'Surveillance sampling to monitor the pH of agricultural soils in areas of existing and emerging soil acidity on Eyre Peninsula 2018-2023'

B Masters, B Hughes, J Telfer, T Wilson, B Armour

'Surveillance sampling to monitor the pH of agricultural soils in areas of existing and emerging soil acidity on Eyre Peninsula 2018-2023'

Information current as of 6th June 2023

All Enquiries

Brian Hughes

Department of Primary Industries and Regions
Nuriootpa Research Centre

Box 245, Nuriootpa SA 5355
M 0429691468
E brian.hughes@sa.gov.au

Contents

EXECUTIVE SUMMARY

Soil acidity is a significant issue on Eastern and Lower Eyre Peninsula estimated to cost the region between $16 and $19 million per year due to lost production (Forward and Hughes 2019). In 2020, DEW estimated around 297,000 ha to be acid prone with around 223,000 ha already at pH levels where acidity is an issue. The areas affected is expected to increase to 487,000 ha by 2050 if acidification from farming systems continue. There is around 100,000 ha with subsurface acidity (often 10-20 cm deep) and a small area with deeper subsoil acidity (below 20cm deep)

This report details activities and results from the Eyre Peninsula Landscape Board (the Board) '*Surveillance sampling to monitor the pH of agricultural soils in areas of existing and emerging soil acidity on Eyre Peninsula 2019-2023'* project, supported by the Board's Regenerative Agriculture Program and funded by the Australian Government's National Landcare Program. The first year of the project (2018-19) was completed as part of the Board's 'Restoring pH balance project in areas with existing soil acidity' project, supported by the Regenerative Agriculture Program and funded by the Australian Government's National Landcare Program. The 2019-2023 project activities consisted of 2 main components which were;

- **Component 1. Undertake soil sampling and reporting for soil pH changes on at least 15 established surveillance sites on Lower Eyre Peninsula and Eastern Eyre Peninsula**
- **Component 2. Undertake sampling of 10 surveillance sites on target soil types in areas with emerging or potential soil acidity issues.**

Soil sampling on 36 existing surveillance sites in 2018-19 and 2019-20 showed a reduction in the proportion of sites with surface soils below the target pH of 5.5 pH_{Ca} since they were last sampled in 2013-2015. This reflects the application of lime to around 50% of these sites by landholders during this period and is indicative of the upward trend of lime applications in the region in recent years (Forward and Hughes, 2019).

There is still a relatively large number of sites with subsurface layers below 5.0 pH_{Ca}, with surface lime applications not necessarily addressing this issue at depth.

Follow up sampling of the existing sites in 2023 showed twenty sites (56%) had surface soils (0-10 cm) below the target value of 5.5 pH_{CaCl2} and 15 sites (42%) below 5.0 pH_{Ca} at the sub-surface out of 36 sites. Lime was used at 12 sites over the last four years and on 26 sites within the last 13 years(lime use now at 72% of sites). Of the un-limed sites 8 out of 10 sites are now below 5.5 pH_{Ca} in the surface layers and requiring liming in the near future otherwise production will be reduced. The introduction of 5 cm intervals for sampling has provided greater information on pH stratification.

Twenty sites were sampled in 2019/2020 and had follow up sampling in 2023 in the 'emerging' soil acidity zone. In 2023 these showed acidification in 65% in the topsoils and 50% in the subsurface layers. In addition, three sites had lime applications which led to pH correction and several sites had ripping/ delving operations undertaken with mixed results. Individual site trends varied significantly between the sampling times depending on the treatment and soil type.

Overall, while there has been some improvement in the existing zone, soil acidity is still an issue and untreated on some farms. Most landholders have commenced a liming program and are aware of issues, such as subsurface acidity and stratification of pH, and how to manage this over the next decade. In the emerging areas a wide range of pH monitoring sites was established, some farmers have commenced liming while others are looking at sandy soil modification techniques to overcome a range of sandy soils issues.

Organic carbon and salinity (EC) values were assessed on some sites in the 2019/2020 samplings and was within the expected ranges for the soil types and the region. Relatively high concentrations of phosphorus (P) on many existing acidity sites may provide the opportunity for landholders to reduce P fertiliser applications for a time and instead apply lime to address soil acidity.

INTRODUCTION

Eyre Peninsula (EP) has an expanding area affected by soil acidity. In 2020 DEW estimated around 297,000 ha of agricultural land to be acid prone with around 223,000 ha already at pH levels where acidity is currently considered an issue. The areas affected are expected to increase to 487,000 ha by 2050 if the acidification within farming systems continue.

There is around 100,000 ha with subsurface acidity (often 10-20 cm deep) and a small area with deeper subsoil acidity (below 20cm deep)

The development of acidity on Eyre Peninsula in previously unaffected areas has been recognised for some time. High-production farming practices will continue to acidify these areas, with the extent of acidic land increasing unless adequate ongoing treatment is implemented.

A number of projects have been delivered on Lower Eyre Peninsula since 2010 looking to quantify acidification rates on Eyre Peninsula. Results from these projects indicate that under current farming practices and recent seasonal conditions acidification is happening faster than was historically estimated (Masters 2016). It was predicted that soil acidification will continue unless regional lime use rates are increased to above the maintenance rate. Most non calcareous soils under cropping regimes are at risk. This will occur more quickly on soils with low pH buffering capacity (i.e. sandy textured soils) where high nitrogen inputs are used, even though the current soil pH may be close to neutral (e.g. pH_{Ca} 6 to 7) (Forward and Hughes 2019).

Average lime use since 1999 is about 77% of the estimated topsoil acidification rate (35,000 tonnes for all acid prone soils), so a lime deficit has accumulated (Forward and Hughes 2019). However, increased lime sales in the region with estimated sales of more than 50,000 t per year since 2018 has started to reduce this deficit (Forward and Hughes 2019, Masters 2020, and Masters 2021 unpublished).

One other method of reducing acidification, such as adding alkaline clay, has been used in some of the sandy areas, particular around Wharminda, Lock and the northern Cleve Hills.

This report details activities and results from the Board s ‘Surveillance sampling to monitor the pH of agricultural soils in areas of existing and emerging soil acidity on Eyre Peninsula 2018-2023’ project, supported by the Regenerative Agriculture Program and funded by the Australian Government’s National Landcare Program in 2019/20, which were;

- **Component 1. Undertake soil sampling and reporting for soil pH changes on at least 15 established surveillance sites on Lower Eyre Peninsula and Eastern Eyre Peninsula-** 36 measured including 20 as part of the first year preliminary project completed as part of the ‘Restoring pH balance project in areas with existing soil acidity’ project (18-19)
- **Component 2. Undertake sampling of 10 surveillance sites on target soil types in areas with of emerging or potential soil acidity issues**- 20 measured in two years

METHOD OF SOIL SAMPLING

SITE IDENTIFICATION AND METHODOLOGY

EXISTING SURVEILLANCE SITES

There were 65 surveillance sites on Lower and Eastern Eyre Peninsula established in 2010, 40 of which were resampled by PIRSA between December 2013 and February 2015 to monitor pH change under agricultural production (Masters 2015). Under the EP Landscape Board’s ‘Restoring soil pH’ project 20 of these 40 sites were resampled by PIRSA in March 2019 (Masters 2019[1]). In 2019-20 the project aimed to revisit at least 15 more of these sites to measure pH changes since the previous sampling, and 16 ‘existing’ surveillance sites (13 in Lower EP and 3 in the Cleve Hills) were sampled by PIRSA and Board staff in March 2020. These sites had follow up samples taken in early 2023. A total of 36 existing sites were re-measured in 2023 with data from earlier data early 2019 and 2020.

Sites were sampled by returning to the GPS co-ordinate in the southwest corner of the 25 x 25 m sampling area and taking 10 soil cores at random within this area to a depth of 20 cm. Surface (0-10 cm) and subsurface (10-20 cm) layers were bulked separately and sent to EP Analysis for analysis of pH, organic carbon, Colwell P and extractable aluminium (Appendix 1and 2). In 2023, samples were taken on a 5cm interval as well, although no phosphorus or carbon measurements were made.

NEW (EMERGING) SURVEILLANCE SITES

In 2019, PIRSA sampled ten new monitoring sites in districts where soil acidity is considered to be an 'emerging' or potential issue and these sites were added to the database of soil acidity surveillance sites in the region (Masters 2019[2]). An additional 10 new 'emerging' acidity surveillance sites were sampled in March 2020, resulting in 20 "emerging" sites which were re-sampled in early 2023.

As soil acidification occurs more rapidly on low buffering soils in high nitrogen input systems it was decided to target sandy soils in the medium rainfall zone for sampling. In 2019, the project concentrated in the Yeelanna and Karkoo districts (Masters 2019[2]) and in 2020 the Ungarra/Moody Centre and Wharminda districts were targeted. (Figure 1 and Appendix 3 and 4)

In consultation with local advisors, farming systems groups and landscapes project officers a list of potential landholder contacts was developed. Landholders were phoned directly with discussion of the emerging acidity issue and the project and asked whether they had a site that could be used to monitor soil pH. Of the 20 new surveillance sites 2 are located in the Ungarra/Moody Centre district, 7 in the Mt Hill/Wharminda district, 3 in Yeelanna, 5 west of Karkoo and 3 near Lock (Figure 1).

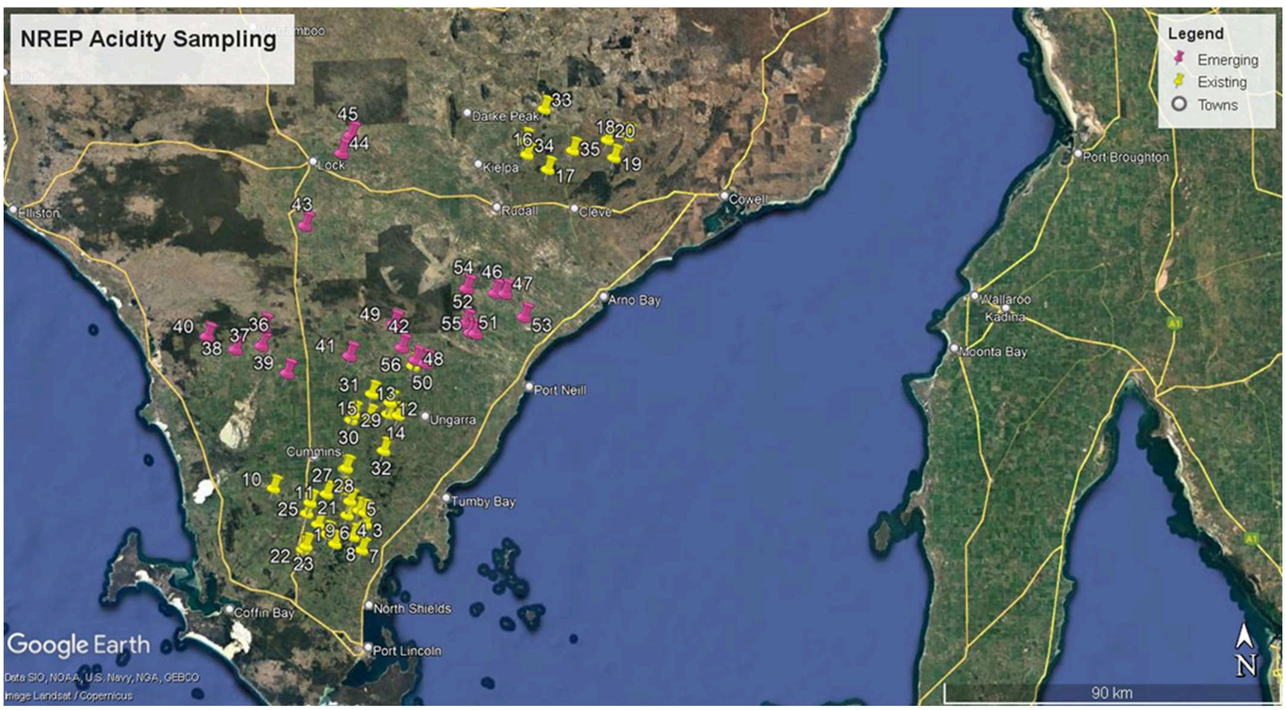


Figure 1. Map showing emerging (pink) and existing (yellow) surveillance sampling sites, 2023

Soil samples were taken to a depth of 20 cm at 10 random locations within a 25 x 25 m sampling area. These samples were bulked in 5 cm increments (0-5, 5-10, 10-15 and 15-20 cm) and a subsample sent to EP Analysis for analysis of pH, EC and extractable Aluminium (Appendix 3 and 4).

As the soil was extremely dry at the time of sampling, and to avoid contamination of the samples from dry surface soil falling down the sampling tube, a combination of sampling techniques was used. The surface layers (0-5 and 5-10 cm) were taken using a collection vial inserted to the appropriate depth and removed using a trowel. The soil was then scraped back to reveal a clean sampling surface at 10 cm below the soil surface and the lower depths were sampled using a hydraulic soil sampling probe. Composite samples from the 0-10 and 10-20 cm depths were also sent for analysis of soil organic carbon (OC) and Colwell P (Appendix 6). This was repeated in 2023 for these sites.

RESULTS OF SAMPLING

Laboratory results were collated and reviewed. Soil pH values were charted against sample depth with these graphs providing a visual representation of the variation in pH down the profile (pH stratification) (Appendix 1 and 3). A summary graph had been sent to the landholder and a detailed site report is being prepared to be sent to each landholder.

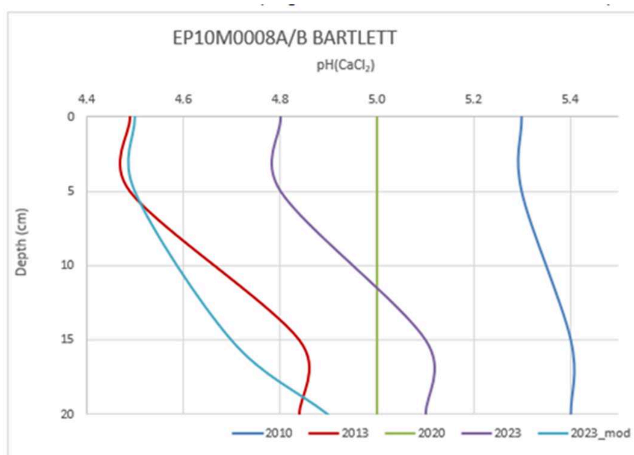
EXISTING SURVEILLANCE SITES

pH and Aluminium results

pH results are presented in Appendix 1 for the existing sites. Each site has been presented with summary information, the comments and recommendations to the landholder and individual graph of results where the different years have been assessed and graphed (see example Figure 2).

The 36 existing surveillance sites sampled including 28 on LEP and 8 EEP sites. These were sampled in 2019 – 20 sites and 2020- 16 sites with follow-up sampling in 2023.

In 2023, twenty sites (56%) had surface soils (0-10 cm) below the target value of 5.5 pH_{Ca} and 15 sites (42%) were below 5.0 pH_{Ca} at the surface (Figure 3) out of 36 sites.



EP10M0008 BARTLETT

BARTLETT	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10M0008A	0	5.3	4.5	5	4.8	4.5	-0.2
	5	5.3	4.5	5	4.8	4.5	-0.2
EP10M0008B	15	5.4	4.8	5	5.1	4.7	0.1
	20	5.4	4.8	5	5.1	4.9	0.1

Figure 2- Example of pH graph by landholder- site

These results show an overall reduction in the proportion of sites with surface soils below 5.5 pH_{Ca} from 69% of sites when surveillance sampling was undertaken around 2010 to 2015 (Masters 2015). There was, however, a slight increase in the proportion of sites with surface soils below 5.0 pH_{Ca}, increasing from 38% when the sites were last sampled to 42% in 2023.

During the 19-20 to 2023 samplings 11 (31%) sites saw acidification of surface soil layers – the remainder either stayed the same or increased and 13 (36%) saw acidification of subsurface soil layers increase by more than 0.1 pH. unit and the remainder either stayed same or increased.

