



**New Smyrna Beach, Florida**  
*Evaluating Alternative Treatment Options To Eliminate Lime Sludge Disposal*





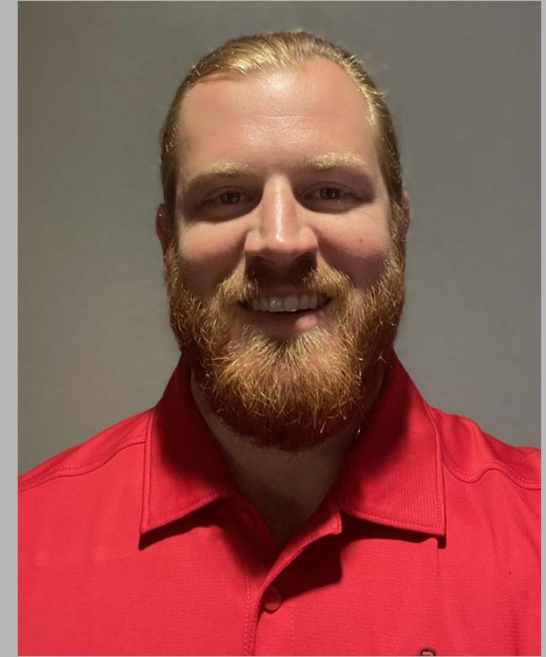
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## *Topics of Discussion*

- New Smyrna Beach Utilities Introduction & Project Drivers
- Existing Lime Softening & ACTINA™ Pellet Softening Process Summary
- Pellet Softening Pilot Testing Results Summary
- Operation & Maintenance Cost Comparisons
- Cost-Benefit & Engineering Analysis
- Questions and Answers

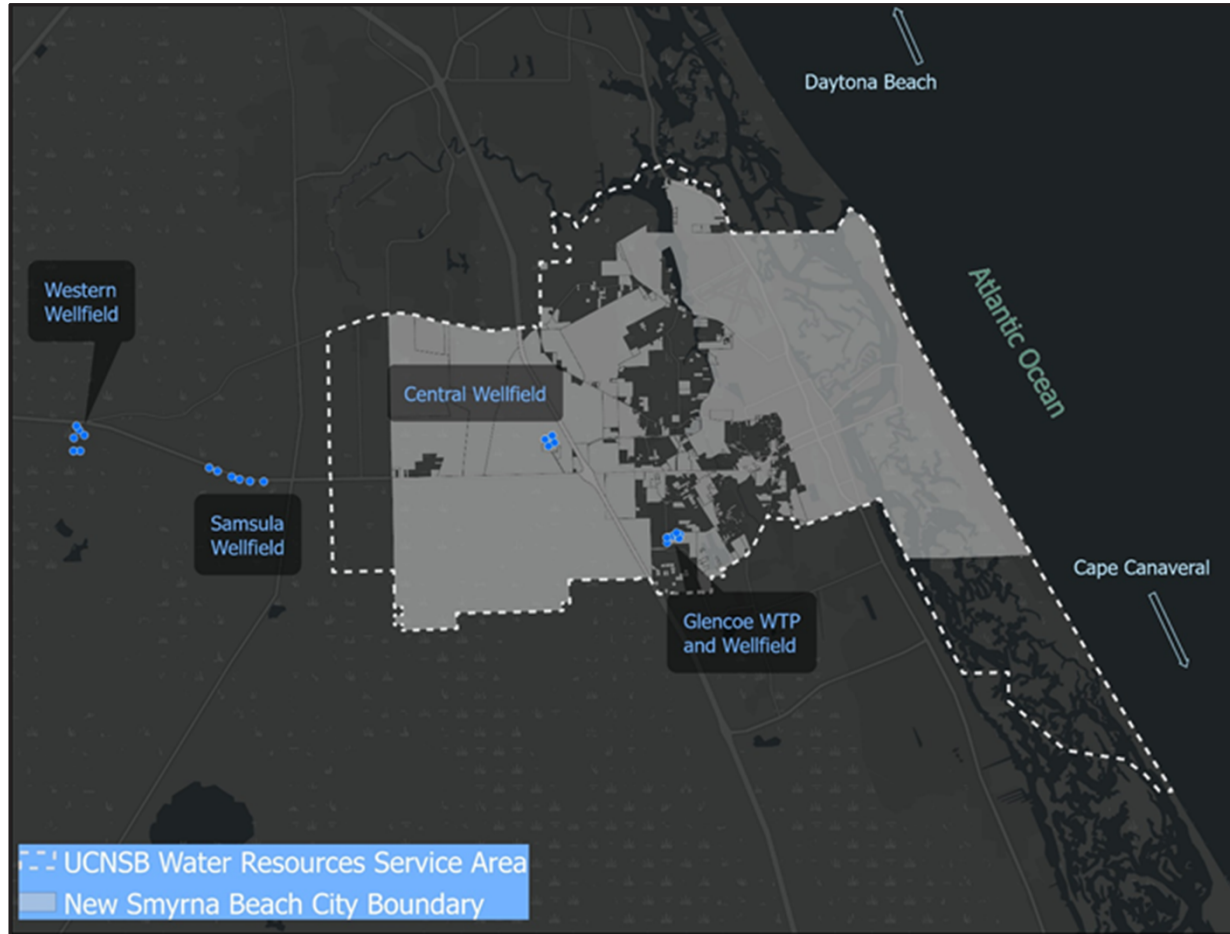
# New Smyrna Beach Utilities Introduction - Glencoe Water Treatment Plant

