



DELTA WATER

IRRIGATION WATER QUALITY

The Hidden Impact of Salts on Soil, Crops & Profitability

Presented by **Louis Botha**

Improve Water. Improve Soil. Improve Yield.

THE FOUNDATION

Why Water Quality Matters

Even clean-looking water can carry harmful salts that:

- › Compact the soil
- › Reduce infiltration
- › Lower fertilizer efficiency
- › Restrict root growth
- › Cause yield losses
- › Block irrigation systems

The quality of your irrigation water determines the quality of your soil.



THE BIG IDEA

Balance Beats pH Alone

Two soils can share the SAME pH — yet one crumbles into healthy structure while the other seals like concrete. The difference is which cations sit on the soil's exchange sites.



Cations compete for the same sites

Calcium, magnesium, sodium and potassium all cling to clay.



They decide soil structure

The mix sets whether particles clump together or fall apart.



Your water shifts the balance

Every irrigation loads new salts onto the exchange complex.



Structure drives every yield

Good structure means water, air and roots move freely.



ESTIMATED SALT DEPOSITS

CLASS	EC	PPM	DESCRIPTION
C1	<25mS/m	<25	Very good
C2	25-75mS/m	213-641	Good
C3	75-225mS/m	641-1924	Bad
C4	>225mS/m	>1923	Very bad

	SAR
S1	Safe on all soil types
S2	Safe on high textured soils
S3	Needs regular gypsum addition
S4	Totally unsuitable for irrigation

			Kg of Salts Applied per Ha/Annum						
EC		TDS	Cubic (m3) Water Applied per ha/annum						
(mS/m)	Class	(mg/L)	1000	2500	5000	7500	10 000	12 500	13 500
25	1	160	160	400	800	1 200	1 600	2 000	2 400
50	2	320	320	800	1 600	2 400	3 200	4 000	4 800
75	2	480	480	1 200	2 400	3 600	4 800	6 000	7 200
100	3	640	640	1 600	3 200	4 800	6 400	8 000	9 600
125	3	800	800	2 000	4 000	6 000	8 000	10 000	12 000
150	3	960	960	2 400	4 800	7 200	9 600	12 000	14 400
175	3	1120	1 120	2 800	5 600	8 400	11 200	14 000	16 800
200	4	1280	1 280	3 200	6 400	9 600	12 800	16 000	19 200
225	4	1440	1 440	3 600	7 200	10 800	14 400	18 000	21 600
250	4	1600	1 600	4 000	8 000	12 000	16 000	20 000	24 000
275	4	1760	1 760	4 400	8 800	13 200	17 600	22 000	26 400
300	4	1920	1 920	4 800	9 600	14 400	19 200	24 000	28 000
325	4	2080	2 080	5 200	10 400	15 600	20 800	26 000	31 200
350	4	2240	2 240	5 600	11 200	16 800	22 400	28 000	33 600
375	4	2400	2 400	6 000	12 000	18 000	24 000	30 000	36 000
400	4	2560	2 560	6 400	12 800	19 200	25 600	32 000	38 400
425	4	2720	2 720	6 800	13 600	20 400	27 200	34 000	40 800
450	4	2880	2 280	7 200	14 400	21 600	28 800	36 000	43 200
475	4	3040	3 040	7 600	15 200	22 800	30 400	38 000	45 600
500	4	3200	3 200	8 000	16 000	24 000	32 000	40 000	48 000

KNOW YOUR LIMITS

Maximum Safe Levels in Water

Irrigation water guideline values (FAO). Stay in the green; above the upper figure, soil structure and crop health start to decline.

PARAMETER (ppm)	SAFE	WATCH	DECLINE
Total salts (TDS)	< 450	450–2,000	> 2,000
Sodium (Na^+)	< 70	70–200	> 200
Chloride (Cl^-)	< 140	140–350	> 350
Bicarbonate (HCO_3^-)	< 90	90–520	> 520
Boron (B)	< 0.7	0.7–3.0	> 3.0
Nitrate ($\text{NO}_3\text{-N}$)	< 5	5–30	> 30

All figures in ppm (mg/L). Salinity check: safe below 0.7 dS/m EC, severe above 3.0 dS/m. Sensitive and sprinkler-wetted crops react at the lower end.



