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Comparative Agricultural Productivity Assessment of Properties Subject to Varying Land Management Techniques

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Comparative Agricultural Productivity Assessment of Properties Subject to Varying Land Management Techniques

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1 INTRODUCTION

SLR Consulting (SLR) was engaged by Hansen Bailey (on behalf of WorleyParsons) to complete a *Comparative Productivity Assessment of Properties Subject to Varying Land Management Techniques* (the Comparative Productivity Assessment). The two properties subject to this assessment are the Tarwyn Park Farm Complex (629.4 hectares) and the neighbouring aggregation of properties formally owned by the Wallings Pastoral Company, known as Wallings (3,358 hectares) located in the Bylong Valley, Central West NSW (the Study Area) (**Figure 1**).

The Tarwyn Park Farm Complex was purchased by KEPCO in February 2014. Up until the 31st of July 2016, the Tarwyn Park Farm Complex had been leased by the previous owner Stuart Andrews, the son of Peter Andrews, who was the architect of the Natural Sequence Farming (NSF) philosophy. The Tarwyn Park Farm Complex is now under KEPCO's management.

During the time that the property had been under private lease, it continued to operate primarily as a grazing enterprise supported by the production of dryland fodder crops. The NSF philosophy, to the best of KEPCOs knowledge, continued to be an integral part of the property management at the Tarwyn Park Farm Complex.

The Wallings property was purchased by KEPCO in January 2014. The primary agricultural enterprise on Wallings immediately prior to KEPCO acquiring the property was cattle grazing on improved and native pastures, supplemented with hay and fodder crop production. The Wallings operation was considered a "traditional" cattle grazing enterprise, with fertiliser application, chemical weed control and the planting of fodder crops and pastures on seasonal occurrences. KEPCO has continued to maintain the traditional cattle grazing enterprise approach on Wallings since the property was acquired.

Following the acquisition of these two properties, SLR's Associate Agronomist Murray Fraser undertook an *Agricultural Productivity Audit* for each property: Wallings in February (SLR, 2014a) and the Tarwyn Park Farm Complex in March (SLR, 2014b). A further *Agricultural Assessment and Land Management Plan* was conducted on the Tarwyn Park Farm Complex in August 2016 (SLR, 2016) once the private lease had expired and farm management was assumed by KEPCO. These three assessments provided the baseline information for this Comparative Productivity Assessment. Soil classification and mapping information was sourced from the *Soil, Land Capability and Strategic Agricultural Land Assessment Bylong Coal Project* (SLR, 2015) which comprises part of the Bylong Coal Project Environmental Impact Assessment.

2 BACKGROUND

Lock the Gate Alliance (LTGA), in connection with the Bylong Valley Protection Alliance lodged an application on 22 July 2016 for an Interim Heritage Order (IHO) under the Heritage Act 1977 for the Tarwyn Park and Iron Tank Properties (Tarwyn Park Farm Complex). Subsequent to this, on 4 October 2016, LTGA lodged a nomination for Tarwyn Park Farm Complex to be placed on the State Heritage Register.

In October 2016, the then NSW Minister for the Environment (M Speakman) decided that the application for an IHO for Tarwyn Park Farm Complex would not be made at this time. However, the Minister also confirmed in his correspondence that the nomination for listing Tarwyn Park Farm Complex on the State Heritage Register would be considered.

For an item to be listed on the State Heritage Register, it must demonstrate it contains values of State Heritage Significance. The Heritage Division of the Office of Environment and Heritage indicated in correspondence to KEPCO dated 26 October 2016 that it "understands that this site may be of state heritage significance for its long history of thoroughbred horse breeding and as the location for the development and demonstration of Natural Sequence Farming by Peter Andrews OAM and family".

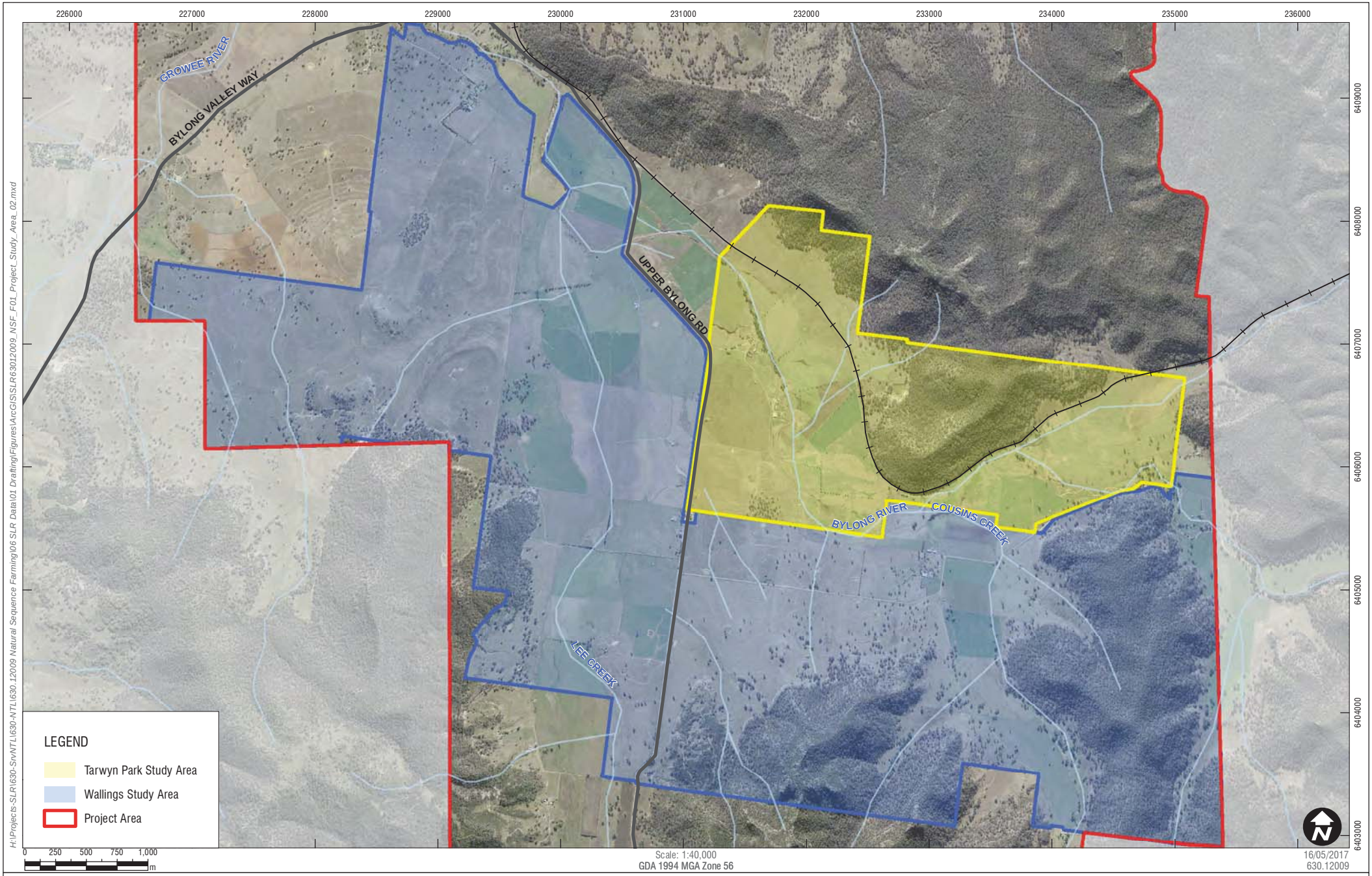
In light of this, KEPCO commissioned a Heritage Consultant specialising in landscape heritage based assessments to conduct an Independent Peer Review of the Assessment of Significance (AoS) completed within the EIS Historic Heritage Impact Assessment (HHIA) (AECOM, 2015) of the Tarwyn Park Farm Complex. The AoS within the HHIA determined that Tarwyn Park Farm Complex, including the homestead, stables, horse burials, various farm buildings, historical rubbish mound and the use of Tarwyn Park for NSF were of local heritage significance. These components were assessed within the HHIA in accordance with the Heritage Council's significance criterion. The purpose of the Independent Peer Review was to confirm that the AoS within the HHIA was completed in accordance with the relevant regulatory requirements. Further the review was to determine whether the Tarwyn Park Farm Complex contained heritage values at a higher level than local significance as assessed within the HHIA.

The Independent Peer Review generally concurs with the conclusions of the AoS for the Tarwyn Park Farm Complex within the HHIA. The NSF component of the Tarwyn Park Farm Complex was assessed as meeting three of the criteria, namely:

- Being associated with a NSW identity;
- Considered a technical achievement by peers; and
- Having social value within the community.

These criteria are directly related to the "value" to which the NSF philosophy and principles provide to the agricultural fraternity (and thus the wider community) in relation to the remediation of agricultural land degradation and increase in agricultural productivity.

The Independent Peer Review identified "whether the property still provides sufficient evidence of the success or otherwise of Peter Andrews' Natural Sequence Farming technique requires further assessment by those with specialist expertise in agronomy and the reclamation of degraded agricultural land". Accordingly, the Independent Peer Review recommended that further research into the methodology and scientific rigour of the NSF technique be carried out. It is noted that the historic use of Tarwyn Park Farm Complex for equine related uses has not been identified as an issue within the Independent Peer Review.



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Comparative Agricultural Productivity Assessment Study Area

FIGURE 1

3 SCOPE OF WORKS

The purpose of this assessment is to detail the agricultural productivity at the Tarwyn Park Farm Complex in comparison with neighbouring properties in the Bylong Valley that have not been subject to NSF land use (Wallings). This Comparative Productivity Assessment was compiled according to the scope of works detailed in **Table 1** below.