## New Smyrna Beach Utilities Water System

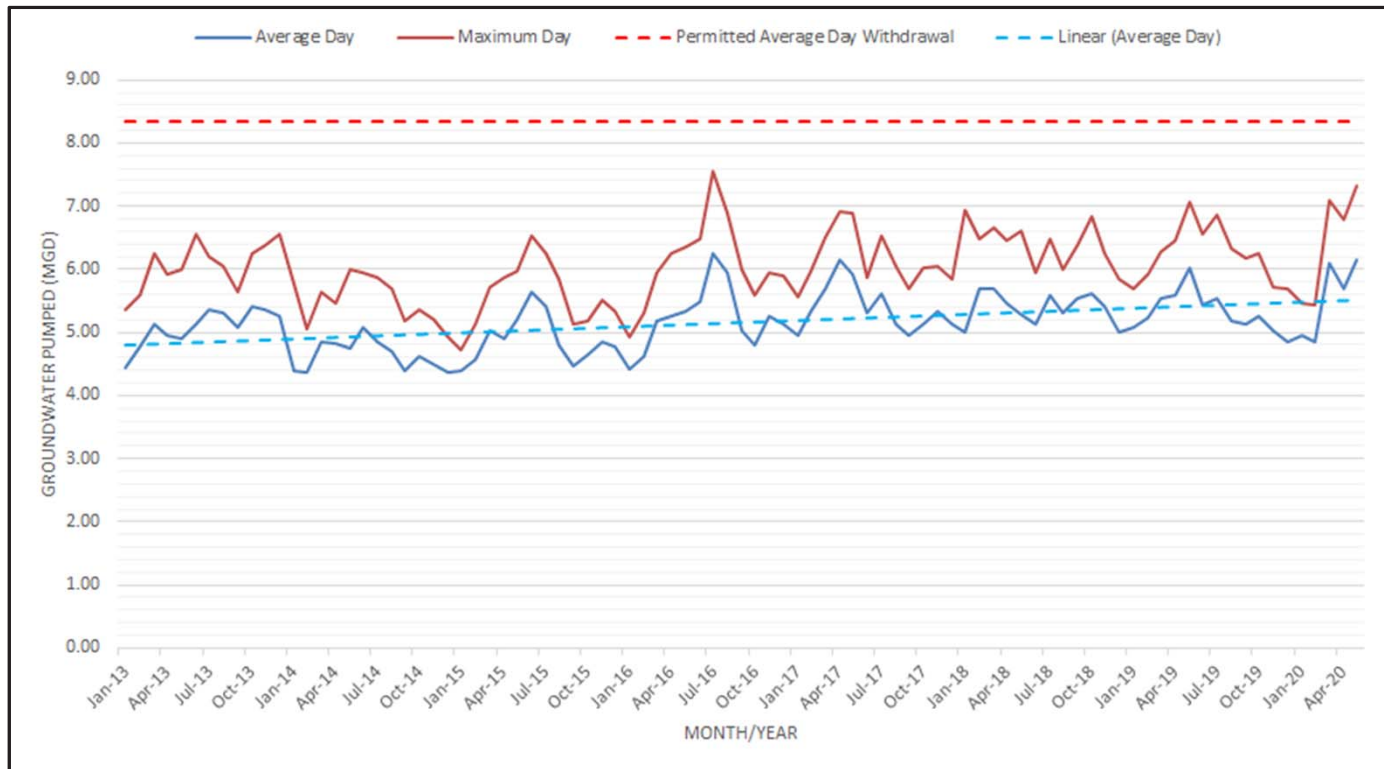
- 23 Raw water supply wells
  - Four wellfields
  - Depth: 180-feet to 364-feet
- 10.368 MGD lime softening WTP
  - Circa: 1978/2005
- 306 miles of water mains (1" to 28")



