

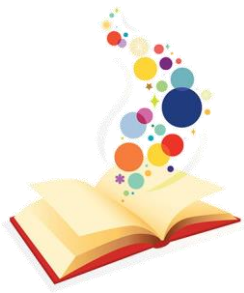
High-Recovery Desalination to the Rescue: Making an Alternative Water Resource a Reality



TECHNOLOGY OR MEDIA	RO	MSF	ED	DI	DM	RO/MSF	RO/ED	RO/DM	RO/MSF/ED	RO/MSF/DM	RO/MSF/ED/DM	RO/MSF/ED/DM/UV	RO/MSF/ED/DM/UV/CL	RO/MSF/ED/DM/UV/CL/PT	RO/MSF/ED/DM/UV/CL/PT/CO	RO/MSF/ED/DM/UV/CL/PT/CO/BI	RO/MSF/ED/DM/UV/CL/PT/CO/BI/ST	RO/MSF/ED/DM/UV/CL/PT/CO/BI/ST/AM	RO/MSF/ED/DM/UV/CL/PT/CO/BI/ST/AM/OP	
PROCESS																				
AMMONIA																				
ARSENIC																				
CHROMIUM																				
DISSOLVED SOLIDS																				
FLUORIDE																				
GROSS ALPHA																				
HARDNESS																				
IRON																				
LEAD																				
MANGANESE																				
NITRATE																				
NICKEL																				
SILICA																				
SILICON																				
SULFIDE/SODIUM																				
SUSPENDED SOLIDS																				
TOC/ORGANICS/COLOUR																				
TURBIDITY																				
URANIUM																				
VOC/PCE/PCB/DBP																				



Ronit Erlitzki. PhD
Director of BD & Innovation
404554 7883
ronit@adedgetechnologies.com



This is a story about...



People
Limited water sources
Surface water & Groundwater
Water quality
Multiple contaminants
Cost effectiveness
Innovation
Tight schedule



HALF EMPTY



HALF FULL



Once upon a time there was an Indian Community in AZ....



Diversified Economy:

- Agriculture
- Casino
- Transportation
- Golf Club
- Entertainment complex

Improvements:

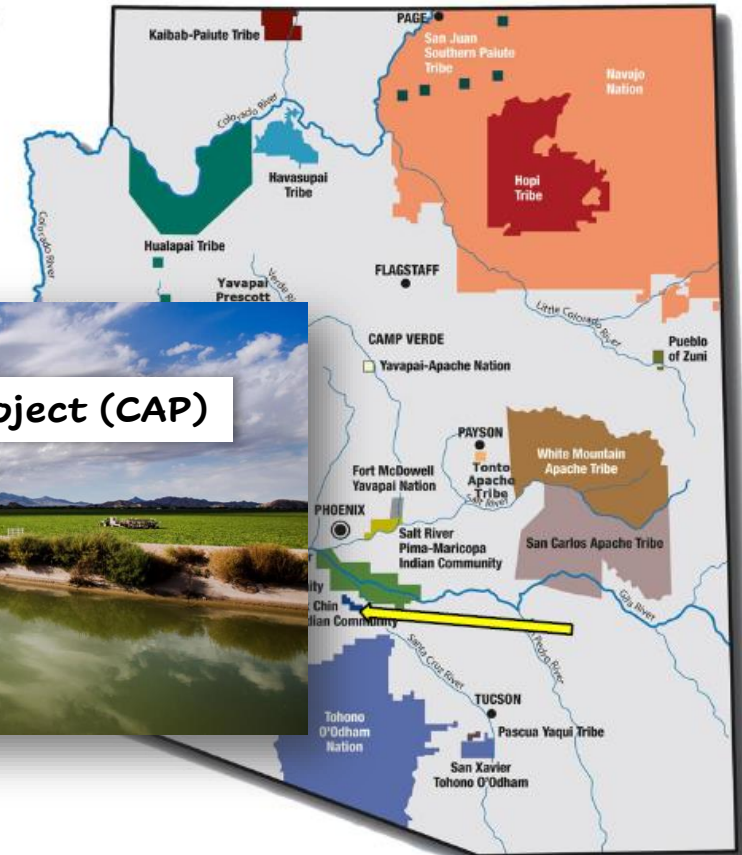
- New fire station
- Water reclamation facility
- Surface water treatment plant

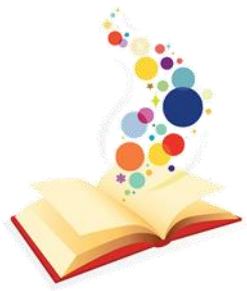
Santa Rosa Canal Surface Water Treatment*

*Central AZ Project (CAP)



Surface Water Treatment Plant





The Community was Very
Happy until....