Table 1 Scope of Works

Assessment Component	Section
Review of Agricultural Baseline Condition reports prepared by SLR for Tarwyn Park Farm Complex and Wallings to compare the agricultural productivities and attributes and land degradation issues identified for each of these properties upon acquisition by KEPCO	4
Overlay the existing slope analysis and soils mapping on the Wallings and Tarwyn Park Farm Complex areas to identify similar landforms and soil types	5.1
Record soil type, slope and land use for 20 sites on Tarwyn Park Farm Complex, and 20 sites with same/similar soil type, slope and land use on Wallings	Appendix A
Compare soil test results between properties, including nutrient status and Plant Available Waterholding Capacity (PAWC) to determine whether or not the NSF philosophy has improved PAWC compared to similar areas on other properties not subject to NSF	6
Develop a methodology to determine Rainfall Use Efficiency across similar sites for Tarwyn Park Farm Complex and Wallings, which would give an ongoing indication of the practical benefits (if any) of NSF compared to other land uses (including irrigated land) for plant growth/livestock weight gain.	8
Comparison of land degradation issues identified on Tarwyn Park Farm Complex compared to neighbouring properties (Wallings)	7
Comment on the benefits and/or disadvantages of the NSF infrastructure and the land use in comparison with activities undertaken on other properties in the vicinity of the Project	7.1, 7.4
Comment on any deleterious effects of NSF at Tarwyn Park Farm Complex on neighbouring landholders	7.3

4 AGRICULTURAL BASELINE REVIEW

The following sections provide a review of information which forms the agricultural productivity baseline between the Tarwyn Park Farm Complex and Wallings.

4.1 Wallings 2014

The following observations were made when reporting for the *Agricultural Productivity Audit – Wallings Aggregation* (SLR, 2014a), which was conducted on the Wallings aggregation of properties in February 2014, covering a total of 3,358 hectares.

4.1.1 Erosion

Across the Chromosol and Sodosol soils, areas of minor to moderate sheet erosion were identified to occur along the footslopes (5-10% slope) throughout the holding, most likely due to historical overgrazing of native pastures.

Areas of stabilised gully erosion were identified to occur across the holding along with some stream bank erosion in the east along the Bylong River.

4.1.2 Agricultural Operation

The main agricultural operation was confirmed to be grazing cattle for beef production. Stock are bred on property and also purchased as store condition livestock. Lucerne hay and fodder crop production was identified to comprise an important part of revenue generation.

There were two major pasture types found on the Wallings aggregation. Along the valley floor, the grazing area was described to be improved pasture consisting of a mix of grasses, clover and lucerne. The hill country was considered to comprise semi-improved native pastures, with native grasses and varying amounts of clover present.

The Wallings property was described to carry high numbers of cattle with many of the pastures showing signs of overgrazing, exacerbated by an extended dry period.

4.1.3 Improved Pasture

In general, the quality of improved pastures on the Agricultural Suitability Class 1 and 2 land was described to range from ‘run down’ to excellent remnant improved pastures. Many of the lucerne pastures were described to be at the end of their productive life and were recommended to be direct sown to winter wheat for 1 or 2 years before being returned to perennial pasture.

The main weed species identified in the improved pastures were liverseed grass, Paterson’s curse, wireweed, khaki weed, saffron thistle, star thistle and farmer’s friend. Catheads were highlighted as a huge problem, especially where pastures have thinned out due to overgrazing.

At the time of the assessment, it was observed that, in general, the higher quality Class 1 and Class 2 land along the valley floor and edges would benefit from further pasture improvement.

4.1.4 Semi-Improved Native Pasture

The hill country of Class 3 and Class 4 was generally described to be native grass pastures that are in fair condition. They are mainly comprised of red grass and cane grass, with varying amounts of clover present. Many of the pastures were identified to have been overgrazed in the past and it was commented that they would significantly benefit from the introduction of a time control or rotational grazing strategy.

A number of the narrow valleys comprising Class 1 and Class 2 land, such as sites 12 and 16, had not been sown to improved pasture and were dominated by red grass and cane grass, often with good populations of clover.

The main weed species identified within the native pastures are catheads, Paterson's curse, wireweed, farmer's friend, saffron thistle and star thistle.

At the time of the assessment, it was observed that grazing of the native pastures needed to be better managed to allow natural recruitment where desirable species had thinned out due to overgrazing. The management strategy of grazing with many smaller mobs until feed is exhausted should be changed to grazing larger mobs for shorter periods of time. This management strategy has the effect of increasing desirable pasture species, such as red grass, annual ryegrass and clover.

4.1.5 Soil Analysis Observations

In general, the soil nutrient results were described to confirm the field observations. Soils on the Wallings aggregation were identified to provide a suitable growth medium for pastures and winter crops, with pH at most sites ranging from slightly acidic to neutral, which is non-limiting for the majority of pasture plants and crop species able to be grown in the district.

Cation exchange capacity (CEC) was identified to be generally low to moderate, indicating that regular (annual or biennial) fertiliser applications are necessary to keep nutrient levels adequate for maximum plant growth.

The calcium to magnesium ratio (Ca:Mg) were identified to range between very low to high. In paddocks identified with very low to low Ca:Mg, lime or gypsum application was recommended to raise calcium levels. Where pH was moderately acidic and Ca:Mg was low, lime application was recommended as a calcium source but also to raise the pH closer to neutral.

All soils tested were identified to be non-sodic and non-saline and did not require corrective treatment.

Phosphorus, sulfur and nitrogen levels were not tested during the soil surveys. It was recommended testing for these macro-nutrients, along with micro-nutrients such as zinc and copper be carried out before any cropping or pasture improvements program was undertaken.

4.2 Summary

In general, the previous pasture and cropping management of the Wallings aggregation was identified to require improvement to increase production from the cattle enterprise and overall paddock health.

4.3 **Tarwyn Park 2014**

The following observations were made when reporting for the *Agricultural Productivity Audit – "Tarwyn Park"* (SLR, 2014b), which was conducted on the Tarwyn Park Farm Complex in March 2014, covering a total of 629.4 hectares.

4.3.1 Erosion

Stabilised gully erosion was observed in the northern area consisting Chromosol and Sodosol soil types. Minor to moderate stream bank erosion was also observed along the Bylong River which flows through the centre of the Tarwyn Park Farm Complex.

4.3.2 Agricultural Operation

After conducting field inspections and discussing property management with the previous owner, the main emphasis on operation of the Tarwyn Park Farm Complex was identified as beef cattle production, mostly through buying store condition cattle and growing them to market weight. Lucerne hay production on the areas of the valley floor was identified to comprise a minor part of revenue generation on the Tarwyn Park Farm Complex.

Prior to the inspection, the Tarwyn Park Farm Complex had been almost completely de-stocked for over three months, primarily due to the extended dry period which was experienced over spring and summer. As a result of the de-stocking, many of the paddocks were identified to obtain a large amount of dry matter and have good to excellent groundcover.

Two major pasture types were described on the Tarwyn Park Farm Complex. Along the valley floor, the grazing area was described as improved pasture consisting of a mix of grasses, clover and lucerne. The hill country was described as semi-improved native pastures, comprising native grasses with varying amounts of clover present, along with some remnant lucerne pastures which comprise mainly native red grass.

There was little evidence identified of previous annual forage crops such as oats or winter wheat having been grown on "Tarwyn Park', with new lucerne pasture being sown directly into remnant pasture stands without utilising a grazing crop for improved weed control.

Tarwyn Park Farm Complex was described to have been operated under the NSF philosophy which was developed by Peter Andrews.

4.3.3 Improved Pasture

In general the quality of improved pastures on the Agricultural Suitability Class 1 and 2 land was described to range from "run down" remnant pasture to excellent improved pasture. Many of the lucerne pastures were described to have reached the end of their productive life and it was recommended that these areas be direct sown to winter wheat for 1 or 2 years before being returned to perennial pasture.

The main weed species identified in these "run down" improved pastures were liverseed grass, Paterson's curse, wireweed, fleabane, star thistle, black oats and farmers friend. Liverseed grass and black oats completely dominate much of the remnant lucerne pastures.

In general, much of the higher quality Class 1 and Class 2 land along the valley floor and edges would benefit from further pasture improvement.

4.3.4 Semi-Improved Native Pasture

The hill country of Class 3 and Class 4 lands were described to contain native grass pastures that are in fair to good condition. They were mainly comprised of red grass with varying amounts of clover. As stated previously the pastures had benefitted from the rotational grazing practices and also the de-stocking during the recent dry period (in 2013/14). These areas were described to generally have good to excellent groundcover with good levels of mulch between the perennial red grass butts.

Paddocks along the northern hillside were described to have been previously sown to lucerne pasture, but were at the time of the inspection dominated by annual weeds such as liverseed grass, farmers friend and Paterson's curse. With strategic herbicide application and/or strategic grazing the red grass component of these pastures could be allowed to increase in density, to the benefit of the pasture.

The main broadleaf weed species identified across most pastures on the Tarwyn Park Farm Complex are catheads, Paterson's curse, wireweed, farmer's friend, saffron thistle and star thistle.

Grazing of the native pastures was recommended to be better managed to allow natural recruitment where desirable species have thinned out due to overgrazing. The management strategy of grazing larger mobs for shorter periods of time could be enhanced with broadleaf weed control.

Clover content of the native pasture should be increased, ideally to about 20%. In some paddocks, it was suggested this could be achieved simply through more efficient grazing management, whilst for other paddocks it was suggested they would need either aerial or direct drill seeding.

4.3.5 Soil Analysis Observations

In general, the soil nutrient results were described to confirm the field observations. Soils on the Tarwyn Park Farm Complex were described to provide a suitable growth medium for pastures and winter crops, with pH slightly acidic, which is non-limiting for the majority of pasture plants and crop species able to be grown in the district.