SOURCES

Where Do Salts Come From?

Salts enter irrigation water through:

- › Groundwater & boreholes
- › Rivers & dams
- › Fertilizers
- › Natural weathering of rock
- › Recycled irrigation water

COMMON SALTS

Ca

Mg

Na

K

Cl

SO₄

HCO₃

The Good, the Bad & the Ugly

THE GOOD

Calcium (Ca^{2+})

- › Builds soil structure
- › Improves drainage
- › Increases oxygen movement
- › Supports root growth

THE TIGHTENER

Magnesium (Mg^{2+})

- › A necessary plant nutrient
- › Excess levels tighten soil
- › Narrows pore spaces
- › Slows water movement

THE DESTROYER

Sodium (Na^+)

- › Causes soil dispersion
- › Destroys soil structure
- › Leads to crusting
- › Drives compaction

Calcium builds soil. Magnesium tightens soil. Sodium destroys soil.

THE BREAKDOWN

How Soil Compaction Develops

When sodium and excess magnesium dominate:

1

Clay particles
separate

2

Soil pores collapse

3

Air spaces
disappear

4

Water infiltration
slows

5

Roots struggle to
penetrate

RESULT Hard soil · Reduced root development · Reduced crop performance

SYMPTOM 01

Surface Crusting

A hard layer that forms on the soil surface after irrigation or rainfall.

CAUSES

- › High sodium
- › High bicarbonates
- › Poor calcium balance

EFFECTS

- › Reduced seed emergence
- › Water runoff & erosion
- › Reduced infiltration





SYMPTOM 02

Poor Water Infiltration

Healthy soil absorbs water quickly. Compacted soil:

- › Absorbs water slowly
- › Causes puddling
- › Increases runoff
- › Wastes irrigation water

TYPICAL SYMPTOMS

- › Standing water after irrigation
- › Dry soil beneath a wet surface
- › Uneven crop growth

THE COST

Fertilizer Efficiency

High salt levels can:

- › Lock up nutrients
- › Reduce root uptake
- › Increase nutrient leaching
- › Raise fertilizer requirements

COMMON LOSSES

- › Nitrogen · Potassium · Calcium · Micronutrients

What you apply is not what the crop uses.





THE HIDDEN PROBLEM

Bicarbonates

High bicarbonates:

- › Tie up calcium
- › Form calcium-carbonate deposits
- › Amplify sodium effects
- › Raise soil pH

IRRIGATION SYSTEM EFFECTS

- › Scale buildup & blocked drippers
- › Reduced flow & uneven irrigation

THE TARGET

Ideal Soil Cation Balance

ELEMENT	IDEAL BASE SATURATION
Calcium (Ca)	60 – 70 %
Magnesium (Mg)	10 – 20 %
Potassium (K)	3 – 5 %
Sodium (Na)	Below 2 – 3 %

IDEAL RATIOS

Ca : Mg

› $\approx$ 4:1 to 7:1

Ca : K

› $\approx$ 12:1 to 20:1

Ca : Na

› As high as possible

The goal is not eliminating salts — but achieving balance.

NUTRIENT UPTAKE

Nitrogen & Salt Balance

Nitrogen works best when:

- ✓ Soil structure is open
- ✓ Roots have oxygen
- ✓ Water infiltrates properly

Compacted soils cause:

- ✗ Poor nitrogen uptake
- ✗ Increased leaching
- ✗ Reduced fertilizer efficiency

Healthy soil structure improves every kilogram of nitrogen applied.





BEYOND THE SOIL

Impact on Irrigation Systems

SCALE FORMATION

- › Calcium-carbonate deposits
- › Reduced pipe diameter
- › Blocked emitters

BIOFILM DEVELOPMENT

- › Bacterial slime growth
- › Reduced flow & higher maintenance

Poor uniformity → reduced crop performance.

