Memorandum

Date: May 18, 2020

To: Wendy Steffensen
Environmental Project Manager, LOTT Clean Water Alliance

From: James Crook, PhD, PE, Panel Chair
Kevin Hardy, Executive Director

Subject: NWRI Independent Advisory Panel for LOTT RWIS: Subcommittee comments on the human health risk assessment and ecological risk assessment

Purpose of the Panel

In 2013, the National Water Research Institute (NWRI) of Fountain Valley, California, a joint powers authority and 501c3 nonprofit organization, appointed water industry experts to an Independent Advisory Panel (Panel) to provide a credible, third-party, science-based review of the Reclaimed Water Infiltration Study (RWIS) proposed by the LOTT Clean Water Alliance of Olympia, Washington.

The focus of this multi-year scientific study is to determine potential human and/or ecological health risks from the infiltration of reclaimed water into local groundwater in Thurston County, Washington, and possible approaches to reduce those risks.

Purpose of this Subcommittee Memo

The LOTT project team is preparing to conduct risk assessments to determine how residual chemicals detected in LOTT's reclaimed water may affect local water quality when the reclaimed water infiltrates into the groundwater basin. In preparation for this work, LOTT asked the NWRI Panel to review the scope of work for the human health risk assessment (HHRA) and the ecological risk assessment (ERA).

A subcommittee of the Panel met with LOTT Project Team members on April 8, 2020, by web-enabled conference call to discuss the scope of work for the HHRA. The Panel ecotoxicologist reviewed the ERA independently.

This memo documents the findings and recommendations of the subcommittee's review. The subcommittee members are:

- Panel Chair: James Crook, PhD, PE, Water Reuse and Environmental Engineering Consultant
- Panel Risk Assessment Expert: Paul Anderson, PhD, Vice President and Principal Scientist, ARCADIS US, Inc.
- Panel Ecotoxicologist: John Stark, PhD, Professor of Ecotoxicology and Director of Washington Stormwater Center, WSU Research and Extension Center

See Attachment A for brief biographies of the subcommittee members.

Human Health Risk Assessment

Subcommittee Conclusion: The LOTT HHRA is Acceptable

The HHRA scope of work (SOW) represents a conservative approach to evaluating potential risks to human health related to infiltration of reclaimed water to groundwater that may be used as water supply for domestic and municipal supply wells. If the results of the risk assessment determine that potential risks fall within the range considered acceptable by regulatory agencies, then the risk assessment will have demonstrated that the exposures evaluated in the HHRA—in this case, associated with use of the reclaimed water—are safe.

The Proposed Approach is Conservative

It is important to note that the safety of a drinking water supply is generally evaluated using a different approach. The typical approach for evaluating the safety of a drinking water supply compares the concentration of each compound in drinking water to its respective drinking water standard, the Maximum Contaminant Level (MCL). If the concentration of each compound is equal to or less than its respective standard, the water is determined to be safe for potable use.

MCLs typically account only for exposures through drinking the water. However, the HHRA SOW includes multiple exposure scenarios; for example, irrigation at parks and golf courses or exposure to recreational water and surface water and exposure pathways other than direct consumption of drinking water; for example, dermal exposure or fish consumption.

The HHRA SOW also includes 45 compounds in the quantitative HHRA even though the Screening Evaluation demonstrated that the maximum concentrations of many compounds were below their respective Drinking Water Equivalent Levels (DWELs). In most risk assessments, only a few compounds contribute to the majority of the potential risk.

The LOTT project team asked the subcommittee whether it is necessary to assess cumulative risk by summing the potential risk of all chemicals that may be in the water. This step is not necessary because the approach and combination of assumptions set forth in the HHRA SOW are conservative and protective of public health.

Benefits of a More Conservative and Comprehensive HHRA

Including compounds that are likely to pose little, if any, potential risk, and evaluating several non-drinking water exposure scenarios has the benefit of the HHRA being more conservative and comprehensive than a typical drinking water supply evaluation.

While it will likely require additional resources to complete, if such an HHRA finds potential risks to be acceptable, it has the advantage of showing stakeholders that using reclaimed water in all reasonably expected exposure scenarios is safe.

Ecological Risk Assessment

The subcommittee reviewed the ERA plan for the refined risk assessment of contaminants of potential ecological concern (COPECs) associated with the LOTT water treatment system. The subcommittee was impressed by the ERA approach presented by the LOTT project team at the October 2019 panel meeting and by the written ERA document.

Subcommittee Conclusion: The LOTT ERA is Acceptable

The ERA scope of work document outlines an approach for a refined risk assessment, and it follows the approach used for the initial screening assessment. The subcommittee did not find any shortcomings in the approach and believes that the ERA presented here will be protective of ecological health.

Question about Section 3.2.3 Effects Characterization b. Review and Evaluate the Potential Effects Associated with Other Stressors

Other stressors (for example, pH, dissolved oxygen, temperature, fine sediment, and fecal coliforms) are likely to affect environmental conditions at the sites evaluated in the ERA. If unacceptable risks are identified, the effects of other stressors on environmental conditions will be evaluated to determine if residual chemical risks could be effectively controlled by managing other stressors to improve environmental conditions.

