Coorong Tatiara

Sustainability, Agriculture & the Environment

Desalination for Livestock Water Supplies

This fact sheet covers the basic considerations and steps involved in installing a desalination plant for livestock water supply. Maintaining a reliable and sustainable farm water supply is a major concern for livestock producers today.

Many producers may have access to a groundwater supply from a bore; however, in many cases this water may be too high in salts for domestic use or livestock to consumption. Desalination of this water is an option which may be feasible to utilise on farm water resources most effectively

Contents

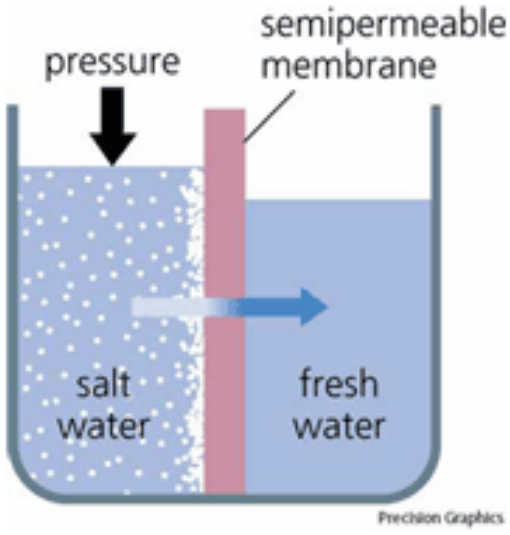
What is Desalination?

Desalination is the process of removing salts from water. There are several methods of desalination; however, this fact sheet is focused on the 'reverse osmosis' technique. The process of desalination does not always completely remove all salts from the water. Sometimes very low levels of salts remain in the water after desalination. The salinity of the water before desalination influences how much salt can be removed. You should always check this with the manufacturer of the unit.

Reverse osmosis

A common process for desalination is reverse osmosis (RO). The RO membrane processes use semipermeable membranes and applied pressure (on the membrane feed side) to preferentially induce water permeation through the membrane while rejecting salts. Reverse osmosis plant membrane systems typically use less energy than thermal desalination processes. Energy cost in desalination processes vary considerably depending on water salinity, plant size, and process type.

The reverse osmosis process



Reverse osmosis uses a thin-film composite membrane, which comprises an ultra-thin, aromatic polyamide thin-film. This polyamide film gives the membrane its transport properties, whereas the remainder of the thin-film composite membrane provides mechanical support. The polyamide film is a dense, void-free polymer with a high surface area, allowing for its high water permeability.

Water Quality

- Suitable for removing most forms of minerals ie manganese, calcium, silica and iron.

Water Testing

- For a thorough assessment of the suitability of bore water for desalination, up to date water results are required.
- An accurate water test enables the determination the size of the unit, and any pre treatment filtration required.

Pre-Treatment of the water may be required

- To remove harmful contaminants.
- To increase the service life of the membranes.
- To educe running costs.

Waste Discharge

- Depending on local regulations, a lined evaporation dam is required.
- This dam needs to be carefully planned to ensure it is large enough to contain the brine discharge.

Anti-scale

- Reverse osmosis filtration desalination units need to incorporate an anti-scale system.
- There are bio-degradable options that can pass through your unit via your waste outlet.
- Anti-scale options do not come in contact with the fresh water produced.
- The anti-scale helps prevent any scale build up on the membranes of the desalination unit.

