



**IMPACT<sup>RO</sup>**

Innovative Micro-disruptive Parallel and Cascading Train RO



**WATER SURPLUS<sup>®</sup>**

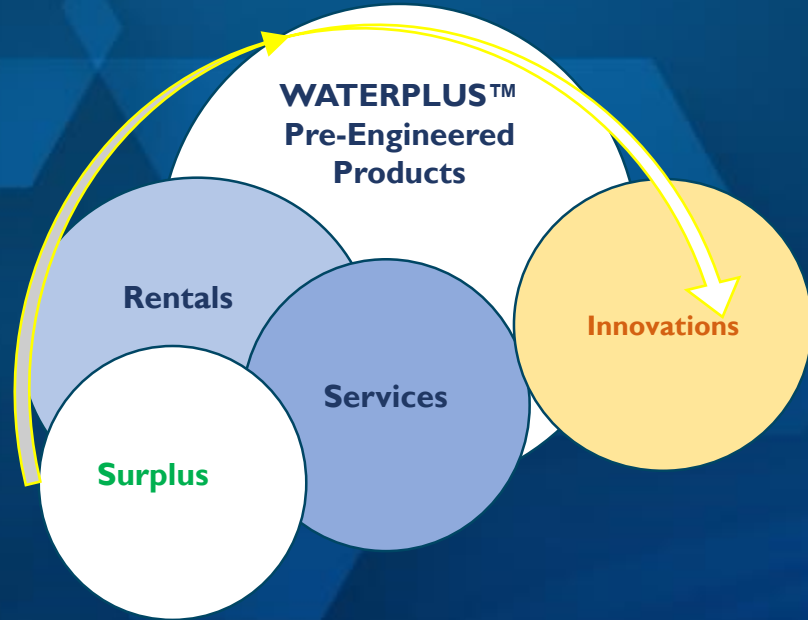
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# STRONG FOUNDATION



30 Years of Business Innovation  
300 Years of Industry Experience



John Barelli



Dileep Agnihotri



Jeff Anderson



Jim Groose



Jon Reinke



Steven Johnson



Tom Roberts



Warren Mathieu



WATERSURPLUS®



MEDIA/RESINS



MEMBRANES

TEMPORARY RENTAL



NEW EQUIPMENT



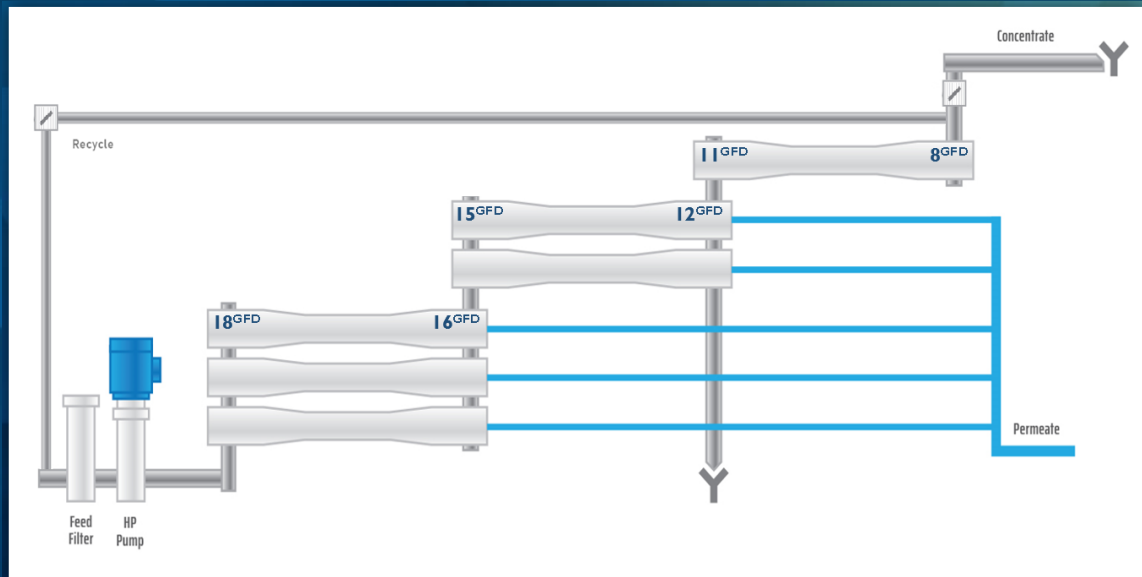




# IMPACTRO

Innovative Micro-disruptive Parallel and Cascading Train RO

# Problem: Multistage Brackish RO Process



- Significant Flux Imbalance
- Recycle Loop – Scaling of entire system
- Static build-up of CP Layer
- Flush and CIP Challenges across 3-Stage Design
- Energy Consumption (Pressure Losses in First Stage)
- Static Conc. Valve

