

30 September 2022

Attention: Troy Watkins
Visy Albury Pty Ltd
117 RW Henry Drive
Ettamogah NSW 2640
Troy.Watkins@Visy.com.au

BY EMAIL

Dear Troy

Re: Soil monitoring in the tree plantations, crops, and pastures irrigated with treated effluent from the Visy Albury Paper Mill

I refer to the written instructions from yourself to undertake soil monitoring to satisfy the conditions of the NSW EPA Environmental Protection Licence No. 1272 (Licence version date 30-Aug-2022) around the effluent application to land from the Visy Albury Pty Ltd Paper Mill. This assessment is for the use only of Visy Albury Pty Ltd and the NSW EPA for regulatory compliance and is not to be relied upon for any other purpose. No responsibility is accepted to any third party who may use or rely on the whole or any part of the content of this report. Please find as follows the results of the monitoring.

Background

Effluent from the Paper Mill at Albury has been applied to tree plantations since 1995 and to crops and pastures since 2003. Soil monitoring has historically been conducted by Timberlands Research Pty Ltd with a dataset dating back to 1993. McMahon has taken over the soil monitoring in 2021 with the retirement of Timberlands' principal. Visy's Environmental Protection Licence requires that soil monitoring within these areas be conducted annually to assess the capacity of the soil to effectively utilise the effluent, both the hydraulic and nutrient load.

Objective and scope

The objective of this report is to satisfy the conditions of the NSW EPA Environmental Protection Licence No. 1272 around the effluent application to land.

The scope is to conduct soil sampling at predetermined locations, undertake laboratory analysis on the collected samples in line with the required test elements, conduct data trends analysis, and provide a written summary and assessment of the results.

Location and description of the project site and its history

The Mill, tree plantations and crop/pasture areas are located adjacent to the Hume Highway around 12km north of the Albury City centre. The footprint of the Mill is around 60ha within the 1,200ha property with surrounding land use being agricultural, large lot residential and industrial.

The Mill was constructed for newsprint production between 1979 and 1981 with water supplied from the Murray River. The water once used in the Mill is treated and stored in the 60ha storage dam. Excess cooling water is discharged to the Murray River and there is contingency for emergency discharge from the storage dam to the same when the dam level dictates.

Visy purchased the closed Mill in 2019 from Norske Skog and plan to modify it for paper production.

Description of the regional and local environment

The tree plantation and crop/pasture areas lie on south trending undulating low hills and long gently inclined footslopes at an elevation range of around 200-260m. Landform elements include rounded crests and gentle waxing slopes with widely spaced and poorly defined drainages.

Soils consist of deep moderately drained red and yellow podzolic soils on the crests and upper slopes. The footslopes and drainage lines consist of deep poorly drained yellow sodosols. A bleached silty colluvial soil (A2 Horizon) in between the topsoil and clay subsoil is a feature of the footslopes indicating limited drainage.

From the available data groundwater is likely present in a low yielding fractured granite aquifer beneath the site with a gradient assumed to be a muted reflection of the surface topography. Some flow is likely to occur through colluvial soil on footslopes and lower slopes and in drainages in years of above average rainfall.

Albury has a warm temperate climate with cool wet winters and warm dry summers. Rainfall exceeds evaporation on average in the winter months only. The long-term average rainfall for Albury (measured at Hume Reservoir, 10km south of Visy Albury) is 694mm while in the year to date 2022 around 790mm has been recorded. This follows on from another wet year in 2021 with above average rainfall also recorded (around 820mm).

Records of fieldwork and laboratory analysis

As conditioned in the Environmental Protection Licence, samples are required to be tested at four depths (0-10cm, 20-30cm, 50-60cm, and 80-90cm) within the tree plantations and at three depths (0-10cm, 20-30cm and 50-60cm) within the crops and pastures. Chemical physical testing is conducted annually on each sample for pH (H₂O) & CaCl₂, electrical conductivity, extractable sulphate, exchangeable cations (calcium, magnesium, potassium, and sodium). Physical testing is conducted every five years for Emerson aggregate stability (last conducted in 2021). Sampling is conducted at the following locations:

- Tree plantation area: 4 irrigated area sample plots.
- Ettamogah and Maryvale crop/pasture area: 9 irrigated area and 4 control area plots.
- Rosevale crop/pasture area: 3 irrigated area and 1 control area plots.