# New Smyrna Beach Utilities Water Resources Service Territory



# New Smyrna Beach Utilities District Raw Water Demands Since 2013



## Future Project/Upgrade Drivers for Glencoe Water Treatment Plant

### Operation and maintenance costs

- Management and disposal of lime sludge
- Labor
- Power
- Chemicals required for treatment of raw water

### Raw water supply

- Quality and quantity



## Drivers for Pellet Softening Pilot

An ACTINA™ Pellet Softening Pilot was conducted at the Glencoe Water Treatment Plant from September 28 - October 14, 2020. Drivers for the pilot included:

1. Aging Lime Softening equipment & infrastructure
2. Rising costs for lime sludge disposal
3. Varied cost for lime
4. Decrease in plant footprint
5. Decrease cleaning costs associated with lime
6. Decrease maintenance costs & frequency
7. Longer filter run times





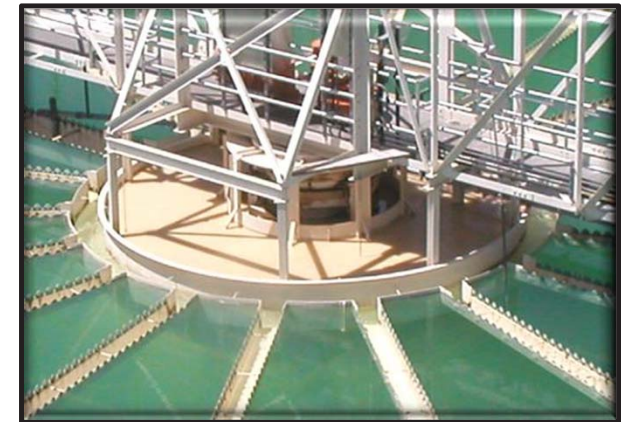
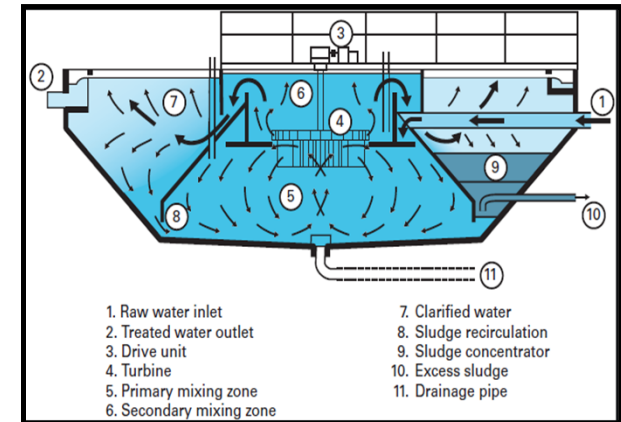
## *Lime & Pellet Softening Summary*

- Existing Lime Softening Process Summary
- ACTINA™ Pellet Softening Process Summary