## DON'T WORK WELL FOR

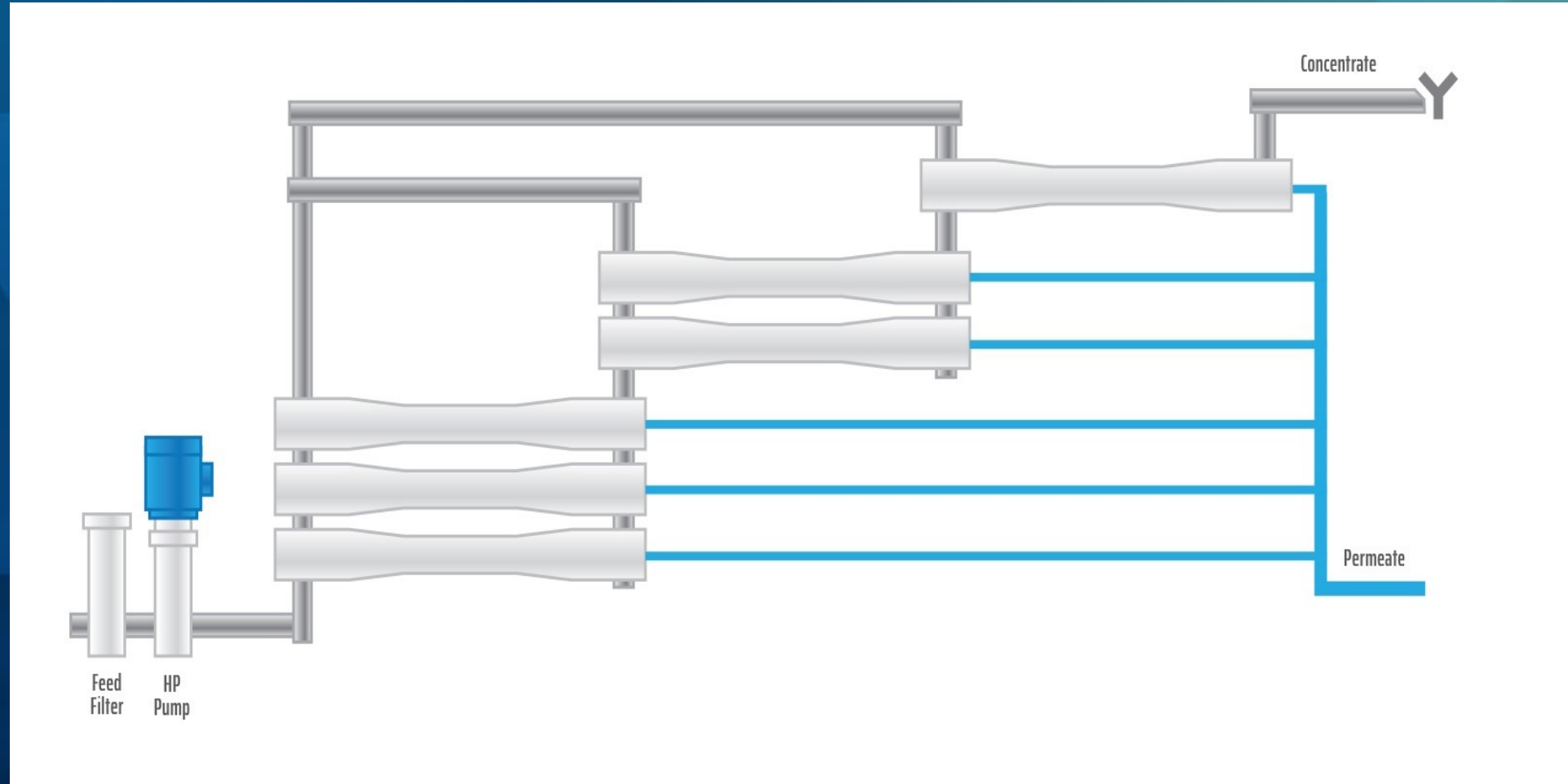
- High Flux Membranes
- Low-TDS feed
- Achieve Recovery >85%