The tree plantation sample plots consist of 20m transects with samples composited from ten locations from the mound (tree row) and inter-row. The crop/pasture samples plots consist of 30m transects with samples composited from six locations.

During sampling on 31 August and 1 September 2022, plantation sites 21 & 28 contained second rotation eucalyptus plantings; and sites 22 & 23 had second rotation pine plantings. Irrigated plots had rough pasture and lucerne; Maryvale had oats and pasture; and Ettamogah had lucerne and spray fallow.

A plan of the sample locations can be seen in **Attachment A**.

Summary of results

Tree plantation areas – Results can be seen in **Attachment B & Attachment C**.

- Average pH (1:5 CaCl₂) ranged from 6.18 to 7.03 in the upper layers (0-10cm, 20-30cm) and between 6.75 and 6.88 in the subsoil layers (50-60cm, 80-90cm). pH (1:5 CaCl₂) rose from the 2021 results in all layers.
- Average salinity (EC_{se}) ranged from 0.91 to 1.75 dS/m in the upper layers and from 3.45 to 4.04 dS/m in the lower layers. Average salinity rose from the 2021 results in all layers.
- Average exchangeable cations (Ca, Mg, Na) generally increased from 2021 levels, apart from exchangeable potassium which remained relatively steady.
- Average exchangeable sodium percentage (ESP) ranged from 9.20% to 32.00%, with all soil layers experiencing increased levels of ESP from 2021, with the highest increases in the subsoil.
- Average extractable sulphur has marked increases in the subsoil from 2021 while in the surface levels was more subdued. The levels of extractable sulphur in the subsoil are the highest historically recorded.

Crops and pasture areas – Results can be seen in **Attachment C & Attachment D**.

- Average pH (1:5 CaCl₂) ranged from 4.98 to 6.08 in the un-irrigated plots, and between 6.09 and 6.44 in plots irrigated with effluent. Average pH (1:5 CaCl₂) declined slightly from the 2021 results in the un-irrigated and irrigated plots.
- Average salinity (EC_{se}) ranged from 0.43 to 1.23 dS/m in the un-irrigated plots, rising from 2021 levels. In the irrigated plots, average EC_{se} ranged from 0.43 to 1.23 dS/m remaining relatively stable or slightly decreasing from 2021.
- Average exchangeable cations (Ca, Mg, K, Na) generally remained consistent with 2021 levels with some slight variation.
- Average exchangeable sodium percentage (ESP) was recorded as 3.44% (0-10cm), 14.26% (20-30cm) and 21.48% (50-60cm) in the un-irrigated plots rising slightly from 2021 levels. The ESP was recorded at 1.72% (0-10cm), 11.04% (20-30cm) and 16.02% (50-60cm) in the irrigated areas declining slightly from 2021 levels at depth.
- Average extractable sulphur in the un-irrigated plots was similar to or slightly higher than 2021 levels, ranging from 11.6 to 70.0 mg/kg. Levels were similar to or slightly higher than 2021 in the effluent irrigated plots, ranging from 6.92 to 66.25 mg/kg.

Soil salinity – Results can be seen in **Attachment E & Attachment F**.

- Average salinity in the root zone of the plantation areas was 2.1 ± 1.0 dS/m. Plantation soil salinity had previously been declining between 2018 and 2020 but has increased over the last two years.
- Average salinity in the root zone of the effluent irrigated crops and pasture areas was 0.6 ± 0.3 dS/m. The average soil salinity has decreased slightly from 2021.
- Average soil salinity in the root zone of the un-irrigated crops and pasture areas was 0.7 ± 0.4 dS/m. Soil salinity has increased slightly from 2021.
- The coefficient of variation of average soil salinity ranged from 64% (irrigated crops & pasture) to 46% (plantation), which is fairly consistent with previous monitoring results.

