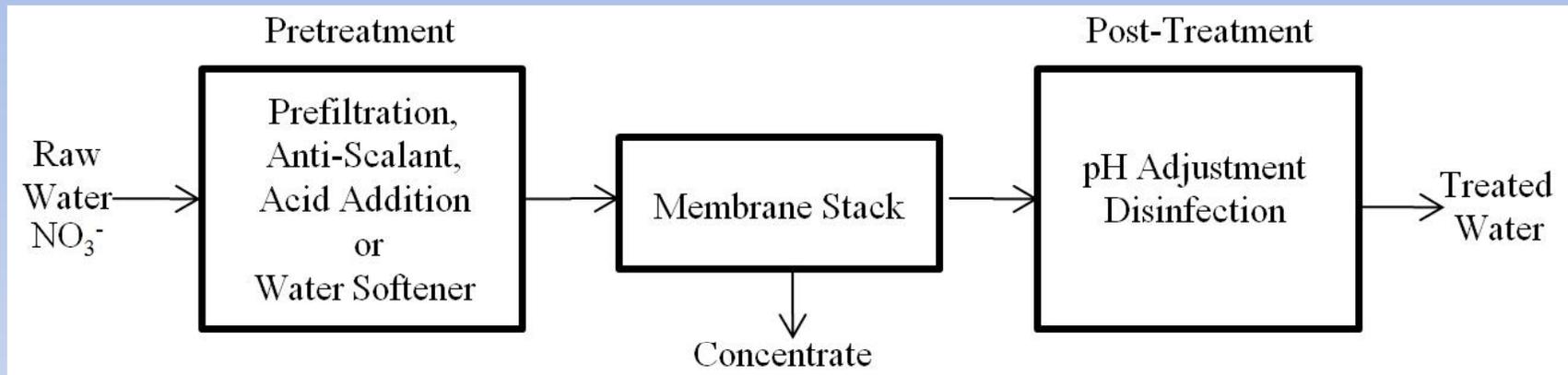


Selective Electrodialysis

California Department of Public Health
Drinking Water Program
September 2013

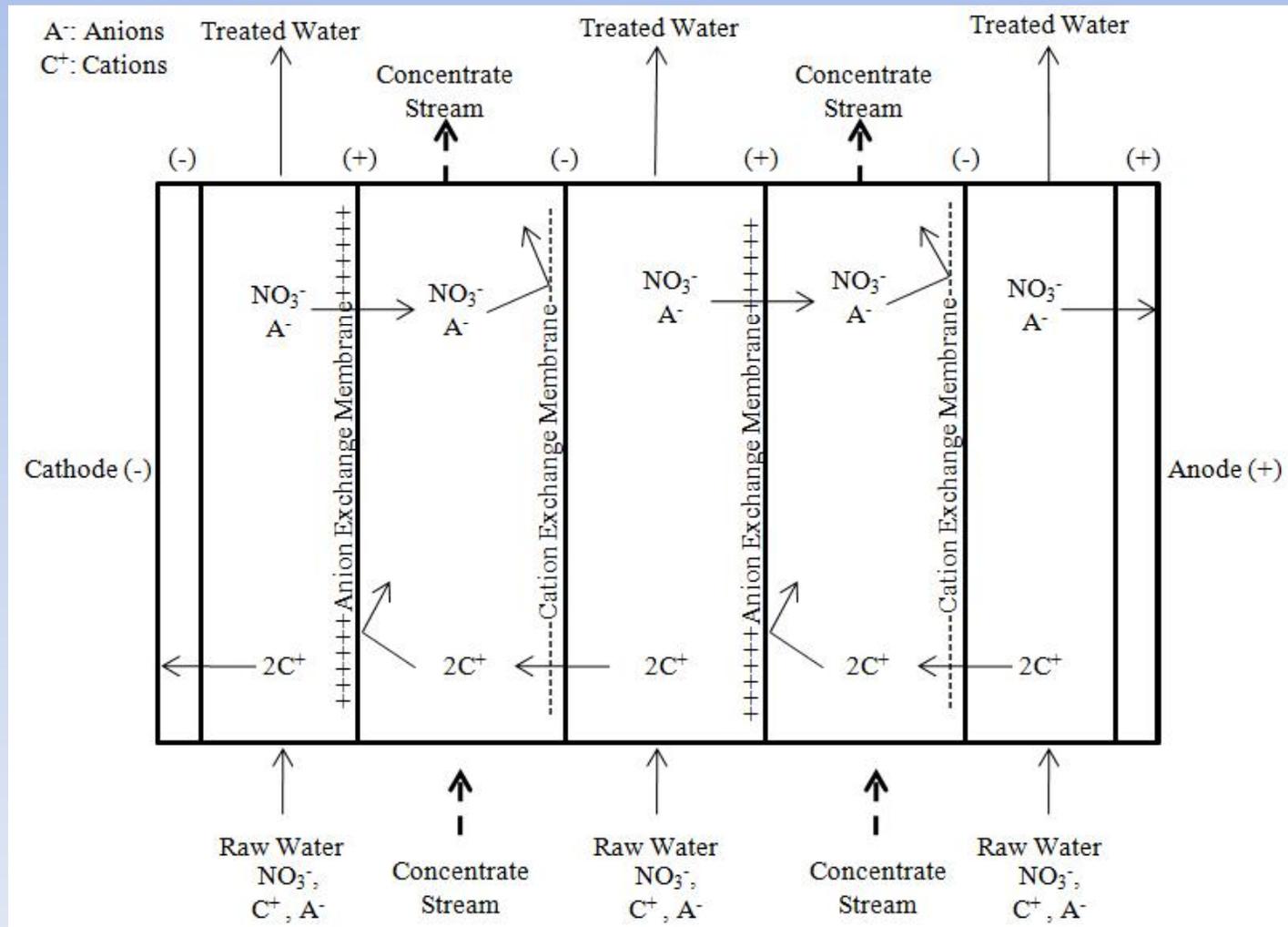
Eugene Leung

Treatment Scheme



- Use of Anion and Cation Selective Exchange Membranes
- SED is not a direct filtration method
- Pretreatment is needed for constituents that may foul the membrane

Electrodialysis Membrane Rack



Potential Treatment Benefits

- Treatment Objective: *Maximize water recovery with the minimum amount of energy and chemical usage*
- Lower pumping costs compared to reverse osmosis
- SED process selectively removes nitrate, the Total Dissolved Solids (TDS) remains in the treated water stream.
- TDS in the concentrate will be much lower compared to an RO system treating the same water source.
- The concentrate can potentially be use for irrigation without the salinity adversely affecting plant growth.

Disclaimer

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Shikun & Binui Water

Selective Electro Dialysis (SED)



Nitrate Treatment Workshop

September 2013



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Company Profile

- Shikun & Binui is Israel's largest housing and construction group, with global presence in more than 20 countries across Africa, Asia, Europe and central America
- S&W Water is Shikun & Binui's water arm
- S&B Water designs, builds and operates water treatment plants , with over 15 years of experience in the field , in both Turn Key and BOT projects .



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Shikun & Binui Water Activity

- Hadera Desalination Plant
 - Built, operates and owns the Hadera Desalination Plant, a 33.5 billion gallon per year, in partnership with IDE
 - The largest sea water reverse osmosis desalination plant in the world
- Groundwater Remediation and Reclamation
 - Designs, builds, operates sophisticated facilities for ground-water remediation
 - 11 full scale SED nitrate treatment facilities in Israel supplying 2.4 billion gallons per year of potable water
- Municipal Water and Sewage management
 - Providing water and sewage services to 35,000 inhabitants.