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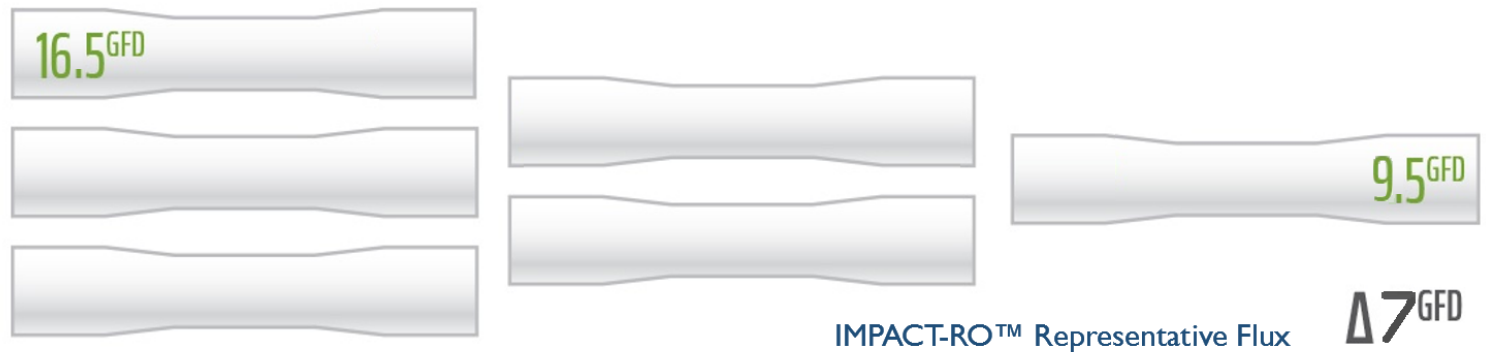
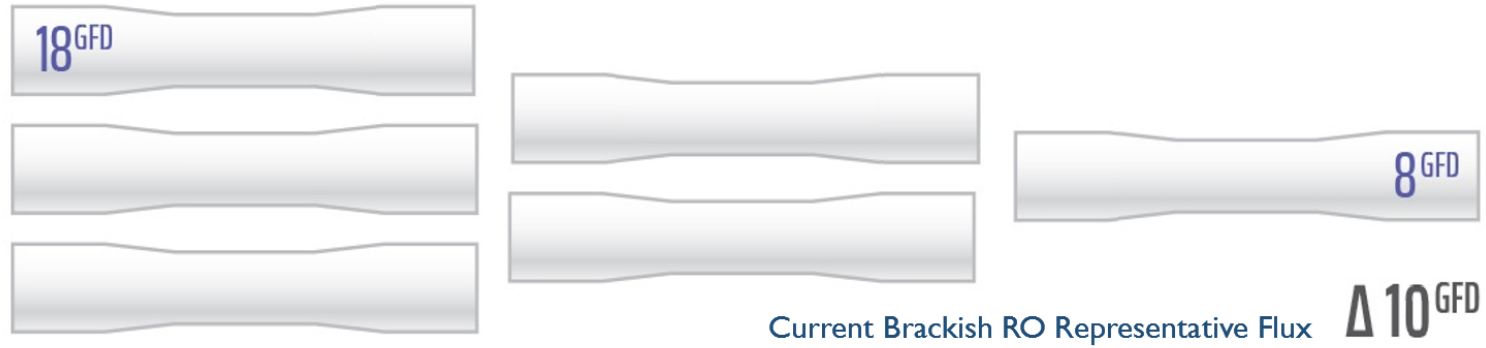


