The WaterHub® - Sustainable Utility Management Through Water Reclamation and Reuse
Eco-Engineered Reuse Systems

Living, Learning Laboratory

Changing the Paradigm of Water Reuse
The Water Apocalypse

Water Scarcity
Aging Infrastructure
Environmental Pressures
Rising Rates
The Cycle of Drought

How will you prepare for recurring droughts?

“Water Managers in 40 states expect water shortages in some part of their state within the next 10 years.”
- US Government Accountability Office

“Nearly one in ten watersheds are stressed. By midcentury, we expect to see less reliable surface water supplies in the United States. This is likely to create growing challenges for agriculture, electrical suppliers, and municipalities.”
- NOAA
Fixing A Failing System

“Through strategic, sustained investment, bold leadership, thoughtful planning, and careful preparation for the needs of the future, America’s infrastructure will be improved and restored.”

- American Society of Civil Engineers, 2017 Report Card for America’s Infrastructure

Suggested Solutions...

- Raise Awareness for the True Cost of Water
- Increase Costs for Water and Wastewater Services
- Develop and Harness New Technologies
- Increase Private Financing
- Implement Water Reuse & Expand Water Recycling

OVERVIEW

The nation’s 1,748 wastewater treatment plants protect public health and the environment. Years of treatment plant upgrades and more stringent federal and state regulations have significantly reduced untreated releases and improved water quality nationwide. It is expected that more than 56 million new users will be connected to centralized treatment systems over the next two decades, and an estimated $277 billion is needed to meet current and future demands. Through new methods and technologies that turn waste into energy, the nation’s 2,263 biogas plants help communities better manage waste through reuse.
The WaterHub®: Decentralized Reclamation & Reuse
Unique Development Approach

Operating Lease | DBO Agreement | Performance Contract

Benefits
- No up-front capital
- Innovative technologies
- Leverages superior credit rating
- Lifecycle savings
- Long-term pricing stability
- No O&M responsibilities
- SW bears majority of risk
# Water Processing Agreement

## Client Benefits
- Utility Plant Operational Resiliency (N+1 Water Supply)
- Campus Sustainability Initiative
- Guaranteed Savings over Business-as-Usual
- Hands-Off Operations

## Developer Risk
- Proper System Engineering & Design
- Construction / Development Costs & Bonds
- Facility Operational Cost
- Facility Maintenance Cost
- Production of Compliant Reclaimed Water
- Any Escalation of Long-term water / sewer costs
- Long-term Upkeep of Plant

## Client Responsibility
- Minimum Annual Purchase of Compliant Reclaimed Water (Based on historical water use)
- Land Lease and Pipeline Easement
- 30 Year Operating Agreement
Owner / Developer Mindset

- Vendor Accountability
- Project Economics
- Capital Expenses
- Operational Efficiency
- Energy Footprint
- Productivity
- Safety / Compliance
- Asset Management
- Community Outreach
- Community Awareness
- Expandability
- Uptime
- Resiliency / Redundancy
- Operational Expenses
- Return on Investment
**Preliminary Assessment Data Request**

- **Water Use (3 years)**
  - Total campus inbound water by Month and Location
  - Chiller Plant/Cooling Tower Make-Up by Month and Location
  - Boiler Make-Up/ Power Block Usage by Month and Location
  - Irrigation by Month and Locations
  - Any Supplemental Sub-Metering Data

- **Economics (3 years)**
  - Recent Water & Sewer Bills
  - Internal OPEX Breakdown for Potable Water Production and Wastewater Pretreatment inclusive of:
    - Energy
    - Manpower
    - Chemical
    - Repair/Replacement

- **Wastewater and Quality Testing**
  - Current Industrial Discharge Permit
  - Historical Groundwater Influent Quality Testing
  - Wastewater Influent and Effluent Quality Testing
    - Industrial and Sanitary

**Estimated Utility Demands By Location**

- Available Resources
- Utility 1
- Utility 3
- Utility 4
- Utility 5
- Utility 6
Feasibility Study Scope of Work

❑ Existing Conditions Assessment
  ❑ Water Balance & Demands
  ❑ Site & Infrastructure Review
  ❑ Utility Water Audit / Review
  ❑ Future Demand / Load Forecasts
  ❑ Water Supply Resiliency Review