Lime was used at 12 sites over the last four years and on 26 sites within the last 13 years. Of the un-limed sites (10) 8 sites are now below 5.5 pH_{Ca} in the surface layers and requiring liming in the near future otherwise production will be reduced(see Appendix 1).

The concentration of aluminium is very much linked to the pH of soils which is demonstrated in Figure 4 which shows the relationship between $CaCl_2$ Aluminium and pH. Aluminium toxicity seems to be a major factor in the yield reductions related to cereals but sensitive legumes, such as lentils and vetch, seem to have a pH impact from acidity above when aluminium becomes toxic (around 2 mg/kg for sensitive cereals).

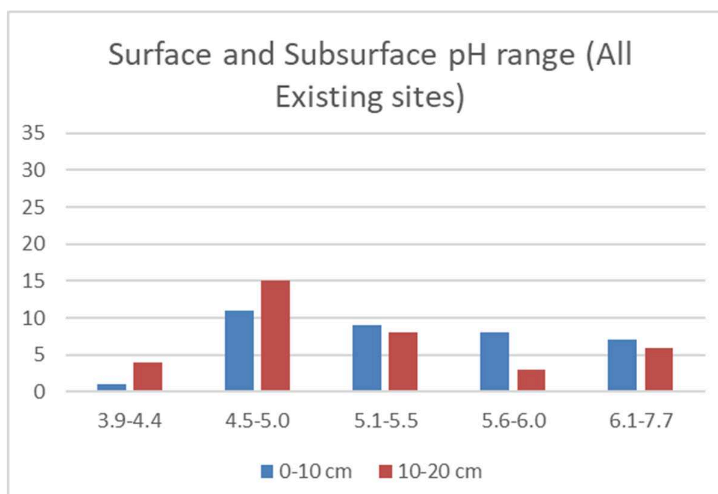


Figure 3- Existing sites pH ranges

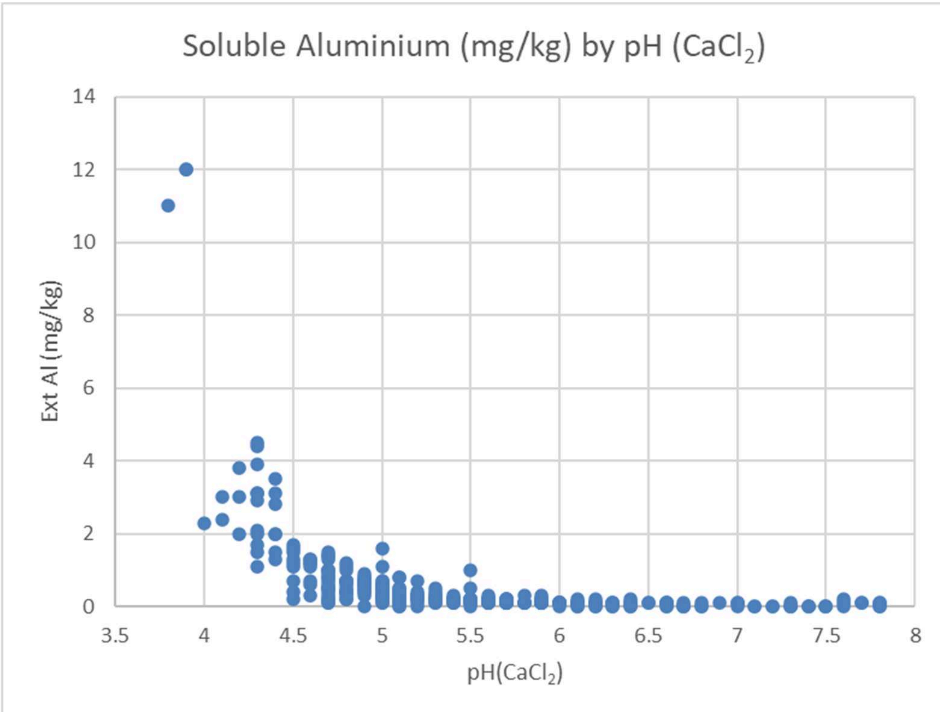


Figure 4- Relationship between soil extractable Al (mg/kg) and soil pH ($CaCl_2$) for all pH data (144 values across 36) from all existing EP sites.

Organic Carbon and Colwell P results – from 19/20 sampling

All sites had surface soil P levels above that considered adequate for crop production (20-35 mg/kg depending on soil type), with many sites having surface P above 50 mg/kg. A high proportion of sites also had Colwell P values above 20 mg/kg in the 10-20 cm layer, indicating some fertiliser leaching at these sites.

NEW (EMERGING) SURVEILLANCE SITES

pH and Aluminium results

Across the 20 sites re- sampled in 2023 (10 in Kapinnie/Brooker/Lock districts in 2019, 10 in Moody/Mt Hill/Wharminda districts in 2020):

- there were thirteen sites which had acidification of surface soil layers (0-10 cm) between 2019/20 and 2023 by more than 0.1 pH unit, this included 50% of the 14 LEP sites , and 75% of the 6 EEP sites in this emerging data set- 65% in total.
- 10 (50 %) sites saw acidification of subsurface soil layers (10-20 cm) between 2019/20 and 2023 by more than 0.1 pH unit.
- Liming was undertaken on 3 (15% of sites) which generally halted or neutralised acidity.
- Ripping/delving had some increases in pH however responses were variable.
- Several sites (15% or 3 sites) recorded improved pH since 2019/20 but have alkaline red brown earths within the same paddock as the pH sampling site. At these sites, the recorded pH increase might be the result of natural variability within the paddock.

Liming was recommended at several sites as can be seen on the recommendations section (see Appendix 3). In Table 1 an analysis is made of the range of pH levels observed in these sites. Some of the emerging sites are still well above critical pH for acidity but in some ways these are the more interesting to study over the next decade or so. When comparing the 2019-2020 data and the 2023 data, it must be remembered that three sites had been limed in this period.

Table 1: Analysis of pH data at different sampling depths in 2019-20 and 2023 at 20 emerging sites

	19-20	19-20	19-20	19-20	23	23	23	23	Comment 2023 data
SOIL DEPTH (cm)	MIN pH (CaCl2)	MAX pH (CaCl2)	MEAN pH (CaCl2)	Range pH (units)	MIN pH (CaCl2)	MAX pH (CaCl2)	MEAN pH (CaCl2)	Range pH (units)	
0-5	4.5	6.5	5.73	2	4.3	7.2	5.6	2.9	7 below 5.5
5-10	4.3	6.4	5.57	2.1	4.3	7.1	5.5	2.8	8 below 5.5
10-15	4.3	7.7	6.08	3.4	4.3	7.6	5.9	3.3	5 below 5.0
15-20	4.5	8	6.65	3.5	4.3	7.8	6.4	3.5	2 below 5.0

Aluminium results were reflective of pH levels and the percentage sand content of the soils. This data was loaded onto the database.

Organic Carbon and Colwell P results

Soil organic carbon values and Colwell P were undertaken in the ten emerging samples in the 2020 sampling set only. Organic carbon results were in the range expected for the targeted soil type (Appendix 4 and Table 2). One of the very sandy sites (EP20S0145-148 Modra) had very low soil organic carbon (<0.5%) at the surface (0-10 cm). Without organic carbon to buffer pH change these soils are at risk of acidifying very quickly.

Table 2. Analysis of Soil Organic Carbon and Colwell P results

	Soil organic carbon in surface layer (0-10 cm)	Soil organic carbon in subsurface layer (10-20 cm)	Cowell P in surface layer (0-10 cm)	Cowell P in subsurface layer (0-10 cm)
min	0.3	0.2	13	11
max	1.3	0.7	30	23
average	0.9	0.4	23	18
range	1.0	0.5	16	12

Most sites (70%) had surface soil Colwell P levels above the minimum considered adequate for crop production on sand (20 mg/kg). Four sites also had Colwell P values above 15 mg/kg in the 10-20 cm layer, indicating some fertiliser leaching at these sites.

SUMMARY AND CONCLUSIONS

In 2019-2020 soil analysis showed a reduction in the proportion of surveillance sites with surface soils below the target pH of 5.5 $CaCl_2$ since last sampled in 2013-2015.

Follow up sampling of the existing sites in 2023 showed twenty sites (56%) had surface soils (0-10 cm) below the target value of 5.5 pH_{Ca} and 15 sites (42%) were below 5.0 pH_{Ca} at the sub-surface out of 36 sites. Lime was used at 12 sites over the last four years and on 26 sites within the last 13 years (lime use now at 72% of sites). Of the un-limed sites , 8 out of 10 sites are now below 5.5 pH_{Ca} in the surface layers and requiring liming in the near future otherwise production will be reduced. The introduction of 5 cm intervals for sampling has provided greater information on pH stratification. The increase in liming over the last four years is a positive that most farmers are now aware and treating acidity, although further work is required. Subsoil issue and stratification issues need further awareness as conventional soil testing will not detect these issues.

Of the emerging sites, twenty sites were sampled in 2019/2020 and had follow up sampling in 2023 in this soil acidity zone. In 2023, these showed acidification in 65% in the topsoils and 50% in the subsurface layers. In addition, three sites had lime applications, which led to pH correction and several sites had ripping/ delving operations undertaken with mixed results. Individual site trends varied significantly between the sampling times depending on the treatment and soil type. The three landholder who commenced liming and the use of other soil modification techniques is positive although further work is required to ensure the use of soil modification is suitable to treat acidification and for how long.

Future Directions

In the existing area the future issues will be more linked to subsurface and stratification issues as famer introduce liming programs. Case studies of these will possibly be more useful than a large number of monitoring sites as often monitoring sites are the first areas limed on farms. It would be useful to re- assess some of the existing acidity monitoring sites, particularly where lime has not been applied or there is the potential for sub-surface acidity or stratification issues- timing should be around the 5 years since liming.

The acidity map for Eyre Peninsula is shown on Figure 5 and highlights that there is a considerable area at risk but yet to develop acidity as well as a large areas where acidity is expanding. Where liming has not commenced or has only a few participants, continued establishment of new acidity and monitoring of existing sites is recommended.

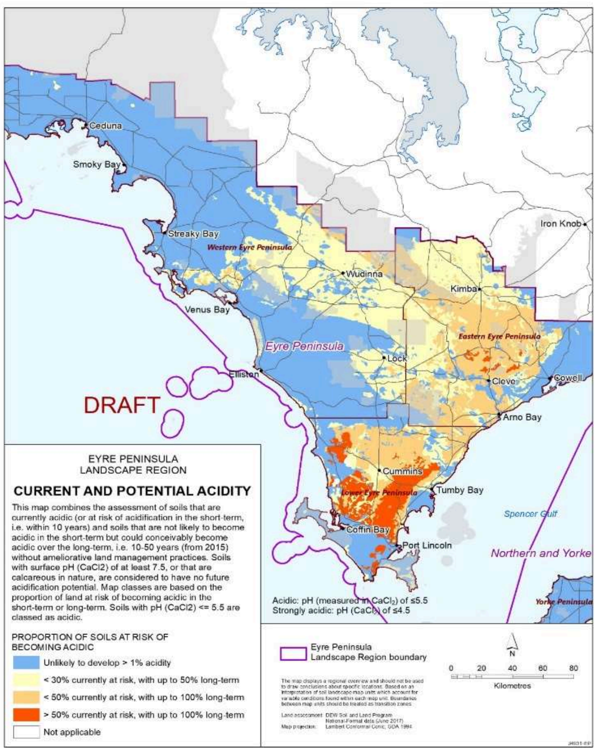


Figure 5 – Current and Potential soil acidity map, Eyre Peninsula, DEW, 2022

Our understanding of how different soil modification techniques on sandy soils affect acidity needs some study. The establishment of new sites in the areas where no sites are existing (see Figure 1) even though that may come back with no issues yet is a useful tool to trace the acidification of profiles. It may be possible to link some of the acidification sites with carbon site set up under other programs. The new sites need to be established as quick as possible.

REFERENCES

Forward, G. and Hughes, B (2019) '*Soil acidity status report for the Eyre Peninsula Natural Resources Management Region*' DEW, September 2019.

Masters, B (2016) 'Managing Soil Acidity on Eyre Peninsula', Final Project Report, PIRSA, June 2016

Masters, B. (2015) '*Awareness of the effects of acidity and low pH on lower EP soils'* Final Project Report, Rural Solutions SA. July 2015.

Masters, B. (2019[1]) *'Restoring Soil pH balance in areas with existing soil acidity 2018-2019.* Final Project Report, PIRSA. June 2019.

Masters, B. (2019[2]) 'Increase awareness of potential acidification on at-risk agricultural land on Lower Eyre Peninsula *2018-2019'.* Final Project Report, PIRSA. June 2019.

Masters, B (2020) 'Surveillance sampling to monitor the pH of agricultural soils in areas of existing and emerging soil acidity on Eyre Peninsula 2019-2023' . Project report. June 2020.

ABBREVIATIONS

Al -	Aluminium
cm-	Centimetres
DEW–	Department for Environment and Water.
EC-	Electrical Conductivity; an indicator of soil salinity
EP -	Eyre Peninsula
EEP -	Eastern Eyre Peninsula.
FASC-	Farming Acid Soils Champions
ha-	hectares
LEADA -	Lower Eyre Agricultural Development Association.
LEP –	Lower Eyre Peninsula
mg/kg -	Milligrams per kilogram, a measure of analyte concentration in soil.
N-	Nitrogen
NLP-	National Landcare Program
P-	Phosphorus
OC -	Organic Carbon
pH-	Potential hydrogen; a measure of soil acidity and alkalinity
pH ($CaCl_2$) -	pH in calcium chloride solution
PIRSA-	Primary Industries and Regions SA
t-	tonnes
t/ha -	tonnes per hectare