Test Report - Water Analysis

Samples Received: 2024-09-26
Sampling date: 2024-09-26
Sampled by: None
Report #:
Order #:
Acc #:
Testing date (ICP): 2024-09-30
Testing date (Gallery): 2024-09-27
Testing date (Micro): 2024-09-26

2

Condition: Acceptable - Laboratory supplied container/s used
Sub-contractor: None

LAB No.		CAA-000-8225	For the use of:				Method Reference
Your Reference		Irrigation Water, Komati River	Drinking water	Bottled water	Waste water for discharge	Waste Water for irrigation	
Parameter:		Unit:	Results:				
Conductivity @ 25°C	mS/m	49					LAB-003*
Total Alkalinity as CaCO ₃	mg/l	170					Gallery**
Chloride as Cl	mg/l	54.0					LAB-004*
Nitrate as N	mg/l	1.03					LAB-004*
Nitrate as NO ₃	mg/l	4.56					LAB-004 - Calculation*
Total Dissolved Solids	mg/l	348					LAB-003 - Calculation*
pH _a @ 25°C		8.00					Calculation**
Langelier Index @ 25°C		0.18					Calculation**
Alkalinity Hazard	mg/l	0.58					Calculation**
Irrigation Class		C2-S1					
Total Coliform	MPN/100 ml	>2420					Lab-002*
E. coli	MPN/100 ml	6					Lab-002* / ***
Heterotrophic plate count	cfu/ml	1014					EasyDisc PCA**
Carbonates (CO ₃)	mg/l	20					Titration / Calculation**
Bicarbonates (HCO ₃)	mg/l	150					Titration / Calculation**
Hydroxyls (OH)	mg/l	0					Titration / Calculation**

*SANAS Accredited

**Not SANAS Accredited

Test Report - Water Analysis

Samples Received: 2024-09-26
Sampling date: 2024-09-26
Sampled by: None
Report #:
Order #: 38885
Acc #:
Testing date (ICP): 2024-09-30
Testing date (Gallery): 2024-09-27
Testing date (Micro): 2024-09-26

Sample condition: Acceptable - Laboratory supplied container/s used
Sub-contractor: None

LAB No.		CAA-000-8225	For the use of:				Method Reference
Your Reference		Irrigation Water, Komati River	Drinking water	Bottled water	Waste water for discharge	Waste Water for irrigation	
Parameter:		Unit:	Results:				
Dissolved Aluminium as Al	mg/l	<0.05					LAB-001*
Dissolved Arsenic as As	mg/l	<0.007					LAB-001*
Dissolved Boron as B	mg/l	<0.07					LAB-001*
Dissolved Barium as Ba	mg/l	0.05					LAB-001*
Dissolved Calcium as Ca	mg/l	21					LAB-001*
Dissolved Cadmium as Cd	mg/l	<0.0009					LAB-001*
Dissolved Cobalt as Co	mg/l	<0.003					LAB-001*
Dissolved Chromium as Cr	mg/l	<0.003					LAB-001*
Dissolved Copper as Cu	mg/l	<0.02					LAB-001*
Dissolved Iron as Fe	mg/l	<0.05					LAB-001*
Dissolved Mercury as Hg	mg/l	<0.001					LAB-001**
Dissolved Potassium as K	mg/l	1.3					LAB-001**
Dissolved Magnesium as Mg	mg/l	22					LAB-001*
Dissolved Manganese as Mn	mg/l	<0.01					LAB-001*
Dissolved Molybdenum as Mo	mg/l	<0.01					LAB-001*
Dissolved Sodium as Na	mg/l	67					LAB-001*
Dissolved Nickel as Ni	mg/l	0.006					LAB-001*
Dissolved Phosphorus as P	mg/l	<0.1					LAB-001**
Dissolved Sulphur as S	mg/l	5.7					LAB-001*
Dissolved Antimony as Sb	mg/l	<0.02					LAB-001**
Dissolved Selenium as Se	mg/l	<0.011					LAB-001*
Dissolved Silicon as Si	mg/l	10					LAB-001*
Dissolved Vanadium as V	mg/l	<0.010					LAB-001*
Dissolved Zinc as Zn	mg/l	<0.013					LAB-001*
Calcium Hardness as CaCO ₃	mg/l	52					LAB-001 - Calculation*
Magnesium Hardness as CaCO ₃	mg/l	89					LAB-001 - Calculation*
Total Hardness as CaCO ₃	mg/l	141					LAB-001 - Calculation*
Sodium Adsorption Ratio (SAR)		2.47					LAB-001 - Calculation*
Dissolved Sulphur as SO ₄	mg/l	17					LAB-001 - Calculation*
Dissolved Phosphorus as PO ₄	mg/l	<0.31					LAB-001 - Calculation**
Dissolved Silicon as SiO ₂	mg/l	22					LAB-001 - Calculation**
pH @ 37°C	pH units	8.18					LAB-003*

