

Irrigation of Treated Water



EPA licensing decisions – legislative and policy framework

- Protection of the Environment Operations Act 1997
 - Establishes licences, can contain conditions
 - Water pollution - offence and definition
 - Matters to be considered in licensing decisions

POEO Act – Section 45 licensing decisions

- Matters that must be considered by the EPA:
 - The objectives of the EPA
 - The pollution and its impact
 - The practical measures to prevent, control, abate or mitigate pollution, and to protect the environment from harm
 - The environmental values of the waters
 - The practical measures to maintain or restore those environmental values

Effluent reuse by irrigation – some considerations

Soil	<ul style="list-style-type: none"> Root zone salinity Soil structural stability Build-up of contaminants in soil Effects on soil biota Release of contaminants from soil to crops and pasture
Plants	<ul style="list-style-type: none"> Yield Product quality Salt tolerance Specific ion tolerance Foliar injury Uptake of toxicants in produce for animal or human food Contamination by pathogens
Water resources	<ul style="list-style-type: none"> Deep drainage and leaching below root zone Movement of salts, nutrients and contaminants to groundwater and surface waters
Other important factors	<ul style="list-style-type: none"> Quantity and seasonality of rainfall Soil properties Crop and pasture species and management options Land type Groundwater depth and quality

Effluent reuse by irrigation – policy and guidelines

Some relevant policies and guidelines:

- NWQMS – principles and policies
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)
 - (Volume 3) Water quality for irrigation and general use
- EPA Environmental Guidelines – Use of Effluent by Irrigation
- Indicators of Sustainability for Effluent Reuse in the Intensive Livestock Industries: Piggeries and Cattle Feedlots

Salinity

- Generally measured as electrical conductivity (EC) or total dissolved solids (TDS)
 - expressed as $\mu\text{S}/\text{cm}$ or dS/m and mg/L
- Includes all dissolved matter – major anions and cations, minor components (metals, metalloids etc) but not gases or organic matter
- Has important properties of itself as well as the various components