Cation exchange capacity (CEC) was mostly moderate, indicating that regular (annual or biennial) fertiliser applications are necessary to keep nutrient levels adequate for maximum plant growth.

The calcium to magnesium ratio (Ca:Mg) was identified to be mostly low. Paddocks with low Ca:Mg were recommended to receive an application of gypsum to raise calcium levels.

All soils tested were non-sodic and did not require corrective treatment.

Most sites tested on the Tarwyn Park Farm Complex were identified to be non-saline. However one area in the north-west, on the eastern side of the Bylong River recorded a high ECe (saline). It was recommended that pasture species with a high salt tolerance, such as tall wheat grass, paspalum and strawberry clover, be sown for maximum fodder production.

Phosphorus, sulfur and nitrogen levels were not tested during the soil survey. It was recommended that testing for these macro-nutrients, along with micro-nutrients such as zinc and copper is carried out before any cropping or pasture improvements program is undertaken.

4.3.6 Summary

Improved productivity can be achieved from the Tarwyn Park Farm Complex without significantly modifying the agricultural enterprises that are currently being carried out.

4.4 Tarwyn Park 2016

A further site inspection was carried out at Tarwyn Park Farm Complex in August 2016, upon expiration of the lease held by the previous owner. That assessment specifically focused on the Natural Sequence Farming (NSF) components of the property. The following observations were made when reporting for the *"Tarwyn Park" Agricultural Assessment and Land Management Plan* (SLR, 2016).

4.4.1 Erosion

Stream bank stability of the Bylong River was generally described to be excellent, mainly due to a high percentage of pasture groundcover and reduced water flows resulting from the leaky weirs. The only area identified to comprise stream bank erosion was at two bends very close to **Site TP8**, possibly due to the exposure of very coarse sand during periods of high flow.

Across the Tarwyn Park Farm Complex, pasture groundcover was described as excellent and as a result there was very little erosion identified. On the north eastern side of the railway line, there was an area that had previously been subject to gully erosion (possibly due to the exposure of sodic subsoils), which has been repaired through earthworks which has self-regenerated with red grass and annual ryegrass. Construction of the earthen bank occurred prior to the 2014 inspection.

4.4.2 Weed Control

Under the NSF principles, very little traditional weed control using herbicides has been carried out on the Tarwyn Park Farm Complex, as all plant growth was considered a "nutrient cycler". As rotational grazing with high numbers of cattle was carried out, most plant growth was eaten prior to the mob being moved to the next paddock. Whilst this can be viewed as a fairly successful weed control method, it does have the disadvantage of slower growth rates in cattle compared to those grazing improved pasture with good weed control.

The main priority for weed control was identified to be within and around the stand of Coastal Grey Box Woodland on the property. There was described to be a high density of African boxthorn within this area, which is a declared noxious weed. As boxthorn is spread by birds eating the seeds and then dropping them out when roosting in a tree, it has the potential to become a big problem very quickly.

4.4.3 Fertiliser Application

During the August 2016 field inspection, a previous stockpile area of rock phosphate and lime was found. Rock phosphate supplies slow release phosphorus while lime supplies calcium. In all but one of the 20 soil tests carried out, sulfur was either marginal or deficient. This may have resulted from sulfur being removed from paddocks (in the form of beef) and not being replaced over a period of time.

4.4.4 Improved Pastures

Much of the lucerne area was described to have reached the point where the pasture requires renovation. A lower legume content that was observed in these pastures results in more time to fatten cattle to market weights. As organic carbon levels are very good, it is recommended that minimal cultivation take place in order to continue building carbon levels.

As previously outlined, weed control on the Tarwyn Park Farm Complex was largely undertaken through strategic grazing pressure. As a result, a significant portion of pasture composition was observed to have been made up of broadleaf weeds.

4.4.5 Semi-Improved Pastures

The majority of the native pasture areas, which was described to comprise mostly red grass, were noted to be in good to excellent condition. The addition of clover (along with phosphorus and/or sulfur) was suggested to increase the feed value of these pastures, giving higher weight gain in livestock during the winter months.

Weed control in the native pasture and remnant lucerne areas was described to have the added benefit of creating an excellent base for future rehabilitation efforts on any disturbed areas as the weed seed bank will be depleted and the desirable species seed numbers will have increased.

4.4.6 Summary

In general, overall property condition was described to be similar to 2014. The main point of difference was that the lucerne pastures had thinned out, as would be expected, since the previous inspection. It was evident from the site inspection that no new lucerne pasture had been sown in that time.

There were no prohibitive factors identified for the Tarwyn Park Farm Complex to continue being operated under the NSF philosophy to produce beef cattle in a rotational grazing system with stocking rates varying between seasonal conditions and associated pasture growth and available standing dry matter.

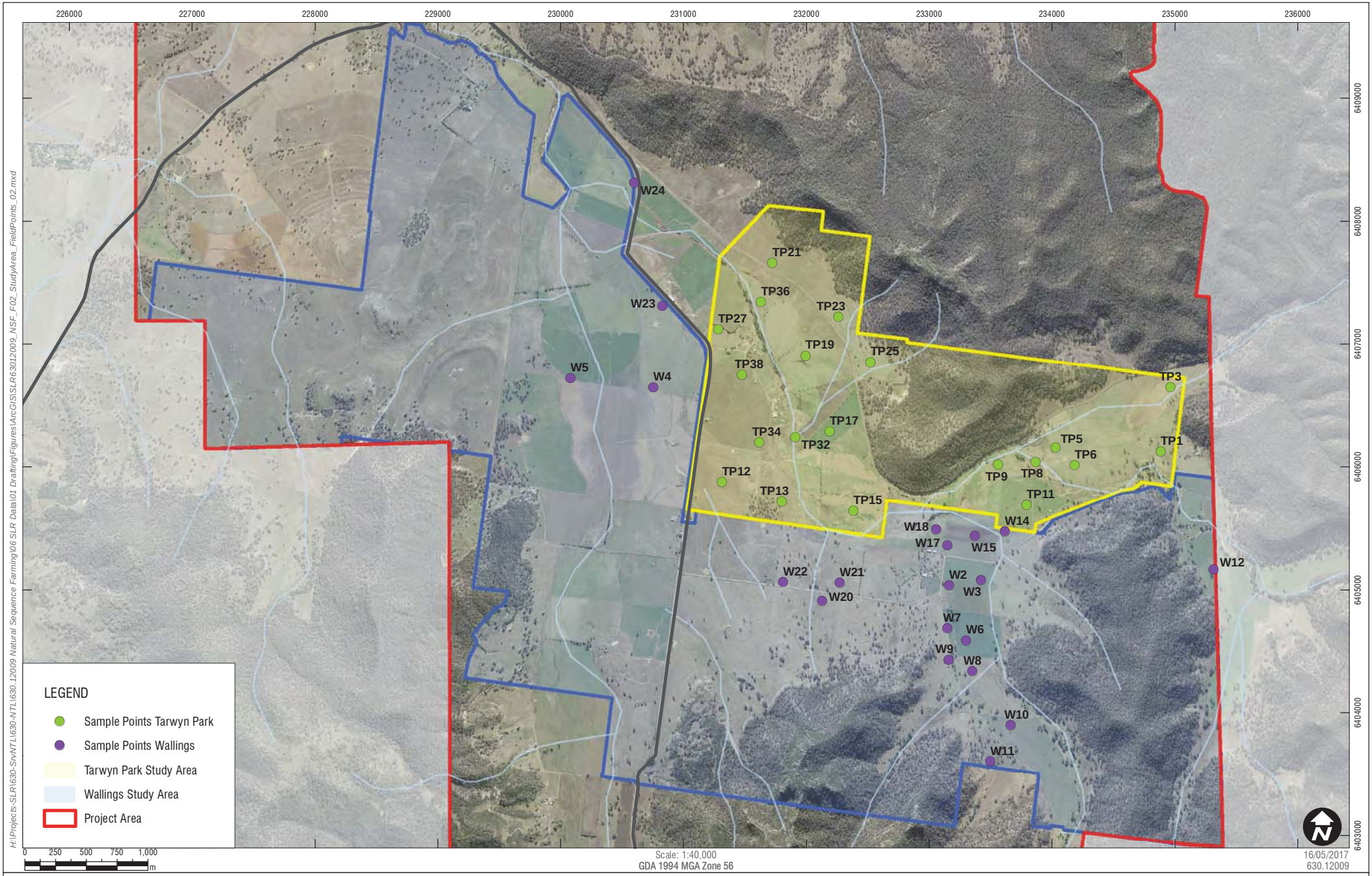
5 METHODOLOGY

5.1 Site Selection

Sites for comparison between the Tarwyn Park Farm Complex and Wallings were selected using soil mapping data, slope analysis and land use information obtained from previous assessments conducted by SLR. This site selection process enabled similar sites on the Tarwyn Park Farm Complex and Wallings to be compared for potential agricultural productivity. The Study Area was assessed by SLR's Associate Agronomist, Murray Fraser, over the period 4th-7th April, 2017.

Sites of the same Australian Soil Classification (ASC) soil type, slope and pasture type on Tarwyn Park Farm Complex and Wallings were selected for comparative analysis. An example of the layout of Site photo's (as provided in **Appendix A**) is shown below in **Table 2**. For each site on the Tarwyn Park Farm Complex and Wallings properties a landscape and soil photograph are provided. Sampled sites are shown on **Figure 2**. The slope analysis across the two properties is shown on **Figure 3** and the soil types are shown on **Figure 4**.