# **IMPACT-RO™ Brackish RO Process (Patent Pending)**



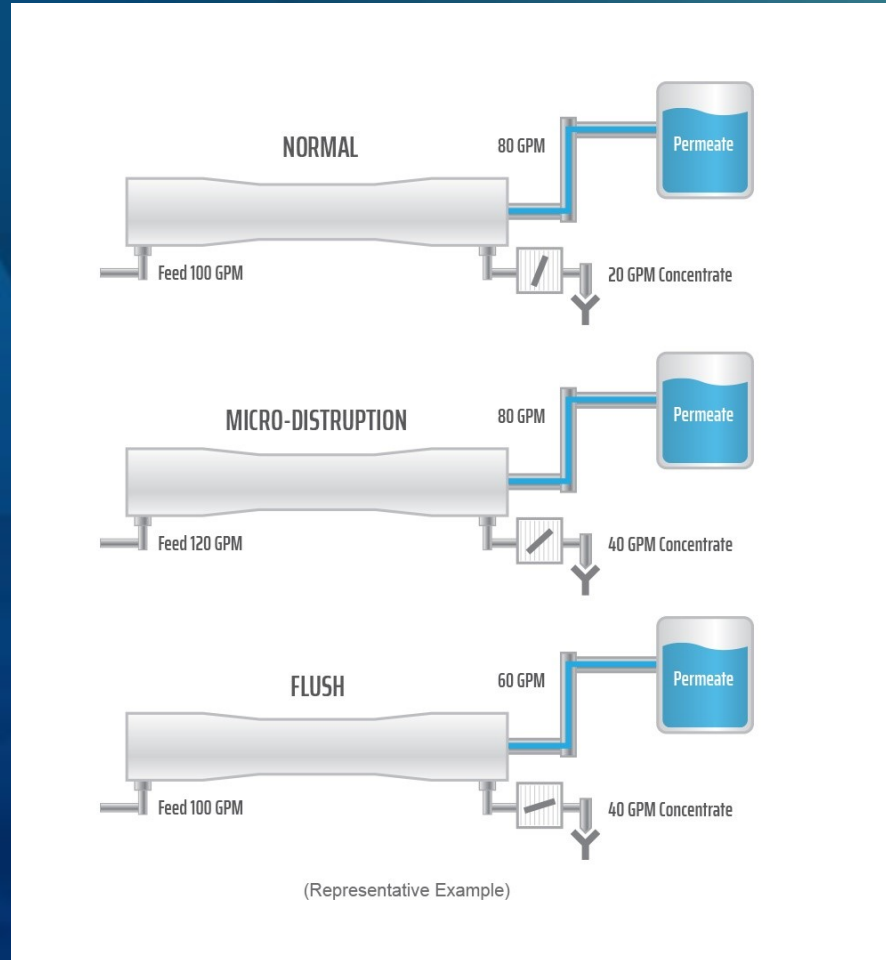
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# IMPACT-RO™ 20-35% Improved Flux Balance



