PureWaterSF

Innovate. Research. Explore.

May 2019

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) is leading innovative research to explore how we can treat our building's wastewater to create a high-quality water supply.

What is purified water?

Purified water is produced using an advanced purification treatment process that takes wastewater and treats it through ultrafiltration, reverse osmosis, and advanced oxidation with ultraviolet light. From a water quality perspective, the purified water produced from these treatment steps is expected to meet state and federal drinking water standards. How this purified water enters the distribution system (direct or indirect) determines which regulatory framework and additional California State potable reuse requirements apply, if any.

This factsheet explains why the SFPUC is pursuing purified water, how the purification system works, and how the PureWaterSF project contributes to a growing body of research.

Why are we researching this?

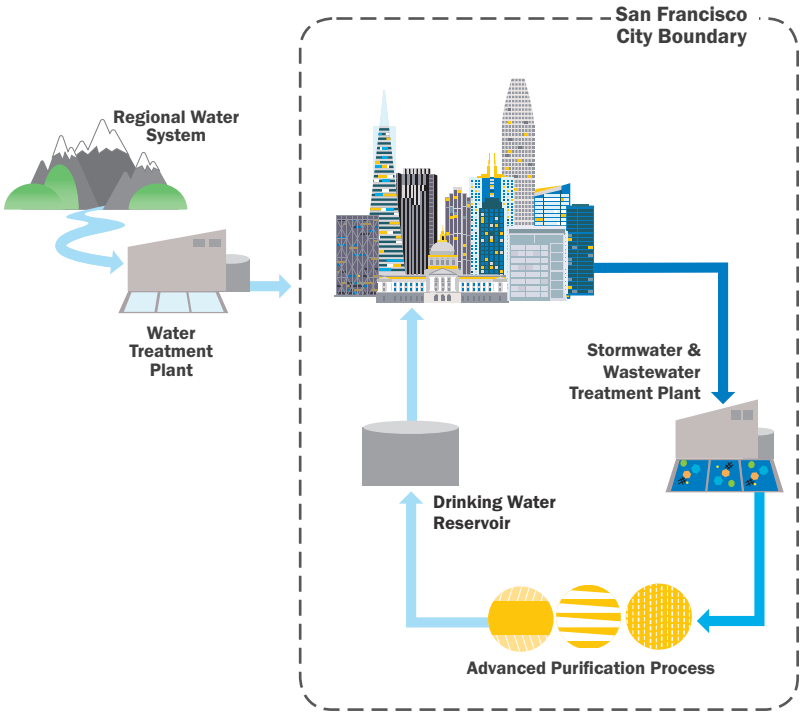
The SFPUC is a leader in the innovative and sustainable use of water in an urban setting. With adoption of the Non-Potable Water Ordinance in September 2012, the SFPUC installed a constructed wetland treatment system called the Living Machine™ at its headquarters.

The SFPUC is now conducting research on how to further purify this treated water to a level that can be compared to drinking water standards.

San Francisco's infrastructure is unique. The majority of the city's water supply is captured and treated far from San Francisco. There is no water treatment plant within the city, and no available water storage capacity.

The combined wastewater collection system (which takes wastewater and stormwater into the same pipes) produces lots of wastewater. Therefore we need to assess the option of purifying water and blending it directly in the city reservoir distribution system.

How can we use purified water in San Francisco?



How is the research project being funded?

The SFPUC has a responsibility to plan and implement projects now to be ready in advance of future needs so we can reliably manage our water resources. Research and development into water reuse helps us explore options and take steps to prepare for the risks we face in ensuring a sustainable water future for generations to come.

THE Water Research FOUNDATION

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

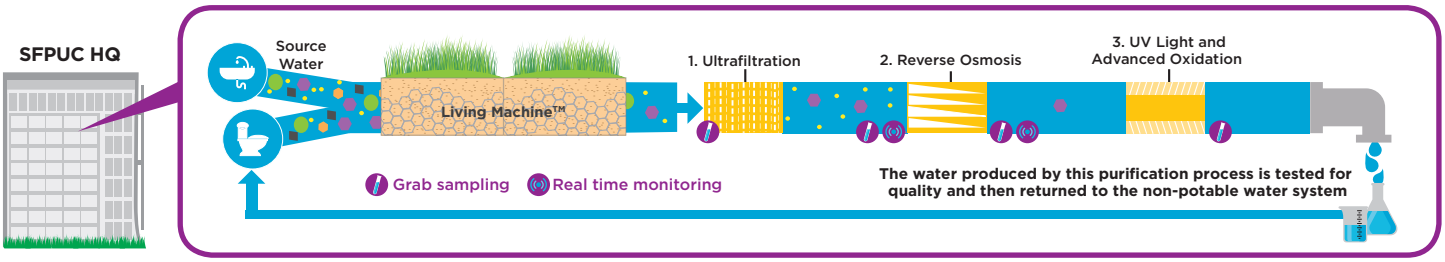
Funding for this research is provided in partnership with The Water Research Foundation and the United States Bureau of Reclamation.

