

# NEW TRICKS FOR OLD LOGS

## Innovation in Wastewater Treatment Efficiency

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# EVERYONE POOPS

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**Kane/Miller**  
BOOK PUBLISHERS



63rd St E

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- Thanks for thinking about this stuff – it's important and ubiquitous.
- Treatment to ever more stringent standards is expensive.
- Trends in PNW:
  - More BNR = more energy = more expense
  - Get out of surface water discharges
  - Reuse water & groundwater recharge (just starting)
- ***The Utility of the Future* is the current buzzword**

# THE UTILITY OF THE FUTURE . . .

- Recognizes wastewater as a medium to move valuable material to the Water Resource Recovery Facility (WWTP's are now WRRF's).
- To the extent possible, unlocks the energy embedded within the stream to complete its work.
- Actively engages with its current and future customers to help inform and manage growth, rather than reacting to it.
- Provides a significant percentage of the community's potable water, whether for consumption or other beneficial uses.

# THE UTILITY OF THE FUTURE . . .

- **Will be required to focus on energy efficiency and energy management in both design and operations in order to meet its other goals.**

# LOOKING AHEAD: EEM'S YOU CAN EXPECT

- **Next 5 years**
  - Real time water quality information
  - Avoid Aeration if possible
    - Primary Filtration
    - Primary DAFT
    - Side stream treatment of high load return streams
  - Maximize cogen potential with augmented feedstock
- **Next 10 years**
  - Internet of things will invade subsystems
  - LED's may be robust enough for UV disinfection

# REAL TIME WATER QUALITY MONITORING



## Benefits of real-time information in wastewater treatment:

- Event detection – “seeing” what is coming into the plant
- Enabling advanced process control – maximize efficiency
- Finished water quality assurance – rest easy knowing the plant is working and violations are avoided

The LiquID Station 2000 is an advanced, automated, online instrument for wastewater process monitoring and management. The hybrid-multispectral optical platform provides effectively continuous real-time data in a range of key wastewater parameters, including **BOD, CBOD, COD, TSS, Ammonia, Nitrate + Nitrite, and others**. The LiquID Station reports readings about every 2 minutes, delivered directly to an operator’s workstation, and requires no reagents or regular operator intervention.

# REAL TIME WATER QUALITY MONITORING



- **The OptiQuant™ Suspended Solids Analyzer** monitors and helps maintain the proper solids level in both the return nitrification sludge and the waste nitrification sludge as well as the aeration basin itself.

- **The HACH LDO™ Dissolved Oxygen Sensor** is the state-of-the-art DO system providing the most accurate measurements and requiring the least amount of maintenance of any DO system on the market today.

- **The OptiQuant UV Nitrate Analyzer** with in-situ probe measures nitrate readings in the aeration basin without chemicals or special pumping.

- **The Amtax™ Ammonia Analyzer** equipped with a Filtrax™ in-situ Filtration System monitors ammonia levels in the final plant effluent.



**PHOSPHAX™ SC**  
Phosphate Analyzer

# REDUCING LOAD ON SECONDARY

Process Area	% Power	KWH/LB <u>cBOD</u> removed
Pretreatment	20%	NA
Primary	4%	0.17 KWH
Secondary	51%	1.19 KWH
Final	15%	
GBT	4%	
Digestion	6%	



Before 23 MGD 10% removal TSS  
 After 45 MGD > 50% removal TSS  
 Annual 25.5% improved capture  
 Annual 746,250 KWH

- Numbers from MWMC plant in Eugene, OR.
- Courtesy of Bob Sprick, Ops Manager (retired)