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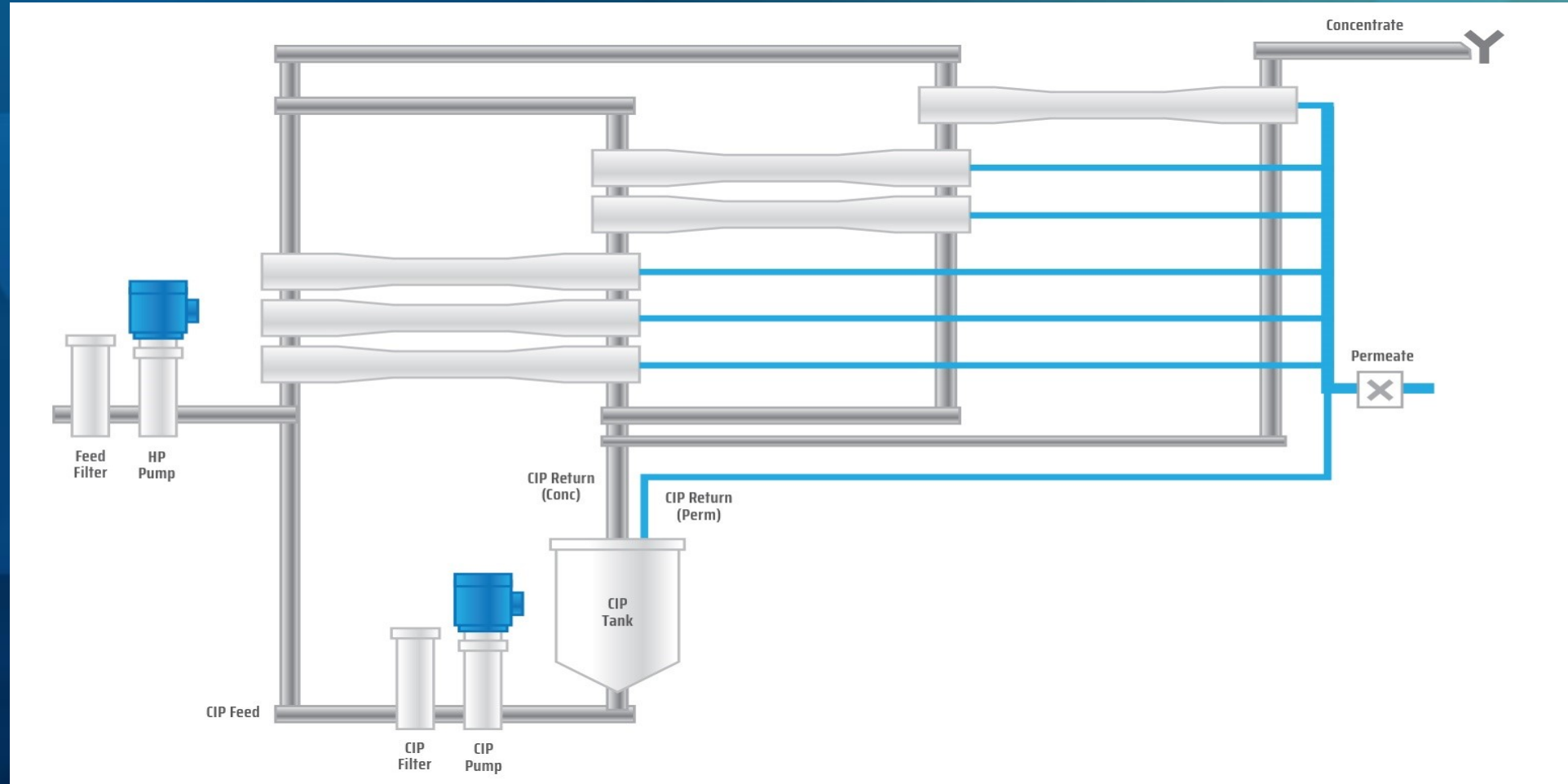
# IMPACT-RO™ - Variable Recovery & Dynamic Process



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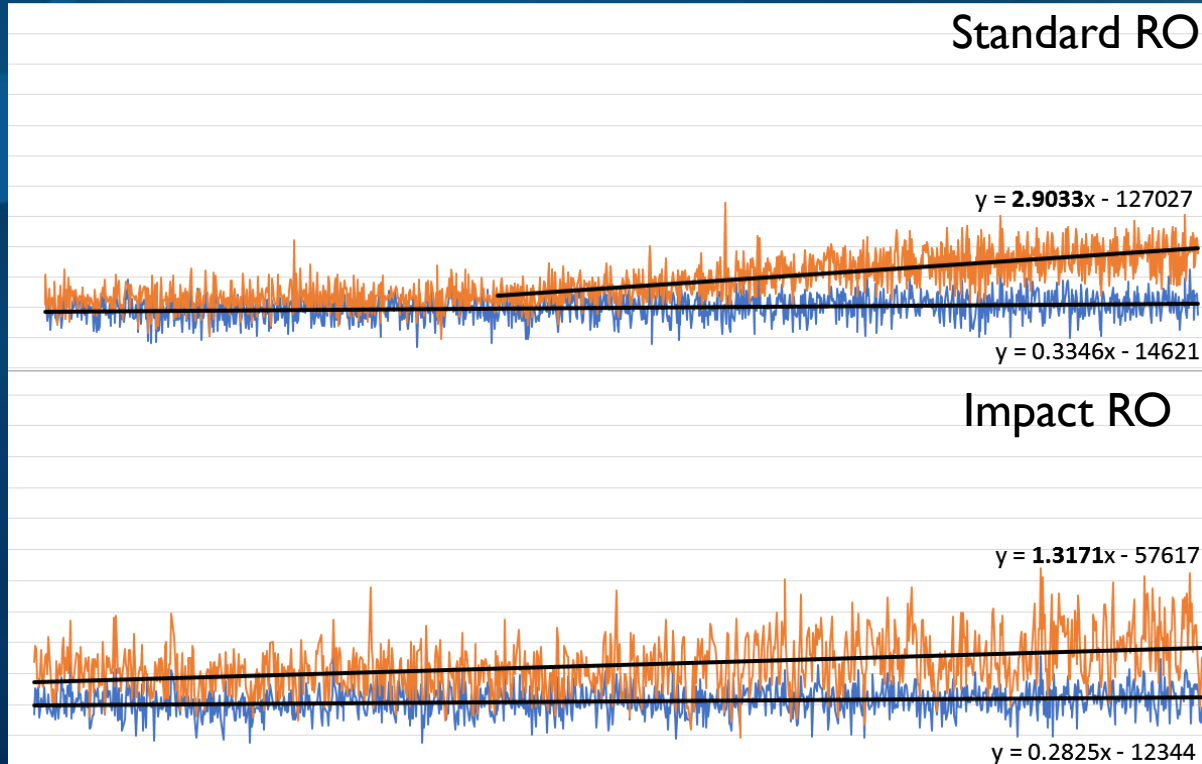
# IMPACT-RO™ - 3x Less CIP Duration – Parallel CIP



