

Nanostone Desalination Technology

Learn how Nanostone is solving GCC's seawater toughest challenges:

- Dependable, uninterrupted pretreated water with a single step
- Operates through algal blooms with no downtime, no intervention
- Dependable, consistently high quality feed to SWRO
- Lowest cost of ownership available



www.nanostone.com



Nanostone Desalination Technology



The Problems We Solve

Reverse osmosis (RO), the state-of-the-art technology for seawater desalination, performs well over extended periods so long as the feedwater is largely free of suspended solids and low in dissolved organics.

However, existing pre-treatment technologies supplying RO systems struggle when exposed to high levels of dissolved organics, harmful algae blooms, and other sudden and variable influxes of suspended solids. When this material passes the pre-treatment system RO fouling increases drastically, reducing plant

capacity, increasing cleaning cycles and chemical consumption and causing premature RO membrane failure.

For developers, owners and operators, these problems result in:

- Reduced plant utilization, which severely impacts plant economics;
- Elevated risks of operational disruptions; and
- Higher treatment costs



Who We Serve

We are working with leading developers, owners and operators of large seawater desalination plants to integrate our solutions into greenfield desalination plants and also to retrofit our solutions into under-performing plants currently in operation.



Why Switch to Nanostone? It's The Lowest Cost To Treat

Expect a Full Return
On Your Investment
In 2 Years or Less

Nanostone's novel desalination solution is the lowest cost to treat, because it provides a reliable and robust treatment that significantly reduces:

- CAPEX
- OPEX
- Complexity
- Land requirements

It's a single-step solution that eliminates multiple pretreatment processes, which reduces capital expense and footprint.

KEY FEATURES:

- Runs stably at high solids loading, especially inorganics
- Dosing of coagulant is well-tolerated and even improves performance
- pH resistance from 1–13 in cleaning, 2–12 in operation
- Operational temperature 33 –113 °F (0.5–45 °C)



98% AVAILABILITY Incredible Desal Performance



Nanostone's technology runs stably at high solids loading, especially inorganics, and dosing of coagulant is well-tolerated and even improves performance.

Our solution handles harmful algal blooms effectively and removes high levels of suspended solids, SDI and dissolved organics from seawater with high reliability, enabling RO desalination systems to operate to rated capacity and planned costs over an extended life.

In fact, we have helped water plants continuously run at availabilities up to 97-98% – against the most challenging waters.

Visit nanostone.com to view our case studies.



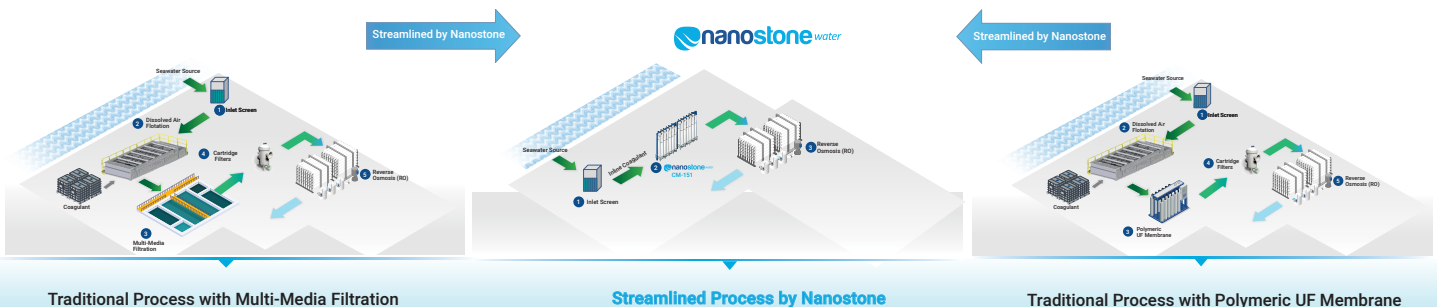
SIMPLIFIED PROCESS

Reduce Your Plant Footprint by 40%

Your plant could provide the best quality of water for your RO system with a single process. Nanostone's technology eliminates unnecessary processes like DAF and media filters or other pretreatment for RO systems.

It also can be easily retrofitted within your existing Polymeric UF. (And for new greenfield plant projects, it requires less construction time).

SEAWATER DESALINATION PRE-TREATMENT



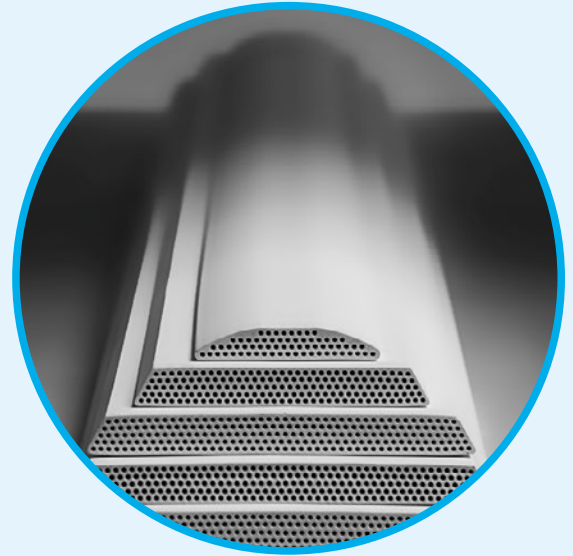


How Does Nanostone Stack Up Against Conventional Pretreatment Methods?