❑ Supplemental Field Investigation
  ❑ Validate process / Cooling makeup
  ❑ Wastewater Flow Monitoring
  ❑ WW Characterization

❑ Establishing the Vision
  ❑ Opportunities & Constraints
  ❑ Campus Sustainability / Resiliency Goals
  ❑ Developing a Basis of Design for Systems

❑ Concept Design
  ❑ Site Plan
  ❑ Conceptual Layout & Design
  ❑ Water Supply Resiliency Assessment
  ❑ Preliminary Constructability Review & Budget
  ❑ Lifecycle Economics
Supplemental Field Investigation

TASKS:

- Review all 3rd party flow & water quality testing
- Administer supplemental field investigations where needed
  - Wastewater flow monitoring
  - End-use flow validation
  - Wastewater characterization
- Develop field testing reports summarizing results

FLOW MONITORING

- Seasonal variations in flow
- Diurnal patterns
- Reuse potential

WASTEWATER CHARACTERIZATION

- Variability
- Treatability
- Contaminants of Concern
- Informs basis of design
Understanding Water Issues

Deposition

- Particle Entrainment
- Growth Sites
- Underdeposit Corrosion
- Corrosion Products

Biofouling

- Growth Sites
- Metabolic Products

Corrosion
Utility Water Audit

**TASKS:**

- Catalogue existing utility / process water equipment at targeted reclaimed water end use locations
- Assess process water equipment conditions (w/ Azure Water)
  - Corrosion Rates
  - Non-destructive testing
  - Inspection reports
- Review chemical treatment program administration / maintenance
  - Operator logs
  - Disinfection / Inhibition Program
- Validate operating loads and water demands / diurnal profiles
- Review district energy expansion / modification plans & assess future operating loads
- Establish baseline water quality characteristics
**System Design Basis**

**FIELD INVESTIGATION:**
- 7 Days of Composite Sampling
- 120 Days of Flow monitoring
- Ongoing to provide highest quality dataset
- Campus Outfall:
  - Avg Flow - 575k GPD
  - Est Annual – 190 MGY
- North Rd Outfall Avg:
  - Avg Flow - 56k GPD
  - Est Annual – 20 MGY

**EFFLUENT DESIGN:**
- State Class A Standard
- Additional End Use Standards

### Targeted Demands vs Measured Wastewater Resources

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<th>Unit</th>
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The WaterHub at Emory University

CLIENT TYPE
Private University

LOCATION
Atlanta, GA

HYDRAULIC CAPACITY
440,000 GPD

FOOTPRINT
Building: 3,500 ft²
Lower Site: 3,000 ft²

COMMERCIAL OPERATION
May 2015

END USES
Boiler Make-Up
Cooling Tower Make-Up
Toilet Flushing

TECHNOLOGIES APPLIED
Hydroponic – MBBR
Reciprocating Wetlands
The WaterHub at Emory University

CAPABILITIES:
- Up to 400K GPD and 146M GPY Capacity
- Displaces Up to 40% of Total Campus Demand
- Reduces Up to 70% of Campus Wastewater
- Displaces 90% of Utility Water Demand
- Living, Learning Laboratory

PERFORMANCE TO DATE
- 95% of City Water Displaced at Cooling Towers
- Averaging 7 Million Gallons per Month Campus Wide
- 280 Million Gallons of Water Delivered since May 2015
- 99% Up-Time Reliability
- Over 5,000 tours conducted
The WaterHub – Living & Learning Lab

"THE WATERHUB PROVIDES THE EXPERIENCE OF COLLECTING REAL DATA, INTERPRETING RESULTS AND WRITING REPORTS. FOR SOME STUDENTS, IT MAY HAVE BEEN THE FIRST HANDS-ON LAB EXPERIENCE THAT THEY’VE HAD."