*SANAS Accredited

**Not SANAS Accredited

Tests marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this laboratory.

THE SOLUTION

Introducing Delta Water

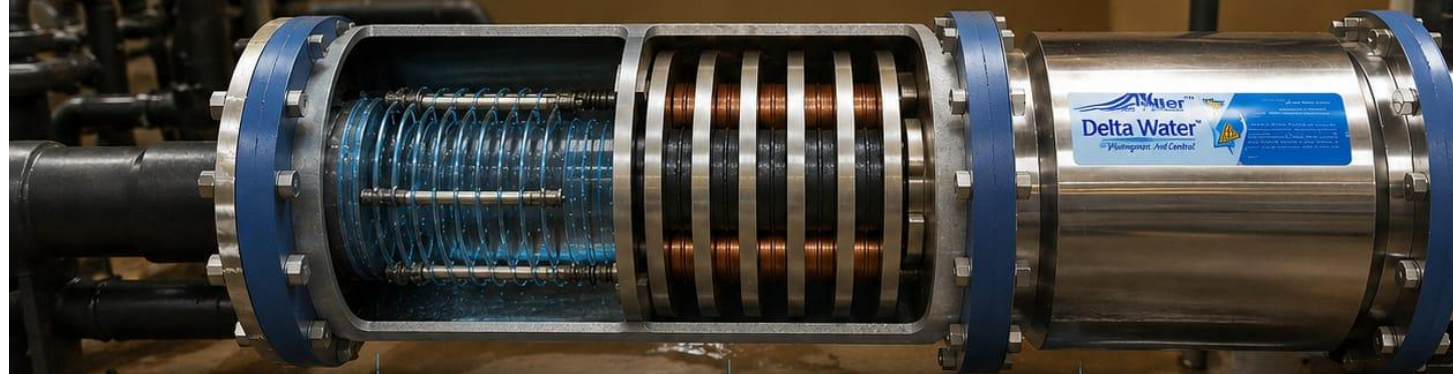
Water-conditioning technology that uses magnetic & hydrodynamic principles to change how dissolved minerals behave.

- › Reduced scale formation
- › Improved water infiltration
- › Reduced soil compaction
- › Better soil structure
- › Improved fertilizer efficiency
- › Cleaner, biofilm-free systems