Discussion

The tree plantation soil monitoring results show marked increases in salinity, extractable sulphur, and sodium which are more noticeable at depth. The cause of these increases is not clearly understood however a new sampling technique was employed in 2022 where undisturbed soil cores were taken instead of disturbed sampling which has previously been used. The undisturbed sampling gives an accurate representation of soil conditions at discrete depths compared to disturbed sampling, but more data is required to assess if current subsoil levels are a result of more accurate sampling, a short-term trend, or seasonal variation owing to above average rainfall and the potential mobilisation of sulphur and salt stores.

Within the pasture plots (both un-irrigated and irrigated) some minor seasonal variations are noted, these likely attributable to changes in irrigation water quality and the amount of irrigation occurring in 2022 owing to the above average rainfall.

The inherent soil characteristics of the poorly drained yellow sodosols on the footslopes provides some challenges to irrigation management as can be seen by higher sodicity and salinity in the subsoils in the tree plantation, crop, and pasture areas, however average levels of soil salinity remain well below the Load Based Licencing threshold of 4.0 dS/m.

It is recommended that the practice of an annual review of the cropping systems and irrigation management is conducted to ensure the maximum sustainable assimilation of nutrients and hydraulic load is occurring.

If you have any queries about the contents of this letter, please contact the undersigned.

Yours sincerely



David McMahon CEnvP SC

BAppSc SA GradDip WRM MEnvMgmt MALGA MEIANZ MSSA

Limitations and disclaimer

DM McMahon Pty Ltd has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Visy Albury Pty Ltd and the NSW EPA and only those third parties who have been authorised by DM McMahon Pty Ltd to rely on this report. The information contained in this report has been extracted from field and laboratory sources believed to be reliable and accurate. DM McMahon Pty Ltd does not assume any responsibility for the misinterpretation of information supplied in this report. The accuracy and reliability of recommendations identified in this report need to be evaluated with due care according to individual circumstances. It should be noted that the recommendations and findings in this report are based solely upon the said site location and conditions at the time of testing. The results of the said investigations undertaken are an overall representation of the conditions encountered. The properties of the soil and groundwater within the location may change due to variations in ground conditions outside of the tested area. The author has no control or liability over site variability that may warrant further investigation that may lead to significant design changes.

