

# Saltworks' Product Fit Map: Industrial Desalination Options<sup>1</sup>



Technology	Chemical Softening / Precipitation	Robust Ceramic Ultrafiltration (UF)	High Recovery Reverse Osmosis (RO) and Nanofiltration (NF)	Electrodialysis Reversal (EDR)	Evaporator-Crystallizer-Solids Management
<b>Fit</b>	Reduce scale potential e.g. prior to desalination with other technologies.	Filter waters (0.05 to 1.2 µm) and thicken slurries up to 40% total solids, which can then be filter pressed.	Lowest cost first recovery of water, now capable of reaching ultra-high recoveries due to higher pressures and improved processes.	Selectively remove ions, desalinate higher organics than RO, and produce highly concentrated brines.	Concentrate brine further, after membrane systems reach operational limits.
<b>Max Brine Concentration</b>	N/A	N/A	1,200 psi: ~80,000 mg/L <sup>2</sup> 1,800 psi: ~130,000 mg/L <sup>2</sup>	~180,000 mg/L <sup>2</sup>	Zero liquid discharge (ZLD) & solids <sup>4</sup> Minimal (MLD) ~300,000 mg/L
<b>Cost</b>	\$	\$	\$-\$	\$-\$	\$-\$-\$
<b>Tolerance for Organics</b>	✓	✓	✓ (with know-how)	✓	✓
<b>Tips</b>	<ul style="list-style-type: none"> <li>Useful to remove or lower scaling ion concentrations on scale saturated brines</li> <li>Coagulants (i.e. ferric chloride) should be avoided if an RO is downstream (key foulant)</li> <li>Slurry sludge or filter cake will be generated</li> <li>Reduce labour costs by investing in automation</li> <li>Consider ScaleSense sensors for real-time monitoring to control chemical dosing &amp; confirm treatment</li> </ul>	<ul style="list-style-type: none"> <li>Use lower cost polymeric filtration if possible, provided TSS &lt; 100 mg/L and oils/grease &lt; 2 mg/L</li> <li>Ceramics fit more severe applications</li> <li>Pick a commodity ceramic UF membrane with common geometry for interchangeability</li> <li>Ceramic UF system engineering needs to consider energy, membrane health monitoring, and self-cleaning</li> </ul>	<ul style="list-style-type: none"> <li>RO &amp; NF are common and commoditized: maximize recovery first, before expanding your treatment train<sup>3</sup></li> <li>Maximizing RO/NF recovery may require scaling ion removal (i.e. BrineRefine)</li> <li>Employ techniques to protect and monitor RO/NF membrane health</li> <li>Our experts can help select the right membrane</li> <li>Consider ScaleSense sensors on dynamically changing waters</li> </ul>	<ul style="list-style-type: none"> <li>Treat water that is too challenging for RO i.e. high organics or silica</li> <li>Excellent for targeting chloride removal from challenging flows</li> <li>Desalt to any level, however efficiency diminishes for desalting to lower than 1,500 mg/L</li> <li>TDS change in desalinated flow will determine cost (Inlet TDS – Treated TDS) with economics challenging &gt; 10,000 mg/L TDS change</li> </ul>	<ul style="list-style-type: none"> <li>Explore brine management options and economics before proceeding to evaporation systems</li> <li>Ensure scaling does not impact performance by analyzing water chemistry and considering a pilot test</li> <li>If applicable, pre-concentrate with membranes</li> <li>For smaller flows (&lt; 200 m<sup>3</sup>/day), bypass membrane system treatment steps</li> </ul>

Saltworks Solution	BrineRefine/IonSelect	XtremeUF	XtremeRO/NF	Flex EDR	SaltMaker Family
<b>Advantage</b>	<ul style="list-style-type: none"> <li>Compact, modular chemical softening to target ions of concern (i.e. Silica, Calcium) with precision controls to prevent waste, improve operations, and automate solids management</li> <li>Handles variable and changing water chemistries</li> <li>No coagulants employed that could damage downstream RO membranes</li> <li>Automation integrates seamlessly to maximize system performance</li> <li>SilicaSelect will target silica for a low cost, low footprint recovery gain or to reduce freshwater use.</li> </ul>	<ul style="list-style-type: none"> <li>Developed and designed to concentrate slurries to new levels (i.e. up to 40% solids Vs. past practice of ~10%)</li> <li>Packaged system complete with self-cleaning, ceramic membrane monitoring, and a lower energy configuration than alternatives</li> <li>Employs robust and commoditized membrane elements, available from many vendors</li> <li>CPVC pipework for corrosion protection, with pressure vessels as either SS316 or titanium depending on chloride levels</li> </ul>	<ul style="list-style-type: none"> <li>Fully packaged automated system, including membrane protection</li> <li>Achieve maximum brine concentrations by removing scaling limits with BrineRefine</li> <li>We can deliver the full package or work with RO/NF vendors of your choice. XtremeRO/NF provides start-of-the-art RO/NF with maximized recovery and 24/7 expert support with our ROAM (Remote Operations &amp; Asset Management) platform</li> </ul>	<ul style="list-style-type: none"> <li>Desalinates waters too challenging for RO, or specifically target chloride removal</li> <li>Next-generation IonFlux ion exchange membranes that withstand solvents, hydrocarbons, and offer 98% monovalent ion selectivity</li> <li>Leave hardness in using our patented electrode blocker.</li> <li>Selective removal of monovalent ions (Li, Na, Cl, etc.) with Flex EDR Selective</li> <li>Treat highly scaling water (Ca/Na &gt; 1) using Flex EDR Selective</li> </ul>	<ul style="list-style-type: none"> <li>Treats a wide variety of saline waters without pre-treatment, and reliably achieves ZLD</li> <li>Smart design with self-cleaning and intelligent automation</li> <li>Four configurations ranging from thermal to electrical drive, including chilled crystallization for specific salt ion pairs</li> <li>All-in-one, modular package that performs evaporation, crystallization, and solids management</li> <li>Avoids complex multi-step processes</li> <li>Smart ZLD with 24/7 expert support via ROAM</li> </ul>

**Notes:**

- Depending on the inlet water conditions, a number of these technologies can be combined to optimize system performance and cost.
- Maximum achievable brine concentration is dependent on water chemistry & capacity needs. Contact Saltworks for free engineering analysis.
- Inlet TDS must be lower than the max brine concentration. Recovery = 1 – (Inlet TDS / Outlet TDS)
- Our ZLD experts can help you optimize your entire process, manage risk, and build-in smart controls.

**Contact us to get started on your project.**

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