APPENDICIES

Appendix 1- RESULTS OF PH ANALYSIS FROM SURVEILLANCE SAMPLING EXISTING SITES – MARCH 2019 – Jan 2023

2023 Sampling site ID	SITE ID	Previous Sampling date	Land holder	Location	Location (Gaps GDA 94, MGA 53S)	Soil texture		Surface pH. CaCl2 (0-10 cm)				Subsurface pH (10-20 cm)				2019/20		(mg/kg)		Lime applications				baseline	
						Surface (0-10 cm)	Subsurface (10-20 cm)	pHCa10	PHCa2015	PHCa2019	pH2023	pHCa10	PHCa2015	PHCa2019	pH2023	surface (0-10 cm)	subsurface (10-20 cm)	surface (0-10 cm)	subsurface (10-20 cm)	Lime 2010 2014	Lime 2014 2019	Lime 2019 2023	Lime 2010 2023	0-10 cm	10-20 cm
1	EP10M0004A/B	2019	GAMEAU	Koppio	571341 E 6181869 N	Loamy Sand	Loamy Sand	4.8	5.3	5.3	5.0	5.7	4.9	5.1	4.7	-0.3	-0.4	1.6	0.9	2.5 t/ha 2011	2.5 t/ha - 2016	Nil	5 t/ha	0.2	-1.0
2	EP10S0001/2	2019	GAMEAU	Koppio	569336 E 6184524 N	Sandy Loam	Light Sandy Clay Loam	5.4	5.0	4.8	4.9	5.6	4.9	4.9	4.9	0.1	0.0	0.6	0.7	Nil	Nil	Nil	Nil	-0.5	-0.7
3	EP10S0003/4	2019	MACDONALD	Koppio	579632 E 6186707 N	Loamy Sand	Light Sandy Clay Loam	5.4	5.0	5.3	5.9	5.4	4.6	5.2	5.3	0.6	0.1	0.2	0.5	4 t/ha (2 t/ha in 2012 and 2014)	4.5 t/ha 2013/18	Nil	4.5 t/ha	0.5	-0.1
4	EP10S0005/6	2019	LETTON	Koppio	579615 E 6189660 N	Coarse loamy sand	Coarse sand	4.8	3.8	4.0	4.8	4.8	3.8	3.9	3.9	0.8	0.0	0.7	12.0	Nil	Nil	3.5 t/ha 2021	3.5 t/ha	0.0	-0.9
5	EP10S0007/8	2019	EAGLE	Koppio	578146 E 6190311 N	Sandy Clay loam	Light Clay	4.9	5.1	4.9	5.0	5.0	4.9	4.9	4.7	0.1	-0.2	0.6	0.4	2.5 t/ha 2011	NR	Nil	2.5 t/ha	0.1	-0.3
6	EP10S0009/10	2019	DENNIS	Koppio	574935 E 6189223 N	Fine sandy loam	Loamy Sand	5.0	4.5	4.7	4.5	4.8	4.7	4.8	4.3	-0.2	-0.5	1.7	3.1	Nil	Nil	Nil	Nil	-0.5	-0.5
7	EP15B00KOPPIO1A/B	2019	LOW	Koppio	578344 E 6179909 N	Sandy Clay loam	Clay loam	5.2	5.0	4.7	5.1	6.2	5.1	5.0	4.8	0.4	-0.2	0.8	0.4	Nil	3 t/ha 2019	Nil	Nil	-0.1	-1.4
8	EP15B00KOPPIO2A/B	2019	DOCKING	Koppio	576264 E 6183521 N	Sandy Clay loam	Clay loam	5.9	4.4	5.3	5.1	6.8	4.9	4.8	4.9	-0.2	0.1	0.5	0.3	Nil	3 t/ha 2017	Nil	3 t/ha	-0.8	-1.9
9	EP10S0035/36	2019	GAMEAU	Koppio	567123 E 6187196 N	Loamy Sand	Loamy Sand	4.6	6.0	5.8	5.7	5.4	4.7	5.6	5.6	-0.1	0.0	0.2	0.1	2.5 t/ha 2013 + lime 2.5 t/ha 2012	ripped 2014	Nil	5 t/ha	1.1	0.2
10	EDILILLIE03A/IE03B	2019	STRAUSS	Edillilie	555805 E 6197132 N	Sandy Loam	Sandy loam	4.9	4.4	4.6	5.3	4.7	4.5	4.4	4.7	0.7	0.3	0.5	1.0	Nil	Nil	NIL	3 t/ha	0.4	0.0
11	EP10M014A/B	2019	MODRA	Edillilie	569769 E 6195023 N	Sandy loam	Sandy loam	4.3	4.6	5.5	6.3	4.9	4.7	4.9	6.1	0.8	1.2	0.1	0.1	2 t/ha 2013	2.5 t/2017	2.5 t/ha 2019/20	7.5 t/ha	2.0	1.2
12	EP10S0019/20	2019	WAGNER	Ungarra	587697 E 6218235 N	Coarse loamy sand	Coarse loamy sand	6.4	6.0	6.1	6.4	6	4.7	5.0	5.3	0.3	0.3	<0.1	0.3	1 t/ha 2010	4.5 t/ha 2013/18	NIL	5.5 t/ha	0.0	-0.7
13	EP10S0021/22	2019	S_TELFER	Ungarra	587000 E 6215269 N	Coarse loamy sand	Coarse loamy sand	5.2	4.3	4.6	5.4	5.6	4.8	4.6	5.0	0.8	0.4	0.3	0.3	Nil	3 t/ha 2017	3 t/ha 2020	6 t/ha	0.2	-0.6
14	EP10S0023/24	2019	PUGSLEY	Ungarra	589643 E 6214755 N	Loamy Sand	Medium Clay	5.4	4.8	5.4	5.2	6.3	6.6	6.6	7.6	-0.2	1.0	0.3	0.1	Nil	Nil	Nil	Nil	-0.2	1.3
15	EP10S0065/66	2019	ADAMS	Cockaleechie	581956 E 6214584 N	Loamy Sand	Loamy Sand	5	5.4	6.2	6.4	4.9	5.0	5.4	5.9	0.2	0.5	0.1	0.2	2.5 t/ha lime 2012/13	1.2 t/ha - 2016	NIL	3.2 t/ha	1.4	1.0
16	EP10S0049/50	2019	EVANS	Gum Flat	626325 E 6285090 N	Loamy Sand	Loamy Sand	4.9	5.5	5.6	5.8	5.9	5.2	5.2	5.0	0.2	-0.2	0.1	0.2	2.5 t/ha 2011	Nil	2 t/ha - 2020	4.5 t/ha	0.9	-0.9
17	EP10S0053/54	2019	Joel NIELD	Gum Flat	632017 E 6277300 N	Sandy Loam	Sandy loam	4.8	4.8	5.6	5.1	5.2	4.4	5.1	6.8	-0.5	1.7	0.2	<0.1	Nil	2.0 t/ha - 2018	NIL	2.0 t/ha	0.3	1.6

2023 Sampling site ID	SITE ID	Previous Sampling date	Land holder	Location	Location (Gaps GDA 94, MGA 53S)	Soil texture		Surface pH. CaCl2 (0-10 cm)				Subsurface pH (10-20 cm)				2019/20		(mg/kg)		Lime applications				baseline	
						Surface (0-10 cm)	Subsurface (10-20 cm)	pHCa10	PHCa2015	PHCa2019	pH2023	pHCa10	PHCa2015	PHCa2019	pH2023	surface (0-10 cm)	subsurface (10-20 cm)	surface (0-10 cm)	subsurface (10-20 cm)	Lime 2010-2014	Lime 2014-2019	Lime 2019-2023	Lime 2010-2023	0-10 cm	10-20 cm
18	EP10S0091/92	2019	Blake Nield	Mangalo	653408 E 6285086 N	Loamy Sand	Sand	NEW	4.8	6.3	5.6	NEW	5.5	7.2	5.4	-0.7	-1.8	0.1	0.1	NEW Site 2015	2.0 t/ha - 2017/18	Nil	2.0 t/ha	0.8	-0.1
19	EP15B00CLEVE2A/B	2019	Paul Briese	Mangalo	649594 E 6279609 N	Loamy Sand	Loamy Sand	4.8	4.7	5.0	5.6	5.1	5.4	4.9	4.7	0.6	-0.2	0.1	0.6	Nil	1.5 t/ha - 2016	Nil	1.5 t/ha	0.8	-0.4
20	EP15B00CLEVE3A/B	2019	Craig Briese	Mangalo	648126 E 6284327 N	Loam	Loam	5.9	5.0	5.1	4.8	6.8	5.4	5.6	5.1	-0.3	-0.5	0.4	<0.1	Nil	Nil	Nil	Nil	-1.1	-1.7
21	EP10M0002A/B	2020	CARR	Koppio	575846 E 6192849 N	Loamy Sand	Loamy Sand	6.0	5.0	4.7	5.6	5.3	4.7	4.6	4.7	0.9	0.1	0.2	0.8	Nil	1.5 t/ha in 2018	2 t/ha - 2020	3.5 t/ha	-0.4	-0.6
22	EP10S0043/44	2020	BYLES	Edillilie	562762 E 6180716 N	Loamy Sand	Loamy Sand	5.6	5.4	5.5	6.2	5.2	4.6	4.5	5.0	0.7	0.5	0.1	0.4	Nil	2.5 t/ha in 2016	Nil	2.5 t/ha	0.6	-0.2
23	EP10S0031/32	2020	PUCKERIDGE	Edillilie	563647 E 6181580 N	Sandy Loam	Sandy loam	4.7	5.0	4.8	4.8	5.2	4.3	4.1	4.3	0	0.2	0.7	1.7	2.0 t/ha	NIL	Nil	2	0.1	-0.9
24	EP10S0033/34	2020	FIEGERT	Edillilie	564290 E 6190160 N	Sandy Loam	Sandy loam	5.2	4.8	4.8	4.4	5.4	4.4	4.4	4.5	-0.4	0.1	2	1.5	Nil	NIL	Nil	Nil	-0.8	-0.9
25	EP10S0037/38	2020	TRELOAR	Edillilie	565364 E 6192949 N	Loamy Sand	Loamy Sand	4.9	5.3	4.8	5.4	5.6	6.2	5.8	5.3	0.6	-0.5	0.1	0.1	Nil	NIL	2 t/ha - 2022	2 t/ha	0.5	-0.3
26	EP15B00KOP3A/B	2020	PIPER	Cummins	574159 E 6195967 N	Fine sandy clay loam	Sandy clay loam	5.5	4.8	5.2	5.5	7.1	4.8	5.1	5.1	0.3	0	0.2	<0.1	Nil, Gypsum 0.5 t/ha 2012	NIL	Nil	Nil	0.0	-2.0
27	EP10M0011A/B	2020	SHEEHAN	Cummins	574858 E 6201407 N	Sandy Loam	Sandy loam	5.8	4.9	4.8	5.7	5.3	4.7	4.3	5.0	0.9	0.7	0.1	0.2	Nil	?	1.8 t/ha in 2021	1.8 t/ha	-0.1	-0.3
28	EP10M0015A/B	2020	LAUBE	Cummins	575326 E 6201585 N	Sandy Loam	Sandy loam	4.3	4.2	4.8	4.9	4.4	4.4	4.2	4.6	0.1	0.4	0.7	0.6	1 t/ha 2012	3 t/ha in 2016	2 t/ha - 2021	6 t/ha	0.6	0.2
29	EP10S0067/68	2020	HOLMAN	Cockaleechie	577920 E 6215712 N	Sandy Clay loam	Medium Clay	6.5	6.0	6.3	6.3	6.3	6.5	7.6	6.6	0	-1	<0.1	0.1	Nil	2.5 t/ha (split application 2018/19)	2 t/ha - 2020	4.5 t/ha	-0.2	0.3
30	EP10S0069/70	2020	HABNER	Cockaleechie	577175 E 6214165 N	Sandy Loam	Clay loam	5.2	5.2	5.7	5.9	6.4	5.3	5.1	5.9	0.2	0.8	0.1	0.1	Nil	2.0 t/ha in 2016	Nil	2.0 t/ha	0.7	-0.5
31	EP10S0077/78	2020	PEARSON	Cockaleechie	582992 E 6220744 N	Light Clay	Light Clay	7.8	7.5	7.3	7.4	7.8	7.7	7.6	7.7	0.1	0.1	<0.1	0.1	Nil	NIL	Nil	Nil	-0.4	-0.1
32	EP10S0079/80	2020	M_TELFER	Ungarra	585392 E 6205719 N	Coarse loamy sand	Loamy Sand	4.7	N.S	5.8	6.6	4.9	N.S	4.9	4.9	0.8	0	0.1	0.8	?	applications of 2.5 t/ha each 2015	1 t/ha-2022	6 t/ha	1.9	0.0
33	EP10M0008A/B	2020	BARTLETT	Gum Flat	631827 E 6293204 N	Loamy Sand	Light Sandy Clay Loam	5.3	4.5	5.0	4.8	5.4	4.8	5.0	5.1	-0.2	0.1	0.4	0.1	Nil	NIL	NIL	Nil	-0.5	-0.3
34	EP10S0051/2	2020	FLAVELL	Gum Flat	626771 E 6281478 N	Loamy Sand	Loamy Sand	6.2	5.9	5.8	5.3	6.0	6.0	5.7	5.2	-0.5	-0.5	0.2	0.2	2.0 t/ha - 2014	Approx 0.5 t/ha in 2015	1.8 t/ha but only spread 2023	0.5 t/ha	-0.9	-0.8
35	EP10S0055/6	2020	HANNEMANN	Gum Flat	638816 E 6281992 N	Clay loam	Medium Clay	5.9	5.9	5.6	5.0	8.2	7.5	7.4	6.6	-0.6	-0.8	<0.1	0.3	Nil	2 t/ha in 2014	Nil	2.0 t/ha	-0.9	-1.6
36	EP10S0029/30	2020	FATCHEN	Ungarra	594215 E 6227500 N	Sand	Sand	6.3	N.S	4.4	4.7	7.7	N.S	4.6	4.4	0.3	-0.2	1.5	2	Nil?	NIL	2.0 t/ha in 2023 - post sampling	NIL	-1.6	-3.3

SITE ID	Previous Sampling date	Landholder	Comments and Recommendations
EP10M0004A/B	2019	GAMEAU	Despite the application of 5 t/ha of lime between 2011 and 2016 improving surface pH compared to the 2010 baseline value at the surface. Surface and subsurface pH values are still well below targets with significant acidification of subsurface layers during this time. A lime application of 2.0 t/ha is recommended and some form of tillage operation might be required to effect pH change in the 10-20 cm layer.
EP10S0001/2	2019	GAMEAU	Surface and subsurface pH are both well below the target values and have recorded significant acidification since baseline sampling in 2010. A lime application of 3 t/ha is recommended and some form of tillage operation might be required to effect pH change in the 10-20 cm layer.
EP10S0003/4	2019	MACDONALD	Regular lime application since 2010 have seen an improvement in surface pH values. However over this time there has been some subsurface acidification. It is recommended that you continue to monitor surface and subsurface pH values and apply lime as required.
EP10S0005/6	2019	LETTON	Although 3.5 t/ha of lime applied in 2021, was effective in improving surface pH compared to 2019 values, both surface and subsurface pH remain well below the recommended target values, with high amount of soluble aluminium which can impact plant growth. A further application of 3.0 t/ha of lime is recommended to bring pH 6.0 CaCl2. A tillage operation might be required to effect pH change in the subsurface layer.
EP10S0007/8	2019	EAGLE	Despite some improvement in pH since the baseline sampling in 2010 (likely the result of the 2.5 t/ha lime application in 2011) pH remains below the target values in both the surface and subsurface layers. As pH has not been maintained above 5.5 CaCl2 at the surface the subsurface (10-20 cm layer) has continued to acidify. A lime application of 3.5 t/ha is recommended to address surface acidification and minimise further subsurface acidification.
EP10S0009/10	2019	DENNIS	Surface and subsurface pH are both well below the target values and have recorded significant acidification since baseline sampling in 2010. This has seen an increase in the amount of soluble aluminium on the site which can affect plant growth. Lime applications of 4 t/ha are recommended to improve surface pH and reduce the risk of further acidification of subsurface layers.
EP15B00KOPPIO1 A/B	2019	LOW	Lime applications prior to planting lucerne in 2019 have improved surface pH. However pH remains below the target surface value of 5.5 CaCl2 and there has been considerable subsurface acidification. A further lime application of 2.5 to 3.0 t/ha is recommended to improve surface pH and minimise the risk of further subsurface acidification.

EP15B00KOPPIO2A/B	2019	DOCKING	Lime applications in 2017 resulted in some soil pH improvement. However since then surface pH has acidified by 0.2 units, with surface and subsurface pH well below target values. A lime application of 2.5 - 3.0 t/ha is recommended to address low pH and reduce the risk of further acidification of subsurface layers.
EP10S0035/36	2019	GAMEAU	pH has not changes since 2019 and is higher than when baseline samples were taken in 2010. Whilst this might be due to some residual benefit from lime applications in 2013/14 there ripping operation in 2014 is also likely to have held this. It is recommended that you continue to monitor pH at the site and apply lime as necessary to reduce the risk of subsurface acidification at the site.
EDILILLIE03A/IE03B	2019	STRAUSS	2023 sampling did not record acidification at this site. This is likely to be a residual benefit from earlier lime applications. As surface pH is below the target 5.5 CaCl2, there is a risk of continued acidification of subsurface layers. A lime application of 2.5 t/ha is recommended to improve surface soil pH. A tillage operation might be required to affect pH change in the acidic subsurface layer.
EP10M014A/B	2019	MODRA	Regular lime applications since 2010 have seen an improvement in surface and subsurface pH values. It is recommended that you continue to monitor surface and subsurface pH values and apply lime as required.
EP10S0019/20	2019	WAGNER	Regular lime applications since 2010 have seen an improvement in surface and subsurface pH values. It is recommended that you continue to monitor surface and subsurface pH values and apply lime as required.
EP10S0021/22	2019	S_TELFER	Lime application have improved surface and subsurface pH at the site. However, surface pH remains slightly below the target of 5.5 and application of a light rate of lime in the order of 1-1.5 t/ha is recommended to reduce the risk of further subsurface acidification.
EP10S0023/24	2019	PUGSLEY	Acidification of the surface layer (0-10 cm) has seen the surface soil at the site drop below the target value of 5.5 CaCl2. Given that the monitoring site is a small area in a highly variable paddock, with shallow alkaline subsoil layers it is recommended that you continue to monitor pH at the site and apply lime as required.
EP10S0065/66	2019	ADAMS	Regular lime applications since 2010 have seen an improvement in surface and subsurface pH values. It is recommended that you continue to monitor surface and subsurface pH values and apply lime as required.
EP10S0049/50	2019	EVANS	Lime applications have resulted in improved surface pH. However, as it has taken time to improve surface pH above the target value 5.5 CaCl2 there has been acidification of subsurface layers during this time. It is recommended that you continue to monitor pH at the site and apply lime as required. Where stratified pH layers exist strategic tillage operations might be required to effect change in the subsurface.