Nanostone's technology operates at high flux – 3 to 4 times higher than PUF (Polymeric UF).

Our ceramic membranes also see a higher recovery than polymeric MF/ UF and conventional methods.



KEY BENEFITS:

- Lower cost and operational complexity, because no air scour is required
- Fewer chemicals and less electricity are needed when removing treatment steps
- Higher water recovery





Higher Quality Water & Lower Operating Expenses



Over a 20 year period...

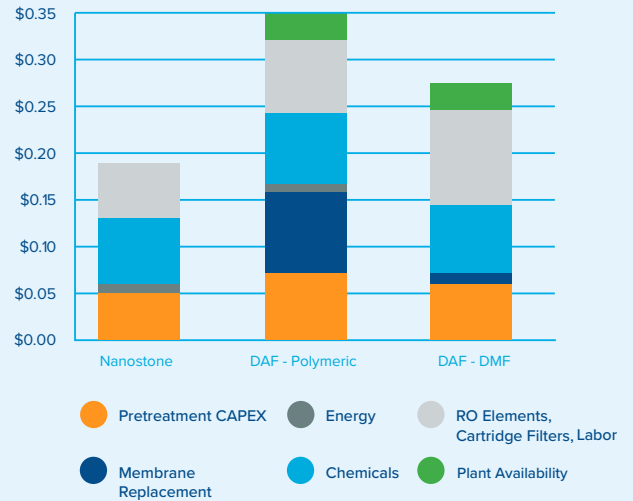
With your current UF membranes, you probably have to shut down your operations and replace your membranes at least **THREE TIMES**.

And every time you clean your membranes with those harsh chemicals? You're shortening their life expectancy even more.

And every time your conventional pretreatment fails due to an algae bloom? You're shortening the lifespan of your RO membranes, too.

Produce high-quality pretreatment water that reduces the load on your RO membranes.

PRETREATMENT COST (\$/m3)



20 Year Warranty
That's right. No membrane replacements for 20 years.

Not during algae blooms.
Not during oil spills.
NEVER.

How?

Our membranes are extremely robust and reliable because there are no fibers to break or repair. Nanostone Water's ceramic membranes do not break, and they never need replacement.





Steady Performance Proved by Field Data



Public Utility Board's Tuas Test bedding Facility – Singapore
Installation Date: October, 2020

Challenge:

- Unreliable SWRO pretreatment necessitating multiple pretreatment steps (DAF, DMF, Polymeric UF)
- Variable seawater quality causing plant shutdowns
- Inadequate pretreatment requiring frequent SWRO cleans
- Expensive combination of processes
- Feed oil and grease concentration was 1.2 mg/L at average, and filtrate oil and grease concentration <0.1 mg/L (detection limit)
- Permeability fully recovered with CIP

Ceramic UF Filtrate Water Quality	
SDI	2.0
Turbidity	<0.05 NTU
TOC Removal	30-70%
UVT	98%

Key Operational Parameters	
Flux	250 LMH
Recovery	98%
Uptime*	97%
Estimated CIP Frequency	90ays



A SWRO facility near Barka Oman using Omani Gulf Seawater In operation phase

The facility has challenges with algal blooms and shuts down or significantly reduces capacity during these algal bloom events with abnormal water quality. With the feed water quality as shown in the table below, the filtrate water SDI was consistently below 1.5, and turbidity below 0.2 NTU.

Seawater Analysis			
Measure	Units	Normal	Algal Bloom
UVA254	%	< 0.1	> 0.3
Turbidity	NTU	< 2	> 30
pH		7.9-8.2	7.9-8
TOC	mg/L	1-2	2 - 3
DOC	mg/L	< 2	< 5
Mn tot	µg/L	< 2	3 - 5
Fe tot	µg/L	10-20	30-70
Al tot	µg/L	10-20	30-50
TSS	mg/L	< 5	> 80
TDS	mg/L	38,000-39,000	39,000-41,000
Chlorophyll-A (as surrogate for phytoplankton and algae)	ppb	< 2	> 50
SDI10 range		7.5-10	
SDI15 range		4.6-6.67	

Durable by Nature, Superior Value by Design.



Nanostone Water - Free Zone Branch
610, Building 4EA, DAFZA, Dubai, UAE

www.nanostone.com