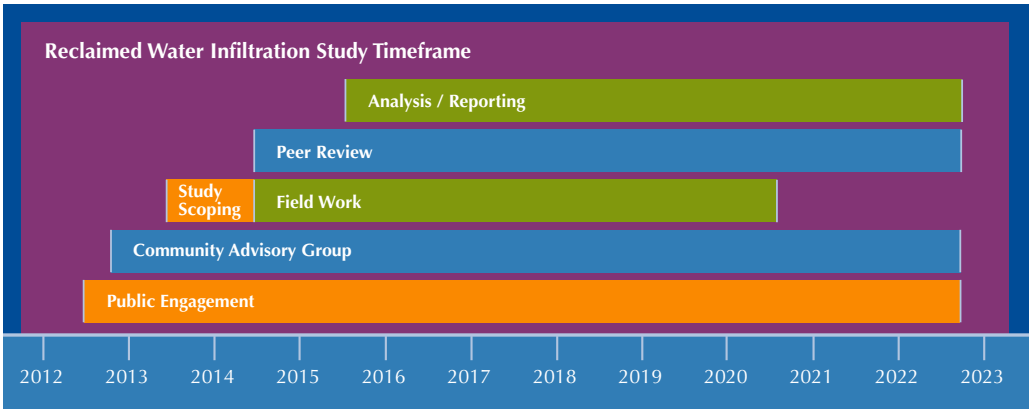
Task 3
Risk Assessment
What are the relative risks of replenishing groundwater with reclaimed water?

Task 4
Cost/Benefit Analysis
What are the costs and benefits of various approaches for treating and using reclaimed water?

Work plans for each study task were developed based on accepted scientific practices, with expertise from HDR Engineering and the rest of the study team. Each work plan was carefully reviewed and refined based on input from two groups: the Science Task Force made up of technical staff from LOTT's partner jurisdictions, the Squaxin Island Tribe, and the State Departments of Health and Ecology; and the Peer Review Panel, a group of nationally recognized experts in health, toxicology, hydrogeology, and wastewater treatment.

These groups, along with the Community Advisory Group, LOTT's Technical Sub-Committee, and the LOTT Board of Directors, reviewed study progress and draft findings as each task of the study was completed. Field work and analysis was extensive, spanning seven years. During this phase of work, the study team:

- Identified 134 residual chemicals for testing.
- Tested for these chemicals in wastewater, reclaimed water, surface water, and groundwater.
- Established a monitoring well network on and near LOTT's Hawks Prairie Recharge Basins site.
- Conducted a tracer test to understand how reclaimed water moves underground through soil layers and aquifers after it leaves the site.
- Sampled the monitoring wells to understand how residual chemical concentrations change as water moves away from the site.
- Created computer models of reclaimed water flow and residual chemical concentrations 100 years into the future.
- Predicted possible risk for humans and wildlife, based on the model and toxicology information for each residual chemical of interest.



- Considered advanced treatment options to reduce residual chemicals in reclaimed water, and compared costs to reduction in risk.
- Identified other possible actions to address residual chemicals in reclaimed water.

Summary Findings

This extensive research effort has resulted in over 2,500 pages of scientific reports outlining analyses and findings, available on LOTT's website at lottcleanwater.org. Findings and outcomes include:

- LOTT's treatment processes are effective at removing many residual chemicals in wastewater, but some chemicals do remain after treatment.
- Residual chemicals are found in our environment – in areas where reclaimed water is infiltrated to replenish groundwater – and in areas where it is not.
- Reclaimed water infiltrated at the Hawks Prairie site flows generally to the south and west in the shallow aquifer and to the east in the deeper aquifer.
- Concentrations of residual chemicals decrease with time and distance from the site as the chemicals adhere to soil, are broken down by microorganisms, and disperse when reclaimed water mixes with groundwater.
- Some residual chemicals remain at low concentrations in water that may be used by people or wildlife.
- Risks to human health are very low; nearly all the chemicals analyzed were below levels of concern; two slightly exceeded the threshold for possible risk: n-nitrosodimethylamine (NDMA) and perfluoropentanoic acid (PFPeA).
- No risks to ecological health were identified; chemical concentrations in study area watersheds were far below levels of concern.