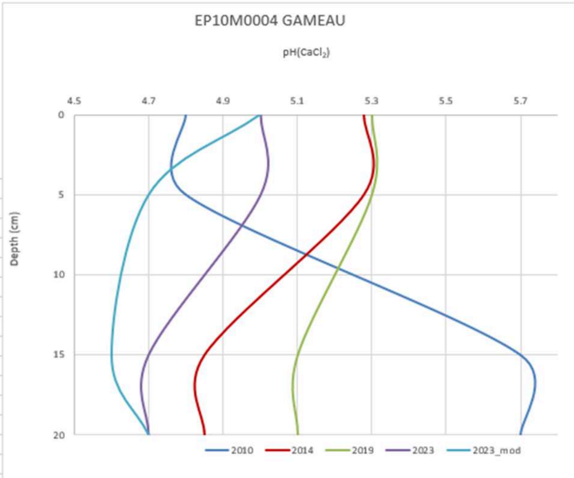
EP10S0053/54	2019	Joel NIELD	Although lime applications in the order of 2.0 t/ha were applied in 2018 the surveillance area at this site has acidified since it was last sampled in 2019. It is recommended that a further lime application of around 2.5 t/ha be applied to increase surface pH above the target value and reduce the risk of further acidifying subsurface layers.
EP10S0091/92	2019	Blake Nield	Although lime applications in the order of 2.0 t/ha were applied in 2017/2018 the surveillance area at this site has acidified since it was last sampled in 2019. It is recommended that a further lime application of 1.0 - 1.5 t/ha be applied to increase surface pH above the target value and reduce the risk of further acidifying subsurface layers.
EP15B00CLEVE2A/B	2019	Paul Briese	Although lime applications in the order of 1.5 t/ha were applied in 2016 which addressed surface acidification to 2023, as it has taken time to bring surface pH above the target 5.5 there has been subsurface acidification at the site. It is recommended that a further lime application of 1.0 - 1.5 t/ha be applied to increase surface pH and reduce the risk of further acidifying subsurface layers.
EP15B00CLEVE3A/B	2019	Craig Briese	There has been continued acidification of both the surface and subsurface layers at this site, with surface pH well below the target value of 5.5 CaCl2. As the site is loamy in texture higher rates of lime are required to change pH by 1 unit. To bring surface pH above the target value and reduce the risk of further subsurface acidification lime applications of 3.5 - 4.0 t/ha are recommended.
EP10M0002A/B	2020	CARR	Regular lime applications since 2010 have seen an improvement in surface and subsurface pH values. However subsurface pH remains below the target value of 5.0 CaCl2 with soil test results showing the presence of some aluminium in soluble forms which can affect plant root growth. A further lime application of 1.0 - 1.5 t/ha is recommended to increase surface pH, restrict the availability of aluminium and reduce the risk of subsurface acidification.
EP10S0043/44	2020	BYLES	Regular lime applications since 2010 have seen an improvement in surface and subsurface pH values. It is recommended that you continue to monitor surface and subsurface pH values and apply lime as required.
EP10S0031/32	2020	PUCKERIDGE	Earlier lime applications seem to have been effective in address acidification since 2019. This might be the result of the site being utilised as a low input pasture during this time. However, pH at the site is well below the target values in both the surface and subsurface layers. Additionally soil sampling has measure soluble aluminium approaching the range that can affect the growth of plant roots. Subsurface acidity can be difficult and expensive to treat. A lime application of 2.5 - 3.0 t/ha is recommended to improve surface pH and reduce the risk of further subsurface acidification. A strategic tillage operation might be required to effect pH change in subsurface layers.

EP10S0033/34	2020	FIEGERT	Soil pH at the site continues to be well below the target values in both the surface and subsurface layers. Soil sampling also shows soluble aluminium at levels which can affect plant root growth. It is recommended that lime be applied at 3.5 t/ha to increase surface pH above the target value of 5.5 CaCl2 and reduce the risk of further acidification of subsurface layers. A strategic tillage operation might be required to effect pH change in the subsurface layer.
EP10S0037/38	2020	TRELOAR	Lime applications have been effective in improving surface pH. However as surface pH fell below the target of 5.5 CaCl2 there was acidification of the subsurface layer. A further lime application of 1.5 t/ha is recommended to improve surface pH and reduce the risk of further subsurface acidification.
EP15B00KOP3A/B	2020	PIPER	Surface and subsurface pH has not changed at the site since 2020. It is recommended that you continue to monitor pH at the site and apply lime as required.
EP10M0011A/B	2020	SHEEHAN	Lime applications have improved the pH of both surface and subsurface layers at the site. It is recommended that you continue to monitor pH at the site and apply lime as required.
EP10M0015A/B	2020	LAUBE	Regular lime applications have improved the pH of both surface and subsurface layers at the site. However, both surface and subsurface layers remain well below the target pH values (5.5 CaCl2 at the surface and 5.0 CaCl2 in the 10-20 cm layer). A further lime application of 2.0 t/ha is recommended to address low surface pH and a strategic tillage operation might be required to effect pH change in the subsurface layer.
EP10S0067/68	2020	HOLMAN	Lime applications have been effective in improving pH at this site. It is recommended that you continue to monitor pH change and apply lime as required.
EP10S0069/70	2020	HABNER	Lime applications have been effective in improving pH at this site. It is recommended that you continue to monitor pH change and apply lime as required.
EP10S0077/78	2020	PEARSON	This site remains well above the target pH value of 5.5 CaCl2. It is recommended that you continue to monitor for any pH changes resulting from production at the site.
EP10S0079/80	2020	M_TELFER	Lime applications have been effective in improving pH at this site. It is recommended that you continue to monitor pH change and apply lime as required.
EP10M0008A/B	2020	BARTLETT	This site has continued to acidify since 2020 and is well below the target pH of 5.5 CaCl2 at the surface. A lime application of 2.0 t/ha is recommended to improve surface pH and reduce the risk of subsurface layers acidifying.
EP10S0051/2	2020	FLAVELL	This site has continued to acidify since 2020 and is still below the target pH of 5.5 CaCl2 at the surface. A lime application of around 1.5 - 2.0 t/ha is recommended to improve surface pH and reduce the risk of subsurface layers acidifying. (NB. I understand that this site has lime applied at around 1.8 t/ha in early 2023, which should be effective in addressing the current pH values at this time).

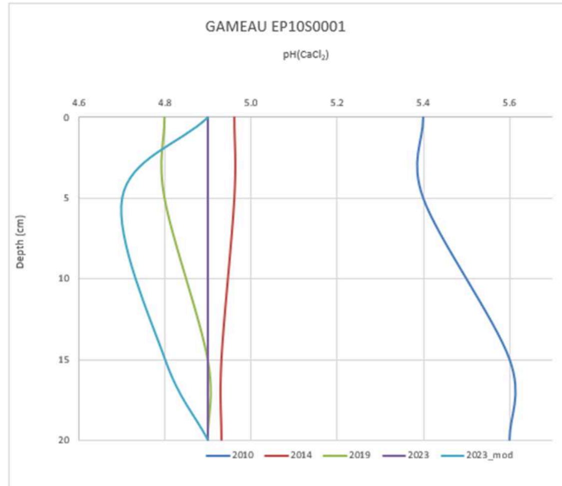
EP10S0055/6	2020	HANNEMANN	Whilst the 2014 lime application was effective in slowing acidification at the site, results indicate significant soil acidification between 2020 and 2023 with surface pH on the surveillance site below the target pH value of 5.5 CaCl2. Given the highly variable nature of this paddock with shallow highly alkaline subsurface layers it is recommended that you continue to monitor surface pH at the site and apply lime where required.
EP10S0029/30	2020	FATCHEN	Sampling results at this site indicated that pH is well below the target value of 5.5 CaCl2 at the surface, and acidification has also seen the 10-20 cm layer fall below the target of 5.0 in the subsurface. As a result soil sampling has highlighted the presence of soluble aluminium in concentrations which can affect the growth of sensitive crop and pasture varieties. A lime application of 3.0 t/ha is recommended to improve surface pH. A strategic tillage operation might be required to effect pH change in the subsurface layer. (NB. I understand that this site has lime applied at around 1.8 t/ha in early 2023, which should be effective in addressing the current pH values at this time).

CHANGE IN PH OVER TIME PROFILE CHARTS – Existing 2019

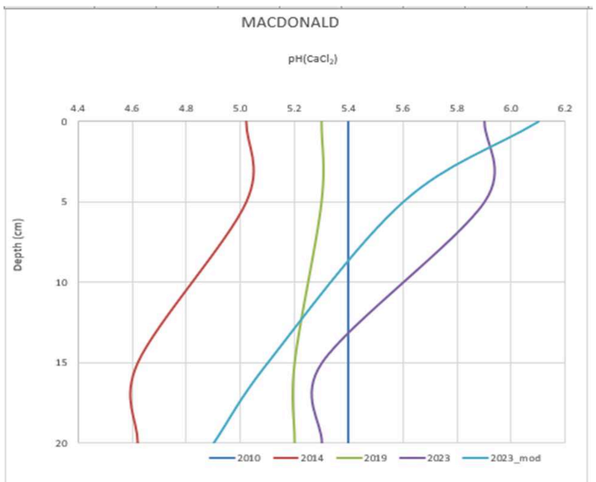
Note* 2023-mod is modified 2023 sampling data at 5 cm increments to 20 cm. Other samples are in 10 cm increments.



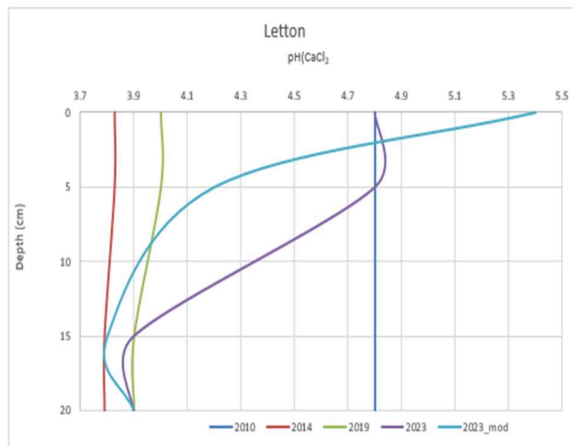
GAMEAU	DEPTH		2010	2014	2019	2023	2023_mo	Chang
EP10M0004A	0	0-10	4.8	5.3	5.3	5	5	-0
	5	0-10	4.8	5.3	5.3	5	4.7	-0
EP10M0004B	15	10-20	5.7	4.9	5.1	4.7	4.6	-0
	20	10-20	5.7	4.9	5.1	4.7	4.7	-0



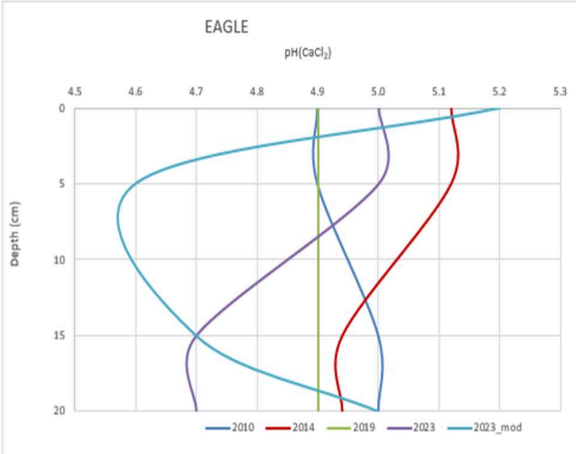
GAMEAU			2010	2014	2019	2023	2023_mo	Change
EP10S0001	0	0-10	5.4	5.0	4.8	4.9	4.9	0.1
	5	0-10	5.4	5.0	4.8	4.9	4.7	0.1
EP10S0002	15	10-20	5.6	4.9	4.9	4.9	4.8	0.0
	20	10-20	5.6	4.9	4.9	4.9	4.9	0.0



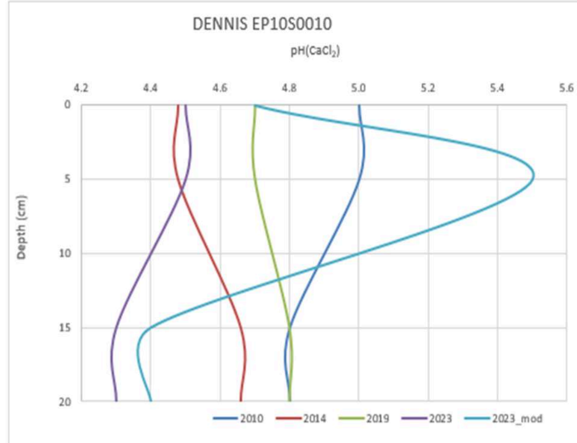
MACDONALD			2010	2014	2019	2023	2023_mo	Change
EP10S0003	0	0-10	5.4	5.0	5.3	5.9	6.1	0.6
	5	0-10	5.4	5.0	5.3	5.9	5.6	0.6
EP10S0004	15	10-20	5.4	4.6	5.2	5.3	5.1	0.1
	20	10-20	5.4	4.6	5.2	5.3	4.9	0.1



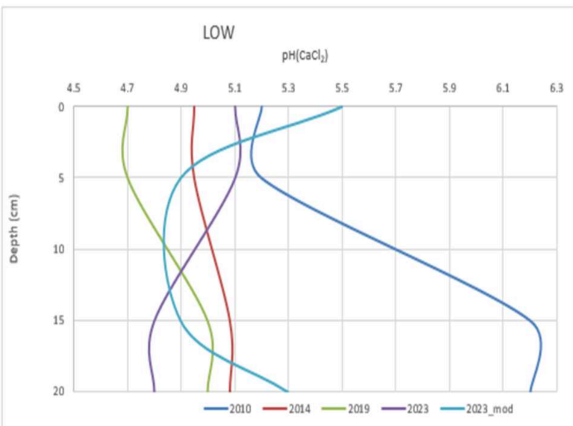
LETTON			2010	2014	2019	2023	2023_mo	Change
EP10S0005	0	0-10	4.8	3.8	4.0	4.8	5.4	0.8
	5	0-10	4.8	3.8	4.0	4.8	4.2	0.8
EP10S0006	15	10-20	4.8	3.8	3.9	3.9	3.8	0.0
	20	10-20	4.8	3.8	3.9	3.9	3.9	0.0