# Lime Softening & Treatment Overview

## Typical Lime Process Characteristics:

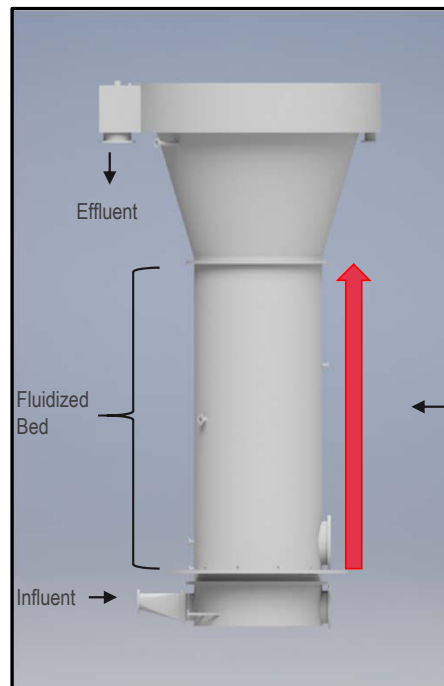
- Operates in pH range of 9.3 and up
- Turbidity (NTU) of 15 - 30
- Loading rates of ~1.5 - 2.0 gpm/ft<sup>2</sup>
  - Large surface area required = Larger footprint
- Mixing area combines raw water, lime & solids
- Relies on maintaining a solids inventory to create surface area for precipitation softening
- Creates sludge to be dewatered and disposed of - <40% solids
- Requires auxiliary lime handling equipment (silos, slakers, feed pumps)
- Requires auxiliary sludge handling operations & equipment
- Moving parts on clarifier



# ACTINA™ Pellet Softening Process

## What is it and what does it do?

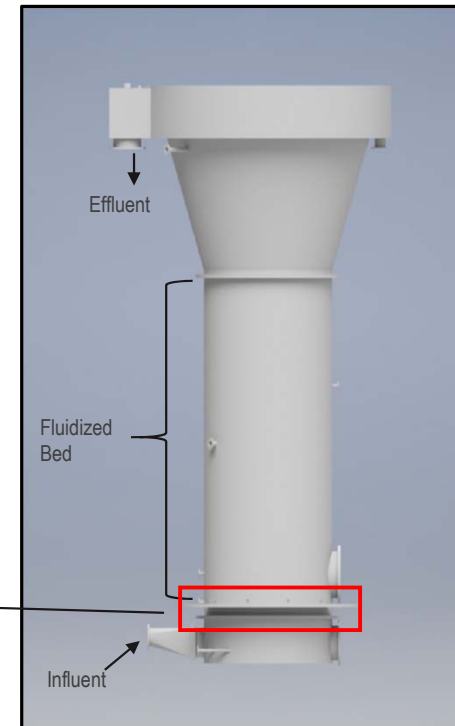
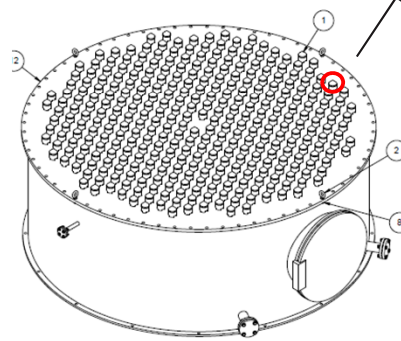
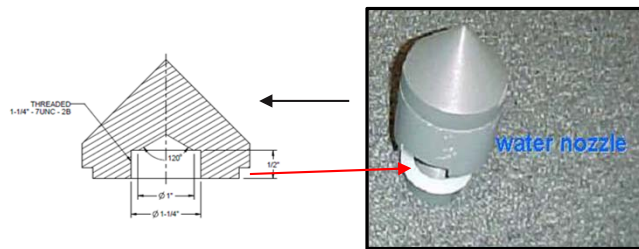
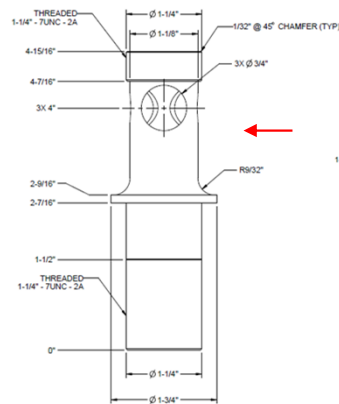
- Simple, fluidized bed reactor that uses a catalyst (sand, pellets) & pH adjustment chemicals (caustic or lime) to promote calcium carbonate precipitation
- Reduces calcium and magnesium hardness, along with Iron, while producing a reusable, easily dewatered pellet