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Nitrate Treatment - Value proposition

Selective Electro Dialysis (SED)

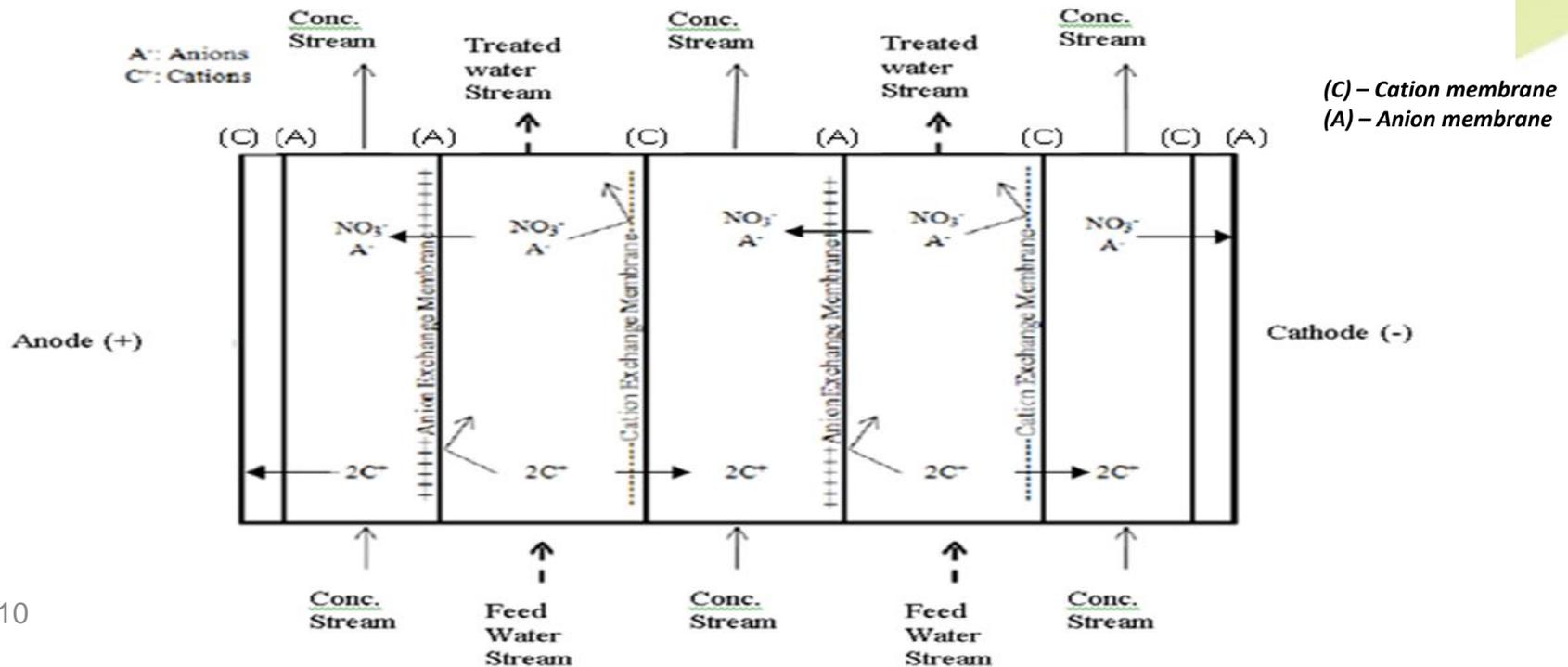
- SED is an electro dialysis based technology. ED, is a well known Nitrate treatment technology which the EPA lists as BAT
- Removes selectively up to 70% of Nitrates (NO_3) and only 5% of Sulfate
- The technology is inert to Silica
- Low energy consumption- commonly uses less than 0.57 Watts/1000gal
- Standard module with 330 membrane pairs can treat up to 440 gpm of feed water
- Standard module with 120 membrane pairs can treat above 154 gpm of feed water
- 95% recovery rate.
- Negligible chemical use in concentrate treatment only.
- SED membrane stack is NSF-61 approved for drinking water treatment



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SED – Nitrate Treatment Technology Principles