Salinity and irrigation

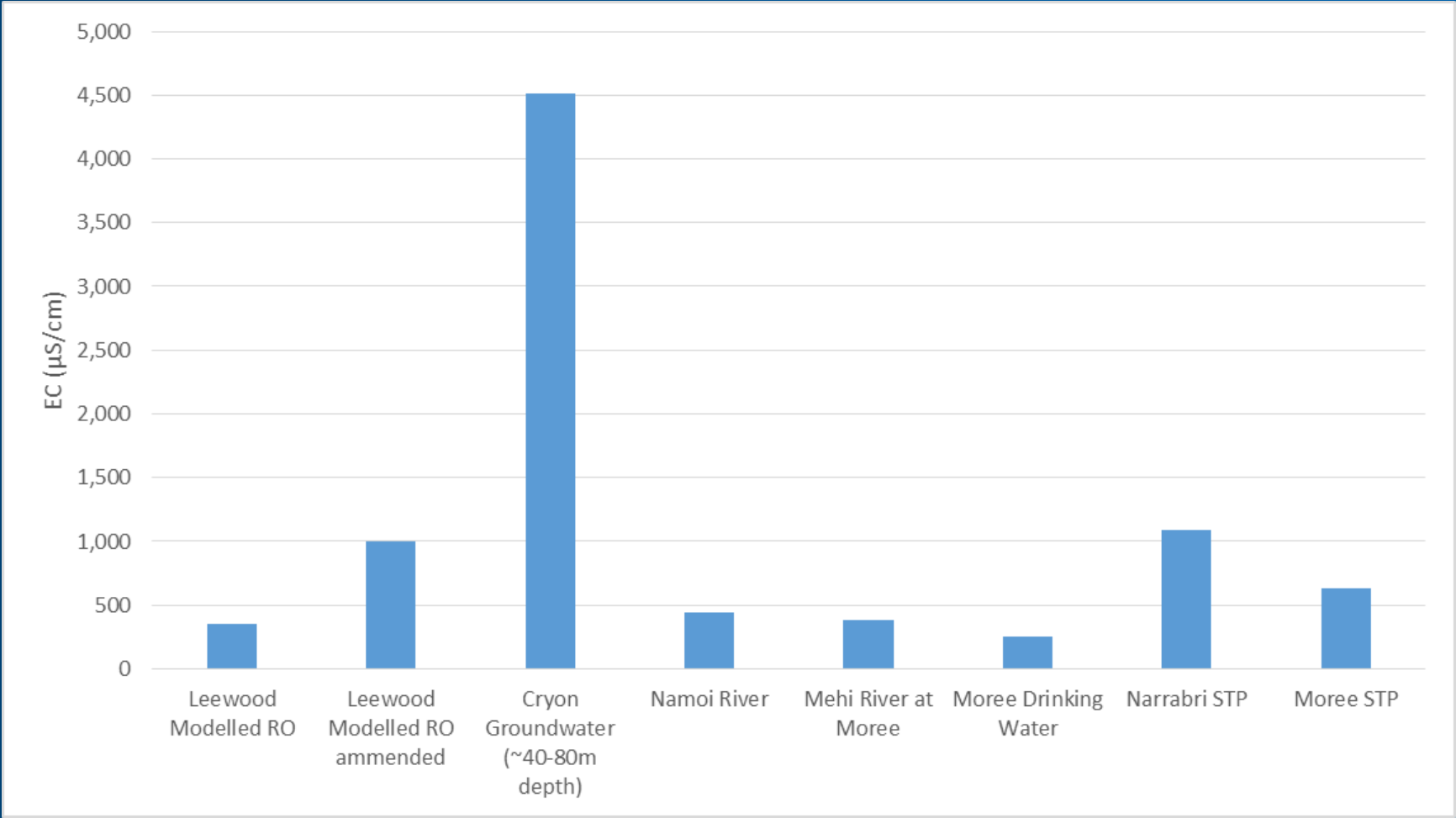
- the effect of irrigation water salinity on land depends on a variety of factors, including:
 - irrigation water quality
 - Salinity, SAR, HCO_3^-
 - soil properties
 - plant salt tolerance
 - climate
 - irrigation management practices

Soil characteristics – salinity related

- Exchangeable sodium percentage
- Average root zone salinity (EC)
- Saturated hydraulic conductivity
- Soil pH
- Effective cation exchange capacity

Water quality of various water sources

	Leewood Modelled RO	Leewood Modelled RO amended	Cryon Groundwater (40-80m depth)	Namoi River	Mehi River at Moree	Moree Drinking Water	Narrabri STP	Moree STP
EC ($\mu\text{S/cm}$)	357	1,000	4,511	443	382	256	1,089	627
TDS (mg/L)	232	<650	2,776	297	269	172	678	461
pH	7.1	7.25	7.42		7.9	7.4	8.6	8.3
Turbidity	<0.5	<1		27	124	0.2		
TP (mg/L)	0.01	6% of feed water	0.099	0.09	0.09		7.28	6.40
TN (mg/L)		50% of feed water		0.55			12.23	5.52
NO ₃ (mg/L)					0.33	3.11	5.80	4.64



Leewood Irrigation Project

- reuse of treated produced water
 - Reverse osmosis and amendment
- combination of centre-pivot and subsurface drip irrigation to irrigate almost 100 hectares
- soil amelioration
 - fertiliser, lime, gypsum
 - deep tillage

Irrigation at Leewood:

- sodic soils
 - soil units in the surface 40 cm exhibit exchangeable sodium percentages (ESP) that rank as a “severe limitation”
 - the ESP of the deeper soil (40 to 100 cm) is also a limitation
- saturated hydraulic conductivity of the subsoil in the range of 1mm/hr

Managing Irrigation at Leewood

- Monitoring
 - Waterlogging
 - Saturated hydraulic conductivity
 - Exchangeable sodium percentage
 - Other soil health indicators
- Irrigation water quality
- Trigger values linked to management responses