Desalination Unit Water Requirements

- A sustainable and constant flow of feed water to the Desalination Plant is required, under a steady pressure.
- Most units should have a safety shut off system in place to protect the unit.
- Most desalination units require a return supply of fresh water produced by the system for sys-

Normal water intakes of animals

Animal	Daily Consumption (litres a day)
Sheep - weaners	2-4
- adult dry sheep - grass land	2-6
- salt bush	4-12
- ewes with lambs	4-10
Cattle - weaners	25-50
- dry stock	35-80
- lactating cow - grass land	40-100
- saltbush	70-140
Dairy cattle	70–250
Horses	40-50
Pigs - sow and litter	25-45
- Boar or dry sow	12-15
- grower 23 – 90 kg	3-12
Poultry (100 birds) -laying hens	33
- broilers	6-32

Note: Livestock water consumption can vary greatly with heat, humidity, exercise, diet, and water quality. Allowances must also be made for wildlife and feral animals also drinking from watering points.

Maximum salinity levels for stock drinking water.

Stock Type	Desirable maximum concentration for healthy growth*		Maximum concentration at which good condition might be expected*		Maximum concentration that may be safe for limited Periods*	
	ppm (mg/l)	**EC Units**	**ppm (mg/l)**	**EC Units**	**ppm (mg/l)**	**EC Units**
Sheep	5,000	7,800	5000 to 10 000	7,800 to 15,625	10 000 to 13 000	15,625 to 20,300
Beef Cattle	4,000	6,250	4000 to 5000	6,250 to 7,800	5000 to 10 000	7,800 to 15,600
Dairy Cattle	2,500	3,900	2500 to 4000	3,900 to 6,250	4000 to 7000	6,250 to 10,900
Horses	4,000	6,250	4000 to 6000	6,250 to 9,375	6000 to 7000	9,375 to 10,900
Pigs	4,000	6,250	4000 to 6000	6,250 to 9,375	6000 to 8000	9,375 to 12,500
Poultry	2,000	3,125	2000 to 3000	3,125 to 4,690	3000 to 4000	4,690 to 6,2,500

*Stock water requirements and maximum advisable levels of salinity vary widely according to season, stock type and type of feed on offer. For more information visit http://www.coorong.sa.gov.au/waterqualityandlivestockhealth

CASE STUDY ONE

Van Den Brink Partners, 'Wandoo'	**Yumali**
Rainfall	**450mm**
Enterprises	**Cattle and hay**
Annual water bill	**$32,000**
Desalination plants installed	**2012**
Cost	**$130,000**
Bore	**9,000EC**
Evaporation pond	**28,000 EC- 32,000 EC**

Powered by mains swer line

Output water has little to no salt.

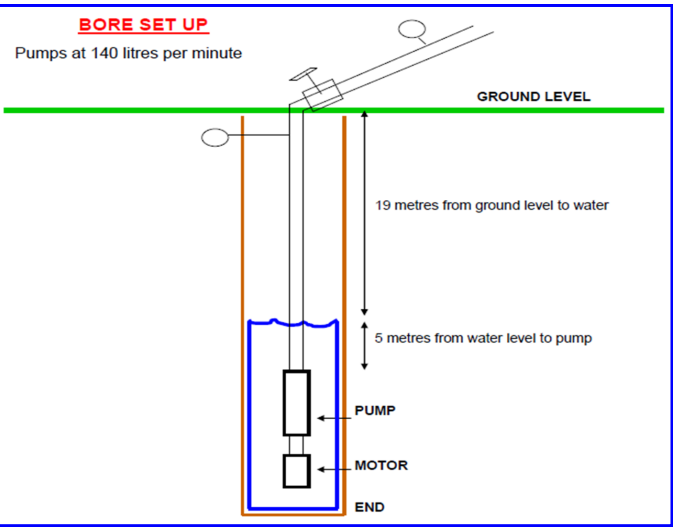
It is shandied with bore water for livestock consumption at 3,000 - 3,500 EC

Challenges

- The SA mains water bills were approximately $8,000 per quarter. Predominantly used for stock water for cattle.
- Needed to look at alternative options for stock water supply.
- Decided on 'Saltfree' Desalination Unit.
- Desalination unit has a soft start function.
- The anti scaler used is 'Permacare – Reverse Osmosis Anti Scalant'.
- Only enough power to run pump OR desalination unit.
- Could look at solar as an option to pump water out to the stock.