The subcommittee asked how LOTT would accomplish the evaluation described above. If, for example, they found that pH affected toxicity of a contaminant of concern, how would they adjust pH in the environment?

The LOTT project team responded as follows:

> The evaluation of other stressors will be a qualitative discussion in the uncertainty section. If there is evidence from the toxicity literature that other stressors such as pH could affect the toxicity of a residual chemical, this information will be presented. However, it is beyond the scope of this evaluation to determine how this information could be applied in risk management.

The subcommittee found this response acceptable and had no further comments or questions.

Attachment A: Subcommittee Members

James Crook, PhD, PE (Panel Chair)

Water Reuse and Environmental Engineering Consultant (Boston, MA)

Jim Crook is an environmental engineer with more than 40 years of experience in state government and consulting engineering arenas, serving public and private sectors in the United and abroad. He has authored more than 100 publications and is an internationally recognized expert in water reclamation and reuse. He has been involved in numerous projects and research activities involving public health, regulations and permitting, water quality, risk assessment, treatment technology, and all facets of water reuse.

Crook spent 15 years directing the California Department of Health Services' water reuse program, during which time he developed California's first comprehensive water reuse criteria. He also spent 15 years with consulting firms overseeing water reuse activities and is now an independent consultant specializing in water reuse. He currently serves on several advisory panels and committees sponsored by NWRI and others. Among his honors, he was selected as the American Academy of Environmental Engineers' 2002 Kappe Lecturer and the WateReuse Association's 2005 Person of the Year. Crook received a BS in Civil Engineering from the University of Massachusetts and both an MS and PhD in Environmental Engineering from the University of Cincinnati.

Paul Anderson, PhD

Vice President and Principal Scientist, ARCADIS US, Inc. (Chelmsford, MA)

Since 2000, Paul Anderson has led research investigating the potential presence and effects of active pharmaceutical ingredients and personal care products in surface water. His research in the area of constituents of emerging concern began with the development of a screening level model (the Pharmaceutical Assessment and Transport Evaluation model) that predicts the concentration of human pharmaceuticals and other compounds released from wastewater treatment plants (WWTPs) in surface water across the United States. He helped develop a database that summarizes peer-reviewed literature on aquatic toxicity, environmental fate in surface water, and treatment plant removal of pharmaceuticals.

Anderson led a team that reviewed the state-of-the-science of endocrine disrupting compounds (EDCs) and the implications of such compounds on wastewater treatment, published in 2005. It described the sources of EDCs in wastewater, their fate in WWTPs, and resulting impacts in the environment. In 2008, he expanded the 2005 work on EDCs to include the full range of organic compounds that may occur in WWTP effluent. The research reviewed the different sources and categories of trace organic compounds; how they are measured; their removal in treatment plants; an introduction to potential ecological and

human health effects of trace organics in treated wastewater, recycled water, and receiving streams; and an overview of current research needs.

Anderson has over 35 years of experience in human health and ecological risk assessment. He has a PhD and an MA in Biology from Harvard University and a BA in Biology from Boston University.

John Stark, PhD

Professor of Ecotoxicology and Director of Washington Stormwater Center, Washington State University Research and Extension Center (Puyallup, WA)

John Stark's research addresses the development of hazard and risk assessment for aquatic organisms inhabiting rivers and streams in the Pacific Northwest. Stark is an expert in population modeling and has developed population-level risk assessments based on matrix and differential equation models.

Recent projects involve determining the effects of stormwater low impact development on salmon, zebrafish, and aquatic invertebrate health and assessing the impact of pesticides on endangered butterfly species. He has published more than 125 peer-reviewed journal articles, numerous book chapters, and a book titled "Demographic Toxicity: Methods in Ecological Risk Assessment."

Stark is a member of the Puget Sound Partnership Science Panel, has served on the Pesticide Advisory Board for the Washington State Department of Agriculture. He holds a PhD in Entomology and Pesticide Toxicology from University of Hawaii, an MS in Entomology from Louisiana State University, and undergraduate degrees in biology and forest biology from S.U.N.Y. and Syracuse University, respectively.

About NWRI

A 501c3 nonprofit organization and Joint Powers authority, the National Water Research Institute (NWRI) was founded in 1991 by a group of California water agencies in partnership with the Joan Irvine Smith and Athalie R. Clarke Foundation to promote the protection, maintenance, and restoration of water supplies and to protect public health and improve the environment. NWRI's member agencies include Inland Empire Utilities Agency, Irvine Ranch Water District, Los Angeles Department of Water and Power, Orange County Sanitation District, Orange County Water District, and West Basin Municipal Water District.

Disclaimer

This report was prepared by an Independent Expert Advisory Panel, which is administered by National Water Research Institute. Any opinions, findings, conclusions, or recommendations expressed in this report were prepared by the Panel. This report was published for informational purposes.

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Publication Number: NWRI-2020-10