List of attachments

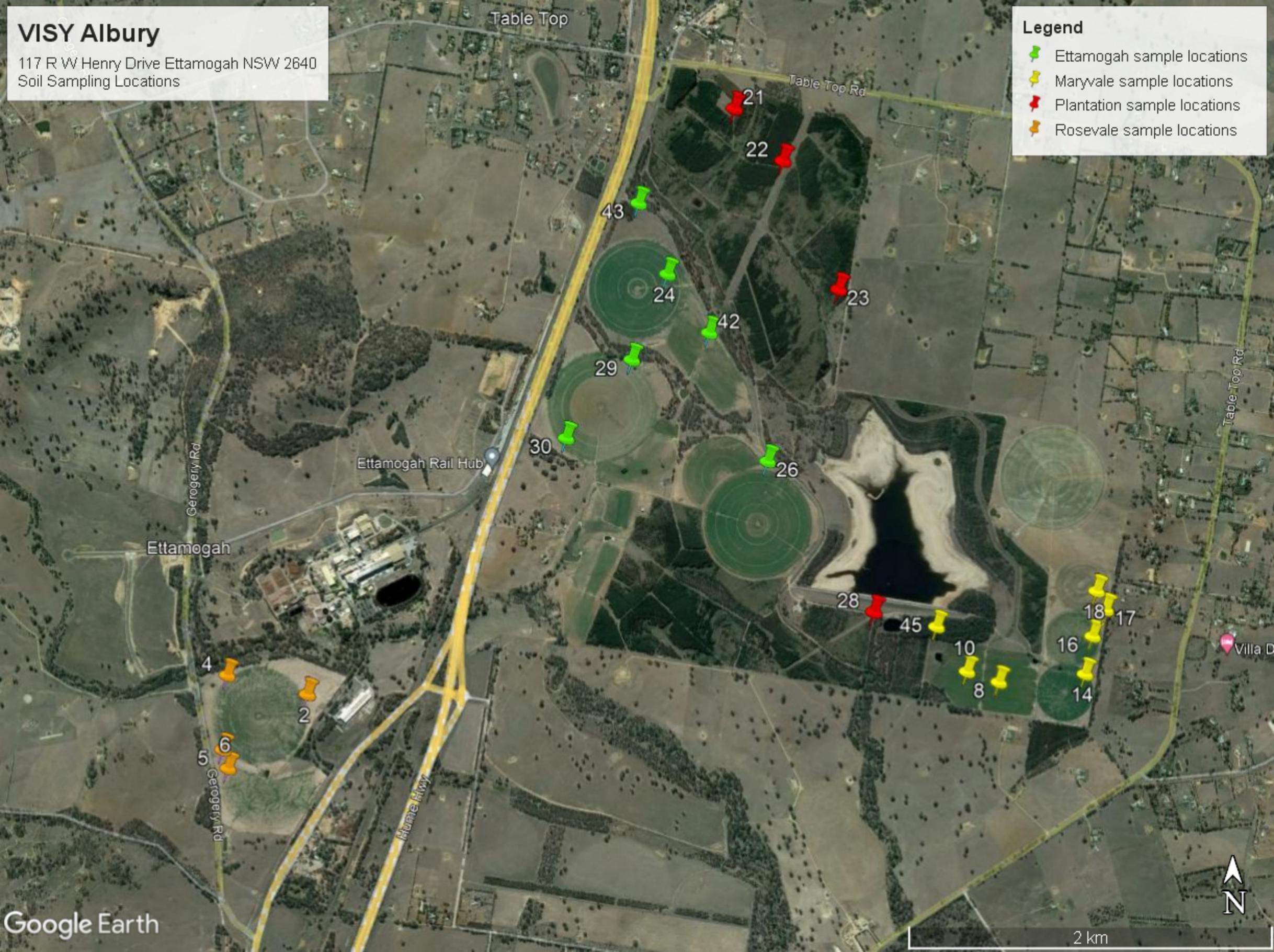
- A.** Sample locations
- B.** Plantation graphs
- C.** Tabulated results
- D.** Crops and pastures graphs
- E.** ECse tabulated results
- F.** ECse graphs