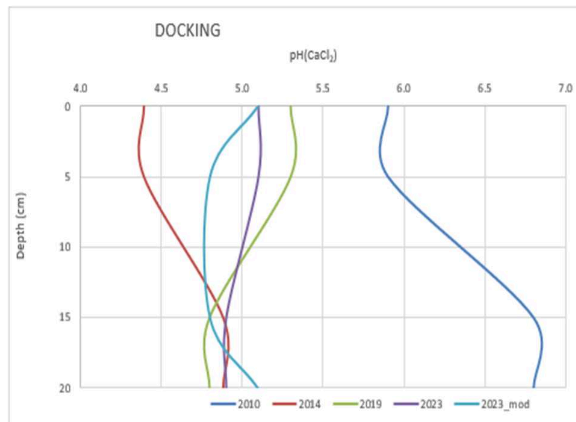
EAGLE			2010	2014	2019	2023	2023_mo	Change
EP10S0007	0	0-10	4.9	5.1	4.9	5	5.2	0.1
	5	0-10	4.9	5.1	4.9	5	4.6	0.1
EP10S0008	15	10-20	5.0	4.9	4.9	4.7	4.7	-0.2
	20	10-20	5.0	4.9	4.9	4.7	5	-0.2



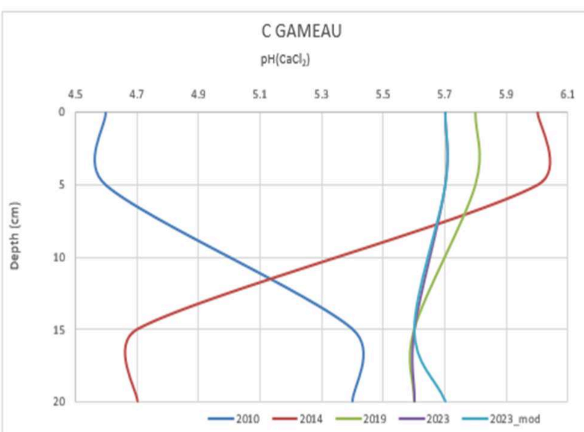
DENNIS			2010	2014	2019	2023	2023_mo	Change
EP10S0009	0	0-10	5.0	4.5	4.7	4.5	4.7	-0.2
	5	0-10	5.0	4.5	4.7	4.5	5.5	-0.2
EP10S0010	15	10-20	4.8	4.7	4.8	4.3	4.4	-0.5
	20	10-20	4.8	4.7	4.8	4.3	4.4	-0.5



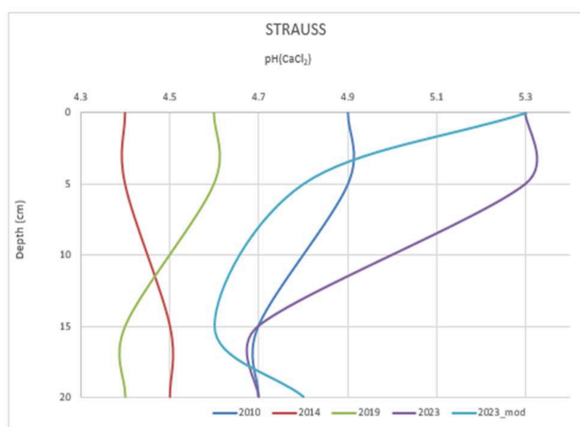
LOW			2010	2014	2019	2023	2023_mo	Change
EP15B00KOPPIO1	0	0-10	5.2	5.0	4.7	5.1	5.5	0.4
	5	0-10	5.2	5.0	4.7	5.1	4.9	0.4
EP15B00KOPPIO1E	15	10-20	6.2	5.1	5.0	4.8	4.9	-0.2
	20	10-20	6.2	5.1	5.0	4.8	5.3	-0.2



DOCKING			2010	2014	2019	2023	2023_mo	Change
EP15B00KOPPIC	0	0-10	5.9	4.4	5.3	5.1	5.1	-0.2
	5	0-10	5.9	4.4	5.3	5.1	4.8	-0.2
EP15B00KOPPIC	15	10-20	6.8	4.9	4.8	4.9	4.8	0.1
	20	10-20	6.8	4.9	4.8	4.9	5.1	0.1

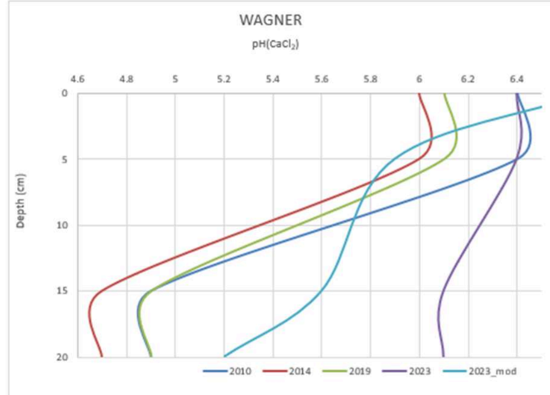


C GAMEAU			2010	2014	2019	2023	2023_mo	Change
EP10S0035	0	0-10	4.6	6.0	5.8	5.7	5.7	-0.1
	5	0-10	4.6	6.0	5.8	5.7	5.7	-0.1
EP10S0036	15	10-20	5.4	4.7	5.6	5.6	5.6	0.0
	20	10-20	5.4	4.7	5.6	5.6	5.7	0.0

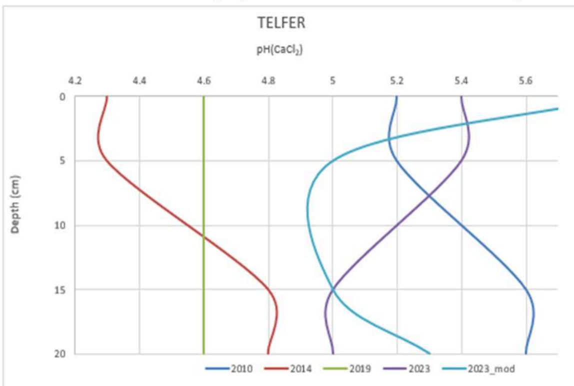


STRAUSS			2010	2014	2019	2023	2023_mo	Change
EDILILLIE03A	0	0-10	4.9	4.4	4.6	5.3	5.3	0.7
	5	0-10	4.9	4.4	4.6	5.3	4.8	0.7
EDILILLIE03B	15	10-20	4.7	4.5	4.4	4.7	4.6	0.3
	20	10-20	4.7	4.5	4.4	4.7	4.8	0.3

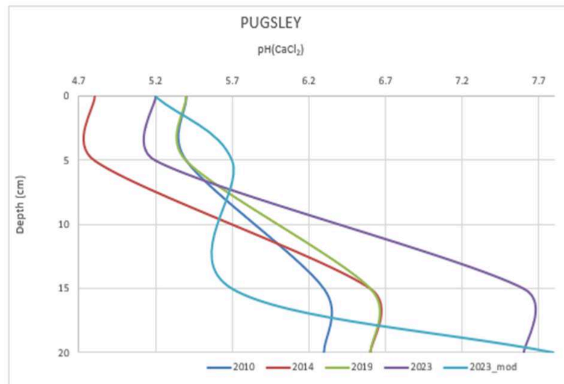
MODRA			2010	2014	2019	2023	2023_mo	Change
EP10M014	0	0-10	4.3	4.6	5.5	6.3	6.4	0.8
	5	0-10	4.3	4.6	5.5	6.3	6.4	0.8
EP10M014	15	10-20	4.9	4.7	4.9	6.1	6.2	1.2
	20	10-20	4.9	4.7	4.9	6.1	6.1	1.2



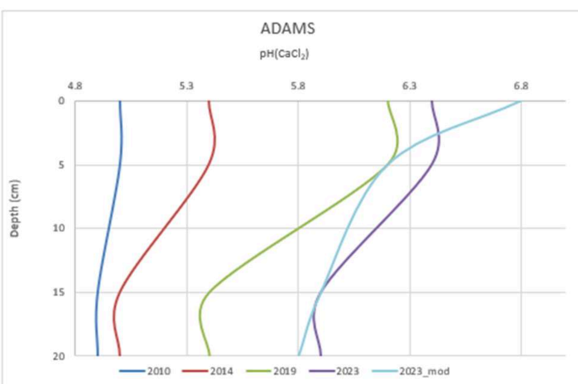
WAGNER			2010	2014	2019	2023	2023_mo	Change
EP10S0019	0	0-10	6.4	6.0	6.1	6.4	6.7	0.3
	5	0-10	6.4	6.0	6.1	6.4	5.9	0.3
EP10S0020	15	10-20	4.9	4.7	4.9	6.1	5.6	1.2
	20	10-20	4.9	4.7	4.9	6.1	5.2	1.2



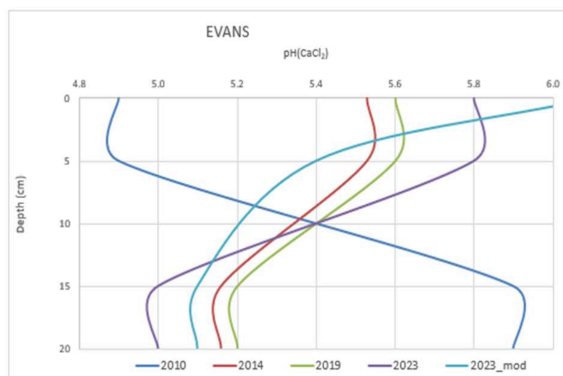
S TELFER			2010	2014	2019	2023	2023_mo	Change
EP10S0021	0	0-10	5.2	4.3	4.6	5.4	5.9	0.8
	5	0-10	5.2	4.3	4.6	5.4	5	0.8
EP10S0022	15	10-20	5.6	4.8	4.6	5	5	0.4
	20	10-20	5.6	4.8	4.6	5	5.3	0.4



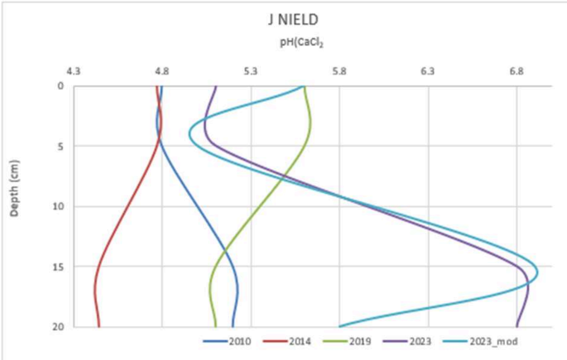
PUGSLEY			2010	2014	2019	2023	2023_mo	Change
EP10S0023	0	0-10	5.4	4.8	5.4	5.2	5.2	-0.2
	5	0-10	5.4	4.8	5.4	5.2	5.7	-0.2
EP10S0024	15	10-20	6.3	6.6	6.6	7.6	5.7	1.0
	20	10-20	6.3	6.6	6.6	7.6	7.8	1.0



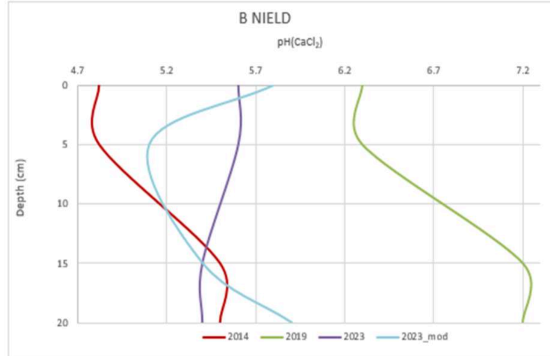
ADAMS			2010	2014	2019	2023	2023_mo	Change
EP10S0065	0	0-10	5	5.4	6.2	6.4	6.8	0.2
	5	0-10	5	5.4	6.2	6.4	6.2	0.2
EP10S0066	15	10-20	4.9	5.0	5.4	5.9	5.9	0.5
	20	10-20	4.9	5.0	5.4	5.9	5.8	0.5



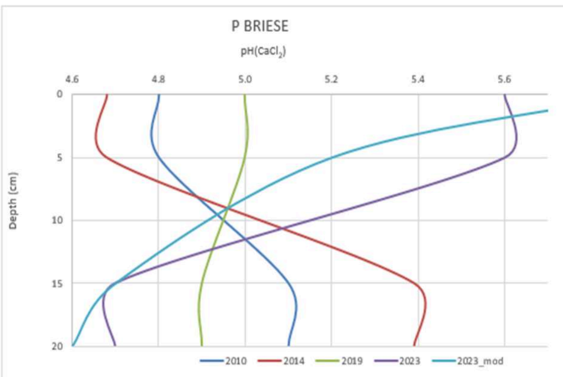
EVANS			2010	2014	2019	2023	2023_mo	Change
EP10S0049	0	0-10	4.9	5.5	5.6	5.8	6.1	0.2
	5	0-10	4.9	5.5	5.6	5.8	5.4	0.2
EP10S0050	15	10-20	5.9	5.2	5.2	5	5.1	-0.2
	20	10-20	5.9	5.2	5.2	5	5.1	-0.2



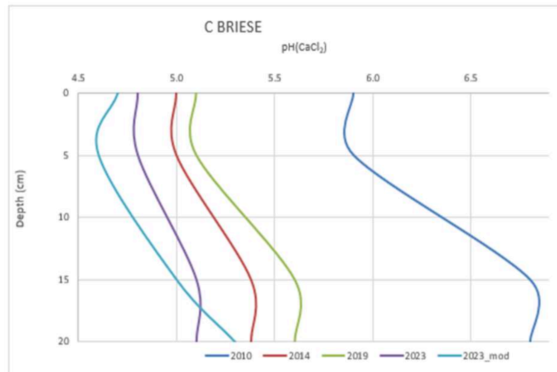
J NIELD			2010	2014	2019	2023	2023_mo	Change
EP10S0053	0	0-10	4.8	4.8	5.6	5.1	5.6	-0.5
	5	0-10	4.8	4.8	5.6	5.1	5	-0.5
EP10S0054	15	10-20	5.2	4.4	5.1	6.8	6.9	1.7
	20	10-20	5.2	4.4	5.1	6.8	5.8	1.7



B NIELD			2010	2014	2019	2023	2023_mod	Change
EP10S0091	0	0-10	NS	4.8	6.3	5.6	5.8	-0.7
	5	0-10	NS	4.8	6.3	5.6	5.1	-0.7
EP10S0092	15	10-20	NS	5.5	7.2	5.4	5.4	-1.8
	20	10-20	NS	5.5	7.2	5.4	5.9	-1.8



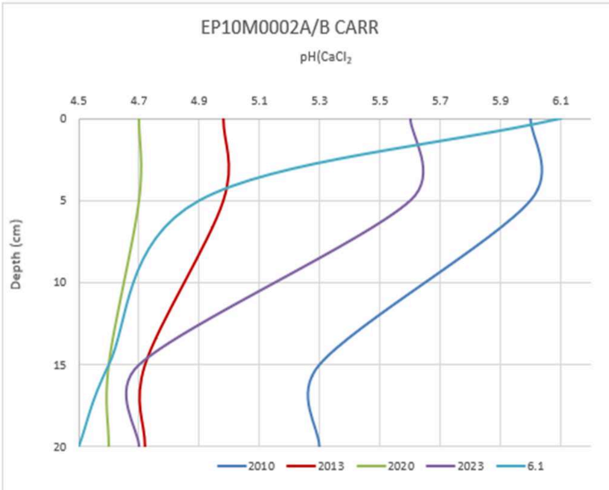
P BRIESE			2010	2014	2019	2023	2023_mo	Change
EP15B00CLEVE2A	0	0-10	4.8	4.7	5.0	5.6	5.9	0.6
	5	0-10	4.8	4.7	5.0	5.6	5.2	0.6
EP15B00CLEVE2B	15	10-20	5.1	5.4	4.9	4.7	4.7	-0.2
	20	10-20	5.1	5.4	4.9	4.7	4.6	-0.2



C BRIESE			2010	2014	2019	2023	2023_mo	Change
EP15B00CLEVE	0	0-10	5.9	5.0	5.1	4.8	4.7	-0.3
	5	0-10	5.9	5.0	5.1	4.8	4.6	-0.3
EP15B00CLEVE	15	10-20	6.8	5.4	5.6	5.1	5	-0.5
	20	10-20	6.8	5.4	5.6	5.1	5.3	-0.5

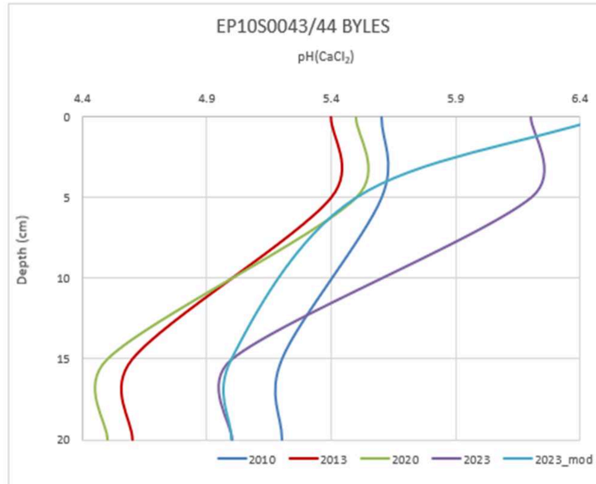
CHANGE IN PH OVER TIME PROFILE CHARTS- Existing 2020

Note* 2023-mod is modified 2023 sampling data at 5 cm increments to 20 cm. Other samples are in 10 cm increments.