Table 2 Appendix A Site Photo Layout



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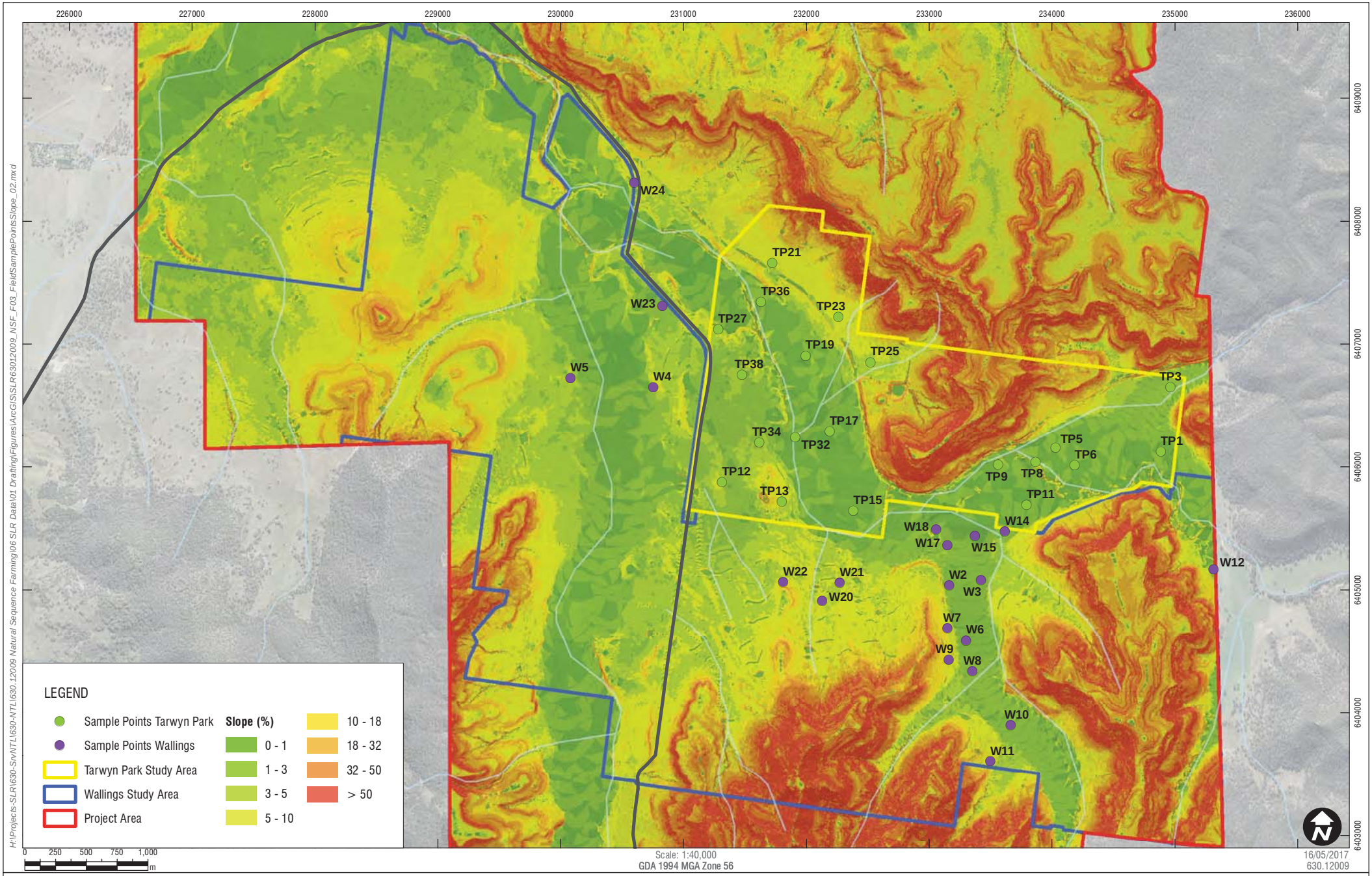
Comparative Agricultural Productivity Assessment
Study Area and Field Points

FIGURE 2



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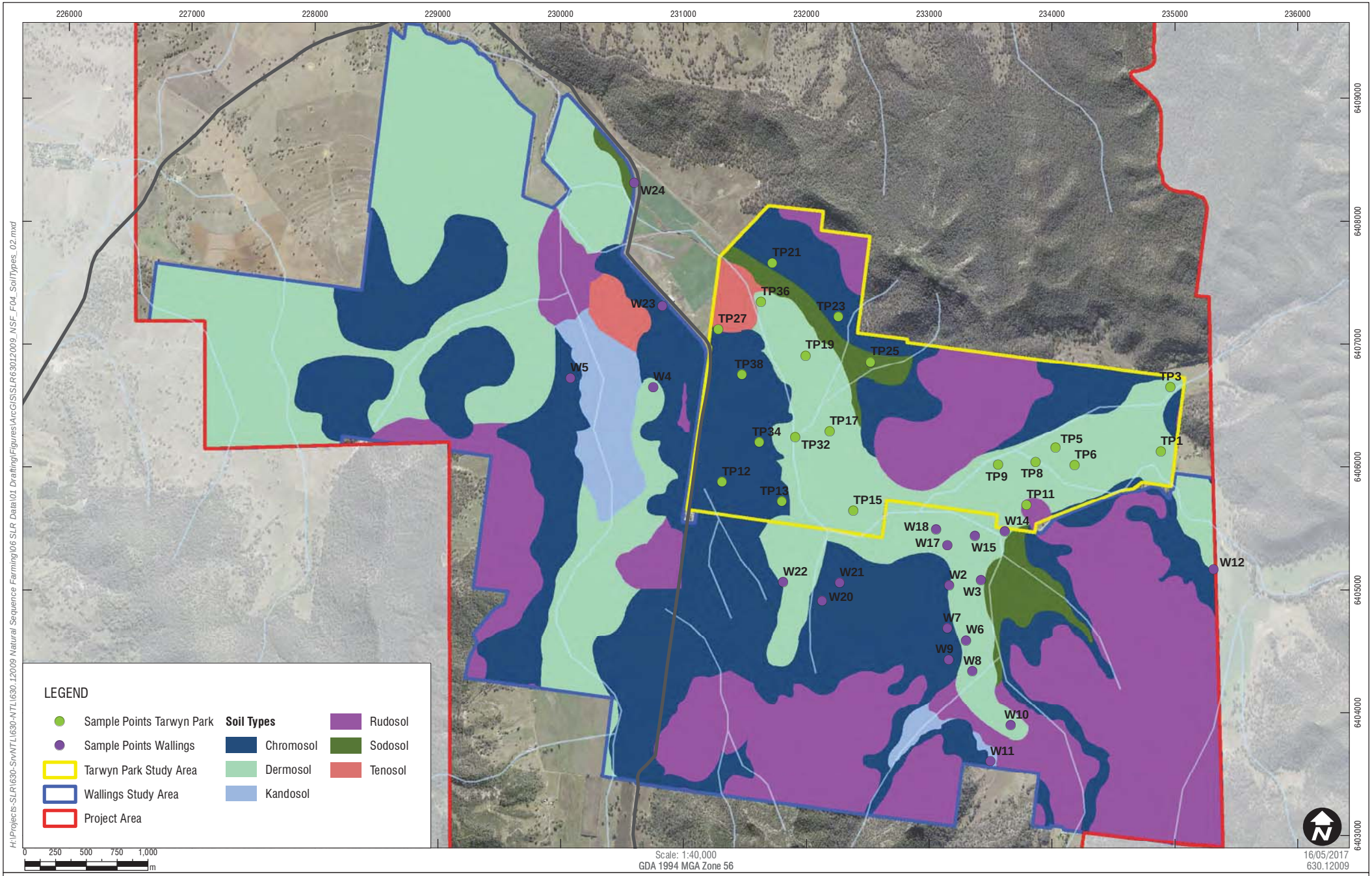
Comparative Agricultural Productivity Assessment
Study Area Slope and Field Points

FIGURE 3



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Comparative Agricultural Productivity Assessment
Study Area Soil Types and Field Points

FIGURE 4

Soil samples were collected in the field from each site which for laboratory analysis, with a summary of the main soil element results shown in **Table 3** below. Full site descriptions and photographs of each site are provided in **Appendix A**.

Table 3 Appendix A Site Comparison Example

Site Number	Site Descriptor
Soil Type	ASC Soil Type
Topography	Dominant Landform
Slope	Slope Percentage Category (LIDAR)
Current Land Use	Agricultural Land Use
Pasture Type	Dominant Pasture Species Present
Soil Element	**Laboratory Analysis Type**
PAWC 0-10 cm	Plant Available Water Capacity 0-10 centimetres
PAWC 10-20 cm	Plant Available Water Capacity 10-20 centimetres
pH ($CaCl_2$)	pH in Calcium Chloride
Ca:Mg	Calcium to Magnesium Ratio
Organic Carbon	Walkely & Black %
Phosphorus	Bray-1 mg/kg
Nitrate Nitrogen	Water Extract mg/kg
Sulfur	KCl 40 S mg/kg

5.2 Laboratory Assessment and Results Interpretation

Soil samples were collected from each site at 0-10 centimetres for nutrient testing at Soiltec Laboratory, Soil Nutrient Testing & Analysis

During the site assessment, SLR collected 80 soil samples from 40 sites (see **Figure 2**) to assess available nutrient status in the top 10 centimetres of soil, as per NSW Department of Primary Industries (2016) recommended sampling depths for dryland pastures, which is 0 – 10 centimetres, while further samples were collected at 10-20 centimetres for analysis of Plant Available Water Capacity (PAWC) at Scone Soil Conservation Laboratory. The samples were analysed at Soiltec Laboratory Service Laboratory for plant available nutrients (as listed in **Table 4**) Full soil test results are provided for the 80 soil samples in **Appendix B**. Optimal nutrient levels for pasture and crop growth shown in **Table 4** are taken from *Soil Analysis: An Interpretation Manual* (Peverill, Sparrow & Reuter, 1999).

