What is

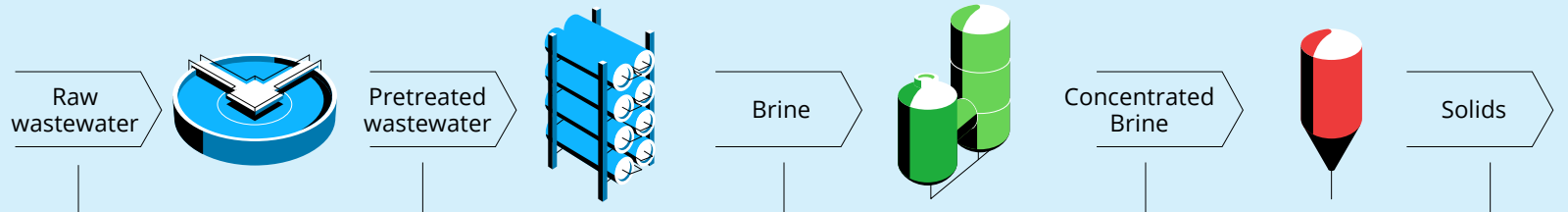
Zero Liquid Discharge?

Zero liquid discharge (ZLD) is an approach to water treatment where all water is recovered and contaminants are removed as solid waste.

Do you need zero liquid discharge?

Before considering zero liquid discharge, understand your treatment goals, economics, and regulatory requirements. For example, concentrating wastewater to a lower volume brine that can be sent for disposal may be more cost effective than producing zero liquid discharge solids.

How to achieve ZLD



Pretreatment

Prepare wastewater for treatment and brine concentration, as per downstream equipment specs.

Tip: Limit chemical pre-treatment to reduce overall treatment costs. More chemicals now means more solids later. Consider downstream equipment that requires less pre-treatment.

Membrane Treatment

Primary water treatment, ie. reverse osmosis (RO) or electrodialysis reversal (EDR).

Tip: Maximizing membrane recovery has the greatest impact on lowering total treatment cost. RO is usually the best option if it suits your water chemistry, but consider EDR if your water contains high organic content to limit pre-treatment.

Evaporator

Brine concentration and volume reduction.

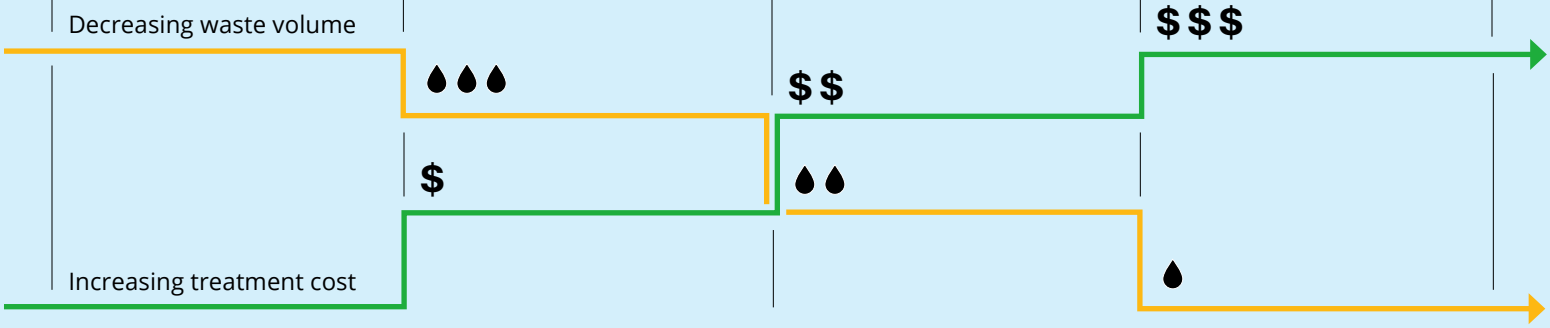
Tip: Watch for scaling issues that result in evaporator downtime and increased treatment costs. Consider robust, self-cleaning technology to limit the high quantities of chemical pre-treatment that will likely be required by scaling waters.

Crystallizer

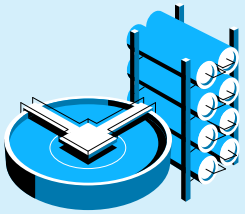
Produce solids for disposal or reuse.

Tip: Compare total system costs of pre-treatment + crystallizer + dryer to advanced one-step crystallizer + bagging system. Plan for blowdown of problematic low solubility residuals, such as nitrates.

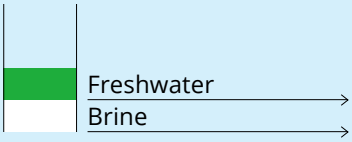
Freshwater

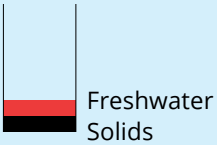


How to calculate cost of ZLD



	Pretreatment & Reverse Osmosis (RO)	Evaporator	Crystallizer
Typical salt concentration in brine	6–8%	16–20%	45-55%: saturated brine as solids removed. Brine recirculates and solids precipitate.
Typical total (cumulative) freshwater recovery from raw wastewater	70%	88%	97.6%
Freshwater recovery of this step only	Recovery (R_{RO}) = 60–80%	Recovery (R_{EVAP}) = 50–75%	Recovery (R_{CRYS}) = 80%
Typical cost	**Cost C_{RO}** = \$0.5–2/m³ inlet	**Cost C_{EVAP}** = \$18-35/m³ inlet	**Cost C_{CRYS}** = \$25-50/m³ inlet
Example	**\$1 USD / m³ inlet**	**\$20 USD / m³ inlet**	**\$40 USD / m³ inlet**
Treatment cost calculation	= **Cost C_{RO}**	= **Cost C_{EVAP}** × (1 − R_{RO})	= **Cost C_{CRYS}** × (1 − R_{EVAP}) × (1 − R_{RO})
Example	= **\$1 USD**	= **\$20 USD** × (1 − **0.7**)	= **\$40 USD** × (1 − **0.6**) × (1 − **0.7**)
Total treatment cost	= C_{RO} + C_{EVAP} × (1 − R_{RO}) + C_{CRYS} × (1 − R_{EVAP}) × (1 − R_{RO})		
Example	= **\$1** + **\$20** × (1 − **0.7**) + **\$40** × (1 − **0.6**) × (1 − **0.7**)		
	= \$11.80 USD / m³ inlet		





Considering Zero Liquid Discharge?

Call Saltworks for any ZLD treatment needs.

Our engineers have extensive experience designing industry-leading treatment solutions and will advise you on the best options for achieving zero liquid discharge.

Projects@SaltworksTech.com

SaltworksTech.com

+1.604.628.6508

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