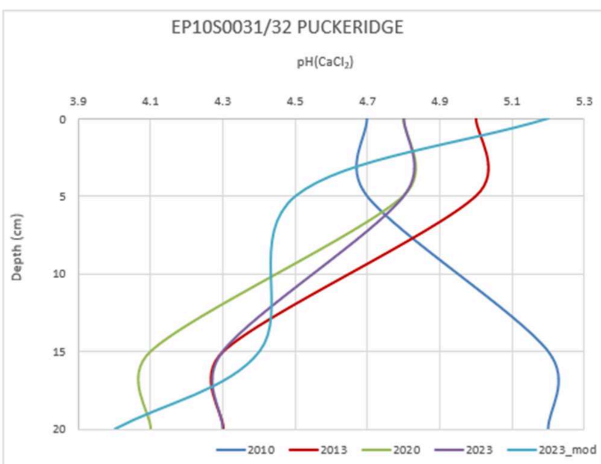
EP10M0002 CARR

CARR	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10M0002	0	6.0	5.0	4.7	5.6	6.1	0.9
	5	6.0	5.0	4.7	5.6	4.9	0.9
EP10M0002B	15	5.3	4.7	4.6	4.7	4.6	0.1
	20	5.3	4.7	4.6	4.7	4.5	0.1



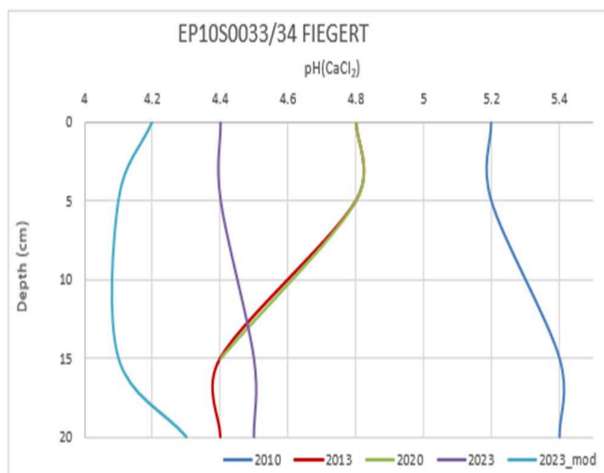
EP10S0043/44 BYLES

BYLES	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10S004	0	5.6	5.4	5.5	6.2	6.5	0.7
	5	5.6	5.4	5.5	6.2	5.5	0.7
EP10S004	15	5.2	4.6	4.5	5	5	0.5
	20	5.2	4.6	4.5	5	5	0.5



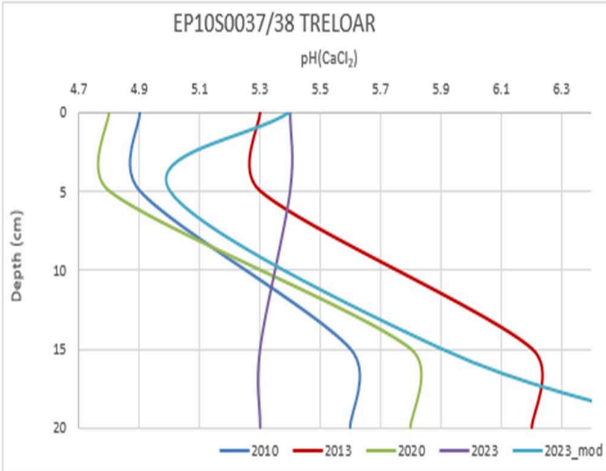
EP10S0031/32 PUCKERIDGE

PUCKERIDG	DEPTH	2010	2013	2020	2023	2023_mo	Change
EP10S0031	0	4.7	5	4.8	4.8	5.2	0.0
	5	4.7	5	4.8	4.8	4.5	0.0
EP10S0032	15	5.2	4.3	4.1	4.3	4.4	0.2
	20	5.2	4.3	4.1	4.3	4	0.2



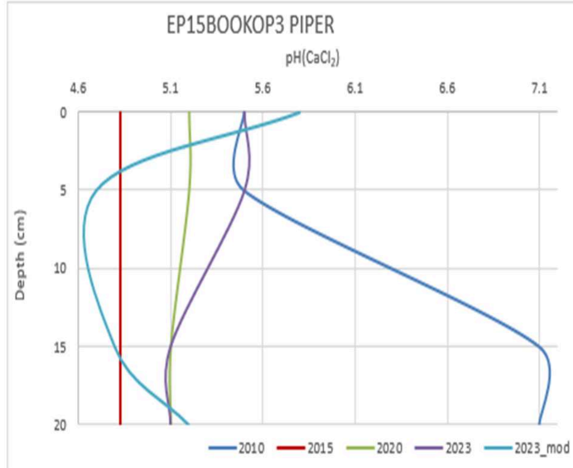
EP10S0033/34 FIEGERT

FIEGERT	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10S0033 F	0	5.2	4.8	4.8	4.4	4.2	-0.4
	5	5.2	4.8	4.8	4.4	4.1	-0.4
EP10S0034	15	5.4	4.4	4.4	4.5	4.1	0.1
	20	5.4	4.4	4.4	4.5	4.3	0.1



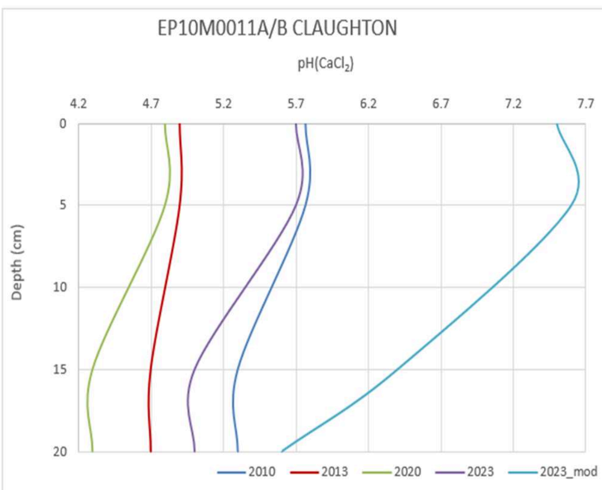
EP10S0037/38 TRELOAR

TRELOAR	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10S003	0	4.9	5.3	4.8	5.4	5.4	0.6
	5	4.9	5.3	4.8	5.4	5	0.6
EP10S003	15	5.6	6.2	5.8	5.3	5.9	-0.5
	20	5.6	6.2	5.8	5.3	6.7	-0.5



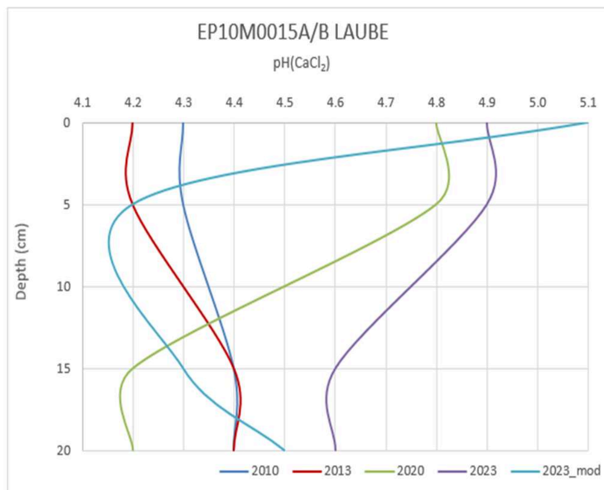
EP15BOOKOP3 PIPER

PIPER	DEPTH	2010	2015	2020	2023	2023_mo	Change
EP15BOOK(	0	5.5	4.8	5.2	5.5	5.8	0.3
	5	5.5	4.8	5.2	5.5	4.7	0.3
EP15BOOK(	15	7.1	4.8	5.1	5.1	4.8	0.0
	20	7.1	4.8	5.1	5.1	5.2	0.0



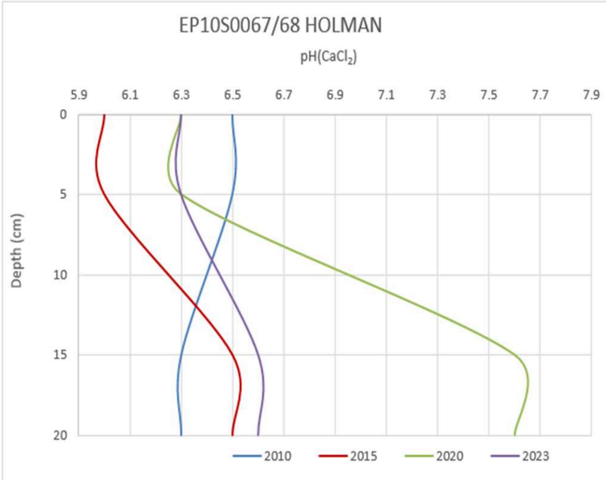
EP10M0011 SHEEHAN

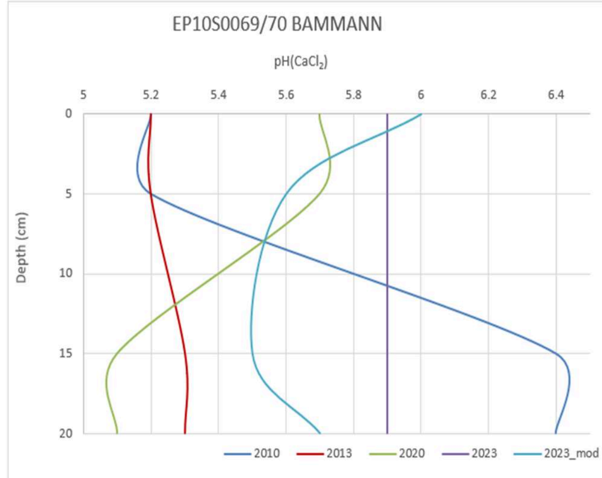
CLAUGHTON	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10M0011A	0	5.8	4.9	4.8	5.7	7.5	0.9
	5	5.8	4.9	4.8	5.7	7.6	0.9
EP10M0011B	15	5.3	4.7	4.3	5	6.4	0.7
	20	5.3	4.7	4.3	5	5.6	0.7



EP10M0015 KOCH

LAUBE	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10S0037	0	4.3	4.2	4.8	4.9	5.1	0.1
	5	4.3	4.2	4.8	4.9	4.2	0.1
EP10S0038	15	4.4	4.4	4.2	4.6	4.3	0.4
	20	4.4	4.4	4.2	4.6	4.5	0.4



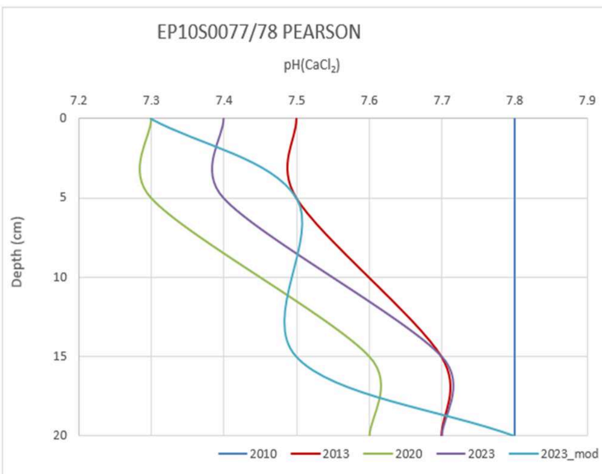


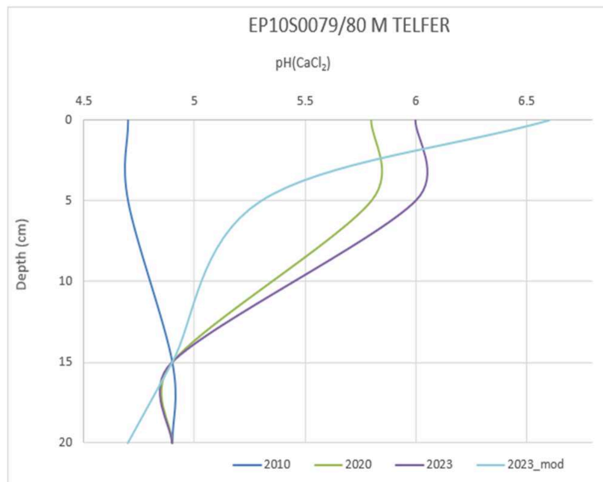
EP10S0067/68 HOLMAN

HOLMAN	DEPTH	2010	2015	2020	2023	2023_moc	Change
EP10S0067	0	6.5	6.0	6.3	6.3	NS	0.0
	5	6.5	6.0	6.3	6.3	NS	0.0
EP10S0068	15	6.3	6.5	7.6	6.6	NS	-1.0
	20	6.3	6.5	7.6	6.6	NS	-1.0

EP10S0069/70 HABNER

BAMMANN	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10S0069	0	5.2	5.2	5.7	5.9	6	0.2
	5	5.2	5.2	5.7	5.9	5.6	0.2
EP10S0070	15	6.4	5.3	5.1	5.9	5.5	0.8
	20	6.4	5.3	5.1	5.9	5.7	0.8



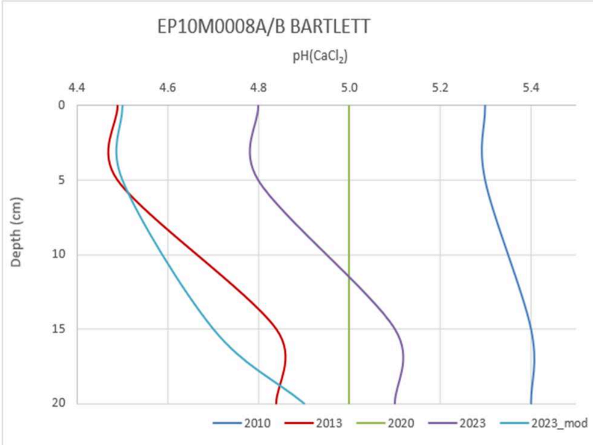


EP10S0077/78 PEARSON

PEARSON	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10S007	0	7.8	7.5	7.3	7.4	7.3	0.1
	5	7.8	7.5	7.3	7.4	7.5	0.1
EP10S007	15	7.8	7.7	7.6	7.7	7.5	0.1
	20	7.8	7.7	7.6	7.7	7.8	0.1