DELTA WATER™ DEVICE – CUTAWAY VIEW

TRANSFORMING WATER MOLECULE CLUSTERS AND SALT CRYSTALS

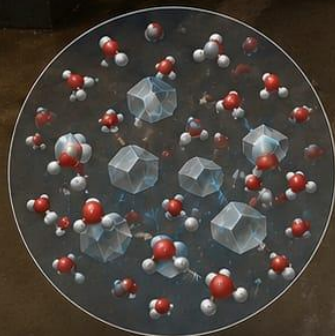


1. INLET –
UNTREATED WATER

2. MAGNETO HYDRODYNAMIC
TECHNOLOGY

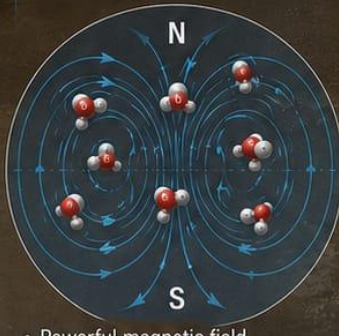
3. MOLECULAR
TRANSFORMATION ZONE

4. OUTLET –
TREATED WATER

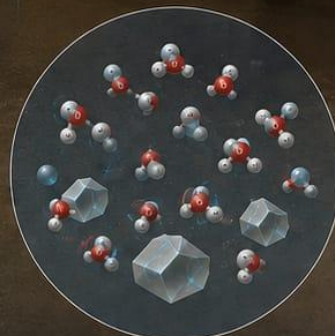


LARGE WATER CLUSTERS
(SURFACE TENSION HIGH)

SALT CRYSTALS
HARD, SHARP EDGES



- Powerful magnetic field applied to moving water
- Creates stable vortex flow
- Induces magneto hydrodynamic forces (MHD)
- Water molecules realign and cluster bonds weaken



- Clusters break down into smaller groups
- Salt crystals lose sharp edges
- Surfaces become smooth and non-adherent