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# 100GPM RO PERFORMANCE - $\text{CaCO}_3$ SCALING @90% RECOVERY

Loss of Membrane Surface Area, No-AS, pH=7.0, No Recycle Loop



Blue: 1<sup>st</sup>+2<sup>nd</sup> Stage Combined  
Orange: 3<sup>rd</sup> Stage Alone

Impact-RO scales at 2.2x less rate

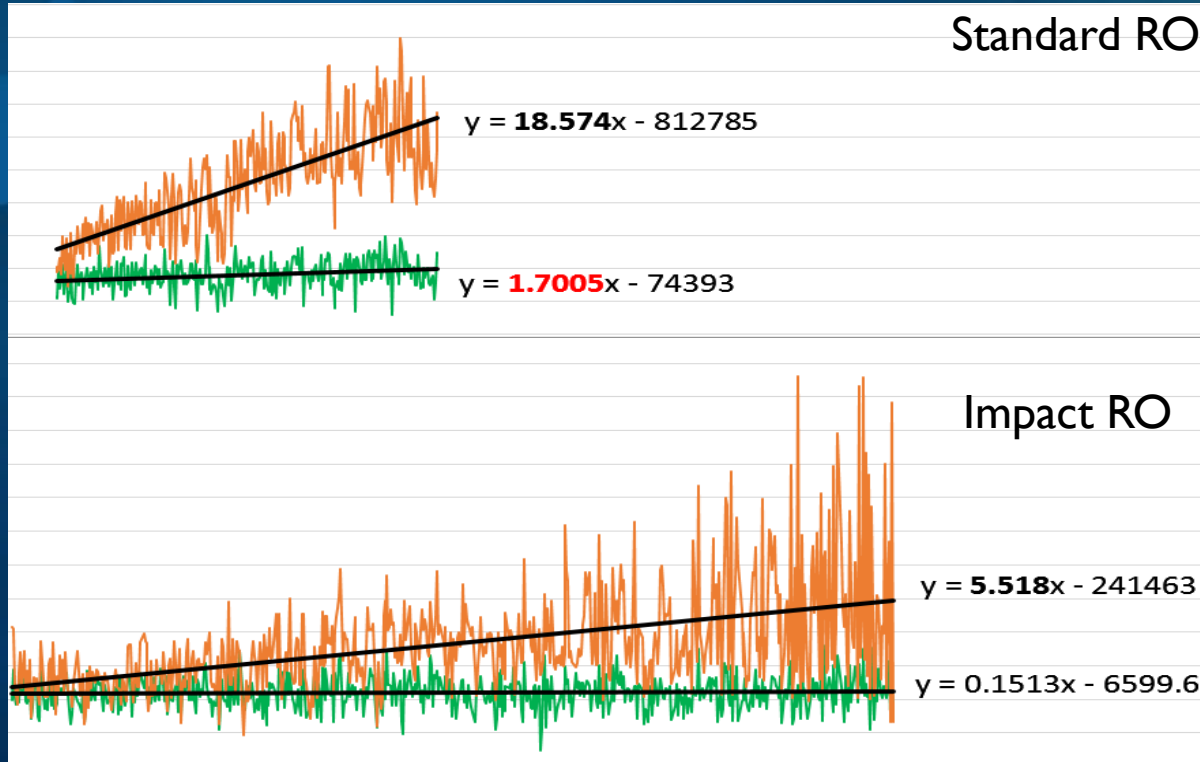


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# 100GPM RO PERFORMANCE - $\text{CaCO}_3$ SCALING @90% RECOVERY