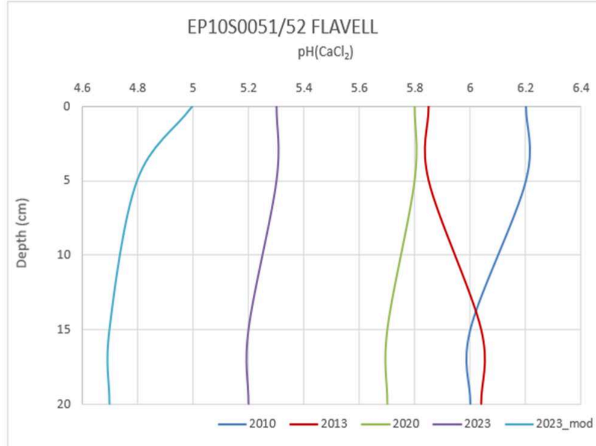
EP10S0079/80 M TELFER

M_TELFER	DEPTH	2010	2015	2020	2023	2023_moc	Change
EP10S0079	0	4.7	NS	5.8	6	6.6	0.2
	5	4.7	NS	5.8	6	5.3	0.2
EP10S0080	15	4.9	NS	4.9	4.9	4.9	0.0
	20	4.9	NS	4.9	4.9	4.7	0.0



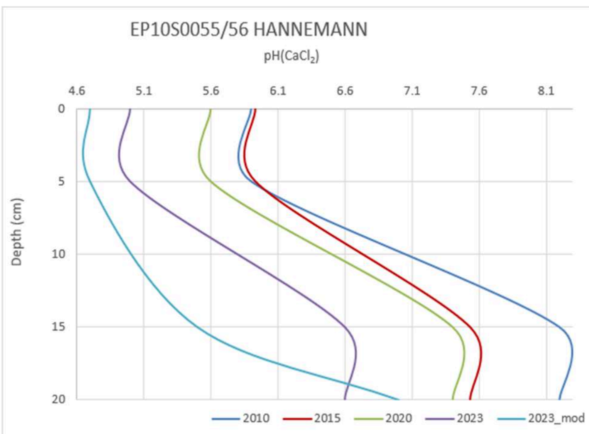
EP10M0008 BARTLETT

BARTLETT	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10M0008A	0	5.3	4.5	5	4.8	4.5	-0.2
	5	5.3	4.5	5	4.8	4.5	-0.2
EP10M0008B	15	5.4	4.8	5	5.1	4.7	0.1
	20	5.4	4.8	5	5.1	4.9	0.1



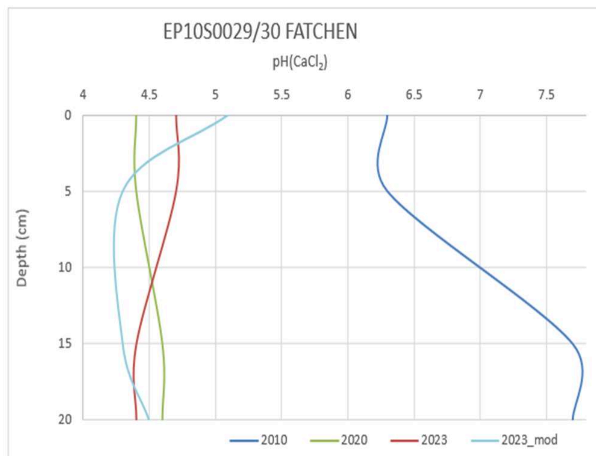
EP10S0051/52 FLAVELL

FLAVELL	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10S0051	0	6.2	5.9	5.8	5.3	5	-0.5
	5	6.2	5.9	5.8	5.3	4.8	-0.5
EP10S0052	15	6	6.0	5.7	5.2	4.7	-0.5
	20	6	6.0	5.7	5.2	4.7	-0.5



EP10S0055/56 HANNEMANN

HANNEMAN	DEPTH	2010	2015	2020	2023	2023_mo	Change
EP10S0055	0	5.9	5.9	5.6	5	4.7	-0.6
	5	5.9	5.9	5.6	5	4.7	-0.6
EP10S0056	15	8.2	7.5	7.4	6.6	5.5	-0.8
	20	8.2	7.5	7.4	6.6	7	-0.8



EP10S0029/30 FATCHEN

FATCHEN	DEPTH	2010	2013	2020	2023	2023_mod	Change
EP10S0029	0	6.3	NS	4.4	4.7	5.1	0.3
	5	6.3	NS	4.4	4.7	4.3	0.3
EP10S0030	15	7.7	NS	4.6	4.4	4.3	-0.2
	20	7.7	NS	4.6	4.4	4.5	-0.2

Appendix 2 -
2020 SOIL NUTRITION- not repeated in 2023

Sample ID	Organic Carbon (%)		EC 1:5	dS/m	Colwell P	mg/kg
SITE ID	0-10	10-20	0-10	10-20	0-10	10-20
EP10M0002A	2.7	0.9	0.097	0.034	69	34
EP10S0043	1.4	0.6	0.108	0.024	58	22
EP10S0031	1.0	0.3	0.081	0.023	29	31
EP10S0033	1.7	0.6	0.201	0.04	95	38
EP10S0037	1.7	1.0	0.154	0.229	61	<14
EP15B00KOPPIO3A	1.7	0.9	0.1	0.039	36	12
EP10M011	1.0	0.5	0.062	0.027	39	12
EP10M015	1.4	0.4	0.078	0.028	60	18
EP10S0067	<0.2	0.5	0.203	0.308	59	<14
EP10S0069	1.1	0.7	0.094	0.061	81	45
EP10S0077	1.8	0.9	0.182	0.174	28	<14
EP10S0079	1.5	0.6	0.075	0.028	26	16
EP10M0008B	1.5	0.5	0.146	0.076	45	<14
EP10S0051	0.8	0.3	0.148	0.051	29	33
EP10S0055	1.9	0.6	0.283	0.334	81	<14
EP10S0029	0.9	0.3	0.061	0.03	24	17

Appendix 3- 2020 EMERGING ACIDITY 'NEW' SURVEILLANCE SITES
Emerging results 2019-20 to 2023

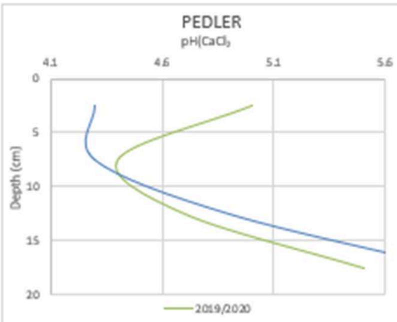
				2019/20				2023				change pH since 2019/2-				
SITE	LANDHOLDER	LOCATION	LAST SAMPLE DATE	0-5	5-10	10-15	15-20	0-5	5-10	10-15	15-20	0-5	5-10	10-15	15-20	LIME SINCE 2019/20
EP19S0 093-96	PEDLER	BRIMPTON LAKE	2019	5.0	4.4	4.7	5.5	4.3	4.3	4.9	5.9	-0.7	-0.1	0.2	0.4	NIL
EP19S0 097-100	MADDERN	BRIMPTON LAKE	2019	5.7	5.3	5.8	6.2	5.2	5.5	5.4	6.1	-0.5	0.2	-0.4	-0.1	Nil
EP19S0 101-104	MORONEY	MITCHELL	2019	6.3	5	5.8	5.3	6.1	4.7	4.8	5.5	-0.2	-0.3	-1.0	0.2	4 t/ha- 2023 (PIF)
EP19S0 105-108	HAZELGROVE	BRIMPTON LAKE	2019	4.8	4.8	6.1	6.7	6.0	5.6	6.8	7.2	1.2	0.8	0.7	0.5	2021 - 3 t/ha
EP19S0 109-112	HOWELL	MITCHELL	2019	6.3	5.6	6.4	6.4	5.9	6.2	7.1	7.3	-0.4	0.6	0.7	0.9	NIL
EP19S0 113-116	CARR	BROOKER	2019	6.2	6.0	6.2	6.5	6.3	6.0	6.1	6.5	0.1	0.0	-0.1	0.0	2022 - 2 t/ha
EP19S0 117-120	GALE	BROOKER	2019	5.9	5	6.5	5.8	5	4.8	5	5.4	-0.9	-0.2	-1.5	-0.4	NIL
EP19S0 121-124	KAY	MURDINGA	2019	6.4	5.3	6.8	6.8	5.5	5.2	5	6.2	-0.9	-0.1	-1.8	-0.6	Nil - but delved
EP19S0 125-128	ZACHER	LOCK	2019	5.4	5	6.4	7	5	4.6	5	5.5	-0.4	-0.4	-1.4	-1.5	NIL - PIF
EP19S0 129-132	GLOVER	PALKAGEE	2019	6.2	5.8	6.6	7.2	5.9	5.5	6.0	6.3	-0.3	-0.3	-0.6	-0.9	Nil
EP20S0 0133-136	JONES	WHARMINDA	2020	5.6	5.4	6.4	6.6	6.0	5.7	6.2	7.3	0.4	0.3	-0.2	0.7	NIL??? Was this ripped/delved, shallow alkaline RBE
EP20S0 0137-140	MASTERS	WHARMINDA	2020	6.2	6.3	5.7	6.9	5.6	5.7	6.7	7.3	-0.6	-0.6	1.0	0.4	Nil
20S0141-	FATCHEN	MOODY CENTRE	2020	4.5	4.3	4.3	5.7	6.1	4.3	4.4	4.9	1.6	0.0	0.1	-0.8	Limed when - prior to beans
20S0145-	MODRA	MOODY CENTRE	2020	4.9	4.8	4.5	4.5	4.5	4.4	4.3	4.3	-0.4	-0.4	-0.2	-0.2	NIL - PIF
20S0149-	SNODGRASS	MOODY CENTRE	2020	5.4	5.2	6.1	6.8	5.9	6.6	6.6	7.0	0.5	1.4	0.5	0.2	NIL - alkaline RBE nearby
20S0153-	CAMERON RED	MT HILL	2020	6.3	6.2	6.8	8	7.2	7.1	7.4	7.8	0.9	0.9	0.6	-0.2	NIL - alkaline RBE nearby
20S0157-	PRIME	WHARMINDA	2020	5.7	5.6	7.3	7.7	5.7	6.6	7.4	7.8	0.0	1.0	0.1	0.1	Nil but paddock ripped
20S0161-	HUNT	WHARMINDA	2020	6.5	6.2	6.9	7.5	6.0	6.0	6.3	6.7	-0.5	-0.2	-0.6	-0.8	NIL
20S0165-	KITSON	WHARMINDA	2020	6	5.3	5.1	5.1	4.9	4.8	4.8	5.0	-1.1	-0.5	-0.3	-0.1	Nil
20S0169-	CAMERON WITE	MT HILL	2020	6.2	6.4	7.7	7.7	5.2	7.0	7.6	7.7	-1.0	0.6	-0.1	0.0	NIL

Comments and Recommendations

SITE	LANDHOLDER	LOCATION	COMMENTS AND RECOMMENDATION
EP19S0093-96	PEDLER	BRIMPTON LAKE	Sampling results indicated that there has been a significant pH decline in both the 0-5 and 5-10 cm layers since 2019. Subsurface acidification occurs where surface pH is not maintained above 5.5 CaCl2. It is recommended that lime be applied the site at 3.5 t/ha to bring surface pH above this target value and reduce the risk of subsurface layers acidifying.
EP19S0097-100	MADDERN	BRIMPTON LAKE	Sampling results indicates that there has been a decline in pH in both the 0-5 and 10-15 cm layers since 2019. Subsurface acidification occurs where surface pH is not maintained above 5.5 CaCl2. It is recommended that lime be applied the site at 1.5 t/ha to bring surface pH above this target value and reduce the risk of subsurface layers acidifying.
EP19S0101-104	MORONEY	MITCHELL	Sampling results indicate that there have been small declines in pH since 2019. This might be a result of site variability but it is useful to continue to monitor pH at the site and ensure it is maintained above 5.5 CaCl2 to reduce the risk of subsurface layers acidifying.
EP19S0105-108	HAZELGROVE	BRIMPTON LAKE	Sampling results indicate that pH has significantly improved since 2019 in all layers to 20 cm. This is presumably the result of lime applications. If surface pH is maintained above 5.5 CaCl2 the risk of subsurface acidification is reduced.
EP19S0109-112	HOWELL	MITCHELL	Sampling results indicate that pH declined in the 0-5 cm layer since 2019. Whilst pH is still above the target 5.5 CaCl2 at the surface it is recommended that you continue to monitor pH change and apply lime as required.
EP19S0113-116	CARR	BROOKER	Sampling results indicate that pH has remained around the same as in 2019 in all layers to 20 cm. This is presumably the result of lime applications. If surface pH is maintained above 5.5 CaCl2 the risk of subsurface acidification is reduced.
EP19S0117-120	GALE	BROOKER	Sampling results indicate that there has been a decline in pH in both the 0-5 and 5-10 cm layers since 2019. Subsurface acidification occurs where surface pH is not maintained above 5.5 CaCl2. It is recommended that lime be applied the site at 1.5 to 2.0 t/ha to bring surface pH above this target value and reduce the risk of subsurface layers further acidifying.
EP19S0121-124	KAY	MURDINGA	Sampling results indicate that despite the delving operation the site the data shows some acidification of soil layers since the original sampling in 2019. Acidification can happen quite rapidly in years where high applications of mineral N or nitrate leaching occur. It is recommended that you continue to monitor soil pH at the site (a pH field kit can be a useful tool to do this) and apply lime as necessary to keep surface pH above 5.5 CaCl2.
EP19S0125-128	ZACHER	LOCK	Sampling results indicate a decline in pH in all layers to 20 cm since 2019 on this sandy site in the paddock. Surface pH is now well below the target value of 5.5 CaCl2, with subsurface acidification occurring where surface pH is not maintained above this level. It is recommended that lime be applied the site at around 1.5 t/ha to bring surface pH above this target value and reduce the risk of subsurface layers further acidifying.
EP19S0129-132	GLOVER	PALKAGEE	Sampling results indicate a decline in pH in all layers to 20 cm since 2019. Although surface pH remains at or above 5.5 CaCl2, there is a risk of continued subsurface acidification if pH falls below this target. It is recommended that you continue to monitor pH and lime as required to maintain these levels.
EP20S00133-136	JONES	WHARMINDA	Sampling results indicate an improvement in pH at the surveillance site. This might be a result of site variability but it is useful to continue to monitor pH at the site and ensure it is maintained above 5.5 CaCl2 to reduce the risk of subsurface layers acidifying.
EP20S00137-140	MASTERS	WHARMINDA	Sampling results indicate that there have been small declines in pH since 2019. This might be a result of site variability but it is useful to continue to monitor pH at the site and ensure it is maintained above 5.5 CaCl2 to reduce the risk of subsurface layers acidifying.