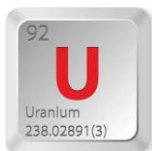
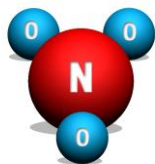


They Faced a Water Supply Challenge!!





So they said “We need an alternative water source!”



- **The problem:**

November 2019: Shut-down of the only source of water (canal)

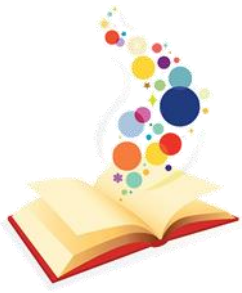
- **Possible solution:**

An Idle well (800 gpm)

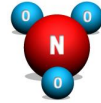
- **Water quality challenge:**

Multiple contaminants





So we said:“ Let’s look at your Groundwater Quality!”



	Nitrate	Uranium 238	Iron	TDS
MCL	10 mg/L	30 µg/L	0.3 mg/L	<500 mg/L
AK Chin WQ	15 mg/L	30 µg/L	1.0 mg/L	1897 mg/L

Treatment approach & efficacy				
Biological - biottra	Yes	No	No	No
Biological - NoMonia	No	No	Yes	No
IX – NO ₃ , U	Yes *	Yes *	No	No
O/F	No	No	Yes	No
RO (High Recovery Flow-Reversal RO)	Yes	Yes	No	Yes

Hardness, alkalinity, silica



and then we told them:
“Pick one...”



1

“Hey, with Flow-Reversal RO we can produce more water - **88% RR vs. 75% RR**, and We’ll reduce concentrate volume by **50%!**”

Design considerations:

- Footprint
- Complexity
- CAPEX & OPEX (competitive compared to IX)
- Concentrate management
- TDS reduction + Multiple contaminants treatment