# ACTINA™ Pellet Softening Process

## How is the influent flow distributed through the reactor?

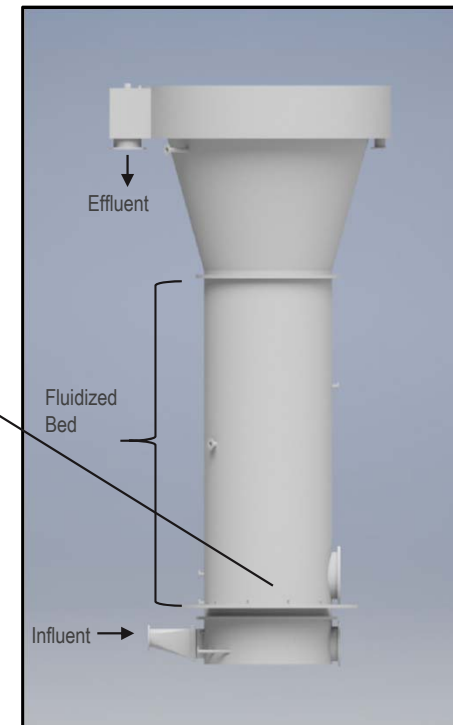
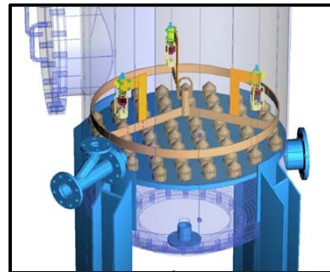
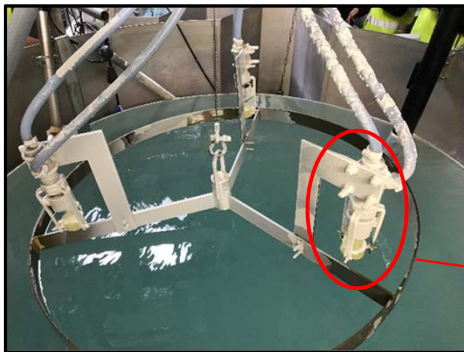
- At the bottom of the reactor is a strainer plate which has numerous flow distribution strainers installed
- Veolia's strainers are specifically designed for pellet softening and allow for material in raw water to pass through
- Even distribution of flow is critical to pellet softening



# ACTINA™ Pellet Softening Process

## How Is the pH Adjustment Chemical Added To the Process?

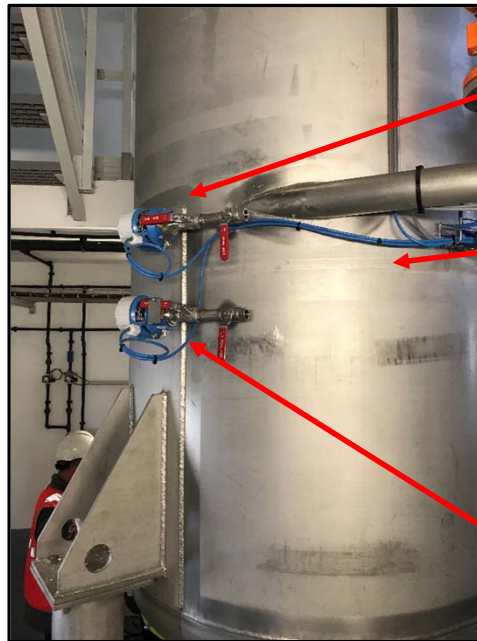
- Raw water pH is increased to 8.5 – 9.5 with caustic soda or lime to reduce calcium carbonate solubility
  - *Caustic/lime plus softened carrier water is pumped to a removable “Spider” that sits in the reactor, just above strainer deck*
  - *Exclusive Veolia Nozzle design ensures equal distribution of chemical across reactor cross section*



# ACTINA™ Pellet Softening Process

## When and how are the mature pellets extracted from the reactor?

- Pressure is continuously measured above and below strainer plate
- Once a predetermined differential pressure or operational time is reached, the pellets are extracted by a pump or gravity
- Pellet extraction is automated, without stopping influent flow



Pressure Sensor above Strainer Plate

Strainer Plate Weld

Pressure Sensor below Strainer Plate



Pellet Extraction Pipe



# ACTINA™ Pellet Softening Process

## How are the extracted pellets dewatered and handled?

- Pellets are self draining – no mechanical dewatering required
  - 95% solids immediately after extraction
- Bin with drain capabilities most common (1 or 1 + 1 standby)
- For larger facilities, a silo with truck unloading