- Technologies exist to further remove residual chemicals from reclaimed water; costs are substantial.
- Actions such as continued monitoring and source control can help inform and address potential risks.
- Study findings are consistent with similar studies conducted in other places in the country and the world.
- The Peer Review Panel indicated that the risk assessments were well designed and protective of human and ecological health. They also stated that based on the current analysis, potential risks from groundwater recharge are low and the water is safe.

These findings indicate that the current use of reclaimed water for groundwater replenishment continues to be a safe and responsible practice. Groundwater recharge is part of our communities' long-term plan for overall wastewater management. This practice helps to reduce the amount of flow discharged to Budd Inlet from LOTT's main treatment plant. It also has the potential to provide additional community benefits, including improved streamflows and mitigation for municipal groundwater withdrawals.

While study findings suggest the current level of treatment is appropriate, interest in advanced treatment may change in the future for a variety of reasons. New improved treatment technologies may be developed; future study updates may indicate a different level of treatment is needed; community interest in a potable quality recycled water may grow. This study provides a solid foundation to further explore advanced treatment options in the future.

Future Considerations

This research effort was a point-in-time study. While it included modeling conditions 100 years into the future, analyses were based on data collected during the study period on or near the Hawks Prairie Recharge Basins site. For these reasons, study conclusions should be viewed as applicable to current conditions and specific to the Hawks Prairie site. Many factors can, and likely will, affect conditions in the future, including:

- Consumer products are under constant development and industrial products and practices change over time. As a result, the types and number of chemicals that make their way into the wastewater system will change in the future. New or different chemicals may enter the system; others may be phased out. As an example, Washington State recently passed legislation that sets an ambitious timeline for phasing out use of per- and polyfluoroalkyl substances (PFAS chemicals) in consumer products.
- Research into potential health effects of residual chemicals will continue over time, improving our understanding of potential risk.
- Regulations are expected to change. State and federal regulations affecting PFAS chemicals are anticipated soon.
- Interest in advanced treatment may change in the future to address an emerging risk or meet water supply needs.
- If additional recharge sites are developed in the future, site-specific conditions and the latest research about residual chemicals will need to be considered.

The study effort addressed many questions regarding residual chemicals in reclaimed water, but some questions remain unanswered. Although the study was designed using multiple layers of health-protective assumptions to err on the side of caution, some uncertainties about findings remain. Analyses focused on a subset of residual chemicals considered representative and indicative of the many chemicals currently in use and likely to enter the wastewater system, but it is possible there are chemicals in the system not yet identified or understood. Potential cumulative effects from combinations of various chemicals are also not well understood. Information about other sources of residual chemicals, such as septic systems and stormwater, is limited.

Steps Beyond the Study

No immediate changes to current practices or level of treatment are currently proposed, due to study findings that indicate use of reclaimed water to replenish groundwater is safe and risks are very low. Instead, next steps beyond the study focus on continuing to refine our understanding of residual chemicals of interest.

Continued monitoring of NDMA, PFPeA, and other PFAS chemicals will provide a more robust data set and clarify trends in chemical presence. NDMA was not detected in study samples consistently and its potential risk may be overestimated. More data about PFAS chemicals will provide a head start for adapting to new regulations.

Targeted sampling to pinpoint sources of these chemicals could shed light on effective source control efforts to reduce chemical inputs into the wastewater system. Comparison of residential versus commercial/industrial effluent and sampling of groundwater, surface water, and septic effluent could help to identify potential sources.

Conditions are sure to change. It will be important for LOTT to keep tabs on industry research, changing regulations, and the chemical landscape to gather new information as it becomes available. Revisiting the study may be necessary in the future to reassess potential risk and study conclusions.

Acknowledgments

LOTT is grateful to the many staff members, consultants, technical experts, elected officials, and community members who contributed their insights and knowledge to this major research effort. Over the course of the study, membership in the various advisory committees has changed; participants have come and gone, but many have devoted their valuable time and expertise to the study. Thank you to everyone who played a role in this important effort to ensure our wastewater management practices are appropriate and responsible.