U.S. Department of the Interior
Bureau of Reclamation
Research and Development Office
Science and Technology Program

Evaluation of Approaches to Determine Mixing and Assimilation of Reuse Effluent

Research Bulletin
S&T Project 7100

Mission Issue

As drought continues in the western United States, development of resilient local supplies and augmentation of drinking water reservoirs with advanced treated recycled water, or SWA-IPR, is becoming an ever-larger component of water resource planning.

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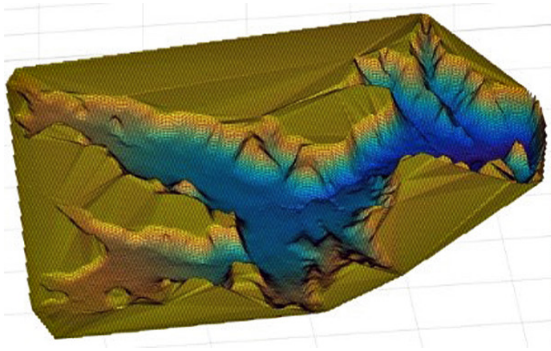
Problem

As drought continues in the western United States, an increasing number of utilities are developing resilient local water supplies and augmenting drinking water reservoirs with advanced treated recycled water. Issues associated with measuring and modeling the mixing and dispersion of recycled water in reservoirs are becoming more prominent.

Hydrodynamic modeling and tracer studies are required as part of the technical studies needed to assess water quality risks and evaluate feasibility of proposed Surface Water Augmentation by Indirect Potable Reuse (SWA-IPR) projects. Technical approaches currently vary based on locality and available information, reservoir configuration, water utility needs, and regulatory requirements.

Solution

Reclamation partnered with the University of Nevada, Las Vegas (UNLV), the Lake Arrowhead Community Services District (LACSD), and the Arrowhead Lake Association (ALA) to complete this research and produce a tracer study and hydrodynamic modeling guidance manual. In developing the guidance manual, Lake Arrowhead was used as a case study reservoir. Data were collected throughout the duration of the project, and a tracer study was completed by UNLV in December 2019. A hydrodynamic model was developed and calibrated with environmental, meteorological, and hydrologic data, then validated with the tracer study measurements. Completed tracer and hydrodynamic modeling studies from other utilities were also reviewed. The review included the City of San Diego's Miramar Reservoir tracer study, which will be used for the Pure Water San Diego SWA-IPR project.



"This document will help water managers understand the process to evaluate the feasibility of surface water augmentation with recycled water. A concise guidebook such as this is especially useful for agencies with limited resources that serve small, rural and/or disadvantaged communities."

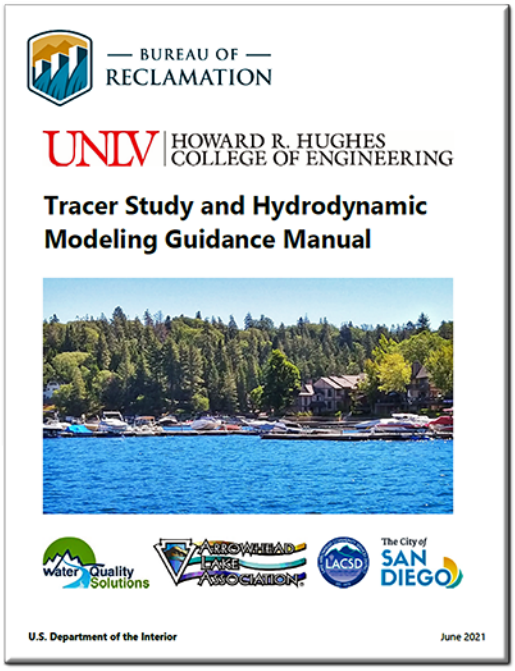
Catherine Cerri,
General Manager,
Lake Arrowhead Community Services District

Application and Results

UNLV used results from the Lake Arrowhead case study combined with guidance from a Subject Matter Expert (Water Quality Solutions) and experienced water agency managers (LACSD, City of San Diego) to develop the tracer study and hydrodynamic modeling guidance manual. This guidance manual will help utilities plan for SWA-IPR projects.

The guidance manual covers major elements of a tracer study and hydrodynamic model, including:

- Regulatory requirements,
- Public outreach,
- Selection of a hydrodynamic model,
- Acquisition, evaluation, and formatting of model input data,
- Preparation for and completion of the tracer study,
- Calibration and validation of the hydrodynamic model, and
- Recommendations for maintenance and follow-on uses of the validated hydrodynamic model.



More Information

https://www.usbr.gov/research/projects/detail.cfm?id=7100

Future Plans

The Tracer Study and Hydrodynamic Modeling Guidance Manual will be distributed to project stakeholders and available as requested. It is Appendix 1 to the Final S&T Report posted on Reclamation's S&T Website and in RISE.

S&T 21023 (currently ongoing) will build on the hydrodynamic modeling effort from S&T 7100. S&T 21023 will develop and test a protocol for long-term measurement and modeling of complex wind fields and water movement in augmented reservoirs to improve prediction accuracies of the residence and travel times, and attenuation needed for implementation of IPR-SWA projects. S&T 21023 will develop a protocol to create gridded wind fields and incorporate them in the S&T 7100 Lake Arrowhead hydrodynamic model, then undertake the first steps to generalize this approach so that improved predictions of water movement can be applied to Reclamation and stakeholder reservoirs.