## ACTINA™ Pellet Softening Performance

Total Hardness Reduction (depending on calcium to magnesium hardness ratio) = 65 to 75%

- Calcium Hardness Reduction = 65 to 85%
- Magnesium Hardness Reduction = 10 to 40%

Iron Reduction = 65 to 75%

Manganese Reduction = 85 to 90%

Fluoride Reduction = 10 to 30%





# ACTINA™ Pellet Softening Installation Base

## 50+ Installations Worldwide

- 30 years of design experience
- Largest installation 80 MGD
- Smallest installation 0.2 MGD
- 17 installations 2 MGD or less
- 19 installations with flow rates 2–10 MGD
- 14 installations > 10 MGD
- 1 US installation in operation, 2 installations under design & contract
- Latest installations benefit from lessons learned and operating experience



## *New Smyrna Beach, FL - Pellet Softening Pilot*

- ACTINA™ Pilot Testing Summary

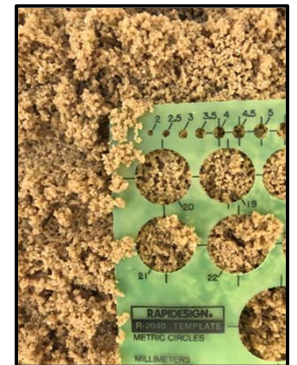
# New Smyrna Beach, FL ACTINA™ Pilot Testing Protocol and Goals

## Overall Testing Protocol

- Four weeks of testing
- Multiple combinations of wells
- Operate with caustic
- Monitored/sample for hardness (total, Ca and Mg), iron, alkalinity, turbidity, and UV254 throughout

## Treatment and Testing Goals

- Softened water total hardness 80 – 120 mg/l as CaCO<sub>3</sub>
- Monitor iron reduction rates
- Establish optimum caustic dosages & pH operation ranges



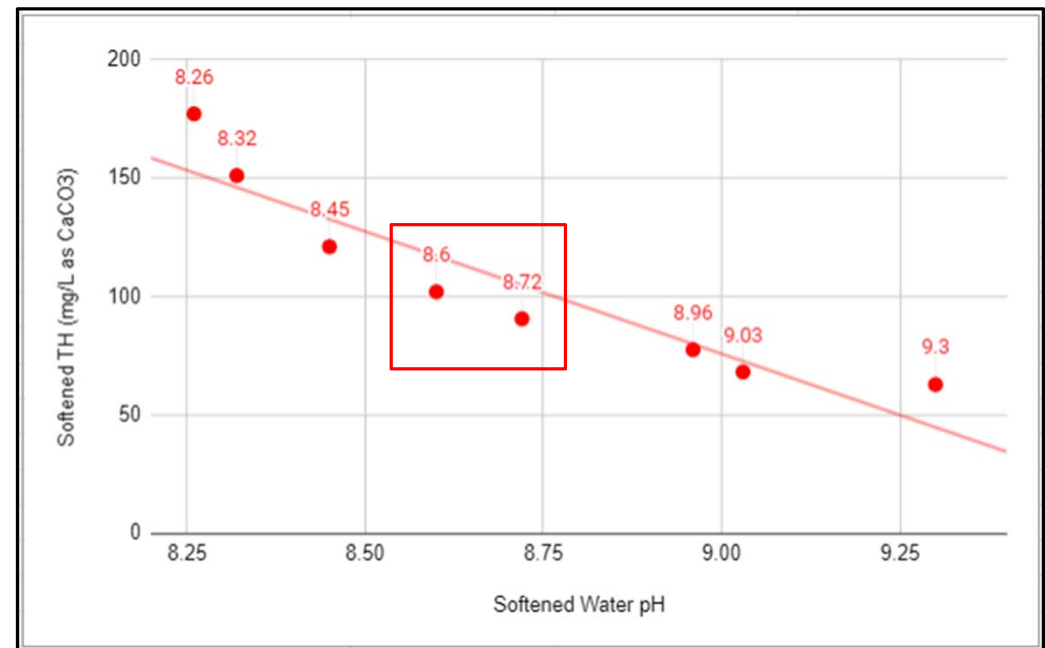
# New Smyrna Beach, FL ACTINA™ Pilot Testing Results