**PRIMARY (PHYSICAL) TREATMENT = LOW ENERGY**



**SECONDARY (AEROBIC) PROCESS = HIGH ENERGY**

# PRIMARY EFFLUENT FILTRATION

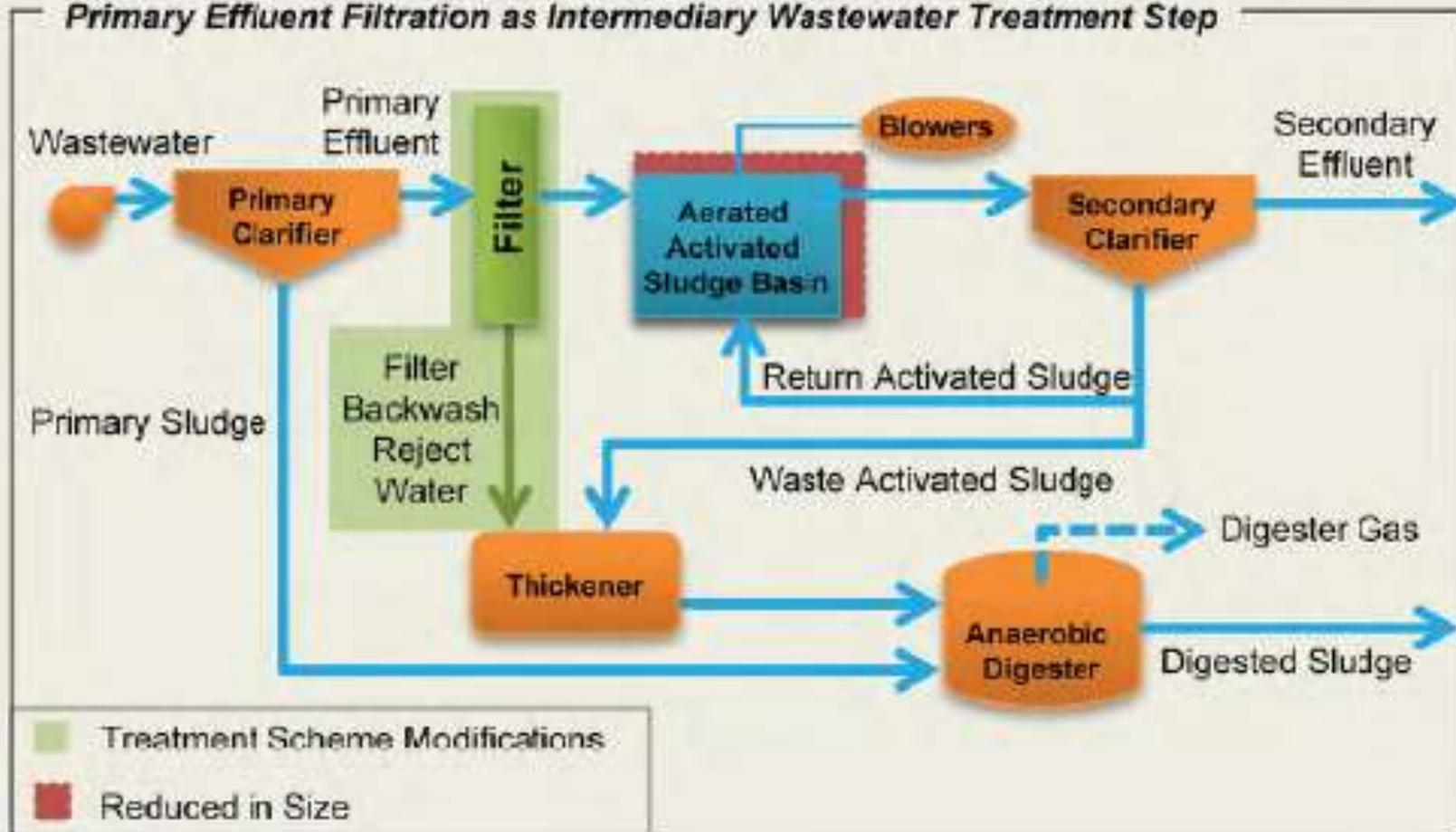
- Research project led by Onder Caliskaner, Ph.D., P.E. at Kennedy/Jenks Consultants
- Use “tertiary filters” on primary effluent to remove load on secondary and improve digester performance.