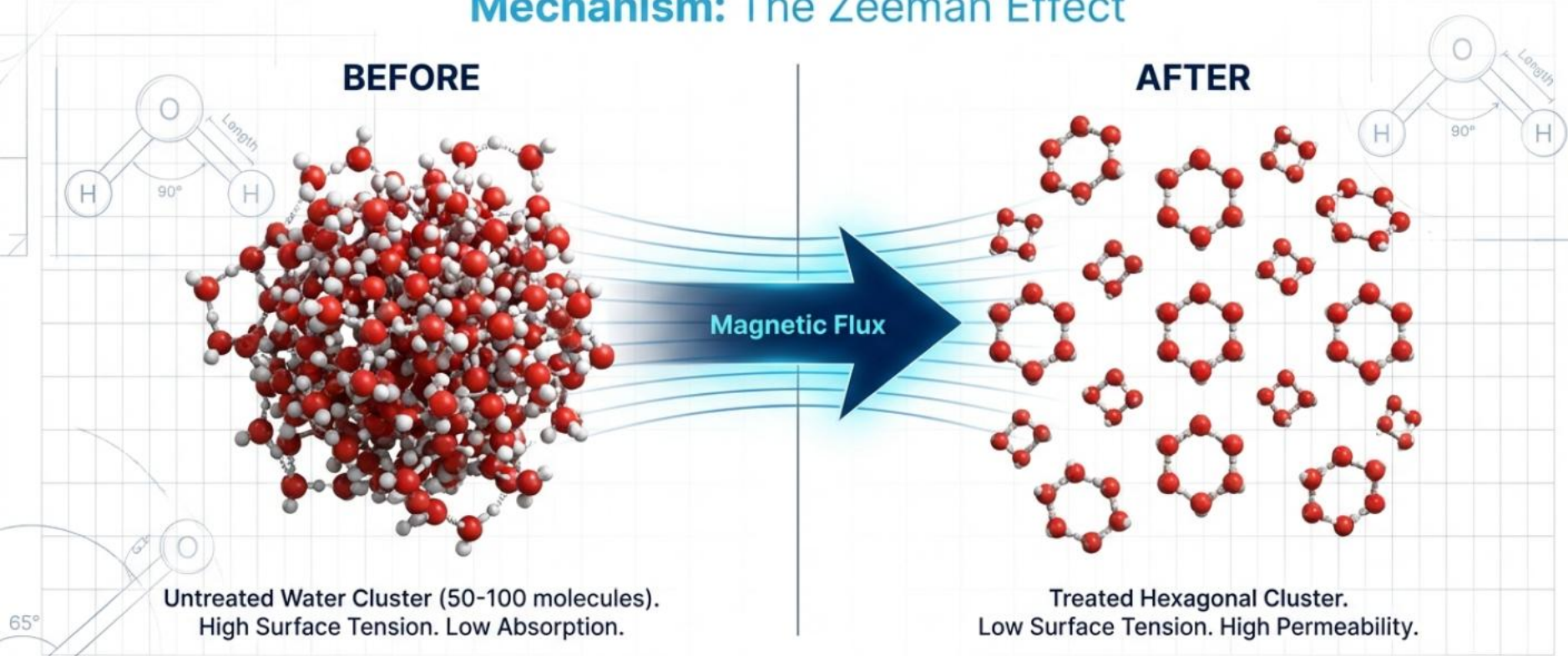


SMALLER WATER CLUSTERS
(SURFACE TENSION REDUCED)

SMOOTH, NON-ADHERENT
SALT CRYSTALS

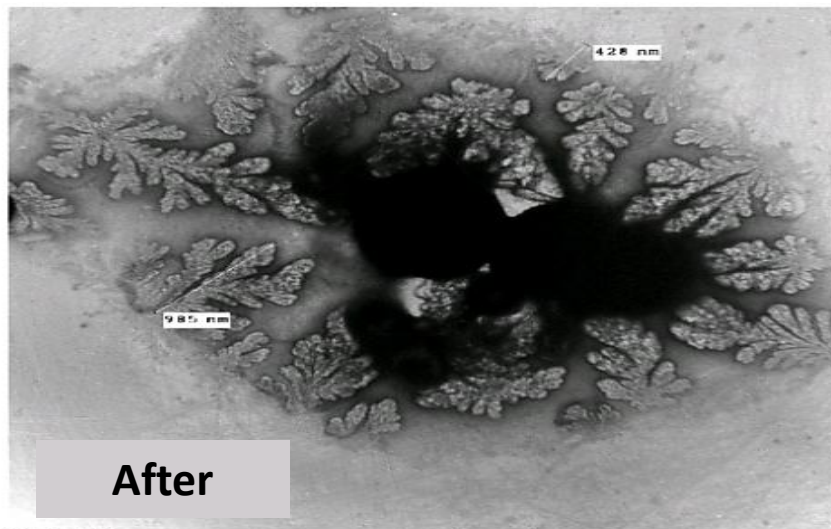
The Physics of Water: Breaking the Hydrogen Bond

Mechanism: The Zeeman Effect



High-intensity magnetic flux increases electron polarization, stretching and breaking hydrogen bonds. This reduces viscosity, allowing water to penetrate plant roots and concrete pores instantly.

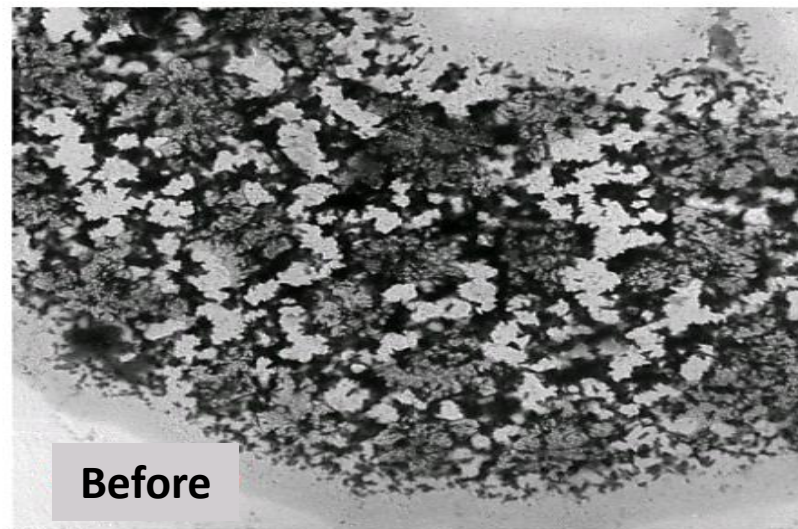
Electron microscope image of water before and after passing through the Delta Water device:



After

MF-1m.tif
Print Mag: 34400x @ 7.0 in
10:33:31 a 04/19/17

500 nm
HV=80.0kV
Direct Mag: 2500x
AMT Camera System



Before

M-4.tif
Print Mag: 34400x @ 7.0 in
11:12:19 a 04/19/17

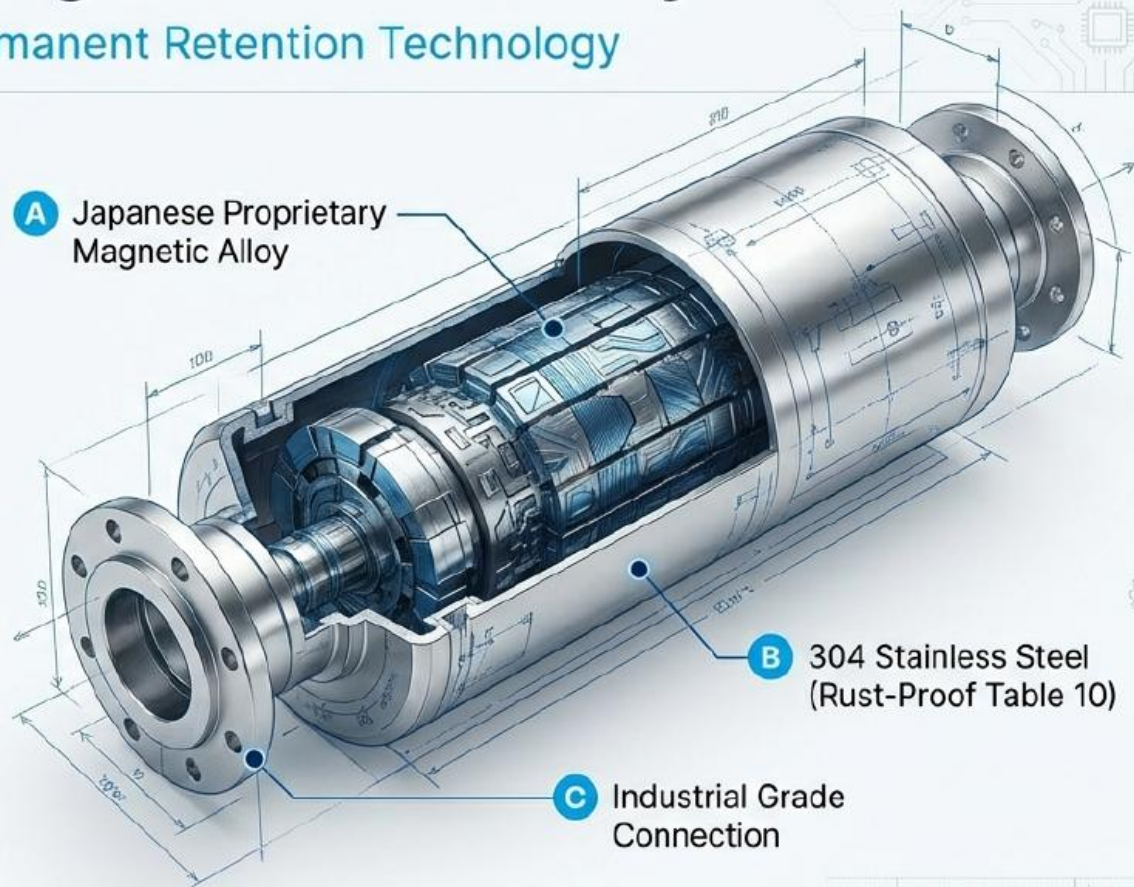
500 nm
HV=80.0kV
Direct Mag: 2500x
AMT Camera System

Water shape among the saline deposits of well water (salinity = 1000 ppm) before and after magnetic treatment with delta water systems. The imaging was done with an electron microscope by the professors of the Faculty of Science - Alexandria University

The World's Highest Magnetic Power Density

14,500 Gauss (1.45 Tesla) – Permanent Retention Technology

- ✔ **Zero Electricity Required:**
Passive magnetic energy.
- ✔ **Lifetime Potency:**
Permanent field retention without recharging.
- ✔ **Maintenance Free:**
No spare parts or chemical refills.
- ✔ **Weather Resistant:**
Designed for harsh agricultural and industrial environments.