2

O/F
AD26 System

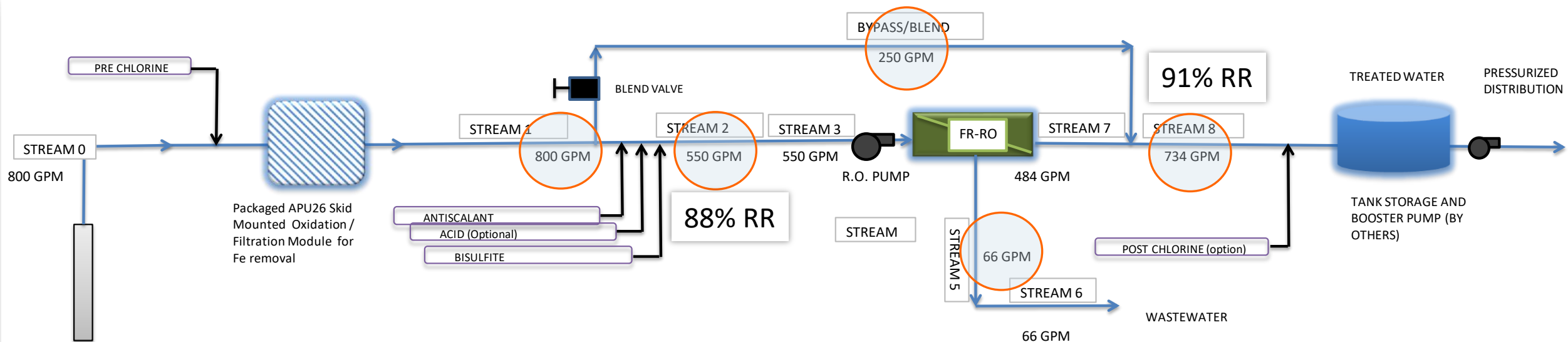


*High
recovery RO*



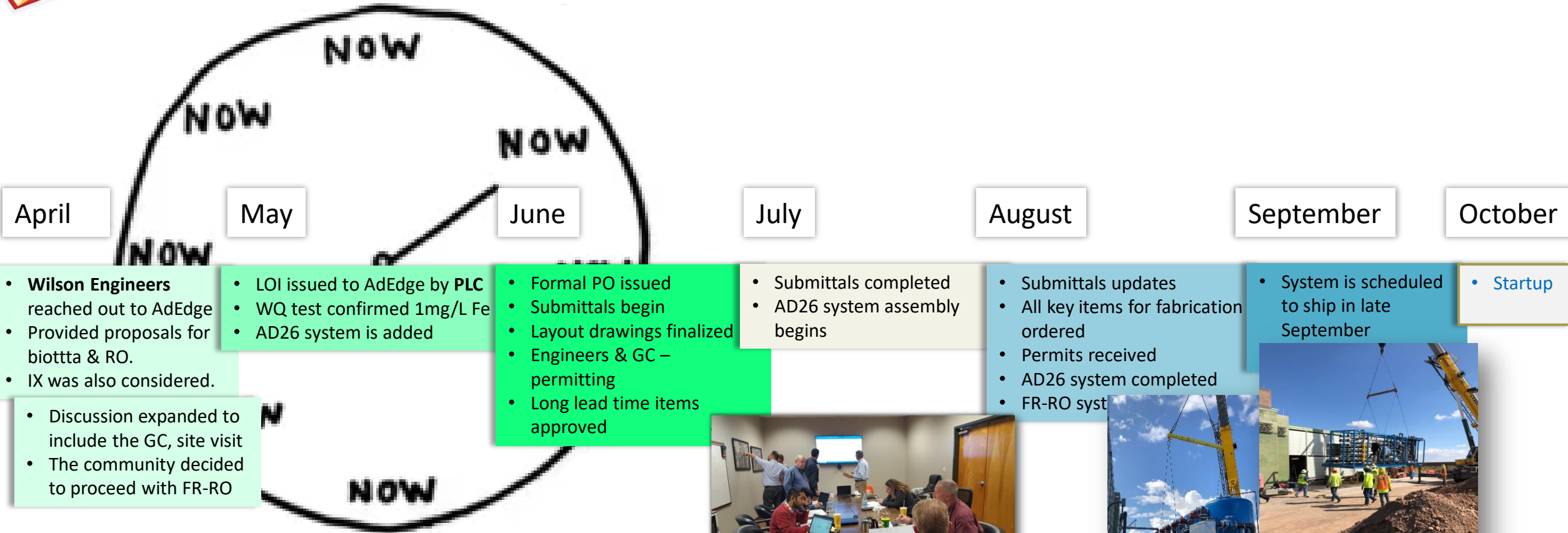


Fit to purpose





“We can do it in 6 month” Project Timeline



April

- **Wilson Engineers** reached out to AdEdge
- Provided proposals for biotita & RO.
- IX was also considered.

- Discussion expanded to include the GC, site visit
- The community decided to proceed with FR-RO

May

- LOI issued to AdEdge by PLC
- WQ test confirmed 1mg/L Fe
- AD26 system is added

June

- Formal PO issued
- Submittals begin
- Layout drawings finalized
- Engineers & GC – permitting
- Long lead time items approved

July

- Submittals completed
- AD26 system assembly begins

August

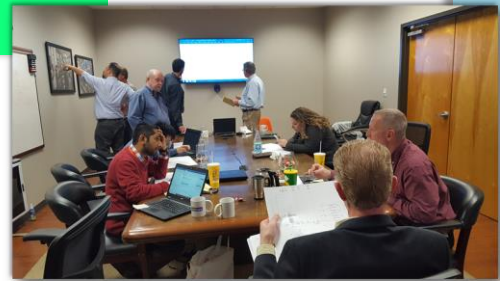
- Submittals updates
- All key items for fabrication ordered
- Permits received
- AD26 system completed
- FR-RO syst

September

- System is scheduled to ship in late September

October

- **Startup**





Sep 2019

Starting
Construction at
the well Site



Sep 2019

APU & FR-RO
systems are
delivered



Oct 2019

Ongoing
construction &
Installation



Mid Oct 2019

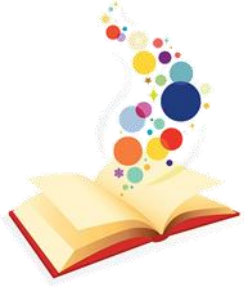
Getting there....