Benefits

- Desalination produces high quality water suitable for use by all livestock, intensive agriculture, spraying, and domestic use.
- Stock do not need salt free water so there is a potential to shandy with bore water.
- This can significantly boost the water output from the desalination plant or reduce the running costs.
- It just needs to be fit for purpose.



Salt Free Desalination Unit powered by mains SWER line

Desalinated water & rain water off the shed (100,000 litre)

Running costs and capacity

This unit is 6½ years old.

- Desalination unit cost $37,000.
- Liner for evaporation pond $12,000.
- Total cost inc. tanks & instillation $130,000.
- The evaporation pond is lined with a 'Fabtech' brand plastic membrane.

Has pumped 44.7million litres of desalinated water.

- Produces70 litres clean water per minute
- Produces 25 litres of waste water per minute.

<u>Operational costs</u>

New membranes every 18 months.

Approx $0.65 per kl compared with SA Water mains supply @ $3.41 per kl. (March 2020 price)

Evaporation pond for the surplus brine

Case Study 2

Van Den Brink Partners, 'McDonald Downs'	**Yumali**
Rainfall	**450mm**
Enterprises	**cattle and hay**
Annual water bill	**$32,000**
Desalination plants installed	**2019**
Bore (approx 2.6 kms from desal unit)	**9,000EC**
Powered by mains swer line	
Shandied Water For Livestock	**3 ,000—3,500EC**

- The SA Mains water bills were approximately $8,000 per quarter. Predominantly used for stock water for cattle.
- Needed to look at alternative options for stock water supply.
- Extra settling tanks were required for the system to settle iron out of the bore water.
- Fine sand in the bore damaged the mono pump, leading to the temporary use of the generator and the vertical multi stage pump.

Benefits

- Desalination produces high quality water suitable for use by all livestock, intensive agriculture, spraying, and domestic use.

Cost

SaltFree desalination unit	$40,060
Trenching	$7,000
Generator *(Honda EM10000K1UH4)*	$5,890
Pump - Sun Solar Tracking Mono	$17,500
Poly tanks *(3 x 22,500, 1x 50,050, 2 x 13,500)*	$15,533
Pump – vertical multistage 1.5KW	$2,710
Pipelines *(2.6 km 3", 2.4 km 1½", 1.5 km 1¼")*	$18,083
Fittings, floats, taps, valves etc.	$3,814
TOTAL COST	**$110,590**

Fine sand in the bore damaged the mono pump hence the need for a backup generator & a vertical multi-stage 1.5KW pump at the bore until the fine sand issue is resolved

Solar Power used to pump the 2.6kms from the bore to the desalination unit via 75mm poly pipe

SaltFree Desalination Unit powered by mains SWER line

Bore water pumped into settling tanks before desalination

Fit for purpose blend of desalinated & bore water

CASE STUDY THREE

Mark Gubbins	**Policemans Point**
Property size —	**Hamilla Downs & Carinya 4,047ha**
Rainfall	**450 to 500mm**
Enterprises	**Cattle**
Annual water bill	**$80,000**
Current annual water cost	**<$15,000**
Desalination plants Established	**2014 & 2016**
Solar powered desal plants cost	**$110,000 each**
Wedge hole salinity	**7,800 to 12,500 EC**
Stock water delivered to troughs	**3,100 EC**

Challenges

When 'Hamilla Downs' was purchased, the mains water cost was 90 cents per kilolitre. At that stage it was affordable. Over the next 6 years the price rose to $3.45 per kilolitre, thus becoming unaffordable, eating heavily into the profit margin of the 2 properties.

On the 'Carinya' property there was an issue with the underground water quality. The poor quality of the inlet water was causing problems in the desalination process due to organic matter. algae, dust & bacteria affecting the water coming into the desalination unit.

