

## **UC Irvine**

### **SSOE Research Symposium Dean's Awards**

#### **Title**

Biofilter For Nitrate Reduction

#### **Permalink**

<https://escholarship.org/uc/item/5q6710sd>

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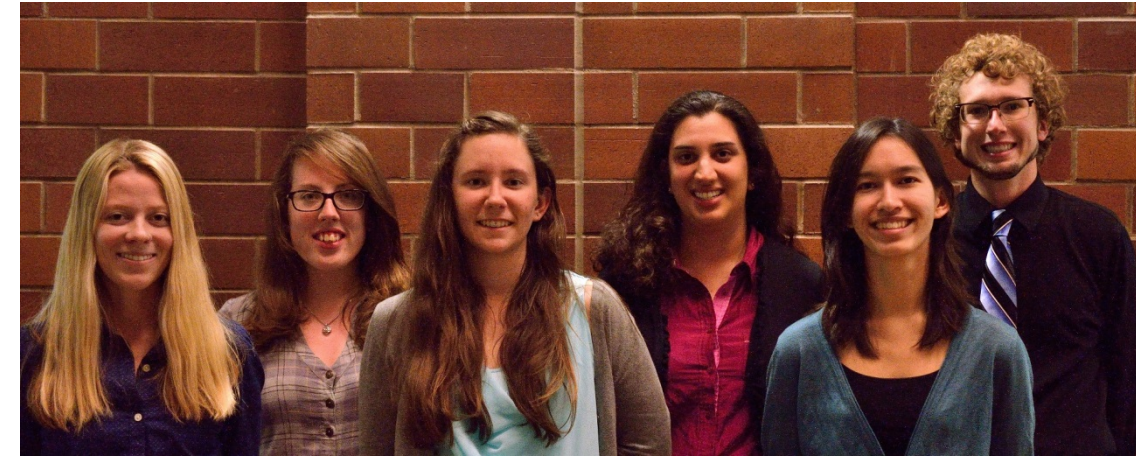
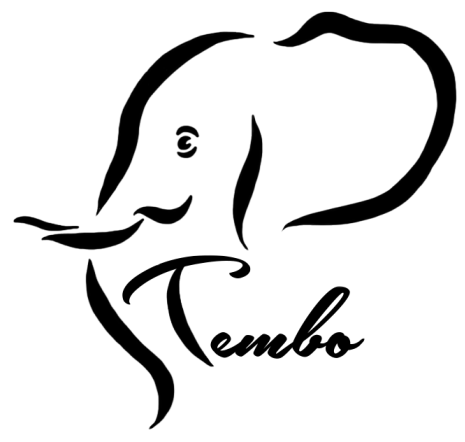
et al.

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## TEMBO INCORPORATED – Group E2

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**Environmental Engineers:**  
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## PROJECT MOTIVATION

In a time of severe drought throughout the Western U.S., it is essential to efficiently utilize all water resources. Using preexisting microorganisms to remove the common contaminant nitrate from impacted water would make one more valuable resource available to the public.

## PROJECT DESCRIPTION

Tembo Inc. and BKT Co. Ltd shall provide Tucson Metro Water District in Arizona with a biological filtration system to reduce nitrate contamination in its irrigation groundwater well so that it may be used to produce drinking water. This design optimizes cost and efficiency, while providing clean water for City of Tucson residents.

## DESIGN APPROACH

- Obtain groundwater well and site information
- Research biofiltration history and designs
- Compare/determine optimal biofilter technologies
- Design biofiltration system
- Design microfiltration and disinfection systems

## DESIGN CRITERIA

- Depth to Water
- Flow Rate
- Nitrate Concentration
- Water Temperature
- pH
- Native Microbes

Bed Type	Removal Efficiency	Clogging	Energy Consumption	Installation Costs	Maintenance Cost
Trickle Filter	Low	High	Medium	Low	High
Packed Bed	Medium	Medium	Low	Medium	Medium
MBBR	High	Low	Medium	Medium	Low
MBR	High	Medium	Low	High	High