- **Funded by California Energy Commission**
- **Demonstration site - Linda County Water District**
- **Pilot testing - City of Roseville**
- **Advisor - Prof. Emeritus George Tchobanoglous / UC Davis**
- **Filter manufacturers**
  - Schreiber Corporation, LLC
  - WesTech, Inc.
  - Aqua Aerobics Systems, Inc.
  - Nova Technologies, LLC
- **Third party verification - Base Energy**

- **Source: PNCWA 2014 presentation**

# PRIMARY EFFLUENT FILTRATION

Figure ES-2: Modified Wastewater Treatment Flow Diagram  
Primary Effluent Filtration as Intermediary Wastewater Treatment Step



# PRIMARY EFFLUENT FILTRATION

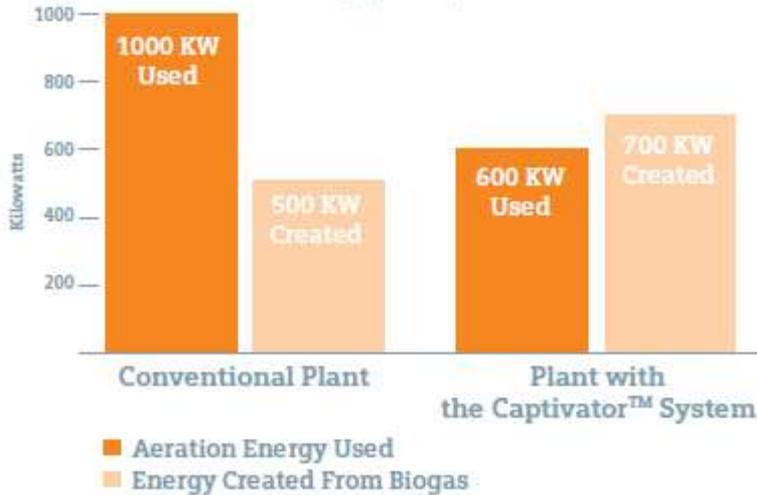
- Every pound of BOD removed in the primaries is one less pound to deal with in the secondary process. Less BOD = less oxygen demand = lower aeration requirements.

- Demonstration tests show 20% – 40% reduction in BOD after primary.

Expected Removal Efficiency	Primary Effluent COD (mg/L)	Primary Effluent BOD (mg/L)
20-25%	300-350	150-175
25-30%	350-400	175-200
30-35%	400-450	200-225
35-40%	450-500	225-250

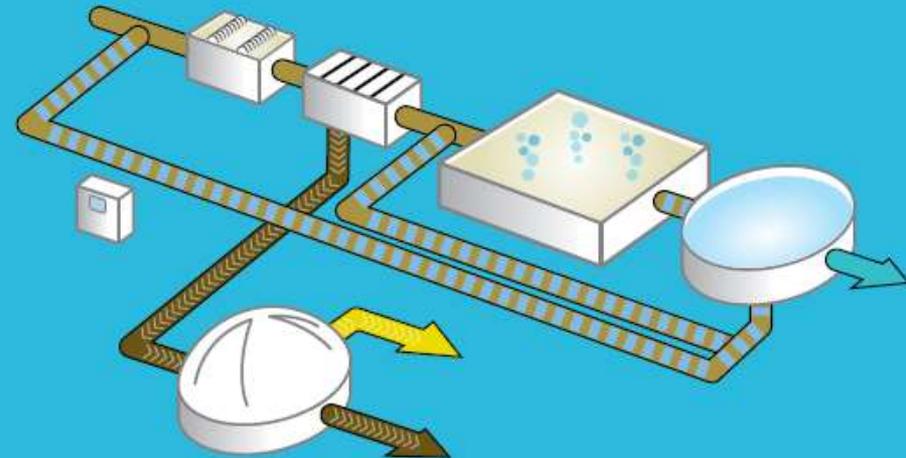
# PRIMARY DISSOLVED AIR FLOATATION

Energy Comparison



## THE CAPTIVATOR™ SYSTEM CAPTURES BOD AND SENDS IT TO THE DIGESTER.

The Captivator™ System utilizes a VLR® Contact Tank (pictured here) from Evoqua to help biomass maximize the absorption of soluble BOD. A Folded Flow® DAF from Evoqua applied to the liquid stream (cover photo) removes and thickens the majority of biomass and incoming SS at high overflow rates.