Mid Feb 2020

Almost done





October 30, 2019



Problems...?

- Hard toe shoes
- Well pump
- Flow meter
- Internet connection
- Fine tuning

The End



2020 Membrane Technology
CONFERENCE & EXPOSITION

March 16–20 | Phoenix, Arizona

AMTA
American Membrane Technology Association

AWWA
American Water Works Association



Flow-Reversal RO



Conventional RO with a (patented!)

twist

Innovative, but not New

Reuse Demo, GA

P2P Award



BUREAU OF
RECLAMATION

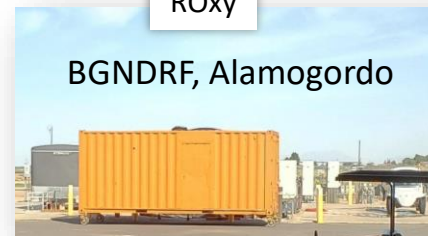


Gwinnett
Water Resources

BW Demo, NM

ROxy

BGNDRF, Alamogordo





75% is Totally 70's



It's Mostly About Concentrate Management

More water

Less concentrate

Site	Conventional RO RR	Flow-Reversal RO RR	% Increase (permeate)	% Decrease (concentrate)
Beverage company	65%	85%	20%	57%
Brewery	75%	92%	27%	68%
Municipal Water Plant	81%	89%	8%	39%
Fracking water	70%	89%	19%	63%
Cooling tower	71%	91%	20%	69%
Beverage company	80%	90%	10%	66%
SWRO 2 nd pass	90%	98%	8%	80%
Municipal Reuse	75%	90%	15%	60%

>\$93,000
Savings / Y

>\$325,000
Savings / Y

> \$650,000
Revenue / Y

Why Makes Flow-Reversal so Unique?



Maximize recovery rate

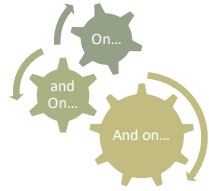
Optimize feed water use

Minimize concentrate volume



It's Working

>30 systems worldwide



Continuous process

works just like conventional RO



New & existing
Retrofit



No proprietary equipment

Adhere to manufacturers' specs



No special operator training
is needed



Low risk
100% Fallback



Added value
Reduced biofouling



OPEX
Chemicals & Power

How does FR-RO Work?