How Delta Water Helps Farmers

SOIL BENEFITS

- ✓ Improved water penetration
- ✓ Reduced surface crusting
- ✓ Reduced sodium effects
- ✓ Better root-zone aeration
- ✓ Improved calcium effectiveness

IRRIGATION BENEFITS

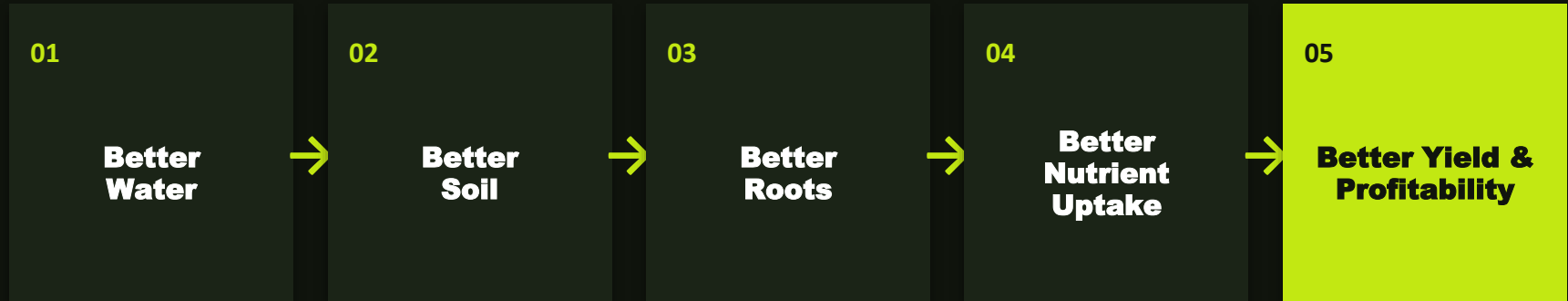
- ✓ Less scale buildup
- ✓ Cleaner drippers
- ✓ Improved flow rates
- ✓ Lower maintenance

CROP BENEFITS

- ✓ Stronger root systems
- ✓ Better nutrient uptake
- ✓ Improved fertilizer efficiency
- ✓ Increased yield potential

ONE IMPROVEMENT, COMPOUNDING RETURNS

The Delta Water Advantage



Better water is the single change that lifts every step that follows.

BEFORE – 1 800ppm



RESULTS AFTER 3 MONTHS



FIELD RESULTS

Before & After: 3 Months with Delta Water

Illustrative results from a representative trial block, measured at install vs. 3 months

BEFORE



WATER INFILTRATION

12 → 28 mm/hr

▲ +133% faster

SOIL COMPACTION

2.8 → 1.6 MPa

▼ 43% softer soil

AFTER



EMITTER SCALE

18% → 4% blocked

▼ 78% cleaner lines

FERTILISER UPTAKE

Base → +22%

▲ nutrient-use efficiency

The Study at a Glance

How irrigation water quality shapes soil, crops and profitability — and what fixes it

THE PROBLEM

Even clear-looking irrigation water carries salts — sodium, magnesium and bicarbonates — that break down soil structure.

THE ROOT CAUSE

Calcium builds soil, magnesium tightens it and sodium destroys it — imbalance drives compaction, crusting and poor infiltration.

THE COST

Salt buildup locks up nutrients, lowers fertiliser efficiency and scales up drippers and pipes — cutting yield and uniformity.

THE SOLUTION

Delta Water conditioning restores infiltration, reduces scale and compaction, and lifts fertiliser efficiency and yield potential.

Better water is the single change that improves soil, roots, nutrient uptake and profitability.

THANK YOU

Improve Water. Improve Soil. Improve Yield.

DELTA WATER SOUTH AFRICA

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KEY MESSAGE

Calcium builds soil. Magnesium tightens it.
Sodium destroys it. Keep calcium dominant — and let Delta Water do the rest.