Table 4 Laboratory Analysis

Soil Component	Test Type	Optimal Level	Status
EC	1:5 Water	< 0.15	Macro Element
pH	1:5 $CaCl_2$	> 5.2	
Calcium	As a percentage of total exchangeable cations	65 – 80%	
Magnesium		15 – 20%	
Potassium		2 – 5%	
Sodium		< 3%	
Aluminium		< 5%	
Ca:Mg	Ratio	3 – 5	

Soil Component	Test Type	Optimal Level	Status
Phosphorus	mg/kg Bray-1	18 – 22	
Sulfur	KCl 40 S mg/kg	> 8	
Nitrate Nitrogen	Water extract mg/kg	> 10	
Organic Carbon	Walkely & Black %	> 2%	
Water Holding Capacity	PAWC %	> 20%	
Copper	DTPA mg/kg	> 0.4	
Zinc	DTPA mg/kg	> 0.7	
Manganese	DTPA mg/kg	4 – 50	Trace Element
Iron	DTPA mg/kg	4 – 50	
Boron	Hot CaCl mg/kg	> 0.5	

Each site analysis was then rated for nutrient levels needed for optimal crop or pasture growth, according to the "traffic light" rating shown in **Table 5** below, with thresholds based on those given in *Soil Sense: Soil Management for North Coast Farmers* (Lines-Kelly 1994). Ratings for PAWC were obtained from *Interpreting Soil Test Results* (Hazelton & Murphy, 2007).

Table 5 Nutrient Ratings

Colour	Rating
Green	Not limiting for pasture or crop growth, "green is good for growing"
Orange	Marginal level, possibly limiting maximum production of crop or pasture
Red	Deficient or toxic, limiting factor for maximum crop or pasture growth

Soil chemical thresholds were compared between Wallings and the Tarwyn Park Farm Complex from the recent *Tarwyn Park Agricultural Assessment and Land Management Plan* (SLR, 2016). Thresholds for each of the nutrient ratings are shown in the following tables. Not Applicable (N/A) is used where those nutrient levels do not occur in any of the soil test results. ECe (salinity) was calculated using EC and a soil texture multiplier as per the methodology outlined in Hazelton & Murphy (2007). Thresholds for macro and trace elements are presented in **Tables 6** to **9**.

Table 6 Soil Chemical Balance Thresholds

ECe (Salinity)	pH	Calcium to Magnesium	Organic Carbon (OC)
dS/m	$CaCl_2$	(Ca:Mg) Ratio	Walkely & Black %
<2.0	>5.2	>3.0	>2.0
2.0 – 8.0	<5.1	<2.9	<1.9
>8.0	<4.5	<2.0	N/A

Table 7 Exchangeable Cation Thresholds

Calcium (Ca)	Magnesium (Mg)	Potassium (K)	Sodium (Na)	Aluminium (Al)
% of Total	% of Total	% of Total	% of Total	% of Total
>65.0	15.0 – 20.0	2.0 – 5.0	<3.0	<5.0
<64.9	>20.1	<2.0 or >5.0	>3.1	N/A
<60.0	>30.0	N/A	N/A	N/A

Table 8 Macro Elements Thresholds

Phosphorus (P)	Nitrate Nitrogen (NO_3)	Sulfur (S)	PAWC
Bray-1 mg/kg	Water Extract mg/kg	KCl 40 S mg/kg	% by weight
>18.0	>10.0	>8.0	>20
<17.9	<9.9	<7.9	10-20
<15.0	<7.0	<6.0	<10

Table 9 Trace Element Thresholds

Copper (Cu)	Zinc (Zn)	Manganese (Mn)	Iron (Fe)	Boron (B)
DTPA mg/kg	DTPA mg/kg	DTPA mg/kg	DTPA mg/kg	Hot CaCl mg/kg
>0.4	>0.7	4.0 – 50.0	4.0 – 50.0	>0.5
N/A	<0.7	<4.0 or >50	<4.0 or >50	<0.5
N/A	<0.5	N/A	N/A	N/A

Soil test results and traffic light ratings were the compared overall between the Tarwyn Park Farm Complex and Wallings, and also between soil types. Assessment of the benefits of NSF (if any) was then made using these comparisons.

5.3 Land Degradation Comparison

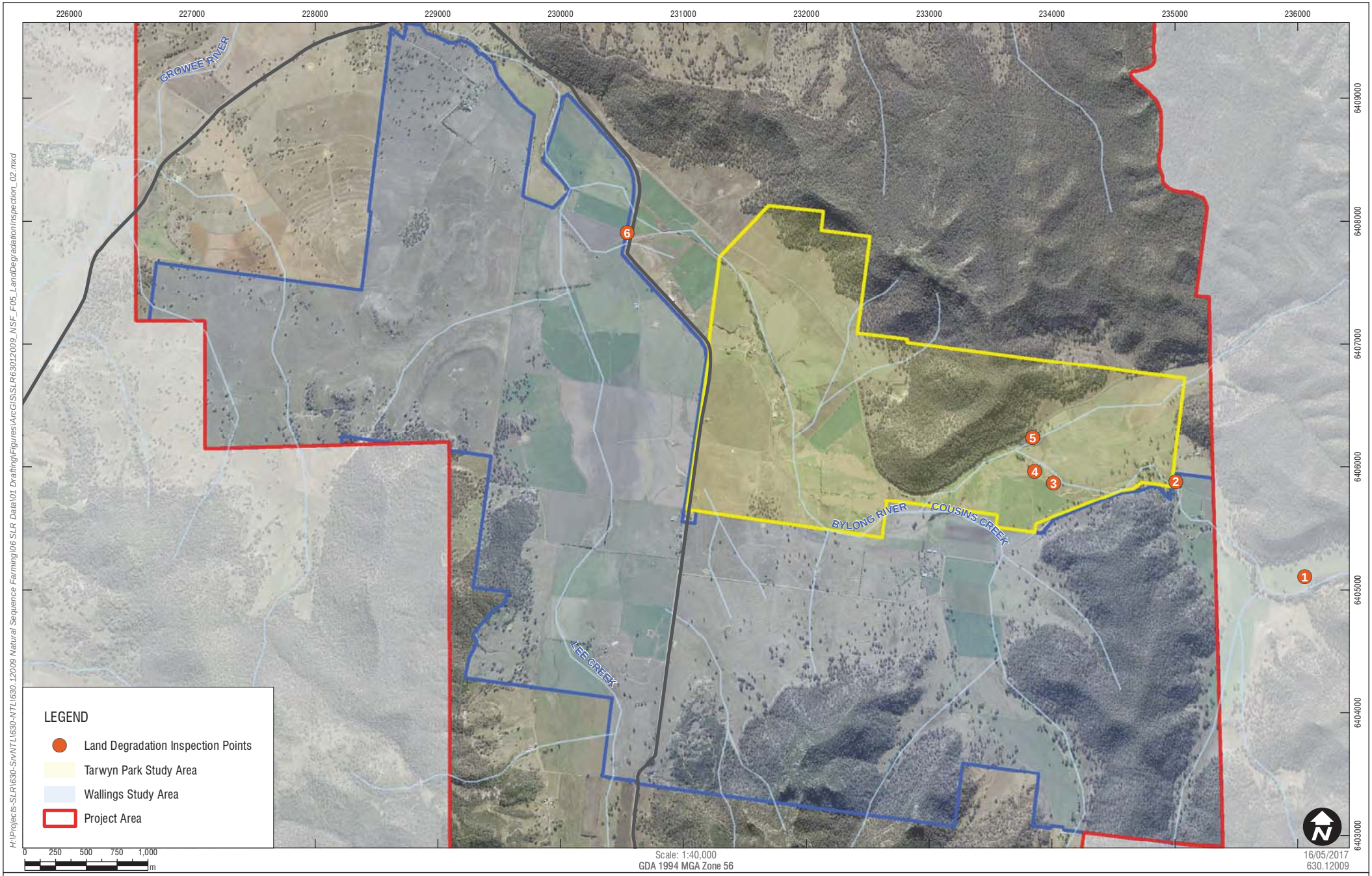
The Study Area (Tarwyn Park Farm Complex and Wallings) was assessed for land degradation at reconnaissance level by SLR's Land and Water Operations Manager, Rod Masters, on 4th April, 2017. The assessment included recorded observations and relevant plates (photographs) for representative sites with the focus being on the differences in land degradation issues (e.g. erosion, waterlogging, salinity, weed infestation, etc.) between the Tarwyn Park Farm Complex and Wallings.

Figure 5 is a site plan showing specific sites where observations were recorded and photographed. **Appendix C** includes the relevant plates for each site with recorded observations.

5.4 Rainfall Use Efficiency

Rainfall use efficiency is a measure of pasture grown per millimetre of rainfall. It can be used as a measure of "farm health", as when soil elements are in balance, the property will produce more kilograms per hectare of dry matter (fodder) per millimetre of rainfall.

The methodology for rainfall use efficiency was developed utilising information derived from *Measuring Rainfall Use Efficiency in Pastures* (MLA, 2008) and *Water use by crops and pastures in southern NSW* (DPI, 2009).



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Comparative Agricultural Productivity Assessment
Land Degradation Inspection Points

FIGURE 5

6 SOIL TESTING RESULTS COMPARISON

A summary of all traffic light ratings and soil test results for each soil element is given below. Observations are provided where there is a difference between property ratings, soil type or averages occurs. All comments on soil element characteristics are derived from *The Grazier's Guide to Pastures* (DPI, 2003).

6.1 ECe (Salinity)

There is no difference in ECe rating (**Table 10**) between the Tarwyn Park Farm Complex and Wallings, with all sites rated as green.