## Average Influent Water Quality During Pilot

Total Hardness (mg/L as CaCO <sub>3</sub> )	Calcium Hardness (mg/L as CaCO <sub>3</sub> )	Magnesium Hardness (mg/L as CaCO <sub>3</sub> )	Total Alkalinity (mg/L as CaCO <sub>3</sub> )	Total Iron (mg/L)	Turbidity (NTU)	pH
331	294	37	307	0.292	0.5	7.47

ACTINA™ pellet softening achieved the goal of 100 mg/L effluent total hardness with an average caustic dose of 122 mg/L, at an average pH of 8.67.

## Caustic Optimization pH vs. Softened Total Hardness



# New Smyrna Beach, FL ACTINA™ Pilot Testing Results

## ACTINA™ Softened Water Quality while using Caustic

pH Adjustment Chemical	Average Dose (mg/L)	Average pH		Total Hardness (as CaCO <sub>3</sub> )		Total Alkalinity (as CaCO <sub>3</sub> )	
		Influent	Softened	Influent	Softened	Influent	Softened
Caustic	122	7.49	8.67	328	98	304	230

### Softened Water pH

- Lower pH operations can reduce recarbonation costs

### Softened Water Alkalinity

- Minimize corrosion potential in the distribution system

### Softened Water Turbidity

- Minimize solids loading on downstream filtration
- Average NTU is 2-3 NTU off of pellet softener with Caustic

### Softened Water Iron

- Iron reduction up to 75% with caustic
- Varies with dose of Caustic being used

### Softened Water UV254

- Not a focused goal of the pilot testing
- Softened water iron levels impacted UV254 levels
- Improvements seen after filtration simulation



pH Adjustment Chemical	Average Dose (mg/L)	Average Total Iron (mg/L)		Average UV254 (%)		
		Influent	Softened	Influent	Softened	Filtered
Caustic	122	0.363	0.103	50	55	56



## *New Smyrna Beach, FL - Pellet Softening O&M Evaluation*

- O&M Cost Comparisons

## Operating Cost Comparisons

### New Smyrna Beach Lime Softening Annual Chemical and Sludge Handling Costs @ Average Daily Flow of 5.12 MGD

- Lime = \$512,000
- Polymer = \$700
- Sludge Handling/Hauling = \$122,000
- Sludge Lagoon Dredging = \$100,000

TOTAL = **\$724,700**

Estimated **\$330,000** in annual savings based on pilot data and O&M analysis!!!

### Estimated ACTINA™ Annual Chemical and Pellet Handling Costs (with 125 mg/L Caustic dose @ ADF)

- Caustic = \$279,787
- Polymer = \$0
- Pellet Handling/Hauling = \$61,156
- Sludge Lagoon Dredging = \$22,500
- Catalyst (sand) = \$31,490

TOTAL = **\$394,934**



## Existing Facility Rehab or Replacement Costs

- Potential Cost Savings with ACTINA™

- Solids Contact Clarifier (Basin) Renovation
  - Estimated repair costs \$100,000+
  - Repairs would require extended period of time with basin out of operation
  - Repairs would likely only last 5–10 years
- Solids Contact Clarifier (Basin) Replacement
  - New clarifiers are estimated to cost over a \$1,000,000 each
  - Infrastructure costs such as concrete and pipeline work could cost in the \$1,000,000's





## *New Smyrna Beach, FL - Engineering Analysis*

- Cost-Benefit & Engineering Analysis

# Treatment Technologies Evaluated

- Membrane softening at a new site
- Lime softening with membrane softening co-located on existing site
- Expanded lime softening facility on existing site
- New pellet softening facilities on existing site



## CAPEX

Process <sup>1</sup>	Capital
Membrane softening facility at new site	\$26,770,000 <sup>2</sup>
Lime softening and membrane softening facility co-located on existing site	\$13,320,000 <sup>2</sup>
Expanded lime softening facilities on existing site	\$11,920,000
New pellet softening WTP at existing site	\$13,630,000

Note:

1. Capital cost includes upgrades and expansion of facilities inside the fence, no additional raw water supply wells included for membrane softening options.