- CHRISTINE MOE, DIRECTOR OF THE CENTER FOR GLOBAL SAFE WATER, EMORY UNIVERSITY

EDUCATIONAL FEATURES:
- Info / Educational Plaques & Signage
- Classroom & Lab Space
- Easy Access Water Quality Ports
- Public Operations Monitors

NOTEWORTHY RESULTS:
- Over 4,500 tours held since May ’15
- Used in graduate thesis studies
- Centerpiece of Student Docent Program
- Integrated into core coursework

RESEARCH & CURRICULUM:
- Used in the following fields:
  - Biology
  - Water, Sanitation & Hygiene (WASH)
  - Journalism
  - Chemistry
  - Law
- New Courses Introduced:
  - Water and Sanitation in Developing Countries
  - Research Methods in WASH
The Virginia WaterHub®

CLIENT TYPE
Industrial Manufacturing

LOCATION
Richmond, VA

HYDRAULIC SIZING
650,000 GPD

FOOTPRINT
Building: 8,200 ft²
Storage Tank: 1,200 ft²
(24 ft. hgt. & 39 ft. dia.)

COMMERCIAL OPERATION
July 2019

END USES
Cooling Tower Make-Up
Open-Aired Chiller Make-Up

TECHNOLOGIES APPLIED
- Hydroponic – MBR
- RO Polishing
The Virginia WaterHub®

CAPABILITIES:
- Up to 650K GPD and 237M GPY capacity
- 40% reduction of consumed water
- 55% reduction of wastewater discharge
- Exceed corporate KPI (25%) in water reduction
- Sustainability featured in campus tour

PROJECT GOALS:
- Conserve community water resources
- Provide leadership in water sustainability
- Relieve strain on local municipal infrastructure
- Insulate operational viability & supply chain
Virginia WaterHub® Goals

- Conserve community water resources
- Provide leadership in water sustainability
- 40% reduction in consumed water
- 55% wastewater discharge reduction
- Relieve strain on local municipal infrastructure
- Insulate operational viability & supply chain
**THE WATERHUB®**

**HOW IT WORKS**

**SUSTAINABLE WATER®**

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**1. Drum Screen** | Wastewater intercepted from sewer passes through screening to remove 2mm or larger solids.

**2. Equalization Tank** | Acts as a storage tank to buffer variations in flow and concentration. Coarse bubble aeration keeps the tank mixed and oxygenated.

**3. Anoxic Tank** | Stage 1 of biological nutrient removal, converts nitrogen compounds to nitrogen gas in low oxygen zones - using mixers to limit settling.

**4. Hydroponic Reactor** | Specific plant species, suspended over aerobic tanks, grow roots into the reactor to provide additional surface area for fixed-film microorganisms.

**5. Post Anoxic Flex Reactor** | The final biological treatment step is a flexible tank operated in either aerobic or anaerobic conditions to remove residual organics or nitrogen.

**6. Submerged Membrane** | Water passes through a 0.5 micron membrane to remove biosolids. The rejected biosolids recycle to anoxic tank for continued microbial growth.

**7. Permeate Tank** | Effluent from submerged membranes is stored here after passing through an ultraviolet disinfection (UV) system that inactivates pathogens.

**8. Reverse Osmosis (RO)** | An RO system treats a side-stream of flow to remove residual minerals and blended into the effluent stream to achieve target conductivity levels.

**9. Reclaimed Water Distribution Pumps** | Pumps designed to supply reclaimed water flow and pressure to industrial users.

**10. Reuse Tank** | Tank to provide clean water storage and chlorine pathogen disinfection.
UPCOMING PROJECTS
City of Austin PDC WaterHub®

LOCATION
Austin, TX

CLIENT
City of Austin

PROJECT TYPE
Building-Scale Wastewater Reclamation & Reuse

HYDRAULIC CAPACITY
5,000 GPD

FOOTPRINT
800 ft²

COMMERCIAL OPERATION
Summer 2021

END USES
Building Toilet Flushing

TECHNOLOGIES APPLIED
Tertiary: Membrane Bioreactor (MBR)
Disinfection: Dual-Stage UV & Chlorine
The WaterHub® at The University of Texas at Austin

CLIENT TYPE
Public University

LOCATION
Austin, TX

PROJECT DESCRIPTION
District-Scale Wastewater Reclamation and Reuse

HYDRAULIC CAPACITY
1,000,000 GPD

FOOTPRINT
15,000 ft²

COMMERCIAL OPERATION
Spring 2021

END USES
Cooling Tower Make-Up
Boiler Make-Up

TECHNOLOGIES APPLIED
Hydroponics
Membrane Bioreactor (MBR)
Reverse Osmosis
# Procurement Process at UT-Austin

**DBOO - District-Scale Water Reclamation and Reuse Facility**

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**Class/Item Code:** 99922-Building Construction, Non-Residential (Office Bldg., Etc.)