1
**Reversing the
flow in the PV**

2
**Block
Rotation**

3
**Continuous
process**

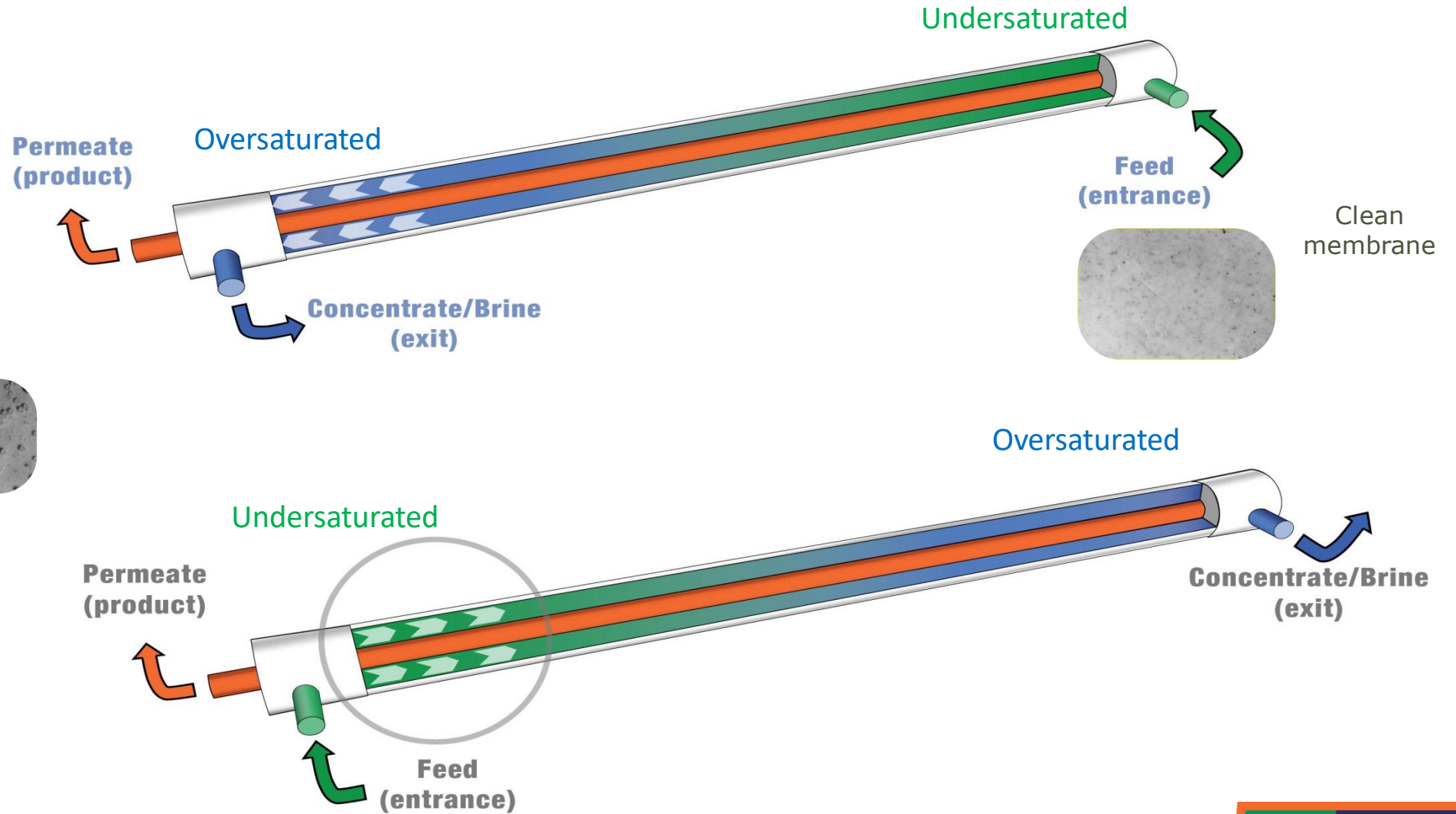
The results: Scale prevention



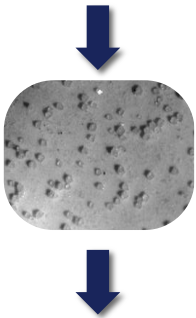
Reversing the Flow in the PV



- 1 Reversing the flow in the PV