For more information on the PureWater Project, please visit **sfwater.org/purewater**

The PureWaterSF system

The PureWaterSF system adds an advanced water purification system onto the existing engineered wetland system of the SFPUC's Living Machine™. The Living Machine™ treats the building's wastewater, turning this resource into recycled water. The PureWaterSF system takes approximately 4,000 gallons/day (or 80%) of the recycled water produced daily by the Living Machine and purifies it to produce 1,296 gallons/day of purified water at a rate of 0.9 gallons/minute. This high-quality water meets drinking water standards using the most advanced purification processes available including ultrafiltration, reverse osmosis, and advanced oxidation. This project will also adhere to and help inform future California potable reuse regulations.

PureWaterSF system purification process



1) After initial water quality sampling and testing, the water taken from the Living Machine™ first goes through **ultrafiltration (UF)** which involves passing recycled wastewater through very fine hollow fiber membranes and removing particulate matter, bacteria, and protozoa. After passing through the membrane, the filtered water mostly contains dissolved salt and organic molecules. **Sampling:** UF effluent is sampled for chloramines, free chlorine, nitrate, TOC, DOC, UV254, and turbidity.

2) The next step is **reverse osmosis (RO)** where the water is pushed through a semi-permeable membrane at high pressure to remove impurities such as viruses, dissolved salts, pesticides, and most organic compounds. RO produces water of a higher level of purity than drinking water. It is the same process used to desalinate seawater. **Sampling:** RO permeate is sampled for TOC, nitrate, nitrite, turbidity, pH, temperature, free chlorine, and UV254.

3) The final step is advanced oxidation which exposes the water to **ultraviolet (UV) light** combined with sodium hypochlorite to disinfect any pathogens and to further reduce chemicals to non-dectable levels. **Sampling:** The finished water is sampled for free chlorine and UVT. **Advanced Data Analytics:** The quality of the purified water will be tested using advanced analytics which includes bioassays (biological assessments) and non-target analysis (NTA) to measure biological effects of various trace level chemicals found in our water system.

After completing the purification train and undergoing final monitoring and assessment, the purified water will then be recombined into the building's non-potable system for toilet flushing.

Research for San Francisco's Future Water Needs

Our Goal: The goal of this research project is to demonstrate how advanced water purification and monitoring technologies can reliably convert building-sourced wastewaters into a high-quality supply to meet diverse end uses. The goal encompasses developing a better understanding of the technology and future applications within our water supply planning in San Francisco.

Our Objectives:

1. Examine reliability of a water purification system at building-scale

This research project examines the reliability of a building-scale water purification system through assessment of treatment technologies and monitoring conventional parameters. These parameters are measured using real-time monitoring for chloramines, free chlorine, DOC, turbidity, TOC, UVA, nitrite, nitrate, pH, and temperature. Grab samples are also tested monthly for water quality targets including: viruses, protozoa, NDMA, and trace pollutants (CECs and DBPs). Data from both grab samples and real-time monitoring are regularly tested and compared to industry standards to ensure high-quality standards are met. Data collected provides valuable information for research and future policy about reliability of advanced water systems in general and for systems at building-scale.

2. Create a research baseline through advanced water quality analytics

The project follows recommendations from the State Water Resources Control Board Expert Panel to use NTA and bioassays to address knowledge gaps and better grasp the significance of water quality "unknowns". Water quality sampling is conducted for pathogen analysis in the raw wastewater that feeds into the Living Machine™ and is treated before going to the purification system. This is part of a pathogen risk analysis and documents pathogen removal in accordance with California regulations. A suite of bioassays is being tested at the University of California, Davis for the following: estrogen, androgen, glucocorticoid-/progesterone, dioxin, genotoxic, and cytotoxic chemicals.

3. Promote transparent science through outreach and communication

The research project contains several outreach components to enhance transparent communication of the science behind this research including: factsheets, a digital wall display, a digital tour video, as well as in-person tours. In later stages, public reports will feature project results and conclusions. Throughout the project, information on the purpose, processes, and system will be shared online at the project's website. All of these components work toward fostering a greater understanding of purified water in our communities. Public feedback will further inform future work by the SFPUC.

4. Provide new opportunities with on-site operator training

PureWaterSF also provides a unique opportunity for operators to receive onsite training with a building-scale water purification system at the SFPUC headquarters. Operator feedback will help inform planning and system development.