### Attachments

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**Prepared By:**
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The University of Texas at Austin
BFS - UFM
215 East 24th Street
Austin, Texas 78712
512-232-6296
ken.bonin@austin.utexas.edu
Projected Chilling Station M/U By Source

Based on 2017 Utility Plan (does not include Weaver PP)

2016 Demand
- 31,328 Peak Tons
- 235 MGY cooling m/u
  - Domestic: 131 MGY
  - Recovered: 49 MGY
  - Reclaimed: 55 MGY

2028 Cooling Projections
- 53% Increase
- 47,675 peak tons
- 360 MGY cooling m/u
  - Domestic: 221 MGY
  - Recovered: 84 MGY
  - Reclaimed: 55 MGY

4% Annual Average Growth Rate
The WaterHub® at Duke University

**CLIENT TYPE**
Private University

**LOCATION**
Durham, NC

**PROJECT DESCRIPTION**
- District-Scale Wastewater Reclamation & Reuse
- Develop Sustainable Water Management District

**HYDRAULIC CAPACITY**
600,000 GPD

**FOOTPRINT**
9,400 ft²

**COMMERCIAL OPERATION**
Spring 2021

**GOALS / OUTCOMES**
- Utility / Operational Resiliency
- Reuse 120 MGY
- 45% decrease in discharge
The WaterHub® at Duke University
The WaterHub® at Duke Process Design
The WaterHub® at Piedmont Atlanta Hospital

LOCATION
Atlanta, GA

CLIENT
Piedmont Healthcare

PROJECT TYPE
Campus-Scale Wastewater Reclamation & Reuse

HYDRAULIC CAPACITY
250,000 GPD

FOOTPRINT
4,300 ft²

GOALS
• Resilient Utility Operations
• Water Conservation
• 75% Decrease in Discharge
• Enable Future Development

TECHNOLOGIES APPLIED
Outdoor Hydroponics
Tertiary: Membrane Bioreactor (MBR)
Disinfection: Dual-Stage UV & Chlorine
The WaterHub® at Piedmont Atlanta Hospital
The WaterHub® at Rocky Mount

CLIENT TYPE
Automotive Manufacturing

LOCATION
Rocky Mount, NC

HYDRAULIC CAPACITY
75,000 GPD

FOOTPRINT
5,500 ft²

COMMERCIAL OPERATION
Winter 2019

END USES
Boiler Make-Up
Cooling Tower Make-Up
Toilet Flushing

TECHNOLOGIES APPLIED
Hydroponic – MBR
The WaterHub® at Rocky Mount

**PROJECT GOALS:**
- Redundant (N + 1) water supply for utilities
- Drought protection
- Long-term economic savings
- Provide leadership in water sustainability
- Insulate operational viability & supply chain

**CAPABILITIES:**
- 100% factory up-time/plant production
- Up to 75K GPD and 27M GPY capacity
- 34% reduction of consumed water
- 90% reduction of wastewater discharge
- 15M gallons of reused water annually
Lessons Learned: General

Don’t Underestimate Public Interest

- Tours, Program Space, Community Outreach
- 4,500 Tours at Emory University

Facility Design Aesthetics

- Public access areas from Front to Back of House
- Pedestrian circulation through system
- Fully enclosed mechanical areas & better operator access

Data Collection & Field Investigations

- Never “too much” operational, sampling & flow data
- Strong data collection investigations in preliminary engineering, save time and money down the road
Lessons Learned: Process

Pre-Fabrication
- Hydraulic “Sweet-spots” to more or less prefabrication
- Skids, Tanks, Operator Rooms

Process Resiliency
- Equipment Redundancy (Primary screening, Influent Pumps, UV, etc.
- Dual Process Trains
- You can’t optimize what isn’t measured
- WQ Sensors starting in influent wet-well

Maintenance
- Removal & Maintenance of Influent Pumps from Wet Well
- Ability to Pump Backwards from Screen or EQ to flush influent lines
- Membrane / Filter Access, Location of Hoists

Turn-Down
- Contingency planning for turn-down scenarios
EXTENDING THE LIFECYCLE OF WATER

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