- 3 Continuous process



Signs of scaling





Block Rotation

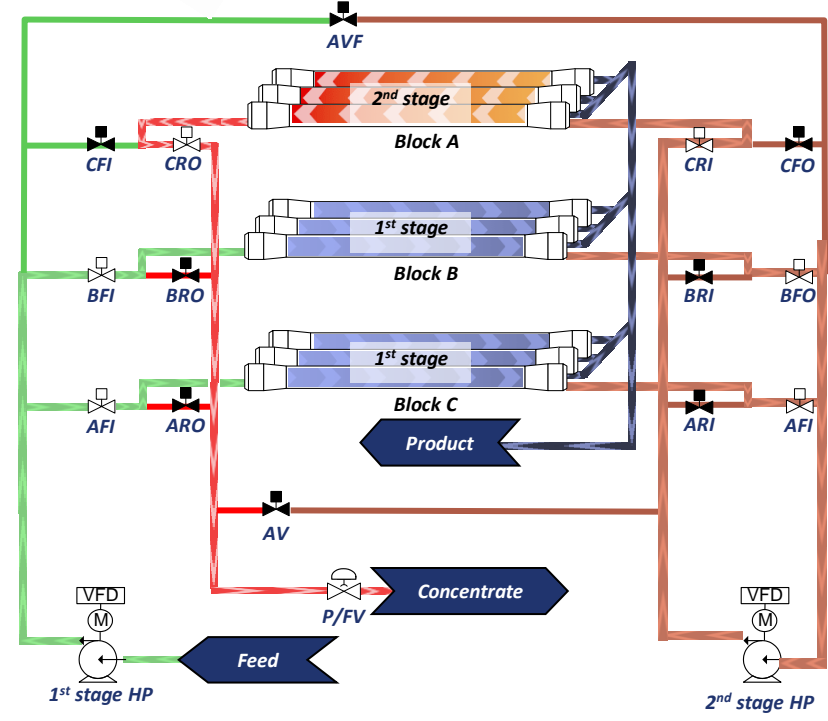
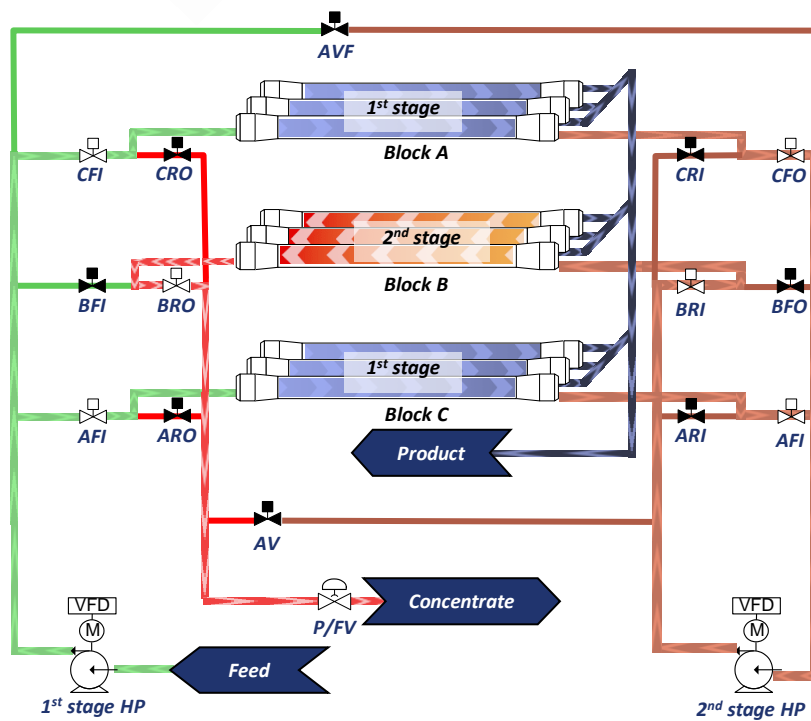
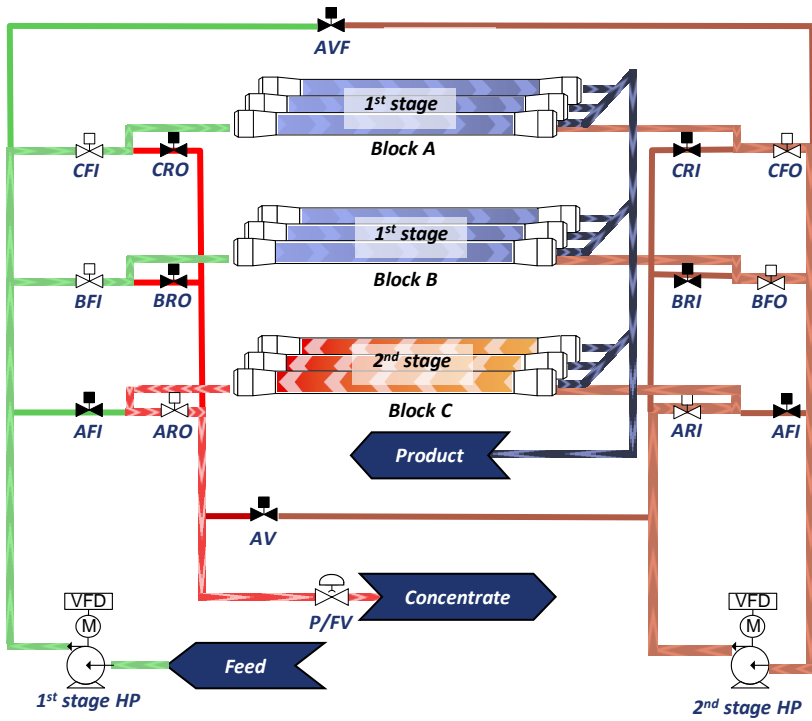
Flow Reversal adaptation to tapered flow array in a 2-Stage RO System