VISY Albury

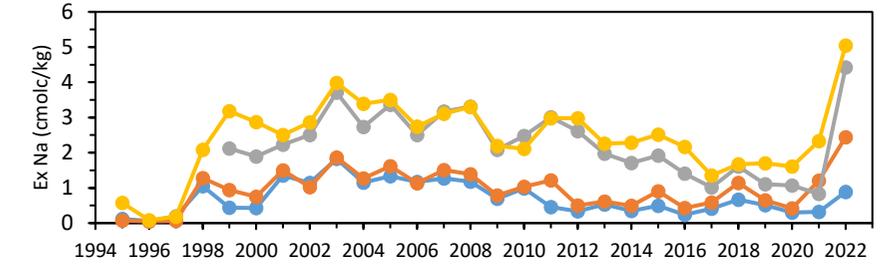
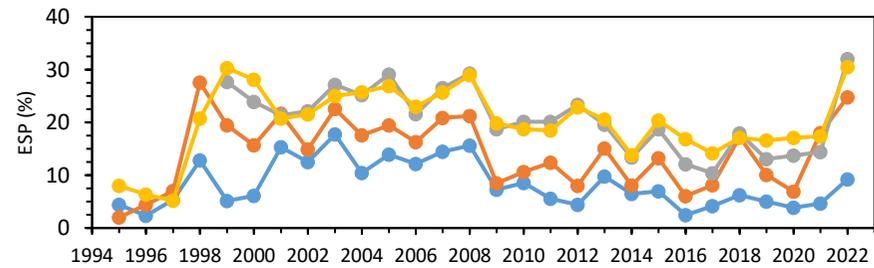
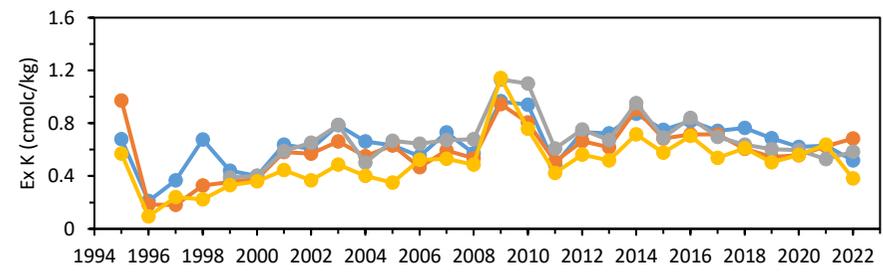
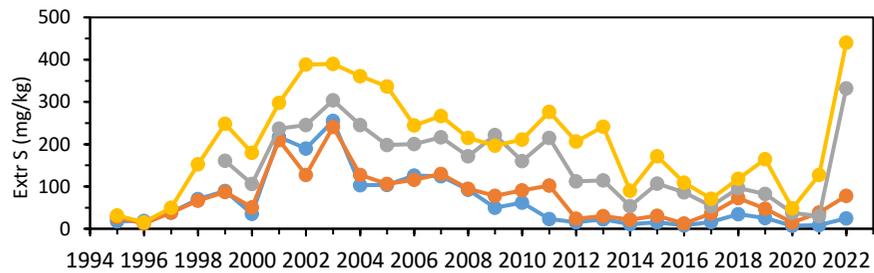
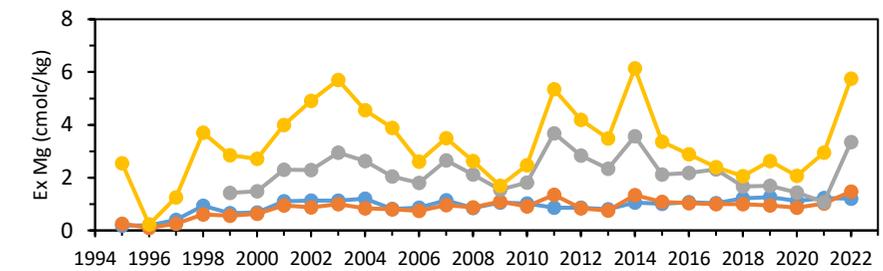
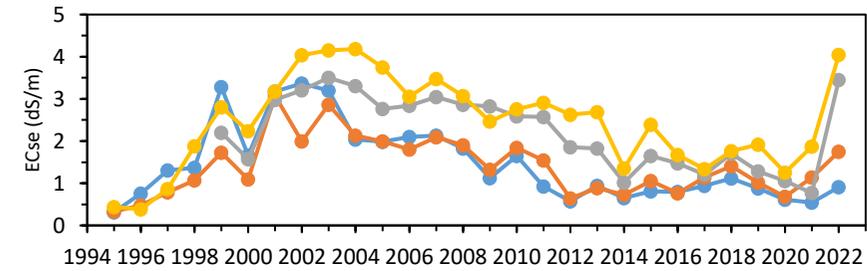
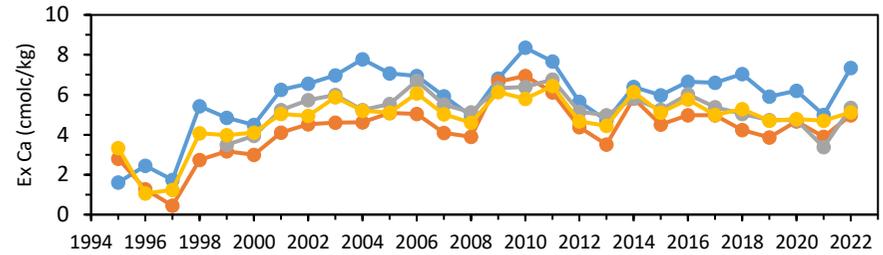
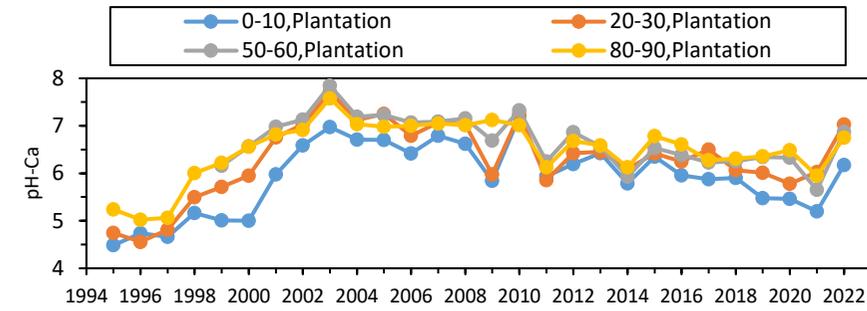
117 R W Henry Drive Ettamogah NSW 2640
Soil Sampling Locations