ECe is below 0.3 dS/m on all sites at Wallings excluding Site W6 (0.9 dS/m), whereas all sites at the Tarwyn Park Farm Complex are above 0.3 dS/m but less than 2 dS/m.

6.2 pH ($CaCl_2$)

A minor difference in pH rating (**Table 10**) with one Dermosol site at the Tarwyn Park Farm Complex rated orange, while one Dermosol site and one Chromosol site at Wallings were also rated orange**.**

Recordings of pH are generally closer to neutral (>6.0) on the Dermosol sites at Wallings, possibly due to historical lime application on this property.

6.3 Calcium to Magnesium Ratio

There is a major difference between the two properties calcium to magnesium ratio rating (**Table 10**), with the Tarwyn Park Farm Complex having two Dermosol sites rated green and two Dermosol sites rated red. The remaining sites on the Tarwyn Park Farm Complex were rated orange.

Wallings has six Dermosol sites, five Chromosol sites and the Rudosol site rated green. Similar to the Tarwyn Park Farm Complex, two Dermosol sites were rated red. The remaining six sites on Wallings were rated orange.

Well-structured soils generally have twice the amount of exchangeable calcium to exchangeable magnesium. If the calcium to magnesium ratio is less than 2:1, then this may indicate reduced soil stability as magnesium tends to increase soil dispersion.

This generally higher calcium to magnesium ratio on Wallings is possibly due to historical lime and/or single superphosphate applications, both of which have high calcium content. This is in comparison with the Tarwyn Park Farm Complex which has not been subject to historical superphosphate applications.

6.4 Organic Carbon

A minor difference in organic carbon levels (**Table 10**) with one Chromosol site at the Tarwyn Park Farm Complex rated orange while the single Sodosol site at Wallings was also rated orange. All remaining sites on both properties are rated green.

Higher organic carbon in the topsoil increases rainfall infiltration and rainfall use efficiency.

Overall, there is no difference in organic carbon levels between the two properties with an average of 3.0% for both properties.

Table 10 Soil Chemical Balance Ratings

Tarwyn Park	ECe	pH ($CaCl_2$)	Ca:Mg	Organic Carbon
TP5	0.7	6.7	3.0	3.0
TP3	0.5	6.2	2.5	3.1
TP1	0.6	7.1	2.6	3.3
TP6	0.6	5.8	3.3	2.9
TP8	1.4	6.3	2.4	3.7
TP9	0.9	5.8	2.4	3.5
TP36	0.7	6.1	2.4	3.3
TP19	0.4	5.8	2.4	2.8
TP32	1.7	7.7	1.9	3.4
TP17	0.9	5.0	1.9	3.0
TP15	0.4	5.7	2.4	2.3
TP23	0.7	5.7	2.6	2.8
TP21	0.5	5.7	2.6	3.1
TP13	0.6	5.6	2.1	3.0
TP38	0.6	5.9	2.4	2.7
TP27	0.5	5.6	2.3	3.0
TP34	0.5	5.3	2.8	2.4
TP12	0.4	5.8	2.2	1.9
TP25	0.5	6.0	2.5	2.9
TP11	0.4	5.3	2.2	3.5
Wallings	**ECe**	**pH ($CaCl_2$)**	**Ca:Mg**	**Organic Carbon**
W2	0.1	5.3	2.6	3.2
W3	0.2	5.5	1.8	3.4
W4	0.2	5.3	1.5	3.3
W6	0.9	5.7	2.5	3.4
W8	0.1	5.5	3.1	3.1
W10	0.1	5.4	3.0	3.2
W12	0.2	5.6	3.0	3.6
W14	0.1	5.0	3.4	3.1
W15	0.1	5.1	3.5	3.2
W17	0.1	5.4	3.4	3.4
W18	0.2	6.0	2.2	3.2
W7	0.1	5.3	2.9	3.0
W9	0.1	4.8	3.0	3.0
W20	0.1	5.3	3.0	3.0
W21	0.1	5.2	3.6	2.8
W22	0.1	5.4	3.2	2.6
W23	0.1	5.4	3.3	2.4
W5	0.1	5.6	2.6	2.9
W24	0.1	5.1	2.2	1.8
W11	0.1	5.8	3.3	2.9

6.5 Exchangeable Calcium

A minor difference in exchangeable calcium levels (**Table 11**) with two Dermosol sites at Tarwyn Park Farm Complex rated orange, whilst at Wallings there was one Dermosol site rated orange and one Dermosol site rated red (the Dermosol is 0.7% below the orange threshold). All other sites on the two properties were rated green.

Exchangeable calcium is a necessary plant nutrient and plays a key role in maintaining soil structure, with an ideal range of 65% to 80%.

Calcium levels on Wallings are general higher (>70%) than at the Tarwyn Park Farm Complex possibly due to historical lime and/or single superphosphate application on the Wallings properties, both of which have high calcium content.

6.6 Exchangeable Magnesium

A minor difference in exchangeable magnesium levels was determined between the two properties (**Table 11**). Tarwyn Park Farm Complex has two Dermosol sites and one Chromosol site rated red, with all remaining sites rated orange. Wallings has three Dermosol sites and the single Sodosol site rated red (the Sodosol is only 0.1% above the orange threshold), with all remaining sites rated orange.

Levels of exchangeable magnesium greater than 20% tend to increase soil dispersion and can also lead to potassium deficiency. Average exchangeable magnesium levels are marginally higher on Tarwyn Park Farm Complex (27.9%) compared to Wallings (25.7%).

6.7 Exchangeable Potassium

A minor difference in exchangeable potassium levels was identified (**Table 11**) with Wallings having two Dermosol sites rated orange (0.4% and 0.1% below the green thresholds), while all other sites at Wallings and Tarwyn Park Farm Complex were rated green.

Potassium deficiency occurs most in sandy soils and so is not widespread in NSW. Potassium can become deficient on intensively used areas such as areas constantly cut for hay or silage. Potassium levels are slightly higher at Tarwyn Park Farm complex (3.6%) than Wallings (2.9%), possibly due to historical hay cutting activities at Wallings.

6.8 Exchangeable Sodium

A minor difference in exchangeable sodium levels was identified (**Table 11**) with the Tarwyn Park Farm Complex having one Dermosol site rated orange, while all other sites at Tarwyn Park Farm Complex and Wallings were rated green.

Generally, when exchangeable sodium levels are greater than 5%, soil structure declines and sodicity becomes an issue. Exchangeable sodium levels on average were higher on Tarwyn Park Farm Complex (1.0%) compared to Wallings (0.3%).

6.9 Exchangeable Aluminium

There is no difference in exchangeable aluminium (**Table11**) between Tarwyn Park Farm Complex (0.0%) and Wallings (0.1%), with all sites rated as green, with levels extremely low.

Aluminium toxicity (greater than 5%) impacts phosphorus uptake in pasture and nodulation in legumes.

Table 11 Exchangeable Cation Thresholds

Tarwyn Park	Calcium	Magnesium	Potassium	Sodium	Aluminium
TP5	71.9	23.9	3.8	0.4	0.0
TP3	68.5	27.0	4.0	0.5	0.0
TP1	69.5	26.3	4.0	0.2	0.0
TP6	73.6	22.0	4.2	0.3	0.0
TP8	67.6	27.8	3.5	1.1	0.0
TP9	67.8	28.2	3.7	0.3	0.0
TP36	66.9	27.9	3.3	1.9	0.0
TP19	67.1	28.5	3.9	0.5	0.0
TP32	61.6	31.8	2.3	4.3	0.0
TP17	63.2	32.9	3.2	0.7	0.0
TP15	66.9	28.3	2.6	2.3	0.0
TP23	68.4	25.8	5.2	0.6	0.0
TP21	69.6	26.6	3.4	0.4	0.0
TP13	64.7	31.4	2.5	1.4	0.0
TP38	68.0	28.1	3.1	0.7	0.0
TP27	66.6	28.5	3.6	1.3	0.0
TP34	70.5	25.4	3.7	0.4	0.0
TP12	65.4	29.3	3.4	1.9	0.0
TP25	68.1	27.5	3.8	0.6	0.0
TP11	65.5	29.8	3.8	0.9	0.0
Wallings	**Calcium**	**Magnesium**	**Potassium**	**Sodium**	**Aluminium**
W2	69.9	27.2	2.5	0.4	0.0
W3	62.3	35.6	1.6	0.4	0.0
W4	59.3	38.5	1.9	0.2	0.0
W6	69.4	28.2	2.0	0.3	0.0
W8	73.3	23.8	2.7	0.3	0.0
W10	72.5	24.4	3.0	0.2	0.0
W12	72.6	24.5	2.6	0.2	0.0
W14	73.4	21.7	4.2	0.2	0.5
W15	74.9	21.2	3.7	0.2	0.0
W17	75.0	22.0	2.7	0.3	0.0
W18	67.4	30.4	2.0	0.2	0.0
W7	72.0	24.6	3.1	0.3	0.0
W9	71.0	23.3	4.2	0.2	1.3
W20	72.1	24.4	3.4	0.2	0.0
W21	74.9	21.0	3.8	0.3	0.0
W22	73.5	22.8	3.2	0.5	0.0
W23	74.1	22.2	3.3	0.3	0.0
W5	70.3	26.6	2.8	0.2	0.0
W24	67.3	30.1	2.4	0.2	0.0
W11	73.8	22.2	3.7	0.3	0.0

6.10 **Phosphorus**

There are differences between the two properties phosphorus ratings according to soil type (**Table°12**), with Wallings having nine Dermosol sites and a Chromosol site rated green. Six Chromosol sites, one Dermosol site, the Sodosol site and the Rudosol site are rated red. It appears that the former landholder concentrated phosphorus based fertiliser application on the Dermosols, where much of this area comprises lucerne pasture. Phosphorus levels are very low at the Chromosol sites, which comprise mostly native grass pasture.