# BIOFILTER FOR NITRATE REDUCTION

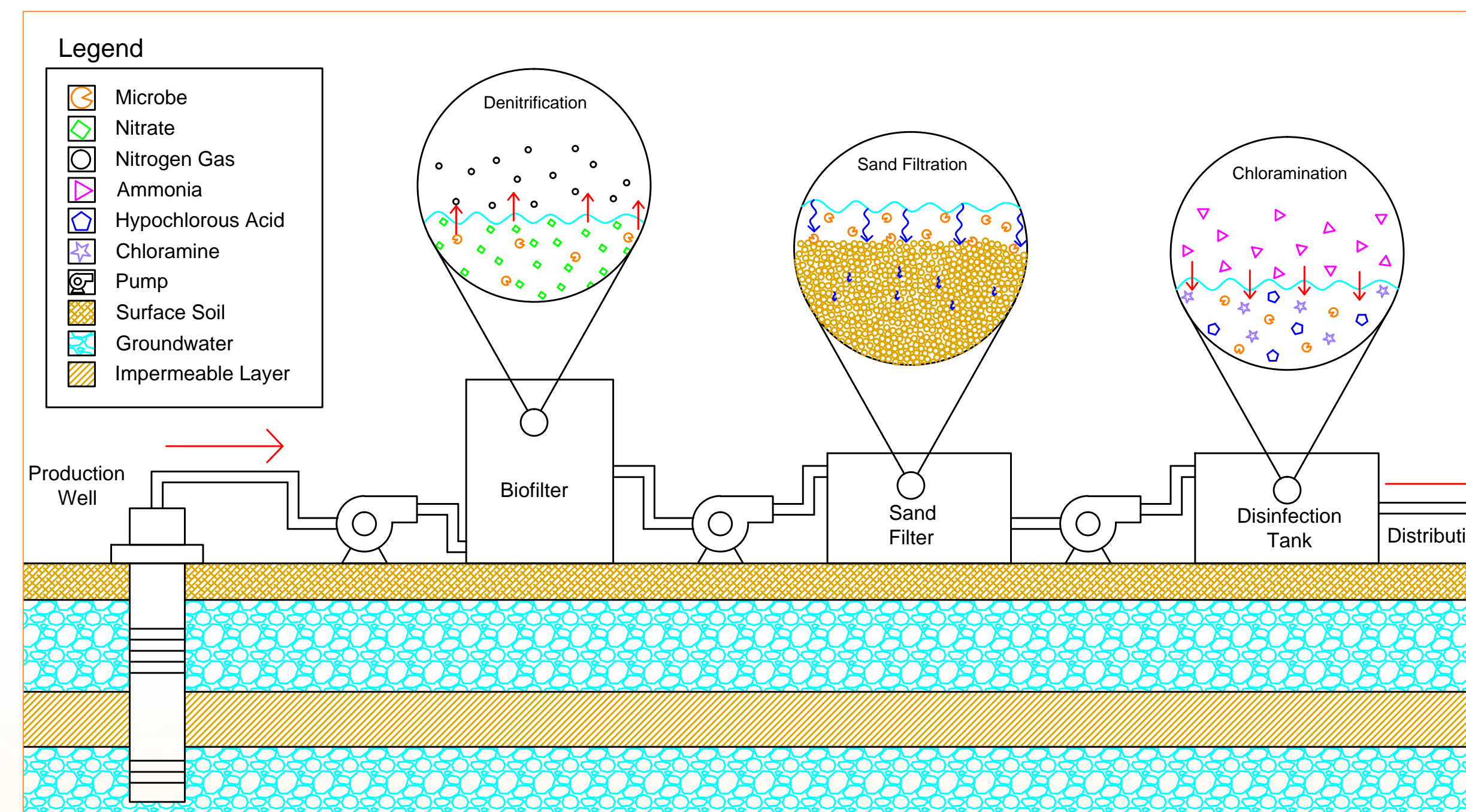


Figure 1. Conceptual Biofiltration System Design

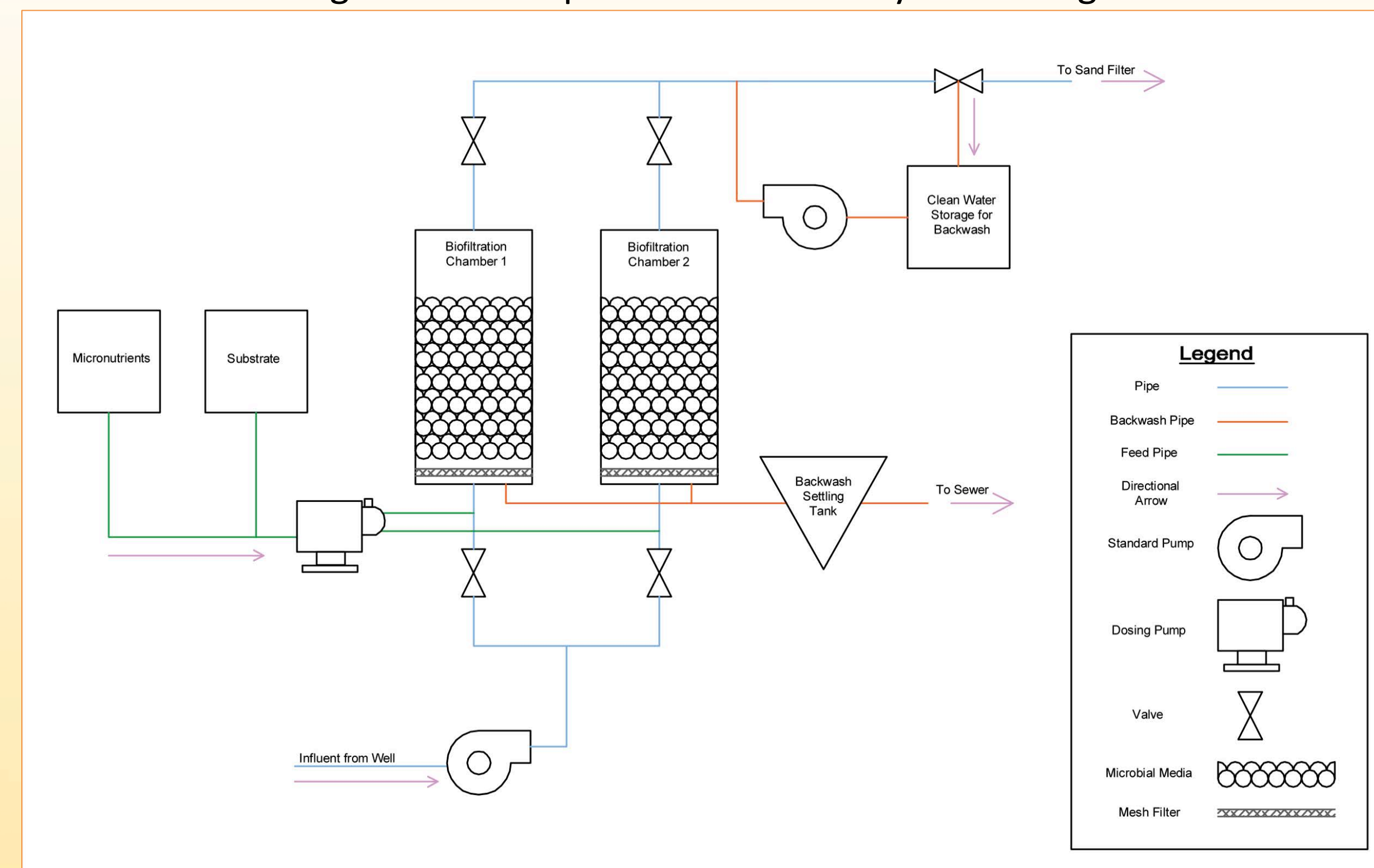


Figure 2. Biofilter Piping and Instrumentation Diagram

## DESIGN ALTERNATIVES

Media Type	Surface Area	Void Ratio	Mechanical Strength	Installation Costs	Maintenance
Granular Media	Low-Medium	Low-Medium	High	Medium	High
Filtration Pads	Medium	Low	Low-Medium	Low	Medium
Dumped Packings	High	High	Low-Medium	Medium	Medium
Structured Media	High	Medium	High	High	Low



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## COLLABORATORS

**Faculty Advisor:**  
Dr. Diego Rosso

**Utility Service Provider:**  
Tucson Metropolitan Water District

**Client Consultant:**  
Dr. Joon Min, BKT Co. Ltd.

## PROPOSED DESIGN

The biofilter design utilizes two tanks containing packed media with an upward flow that then passes through sand filter to contain any microbes that slough off. Any microbes that pass this chamber will be killed in disinfection by chloramination with minimal byproducts as it flows to be distributed.

## ENVIRONMENTAL DOCUMENTATION

- National Environmental Policy Act Categorical Exclusion (NEPA CX) Documentation
- National Pollution Discharge Elimination System (NPDES) Permit
- Pima County Floodplain Use Permit
- Spill Prevention Control and Countermeasure (SPCC) Plan

## CRITICAL COST ELEMENTS

- High Surface Area Media
- Substrate & Nutrients
- Biofiltration Tanks
- Sand Filter
- Pumping System
- Disinfection System
- Control Panel
- O&M
- Construction
- Contingency Plan

## NEXT PHASE

- Design Scaling
- Detailing & Specifications
- Efficiency Optimization
- Feasibility Study
- Cost Analysis