Benefits

On 'Hamilla Downs' they have been able to turn off the mains water supply for 3 years to 95% of the property. The second unit installed on 'Carinya', giving total self sufficiency for farm water.

- The desalination units at 'Hamilla Downs' and 'Carinya' are direct solar powered by 10KVA of solar panels. These are computer controlled to obtain maximum sunlight efficiency for the three phase pumps controlled by variable speed controllers. This powers the desalination unit and transfer pumps.
- Each unit can water approximately 1,000 cattle.
- A daily water production aim of 35,000 litres is stored in a 250,000 litre tank for transfer to satellite tanks around the farms.
- Each unit has a 12KVA diesel generator for backup; this can be operated by timer or remotely. This can over ride the solar power system.

10 KVA solar panels power the desalination unit and transfer pumps

Solar Powered SaltFree desalination unit

Solar Powered SaltFree desalination unit

EPA Requirements

Desalination is a key element of South Australia water security plan 'Water for Good'. Desalination is increasingly being used for a variety of purposes, including the supply of drinking water for livestock as well as for irrigation and industrial purposes.

The Water for Good Plan recognises that there are environmental issues associated with desalination and notes that the disposal of brine (ie wastewater containing high concentrations of dissolved salt) is a key issue that requires comprehensive management. Consequently, the Government has approved significant reforms to licensing requirements regarding desalination under the Environment Protection Act 1993.

These reforms are summarised as follows:

- Desalination is to become a specific activity subject to licensing under the Act.
- Licensing requirements will be extended to include plants that discharge waste to land, plants discharging waste that does not contain chemical additives, and also networks of small plants which desalinate water underground that are within close proximity of each other (ie one km).
- These requirements will apply to plants discharging waste to wastewater treatment systems that are not licensed under the Act, but not to plants where all waste is discharged to licensed sewage treatment works, licensed community wastewater management systems, and licensed industrial wastewater treatment facilities.
- Desalination plants currently licensed under activity 8(7) of the Act, 'Discharges to Marine and Inland Waters', will instead be licensed under the newly prescribed activity of water desalination.

It is intended that these licensing requirements will apply to individual plants with a production capacity of greater than 200 kilolitres (kL) per day, and networks of plants which desalinate water underground that have a combined production capacity of greater than 200 kL/day.

Licensing allows the Environment Protection Authority (EPA) to specify conditions of operation such as requirements to implement measures to prevent or minimise pollution.

Planning and Regulation

Regulatory requirements have been established primarily in response to issues that have arisen over the years that have created either environmental damage, over-use of resources, infrastructure damage or even conflict between land users. Often these issues were not foreseen, and as such the regulatory frameworks have been put in place to prevent or limit any such adverse impacts occurring. In regards to piping water security projects the following may need to be considered as part of the overall plan (noting that this is based on use as stock water only).

Desalination Plants Small desalination plants in themselves might not be classified as development (if taking water from a source outside the River Murray system); however deposition of wastewater containing flocculants might require assessment by the EPA. Depending upon the scale and siting of alternative energy sources, these might also be development.

Storage Tanks Depending on the size, and possibly location, of water storage tanks, they may require development approval. Ensuring that the tank is structurally sound would be the primary concern.

Additional Resources

Desalination
Coorong Tatiara Local Action Plan :
http://www.coorong.sa.gov.au/desalination

Saltfree Pty Ltd—Desalination Units
Brian Schultz - 0410 579 651
http://www.saltfree.com.au

Rowater—Desalination units
Mark Watherston— (08) 8193 2900
www.rowater.com.au

Planning information
http://www.coorong.sa.gov.au/waterplanningconsiderations

DPI NSW fact Sheet—Desalinating Bore Water
https://www.dpi.nsw.gov.au/data/assets/pdf_file/0005/523517/Desalination-of-bore-water.pdf

Coorong Tatiara Local Action Plan

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'National Landcare Program: Smart Farms Program, an Australian Government initiative'.