At the Tarwyn Park Farm Complex three Dermosol sites and four Chromosol sites are rated red. Five Dermosol sites, one Chromosol site and the Rudosol site are rated green, with the remainder rated orange. Of note from these ratings at the Tarwyn Park Farm Complex is that five of the sites rated green have remnant lucerne pasture, indicating that a phosphorus based fertiliser was likely applied during lucerne establishment or as topdressing during lucerne production.

Phosphorus in the Dermosol soils on Wallings was significantly higher (27.6 mg/kg) compared to the Dermosols on the Tarwyn Park Farm Complex (18.5 mg/kg).

Phosphorus is one of the major plant nutrients in the soil. It is a constituent of plant cells, essential for cell division and development of the growing tip of the plant, it is vital for seedlings and young plants.

There is little difference between the average overall phosphorus levels between Wallings (17.7 mg/kg) and Tarwyn Park Farm Complex (17.8 mg/kg).

6.11 **Nitrate Nitrogen**

There is a significant difference in the nitrate nitrogen rating between the two properties (**Table 12**), with all sites on Wallings rated green. The higher nitrate nitrogen levels were observed on the Dermosols (average 42.0 mg/kg) in comparison to the Chromosols (average 24.3 mg/kg). This is most likely due to the higher phosphorus and sulfur levels resulting in greater legume growth and in turn higher nitrogen fixation by these legumes.

At the Tarwyn Park Farm Complex seven Dermosol sites, five Chromosol sites and the Sodosol site were rated green. Three Dermosol sites, one Chromosol site and the Rudosol site rated red, while the remaining Dermosol and Chromosol sites were rated orange.

The most common nutrient that pastures respond to is nitrogen. A vigorous legume component can provide 25 kilograms of nitrogen per tonne of dry matter grown. High soil nitrogen levels promote rapid grass growth, resulting in higher feed quality and digestibility.

On average, across all sites, the nitrate nitrogen was significantly higher on the Wallings property (33.6 mg/kg) compared to the Tarwyn Park Farm Complex (13.2 mg/kg).

6.12 **Sulfur**

There are some differences between the two properties sulfur ratings (**Table 12**) according to soil type, with Wallings having ten Dermosol sites and three Chromosol sites rated orange. Four Chromosol sites, one Dermosol site, the Sodosol site and the Rudosol site on the Wallings property are rated red. It appears that Wallings concentrated sulfur containing fertiliser application on the Dermosol area, where much of this area comprises lucerne pasture. Sulfur levels are very low at Chromosol sites which comprise mostly native grass pasture.

At the Tarwyn Park Farm Complex five Dermosol sites, four Chromosol sites and the Sodosol site are rated red. Five Dermosol sites, three Chromosol sites and the Rudosol site are rated orange. One Dermosol site is rated green. Site TP19 seems a management anomaly as it is within grass pasture and rates green for phosphorus, nitrogen and sulfur.

Sulfur is essential for nitrogen fixation by legumes. Nitrogen fixation provides a “free” source of nitrogen for grass pasture growth. Sulfur in the Dermosols on Wallings was on average marginally higher (6.9 mg/kg) compared to the Dermosols on Tarwyn Park Farm Complex (6.2 mg/kg).

There is little difference between the average overall sulfur levels between Wallings (6.4 mg/kg) and Tarwyn Park Farm Complex (6.0 mg/kg).

6.13 **PAWC 0-10 cm**

There was some difference between the PAWC 0-10 cm ratings between the two properties (**Table 12**), with Wallings having nine Dermosol sites, six Chromosol sites and the Sodosol site rated orange. One Chromosol site and the Rudosol site on the Wallings property were rated red. One Dermosol site and one Chromosol site on the Wallings property are rated green.

At the Tarwyn Park Farm Complex, three Dermosol sites and two Chromosol sites were rated green. Eight Dermosol sites, five Chromosol sites and the Sodosol site were rated orange. The Rudosol site is rated red.

PAWC provides a numerical value for the size of the soil water storage “bucket” which crops and pastures can access. Generally, the higher the clay and organic carbon content, the higher the PAWC. PAWC is measured as the difference between the soils field capacity (full “bucket”) and the crop lower limit or wilting point (empty “bucket”).

There is little difference in the overall average PAWC 0-10 cm between Wallings (15%) and Tarwyn Park Farm Complex (16%).

6.14 **PAWC 10-20 cm**

There is some difference in the PAWC 10-20 cm rating between the two properties (**Table 12**), with Wallings having nine Dermosol sites, six Chromosol sites and the Sodosol site rated orange. Two Dermosol sites, one Chromosol site and the Rudosol site are rated red.

At the Tarwyn Park Farm Complex four Dermosol sites and one Chromosol site are rated green. Three Dermosol sites, five Chromosol sites and the Sodosol site rated orange. Four Dermosol sites, one Chromosol site and the Rudosol site are rated red.

There is little difference in the overall average PAWC 10-20 cm between Wallings (13%) and the Tarwyn Park Farm Complex (15%).

Table 12 Macro Elements Thresholds & PAWC

Tarwyn Park	Phosphorus	Nitrate Nitrogen	Sulfur	PAWC 0-10 cm	PAWC 10-20 cm
TP5	16.6	23.0	5.2	11	5
TP3	13.6	2.3	4.2	23	14
TP1	27.6	6.9	7.8	13	9
TP6	15.4	9.2	5.3	16	8
TP8	15.0	27.6	6.4	17	17
TP9	13.0	11.5	5.6	25	36
TP36	20.4	13.8	6.7	24	23
TP19	31.3	11.5	8.5	12	9
TP32	13.0	11.5	4.3	23	17
TP17	19.3	23.0	6.3	16	21
TP15	18.7	4.6	7.4	11	31
TP23	21.9	16.1	7.2	14	13
TP21	14.0	13.8	4.6	19	14
TP13	13.8	6.9	5.7	21	22
TP38	14.0	23.0	6.1	14	11
TP27	17.3	11.5	5.7	22	12
TP34	15.1	18.4	6.3	16	11
TP12	14.0	9.2	5.2	12	9
TP25	15.7	13.8	5.7	15	13
TP11	26.2	6.9	6.4	2	7
Wallings	**Phosphorus**	**Nitrate Nitrogen**	**Sulfur**	**PAWC 0-10 cm**	**PAWC 10-20 cm**
W2	25.6	36.8	6.5	19	19
W3	26.7	46.0	7.1	19	18
W4	20.5	36.8	6.7	17	16
W6	28.5	18.4	7.5	19	14
W8	23.2	41.4	7.2	13	16
W10	25.4	36.8	7.9	10	9
W12	16.7	50.6	6.0	22	20
W14	18.3	18.4	6.8	9	11
W15	13.1	41.4	5.7	11	9
W17	20.4	64.4	6.9	19	16
W18	27.1	73.6	7.6	20	17
W7	19.3	13.8	6.7	17	14
W9	11.1	18.4	5.1	14	12
W20	14.5	32.2	5.8	15	15
W21	14.4	36.8	6.2	13	8
W22	8.1	23.0	5.3	13	11
W23	11.2	18.4	6.2	11	11
W5	12.9	27.6	5.3	21	13
W24	6.9	18.4	5.0	11	12
W11	9.5	18.4	5.6	6	1

6.15 **Copper**

There is no difference in copper (**Table 13**) between the Tarwyn Park Farm Complex and Wallings, with all sites rated as green. The generally higher copper levels (>1.0 mg/kg) on the Dermosols at Wallings are likely due to historical trace element application. Copper is an essential trace element involved with enzymes which catalyze oxidase type reactions within the plant cell.

6.16 **Zinc**

There is a major difference between the two properties zinc rating (**Table 13**), with the Tarwyn Park Farm Complex having six Dermosol sites and one Chromosol site rated orange and one Chromosol site rated red. The remaining twelve sites are all rated green. All sites on Wallings are rated green. Zinc may be required on light textured soils such as sands or sandy loams and particularly within those soils that are alkaline (not identified in study area). Zinc is required for fodder and grain cropping, although zinc responses in pasture are considered rare. This higher zinc level (>0.8 mg/kg) on the Dermosols at Wallings is possibly due to historical trace element application.

6.17 **Manganese**

There is a major difference between the two properties manganese rating (**Table 13**), with Wallings having four Dermosol sites and the Sodosol site rated orange (>50 mg/kg). The remaining sixteen sites at Wallings are rated green. All sites on Tarwyn Park Farm Complex are rated green.

Toxicity from excessive amounts of available manganese (>50 mg/kg) can affect the growth of crops and pasture in soils where pH is less than 5.5, but only in some soils and then only at certain times of the year. Toxic amounts of manganese disrupt photosynthesis and the function of plant hormones. The anaerobic conditions associated with waterlogged soils can induce manganese toxicity. There was no evidence of manganese toxicity in pastures at Wallings, most likely due to good soil profile permeability and drainage. The higher manganese levels (>30 mg/kg) on the Dermosols at Wallings are likely due to historical trace element application.

6.18 **Iron**

There is a major difference between the two properties iron rating (**Table 13**), with Wallings having all Dermosol sites, one Chromosol site and the Sodosol site rated orange (>50 mg/kg). The remaining seven sites at Wallings are all rated green. All sites on Tarwyn Park Farm Complex are rated green.

Iron is essential for the formation of chlorophyll. Toxicity from excessive amounts of available iron (>50 mg/kg) can affect the growth of crops and pasture in soils where pH is less than 5.5. The anaerobic conditions associated with waterlogged soils can induce iron toxicity. There was no evidence of iron toxicity in pastures at Wallings, most likely due to good soil profile permeability and drainage. The higher iron levels (>40 mg/kg) on sites sampled at Wallings are likely due to historical trace element application.