- 2 Block Rotation
- 3 Continuous process

Block C is 2nd Stage

Block B is 2nd Stage

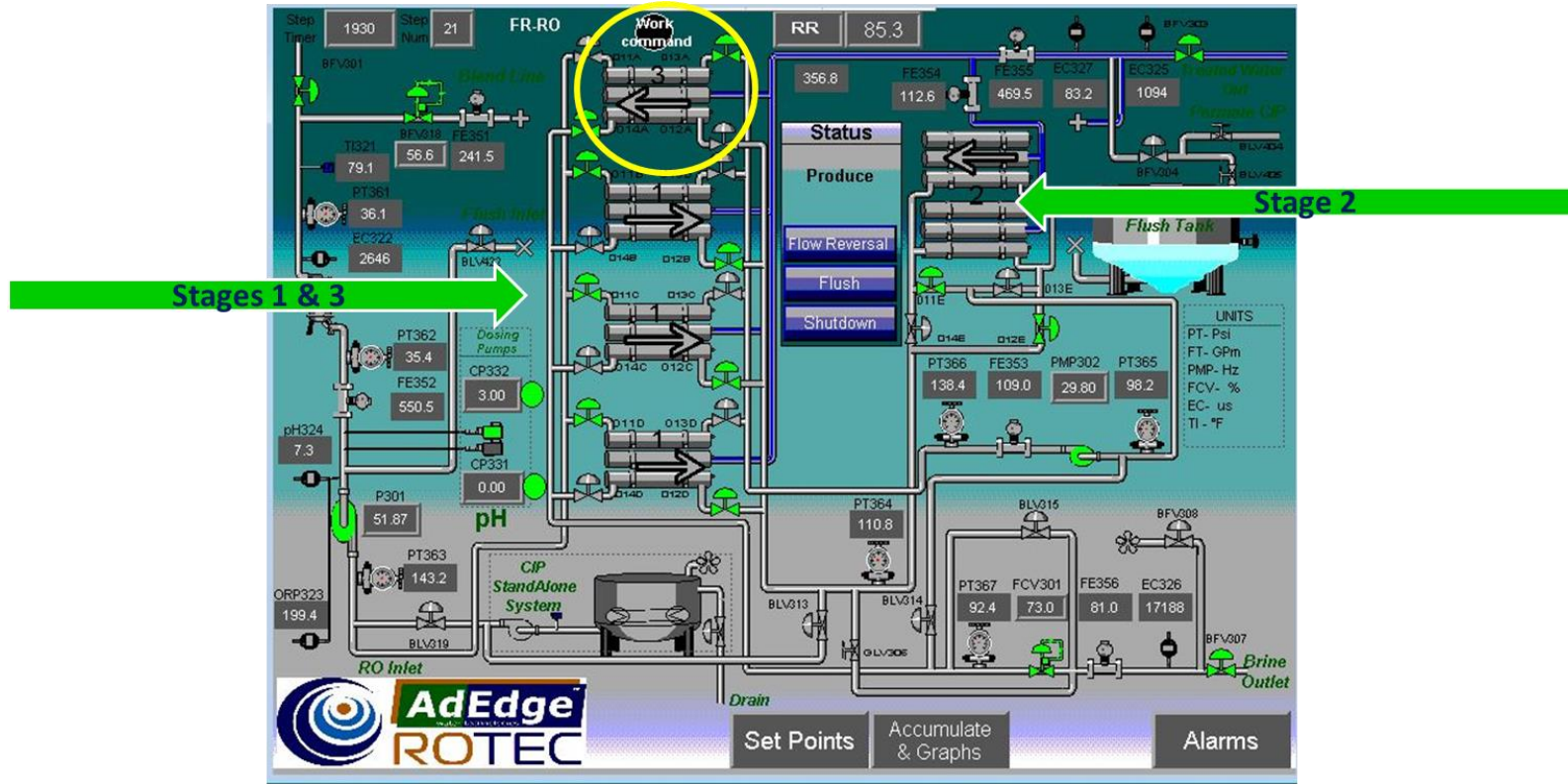
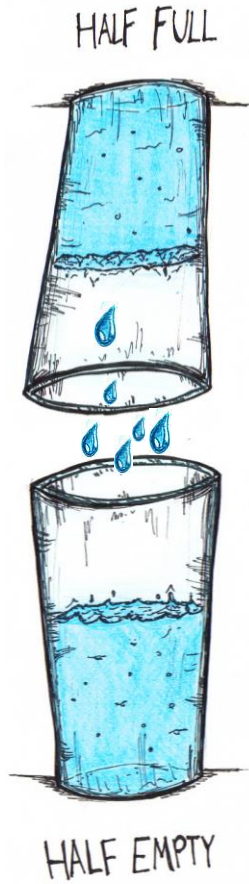
Block A is 2nd Stage