Legend

-  Ettamogah sample locations
-  Maryvale sample locations
-  Plantation sample locations
-  Rosevale sample locations



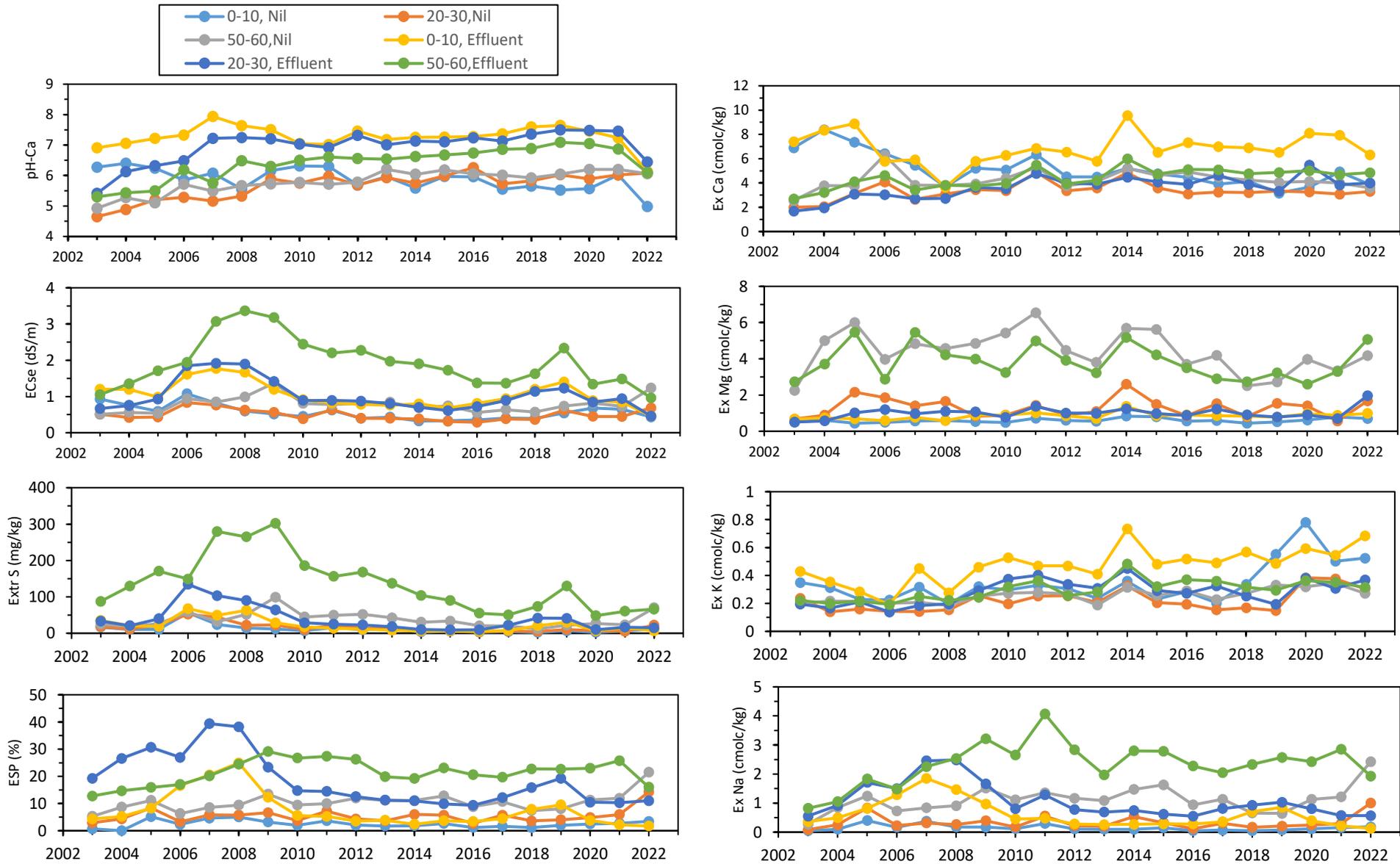
Attachment B: Average pH-Ca, ECse (dS/m), extractable S (mg/kg), ESP (%), and exchangeable cations (cmolc/kg) in effluent irrigated plantation soils since 1995.