- Cation -exchange and selective Anion-exchange membranes are arranged alternately between electrode cells at both ends
- The selective anion membranes, do not allow divalent Anions, (such as Sulfate) to pass through the membrane, allowing relatively low concentrate TDS and lower precipitation potential of poorly soluble salts
- Electro dialysis transfers ions by using direct current as a driving force, creating product water and concentrate streams



SED – Nitrate Treatment Case Study - Nes Ziona well E

Background:

- The public health regulations reduced the allowable Nitrate levels to <70 ppm. And forced the city to shutdown well E and supplemented it with expensive water bought from Mekorot-National Water Co.
- To save on water expenses, the city examined RO and SED as Nitrate treatment alternatives. Due to cost considerations, efficiency, footprint and robustness, the city turned to S&B Water for SED installation
- Following an intensive period of testing and inspection, the ministry of health authorized the facility for routine operation in March 2011

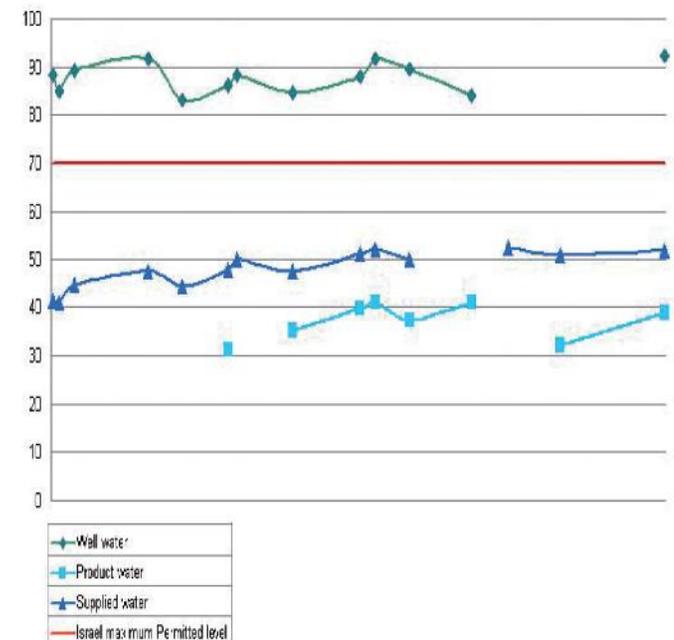


SED – Nitrate Treatment Case Study - Nes Ziona well E

Results:

- Feed flow to SED stack is 444,000 gal/day
- SED plant recovery rate is ~95%
- Feed water Nitrate levels are ~92 ppm as NO₃ (20.8 as N)
- Product water Nitrate levels are <45 ppm (<10 as N) and TDS levels are ~405 ppm
- Supplied water (blended with feed water) Nitrate levels are well below the regulation's requirements
- Total plant energy consumption, including SED operation and supply to the municipality system at 6.5 bar : 1.44 kW/1000gal
- The sole SED energy consumption is: 0.49 kW/1000gal

Well 'E' - Nes Ziona
Nitrate concentration in well, product and supplied water



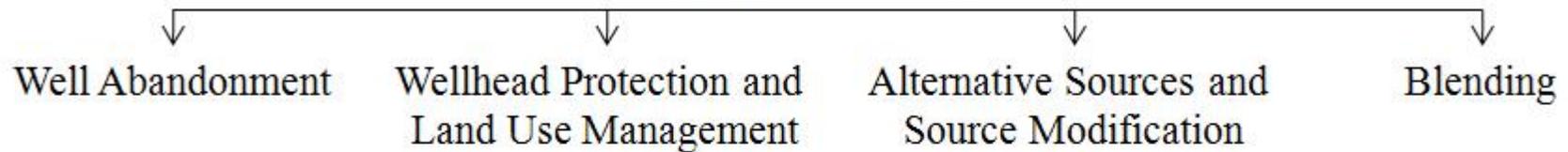
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Non-Treatment Options



Treatment Options