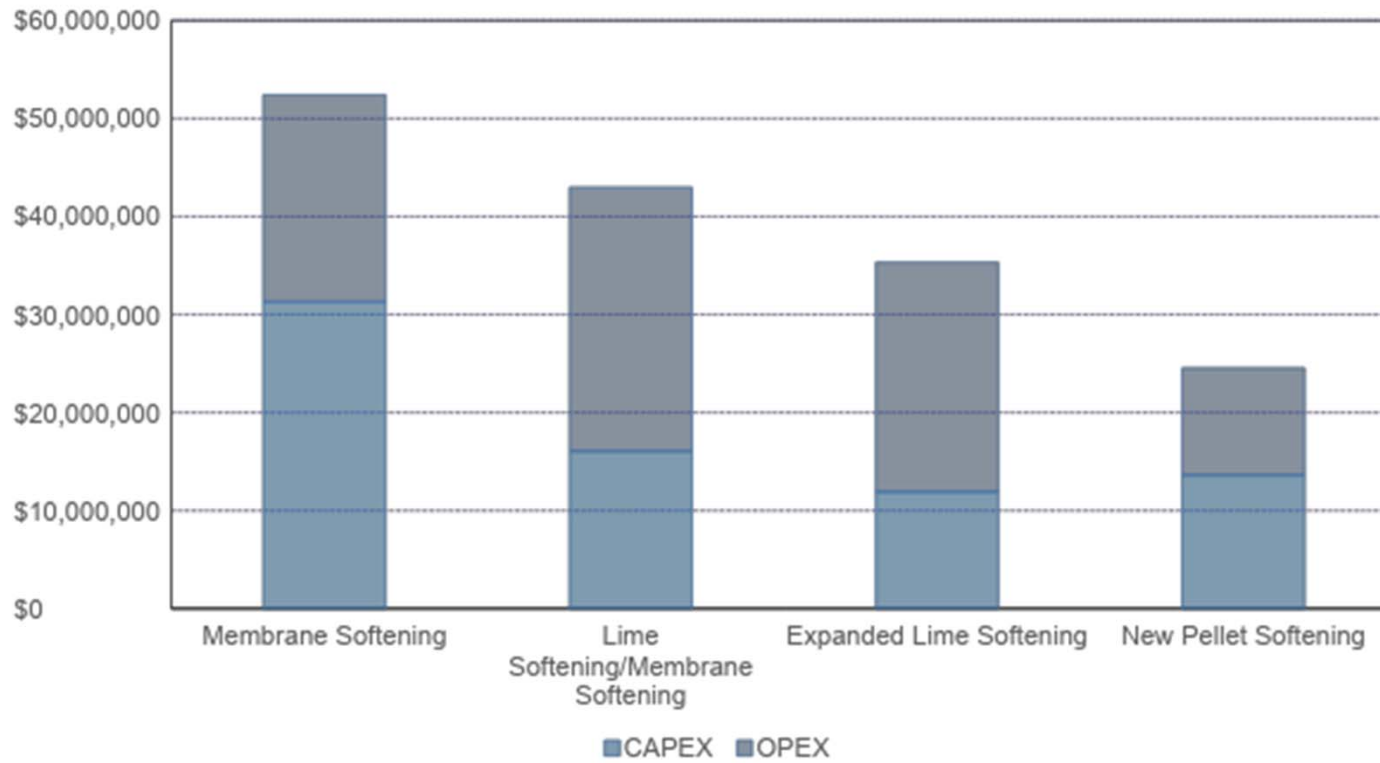
## OPEX

### Key Takeaways:

- Chemicals: About 42% less than options that include lime softening
- Energy: Over 95% less than membrane option and 50% less than lime softening
- Labor: Comparable to membrane softening, but nearly 47% less than lime softening
- Residuals Management: 0 to 75% less than lime softening



## 20-Year CAPEX and OPEX



## 20-Year New Present Value<sup>1</sup>

Process	Capital
Membrane softening facility at new site	\$44,100,000
Lime softening and membrane softening facility co-located on existing site	\$34,900,000
Expanded lime softening facilities on existing site	\$29,120,000
New pellet softening WTP at existing site	\$21,500,000
Notes:	
1. Cost of money 2.86%	



# QUESTIONS



## Contact Us

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