Attachment C: Average pH, salinity (EC), extractable S and exchangeable cations in 2022.

Site	Treatment	Layer cm	pH-Ca	pH-W	EC1:5 dS/m	Extr S mg/kg	Ex Ca cmolc/kg	Ex Mg cmolc/kg	Ex K cmolc/kg	Ex Na cmolc/kg	Sum Ex Cat cmolc/kg	Ex Ca/Mg	ESP %	ECse dS/m
Tree Plantation Ettamogah	Effluent	0-10	6.18	7.23	0.13	24.75	7.35	1.20	0.52	0.89	9.88	5.98	9.20	0.91
		20-30	7.03	8.45	0.25	77.50	4.98	1.48	0.69	2.45	9.55	3.65	24.75	1.75
		50-60	6.88	7.68	0.49	332.50	5.35	3.35	0.59	4.43	13.70	1.78	32.00	3.45
		80-90	6.75	7.60	0.58	440.00	5.13	5.75	0.38	5.05	16.33	1.13	30.50	4.04
Crops & Pastures Ettamogah, Maryvale & Rosevale	Nil	0-10	4.98	5.96	0.06	11.60	3.86	0.70	0.52	0.18	5.48	5.22	3.44	0.43
		20-30	6.08	7.42	0.10	22.00	3.30	1.68	0.30	1.00	6.34	2.26	14.26	0.69
		50-60	6.06	7.46	0.18	70.00	3.60	4.18	0.27	2.43	10.68	1.08	21.48	1.23
	Effluent	0-10	6.13	7.13	0.07	6.92	6.33	0.98	0.68	0.13	8.10	7.10	1.72	0.46
		20-30	6.44	7.74	0.07	15.00	4.01	1.97	0.37	0.57	6.89	3.28	11.04	0.46
		50-60	6.09	7.37	0.14	66.25	4.84	5.07	0.32	1.93	12.28	1.25	16.02	0.96

Attachment D: Average pH-Ca, ECse (dS/m), extractable S (mg/kg), ESP (%) and exchangeable cations (cmolc/kg) in crops & pastures soils since 2003.



Attachment E: Average water-use weighted salinity (WUW ECse) in plantation, crop and pasture soils in 2022.

Site	Irrigated (yrs)	WUW ECse (dS/m)		Plots (n)	CoVar (%)
		Average	Std Dev		
Tree Plantation Ettamogah - Pine & Eucalyptus	27	2.1	1.0	4	46
Irrigated Crops & Pastures Ettamogah, Maryvale & Rosevale	19	0.6	0.3	12	47
Unirrigated Crops & Pastures		0.7	0.4	5	64

Attachment F: Average salinity (WUW EC_{se}) in the root zones of plantation soils (0-90cm) and crops & pasture soils (0-60cm) irrigated with effluent.