- Again, the goal is to unload the traditional aeration basin.

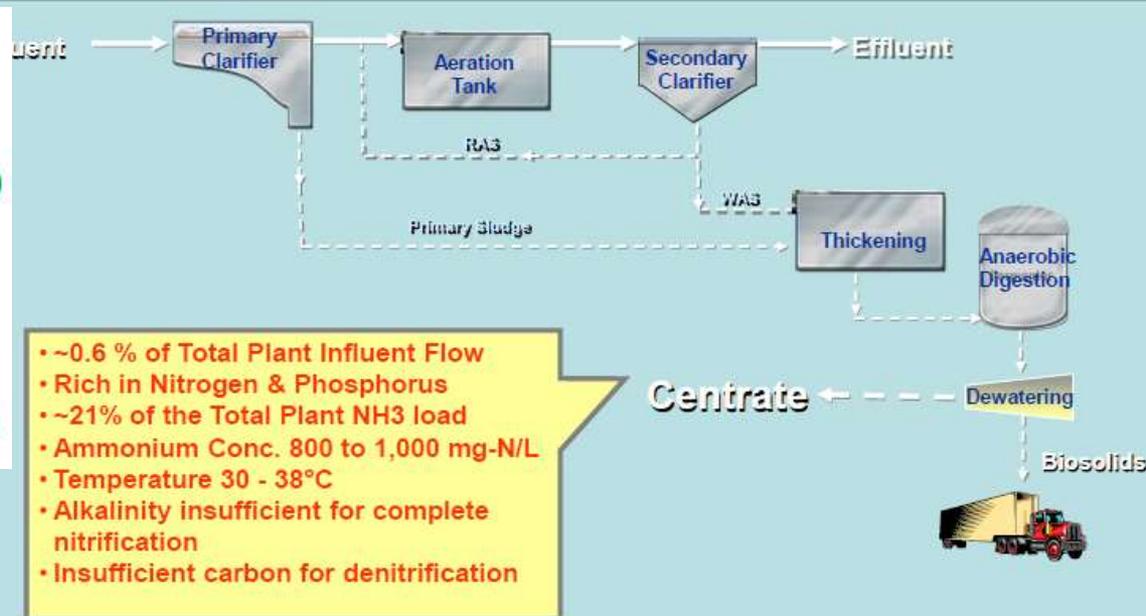
# SIDE STREAM TREATMENT



- 63% reduction in oxygen demand (energy)
- Nearly 100% reduction in carbon demand
- 80% reduction in biomass production
- No additional alkalinity required

- **SBR + Hydrocyclone Granular Sludge (DEMON)**
  - Strass, Austria + ~20 others
  - Cyklar-Stulz – World Water Works, Inc.
- **Upflow Granular Sludge (CANON or ANAMMOX)**
  - Olburgen, Netherlands + ~7 others
  - Paques (NL)
- **Biofilm process (MBBR-style)**
  - ANITA Mox – Malmo & Växjö, Sweden
    - AnoxKaldnes – Kruger - Veolia
  - Deammon – Hattingen, Germany & Stockholm
    - Purac

- Treat nutrient-rich return streams with custom process rather than loading it back into aeration basin.