Loss of Membrane Surface Area, No-AS, pH=7.5, No Recycle Loop



Green: 1<sup>st</sup>+2<sup>nd</sup> Stage Combined  
Orange: 3<sup>rd</sup> Stage Alone

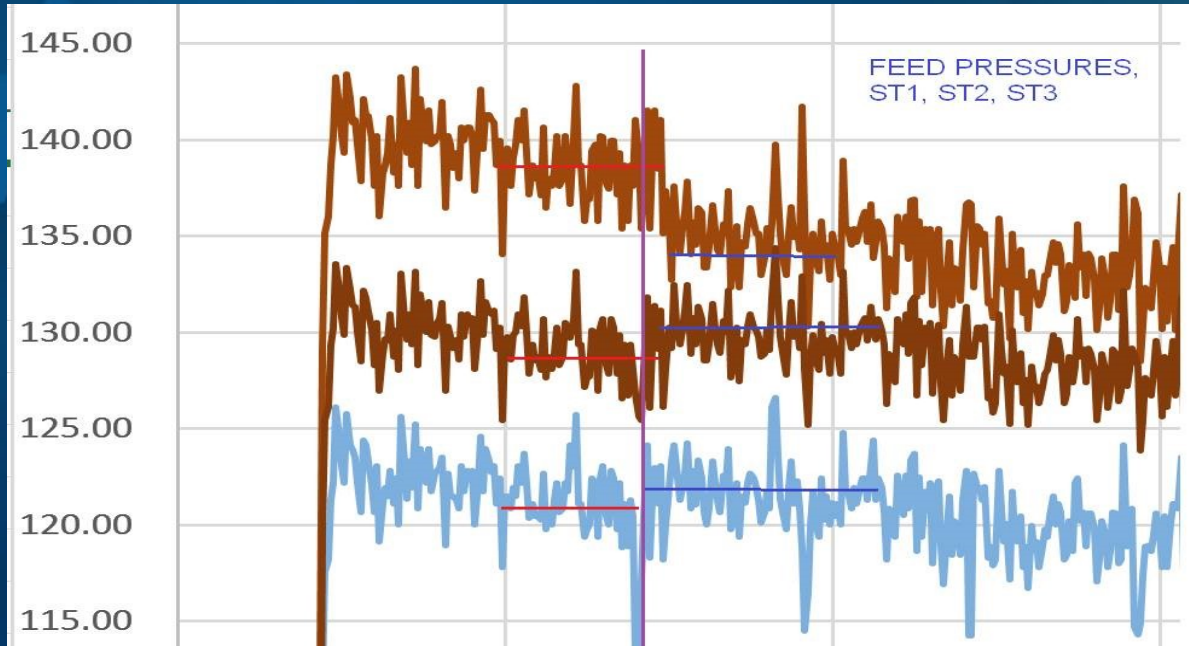
Impact-RO scales at 3.2x less rate  
1<sup>st</sup>+2<sup>nd</sup> Stage No Scaling



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# PERFORMANCE - ENERGY REDUCTION

PREDICTED: 4M Vessels – 4-5%; 6M Vessels 6-8%



Measured 3.9% energy reduction with Impact RO on 4M vessels with switching on of Feed-Forward feature



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# IMPACT-RO™ - SUMMARY BENEFITS

- Balanced Flux Across Multistage RO
  - > 2-3x Less Fouling
  - > 2-3x Less Scaling
- Reduced Energy Usage
  - 4-5% on 4-membrane Pressure Vessels
  - 6-8% on 6-membrane Pressure Vessels
- High Recovery Capability
  - Can achieve 90-95% recovery with Balanced Flux
- Easy to CIP with Impact-RO Design
- Less overall cost for INSTALLED RO system
- Retrofit Upgrade Ready (Multiple Features as Options)



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Thank you!

Questions ?



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