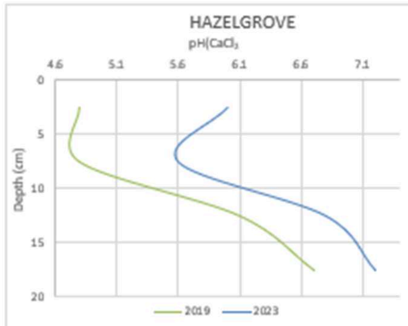
SITE	LANDHOLDER	LOCATION	COMMENTS AND RECOMMENDATION
EP20S0141-144	FATCHEN	MOODY CENTRE	Sampling results indicate good pH improvement in the 0-5 cm layer (by 1.6 pH units from 4.5 in 2019), which is likely the result of lime application prior to growing beans. Whilst this has halted acidification in the 10-15 cm layer there was still some acidification of the 15-20 cm layer. This highlights the importance of keeping surface pH above 5.5 CaCl2 to mitigate the risk of subsurface layers becoming more acidic. It is recommended that you continue to monitor pH at the site and apply lime as necessary.
EP20S0145-148	MODRA	MOODY CENTRE	Sampling results indicate a decline in pH in all layers to 20 cms since 2019. Subsurface acidification occurs where surface pH is not maintained above 5.5 CaCl2. Lime applications of around 3 t/ha are recommended to bring surface pH above 5.5 CaCl2.
EP20S0149-152	SNODGRASS	MOODY CENTRE	Sampling results indicate an improvement in pH at the surveillance site. This might be a result of site variability but it is useful to continue to monitor pH at the site and ensure it is maintained above 5.5 CaCl2 to reduce the risk of subsurface layers acidifying.
EP20S0153-156	CAMERON RED	MT HILL	Sampling results indicate that there have been small declines in pH since 2019. This might be a result of site variability but it is useful to continue to monitor pH at the site and ensure it is maintained above 5.5 CaCl2 to reduce the risk of subsurface layers acidifying.
EP20S0157-160	PRIME	WHARMINDA	Sampling results showed no change in pH in the 0-5 cm layer but a significant increase in pH in the in the 5-10 cm layer. This is likely to result from the deep ripping operation on the paddock where alkaline material brought up from the B horizon clay might be responsible for this change.
EP20S0161-164	HUNT	WHARMINDA	Sampling results indicate a decline in pH all layers to 20 cm since 2019. Whilst still above the target surface pH value of 5.5 CaCl2 it is recommended that you continue to monitor pH change and apply lime as necessary to reduce the risk of subsurface layers acidifying.
EP20S0165-168	KITSON	WHARMINDA	Sampling results indicate a decline in pH in all layers to 20 cm since 2019. Surface pH is well below the target value of 5.5 CaCl2, with subsurface acidification occurring where surface pH is not maintained above this level. It is recommended that lime be applied the site at 2.0 t/ha to bring surface pH above this target value and reduce the risk of subsurface layers further acidifying.
EP20S0169-172	CAMERON WITE	MT HILL	Sampling results indicate pH has declined quite significantly in the 0-5 cm layers. When surface pH falls below 5.5 CaCl2 , there is a risk of subsurface acidification. Lime applications are recommended to maintain surface pH above this level.

EMERGING SOIL PH PROFILE CHARTS



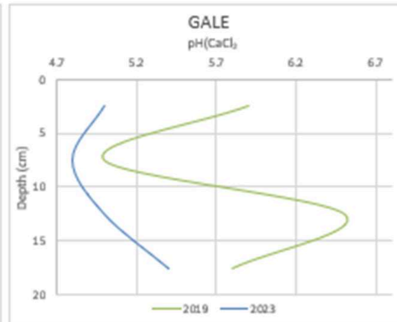
EP19S0093-96

PEDLEF	DEPTH	2019	2023	Change
EP10S00	0	5	4.3	-0.7
EP10S00	5	4.4	4.3	-0.1
EP10S00	15	4.7	4.9	0.2
EP10S00	20	5.5	5.9	0.4



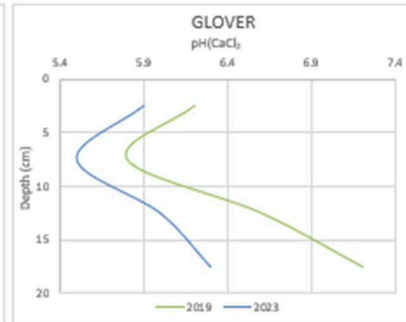
EP19S0105-108

HAZELGF	DEPTH	2019	2023	Change
EP10S010	0	4.8	6	1.2
EP10S010	5	4.8	5.6	0.8
EP10S010	15	6.1	6.8	0.7
EP10S010	20	6.7	7.2	0.5



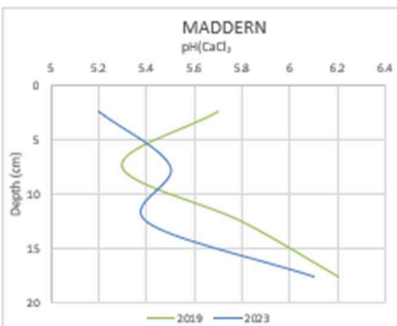
EP19S0117-120

GALE	DEPTH	2019	2023	Change
EP10S01	0	5.9	5	-0.9
EP10S01	5	5	4.8	-0.2
EP10S01	15	6.5	5	-1.5
EP10S01	20	5.8	5.4	-0.4



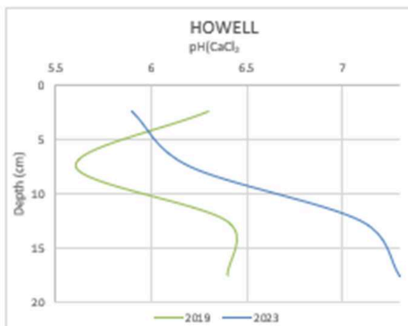
EP19S0129-132

GLOVEF	DEPTH	2019	2023	Change
EP10S01	0	6.2	5.9	-0.3
EP10S01	5	5.8	5.5	-0.3
EP10S01	15	6.6	6	-0.6
EP10S01	20	7.2	6.3	-0.9



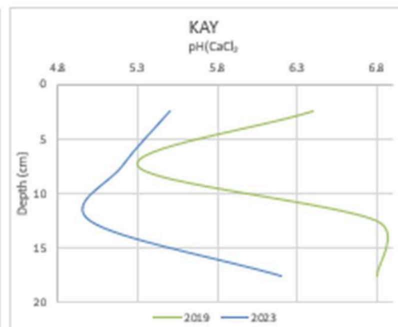
EP19S0097-100

MADDE	DEPTH	2019	2023	Change
EP10S00	0	5.7	5.2	-0.5
EP10S00	5	5.3	5.5	0.2
EP10S00	15	5.8	5.4	-0.4
EP10S01	20	6.2	6.1	-0.1



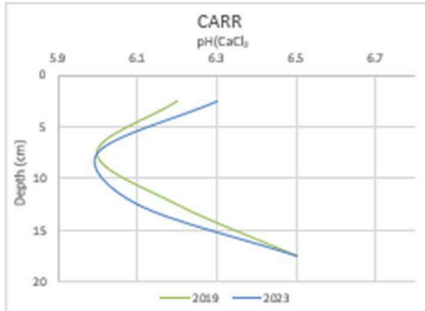
EP19S0109-112

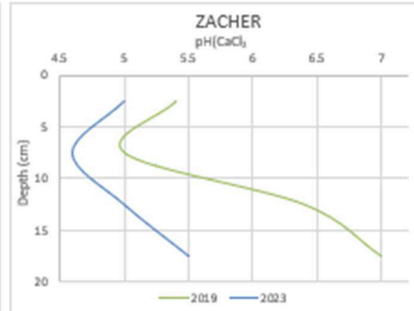
HOWELL	DEPTH	2019	2023	Change
EP10S010	0	6.3	5.9	-0.4
EP10S011	5	5.6	6.2	0.6
EP10S0111	15	6.4	7.1	0.7
EP10S0112	20	6.4	7.3	0.9



EP19S0121-124

KAY	DEPTH	2019	2023	Change
EP10S01	0	6.4	5.5	-0.9
EP10S01	5	5.3	5.2	-0.1
EP10S01	15	6.8	5	-1.8
EP10S01	20	6.8	6.2	-0.6





EP19S0101-104

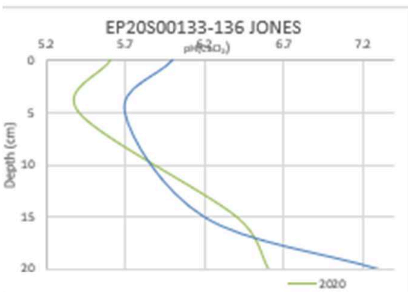
MORON	DEPTH	2019	2023	Change
EP10S01	0	6.3	6.1	-0.2
EP10S01	5	5	4.7	-0.3
EP10S01	15	5.8	4.8	-1.0
EP10S01	20	5.3	5.5	0.2

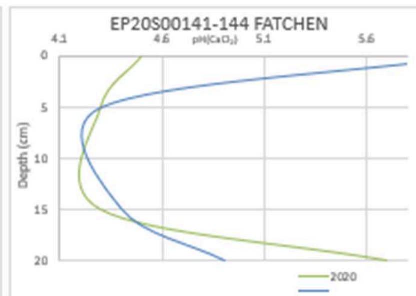
EP19S0113-116

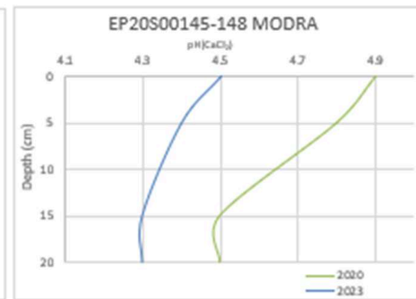
CARR	DEPTH	2019	2023	Change
EP10S0113	0	6.2	6.3	0.1
EP10S0114	5	6	6	0.0
EP10S0115	15	6.2	6.1	-0.1
EP10S0116	20	6.5	6.5	0.0

EP19S0125-128

ZACHEI	DEPTH	2019	2023	Change
EP10S01	0	5.4	5	-0.4
EP10S01	5	5	4.6	-0.4
EP10S01	15	6.4	5	-1.4
EP10S01	20	7	5.5	-1.5







EP20S00133-136

JONES	DEPTH	2020	2023	Change
EP10S00	0	5.6	6	0.4
EP10S00	5	5.4	5.7	0.3
EP10S00	15	6.4	6.2	-0.2
EP10S00	20	6.6	7.3	0.7

EP20S00137-140

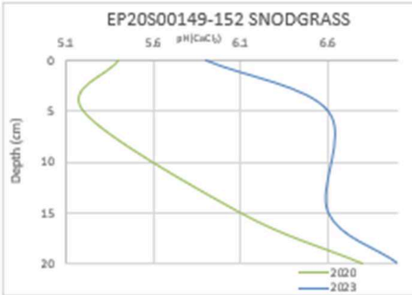
MASTER	DEPTH	2020	2023	Change
EP10S00137	0	6.2	5.6	-0.6
EP10S00138	5	6.3	5.7	-0.6
EP10S00139	15	5.7	6.7	1.0
EP10S00140	20	6.9	7.3	0.4

EP20S0141-144

FATCHE	DEPTH	2020	2023	Change
EP10S0014	0	4.5	6.1	1.6
EP10S0014	5	4.3	4.3	0.0
EP10S0014	15	4.3	4.4	0.1
EP10S0014	20	5.7	4.9	-0.8

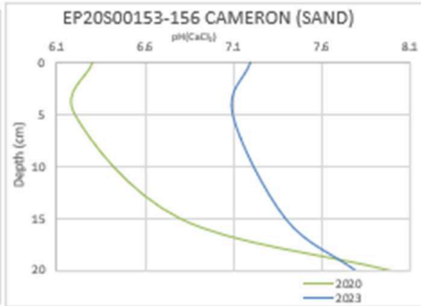
EP20S0145-148

MODRA	DEPTH	2020	2023	Change
EP10S0014	0	4.9	4.5	-0.4
EP10S0014	5	4.8	4.4	-0.4
EP10S0014	15	4.5	4.3	-0.2
EP10S0014	20	4.5	4.3	-0.2



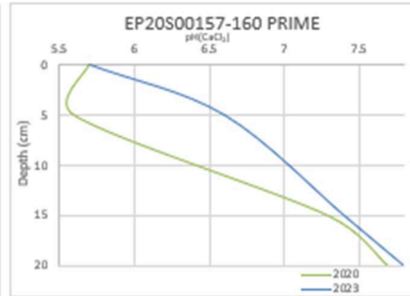
EP20S0149-152

SNODGI	DEPTH	2020	2023	Change
EP10S00	0	5.4	5.9	0.5
EP10S00	5	5.2	6.6	1.4
EP10S00	15	6.1	6.6	0.5
EP10S00	20	6.8	7	0.2



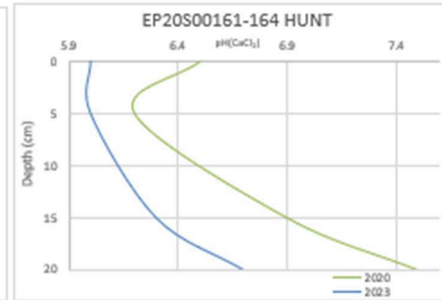
EP20S0153-156

CAMERC	DEPTH	2020	2023	Change
EP10S001	0	6.3	7.2	0.9
EP10S001	5	6.2	7.1	0.9
EP10S001	15	6.8	7.4	0.6
EP10S001	20	8	7.8	-0.2



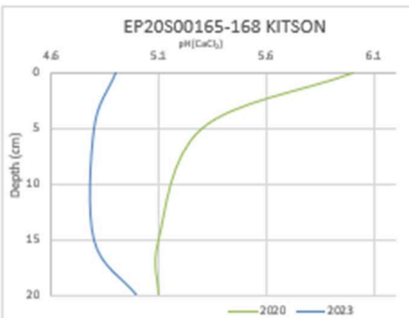
EP20S0157-160

PRIME	DEPTH	2020	2023	Change
EP10S00	0	5.7	5.7	0.0
EP10S00	5	5.6	6.6	1.0
EP10S00	15	7.3	7.4	0.1
EP10S00	20	7.7	7.8	0.1



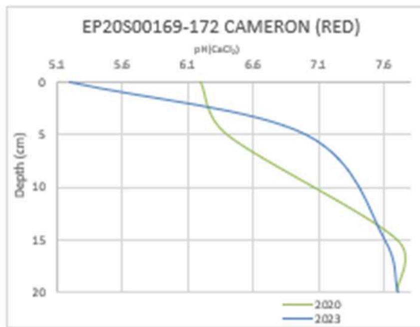
EP20S0161-164

HUNT	DEPTH	2020	2023	Change
EP20S0	0	6.5	6	-0.5
EP20S0	5	6.2	6	-0.2
EP20S0	15	6.9	6.3	-0.6
EP20S0	20	7.5	6.7	-0.8



EP20S0165-168

KITSON	DEPTH	2020	2023	Change
EP10S00	0	6	4.9	-1.1
EP10S00	5	5.3	4.8	-0.5
EP10S00	15	5.1	4.8	-0.3
EP10S00	20	5.1	5	-0.1



EP20S0165-168

CAMERC	DEPTH	2020	2023	Change
EP10S001	0	6.2	5.2	-1.0
EP10S001	5	6.4	7	0.6
EP10S001	15	7.7	7.6	-0.1
EP10S001	20	7.7	7.7	0.0

Appendix 4- SOIL ORGANIC CARBON AND COLWELL P RESULTS- from 2019 and 2020, not repeated in 2023

SITE ID	NAME	LOCATION	DEPTHcm	Soil Colwell P (mg/kg)	Soil Organic Carbon W&B (%)
EP20S00133-136	JONES	WHARMINDA	0-10	19	0.9
EP20S00133-136	JONES	WHARMINDA	10-20	11	0.2
EP20S00137-140	MASTERS	WHARMINDA	0-10	26	0.7
EP20S00137-140	MASTERS	WHARMINDA	10-20	<14	0.3
EP20S00141-144	FATCHEN	MOODY	0-10	22	1.1
EP20S00141-144	FATCHEN	MOODY	10-20	18	0.7
EP20S00145-148	MODRA	MOODY	0-10	24	0.3
EP20S00145-148	MODRA	MOODY	10-20	20	0.2
EP20S00149-152	SNODGRASS	MOODY	0-10	30	1.3
EP20S00149-152	SNODGRASS	MOODY	10-20	18	0.5
EP20S00153-156	CAMERON	MT HILL	0-10	13	0.8
EP20S00153-156	CAMERON	MT HILL	10-20	<14	0.2
EP20S00157-160	PRIME	WHARMINDA	0-10	28	1.0
EP20S00157-160	PRIME	WHARMINDA	10-20	<14	0.6
EP20S00161-164	HUNT	WHARMINDA	0-10	18	0.8
EP20S00161-164	HUNT	WHARMINDA	10-20	<14	0.2
EP20S00165-168	KITSON	WHARMINDA	0-10	27	1.1
EP20S00165-168	KITSON	WHARMINDA	10-20	23	0.3
EP20S00169-172	CAMERON	MT HILL	0-10	24	1.0
EP20S00169-172	CAMERON	MT HILL	10-20	<14	0.3