- ~0.6 % of Total Plant Influent Flow
- Rich in Nitrogen & Phosphorus
- ~21% of the Total Plant NH<sub>3</sub> load
- Ammonium Conc. 800 to 1,000 mg-N/L
- Temperature 30 - 38°C
- Alkalinity insufficient for complete nitrification
- Insufficient carbon for denitrification

# COLLECTION SYSTEM PUMPS GET SMART



## Benefits of SmartRun™

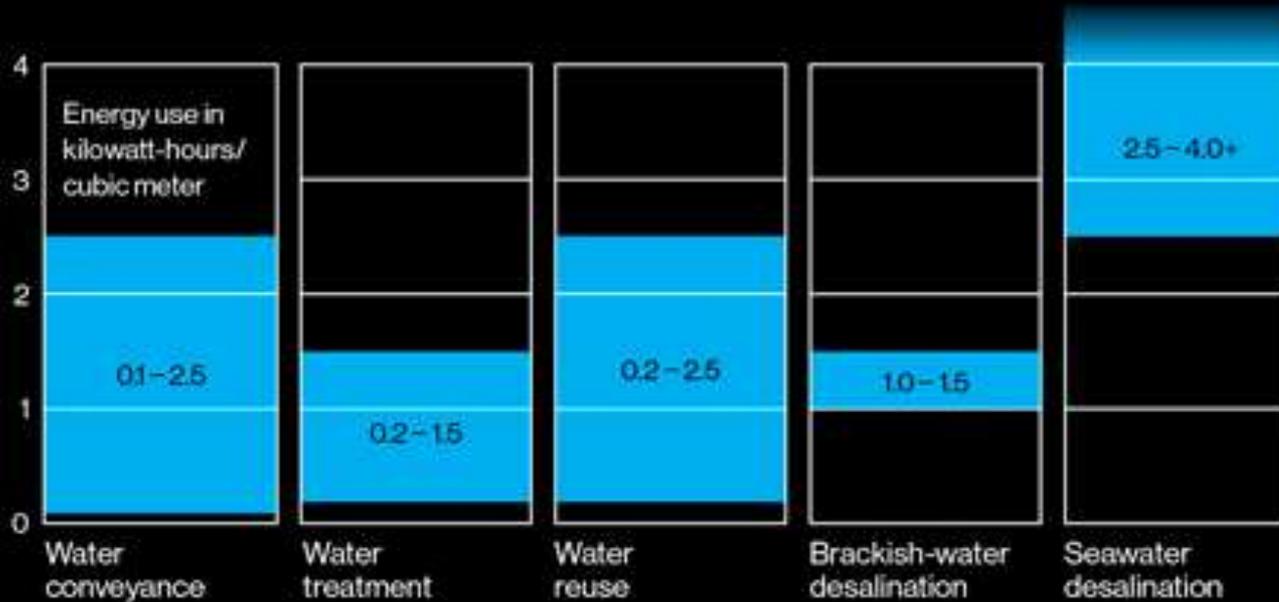
- Simplified intelligence: pre-programmed and user-friendly setup
- No need for special competence: minimal costs incurred during start-up and operations
- Reduced maintenance costs due to pre-programmed sump and pipe cleaning functions
- The pump cleaning function is automatically triggered in the unlikely event of clogging
- Energy consumption reduced by 30%

# FRESH WATER COMING ATTRACTIONS

- **Water utilities are starting to become enlightened as well**
  - Real time water QUANTITY information (this is the “smart meter” revolution for liquids).
  - Utilizing hydraulic models for energy management and optimization.
  - If grid-scale desalination is the future, we will need significant improvements in efficiency within the plants and within distribution systems.

# Water Supplies and Energy: No Free Drink

Seawater desalination still generally uses more energy than alternatives.



**NOTE:**

**4.0 kWh/m<sup>3</sup> =  
6,000 kWh/MG  
treated**

**SOURCE: MIT  
Technology Review**

<http://www.technologyreview.com/featuredstory/534996/megascale-desalination/>

- **EPRI 2013 U.S. Energy Efficiency W/WW report:**
- **Ground water: 2,100 kWh/MG**
- **Surface water: 1,600 kWh/MG**
- **U.S. desalination plants: 12,000 kWh/MG**



# PUBLIC SERVICE ANNOUNCEMENT

# THANKS AGAIN!

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