mental

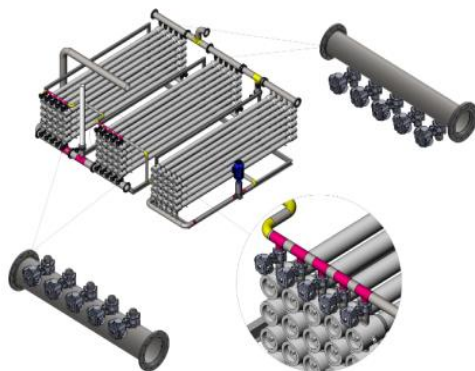
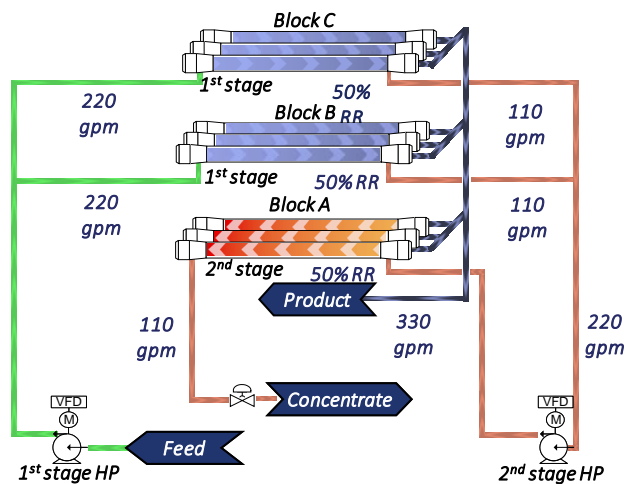
Time to Reverse the Flow.



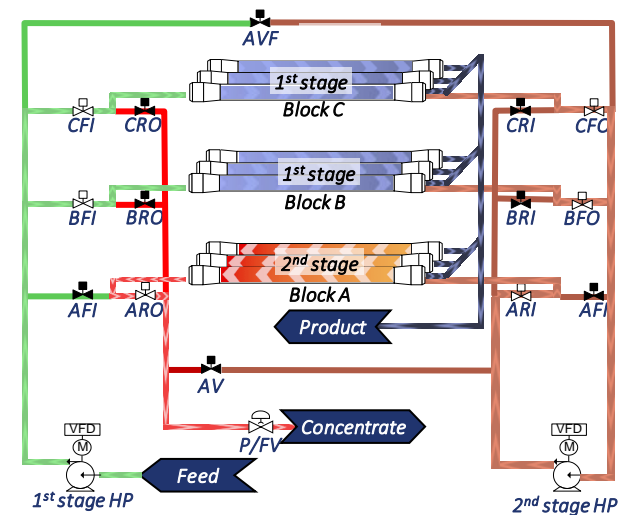


Converting a Conventional RO to FR-RO is Simple

Conventional RO



Flow-Reversal RO



1. New RO Systems (RNS)
2. Retrofit Existing RO Systems (RTF)
3. Concentrate Management System (FR-CONC)