6.19 **Boron**

There is a minor difference in boron ratings between the two properties (**Table 13**). Tarwyn Park Farm Complex has one Dermosol site and one Chromosol site rated orange, while all other sites at Tarwyn Park Farm Complex and Wallings were rated green.

Boron is closely associated with cell division and development in the growth regions of the plant i.e. at the tips of shoots and roots. The higher boron levels (>0.6 mg/kg) at the sites sampled on Wallings are likely due to historical trace element application.

Table 13 Trace Element Thresholds

Tarwyn Park	Copper	Zinc	Manganese	Iron	Boron
TP5	0.7	0.6	14.8	12.3	0.6
TP3	0.7	0.6	15.6	17.6	0.5
TP1	0.8	0.7	16.8	19.1	0.6
TP6	0.6	0.6	15.9	14.2	0.6
TP8	0.8	0.7	21.2	18.9	0.7
TP9	0.6	0.6	13.3	10.5	0.6
TP36	0.8	0.7	18.7	17.5	0.7
TP19	0.6	0.6	12.9	8.5	0.6
TP32	0.8	0.9	24.2	20.2	0.8
TP17	0.6	0.5	13.1	8.6	0.5
TP15	0.5	0.5	6.9	4.8	0.3
TP23	0.6	0.7	15.2	7.8	0.6
TP21	0.8	0.8	19.6	16.5	0.8
TP13	0.9	0.9	23.8	26.9	0.8
TP38	0.7	0.8	15.6	19.2	0.7
TP27	0.7	0.6	14.7	15.2	0.7
TP34	0.6	0.7	11.2	9.3	0.5
TP12	0.4	0.4	4.3	4.1	0.3
TP25	0.7	0.7	16.3	11.2	0.7
TP11	0.7	0.7	19.2	23.5	0.5
Wallings	**Copper**	**Zinc**	**Manganese**	**Iron**	**Boron**
W2	0.7	0.9	46.9	59.6	0.8
W3	1.1	0.9	52.7	62.9	0.8
W4	1.1	0.8	55.3	63.7	0.9
W6	1.0	0.9	45.4	58.6	0.8
W8	1.1	0.9	42.8	53.6	0.7
W10	1.0	0.9	40.8	55.1	0.7
W12	1.4	1.0	56.2	62.9	0.9
W14	1.1	0.9	42.7	56.7	0.8
W15	1.0	0.8	45.5	58.2	0.7
W17	1.2	0.9	49.2	59.1	0.8
W18	1.3	1.0	52.9	60.9	0.9
W7	0.9	0.7	35.7	49.2	0.6
W9	0.7	0.7	33.9	48.6	0.6
W20	0.7	0.7	38.5	48.2	0.7
W21	0.6	0.7	32.7	42.9	0.6
W22	0.7	0.7	34.5	45.7	0.7
W23	0.6	0.6	26.9	39.2	0.6
W5	0.7	0.7	32.1	53.1	0.6
W24	1.0	0.9	50.8	59.1	0.7
W11	0.6	0.7	34.2	43.9	0.6

Table 14 Comparative Rating Summary

Soil Element	Tarwyn Park Rating			Wallings Rating		
ECe	20	0	0	20	0	0
pH (CaCl2)	19	1	0	18	2	0
Ca:Mg	2	16	2	12	6	2
Organic Carbon	19	1	0	19	1	0
Subtotal	60	18	2	69	9	2
Proportion	75%	23%	3%	86%	11%	3%
Calcium	18	2	0	18	1	1
Magnesium	0	17	3	0	16	4
Potassium	20	0	0	18	2	0
Sodium	19	1	0	20	0	0
Aluminium	20	0	0	20	0	0
Subtotal	77	20	3	76	19	5
Proportion	77%	20%	3%	76%	19%	5%
Phosphorus	7	6	7	10	1	9
Nitrate Nitrogen	13	2	5	20	0	0
Sulfur	1	9	10	0	13	7
Subtotal	21	17	22	30	14	16
Proportion	35%	28%	37%	50%	23%	27%
PAWC 0-10 cm	5	14	1	2	16	2
PAWC 10-20 cm	5	9	6	0	16	4
Subtotal	10	23	7	2	32	6
Proportion	25%	57%	18%	5%	80%	15%
Copper	20	0	0	20	0	0
Zinc	12	7	1	20	0	0
Manganese	20	0	0	15	5	0
Iron	20	0	0	7	13	0
Boron	18	2	0	20	0	0
Subtotal	90	9	1	82	18	0
Proportion	90%	9%	1%	82%	18%	0%
Total	**258**	**87**	**35**	**259**	**92**	**29**
Proportion	**68%**	**23%**	**9%**	**68%**	**24%**	**8%**

Table 14 above summarises the traffic light ratings between the two properties. Overall, there is very little difference between the ratings at the Tarwyn Park Farm Complex and Wallings with both properties having 68% green and only 1% difference in both orange and green. The main differences in ratings between the properties are for the following two soil element categories:

- Macro elements (phosphorus, nitrate nitrogen and sulfur), Wallings has 50% green compared to 35% green at the Tarwyn Park Farm Complex, also 27% red at Wallings which is less than 37% red at the Tarwyn Park Farm Complex.

- PAWC, the Tarwyn Park Farm Complex has 25% green compared to Wallings at 5%, although the Tarwyn Park Farm Complex also has slightly more red (18%) than Wallings (15%).

Table 15 Soil Test Property Averages

Average	ECe	pH ($CaCl_2$)	Ca:Mg	Organic Carbon
Tarwyn Park	0.7	6.0	2.4	3.0
Wallings	0.2	5.4	2.9	3.0

Average	Calcium	Magnesium	Potassium	Sodium	Aluminium
Tarwyn Park	67.6	27.9	3.6	1.0	0.0
Wallings	71.0	25.7	2.9	0.3	0.1

Average	Phosphorus	Nitrate Nitrogen	Sulfur	PAWC 0-10 cm	PAWC 10-20 cm
Tarwyn Park	17.8	13.2	6.0	16	15
Wallings	17.7	33.6	6.4	15	13

Average	Copper	Zinc	Manganese	Iron	Boron
Tarwyn Park	0.7	0.7	15.7	14.3	0.6
Wallings	0.9	0.8	42.5	54.1	0.7

As shown in **Table 15**, there is very little difference in the soil test averages between the two properties, with all ratings the same besides iron, which is green for the Tarwyn Park Farm Complex and orange for Wallings, although at this level (54.1 mg/kg) at Wallings, taking into consideration pH levels are not strongly acidic (<4.5), are very unlikely to be causing iron toxicity.

The most significant difference in the averages is nitrate nitrogen being considerably higher at Wallings (33.6 mg/kg) compared to Tarwyn Park Farm Complex (13.2 mg/kg). This may be a result of seasonal waterlogging on Tarwyn Park Farm Complex resulting in a loss of nitrate nitrogen from the soils, as the nitrate nitrogen levels on the Dermosols (mostly floodplain area) are significantly higher at Wallings (42.22 mg/kg) than on the Dermosols at Tarwyn Park Farm Complex (13.2 mg/kg)

7 LAND DEGRADATION COMPARISON

Figure 5 is a site plan showing specific sites where observations of land degradation at Wallings and the Tarwyn Park Farm Complex were recorded and photographed. **Appendix C** includes the relevant plates (photographs) for each site with recorded observations.

7.1 **Tarwyn Park**

Grazing operations at the Tarwyn Park Farm Complex are based around a philosophy called “Natural Sequence Farming” (NSF) which was initially developed and implemented by the former owners, Peter Andrews and then later continued to be implemented by Stuart Andrews. The basic principle of NSF is nutrient cycling on a whole farm basis using livestock and preserved fodder (mostly lucerne hay) to move nutrients around the property, in theory migrating from the higher slopes down to the valley floor. Following are a number of methods used to operate the NSF system on the Tarwyn Park Farm Complex:

- Lucerne hay is produced on the more fertile Agricultural Suitability Class 1 and Class 2 valley floor, which is then moved to the floodplain areas upstream and the Class 3 and Class 4 sloping country where it is fed out to cattle and/or left to breakdown, releasing nutrients into the soil, including the “free” nitrogen which is produced by the lucerne;

- Slowing the flow in the Bylong River, which runs through the centre of the Tarwyn Park Farm Complex, using “leaky weirs” which were constructed of fallen timber and large rocks. It has been claimed by the former landholders that this approach has the effect of raising the watertable along the river flats which enables perennial pastures of fescue, paspalum and lucerne to access sub-soil moisture giving greater dry matter yields;

- Re-construction of natural swamp areas, which act as nutrient sinks thus releasing stored nutrients during times of minor flood; and

- Use of large mobs of cattle for strategic weed control. Herbicides have rarely been used on Tarwyn Park Farm Complex. Instead large mobs of cattle are used to “crash” graze paddocks until feed and weeds have been depleted. Due to the high number of cattle, grazing of preferential species does not occur. Instead the cattle graze all species present due to the high rate of competition.

The principles of NSF have resulted in the majority of paddocks having excellent groundcover, along with good quantities of surface mulch. However, due to the extended period of de-stocking and no weed control through strategic grazing, annual weeds dominate many of the paddocks on the Tarwyn Park Farm Complex.

The stream banks of the Bylong River section traversing the Tarwyn Park Farm Complex are generally stable mainly due to a high percentage of pasture groundcover and reduced water flows resulting from the installation of the leaky weirs within the stream bed.

Across the Tarwyn Park Farm Complex, pasture groundcover is excellent, and as a result, there is very little erosion. On the north eastern side of the railway line there is an area, that had been subject to gully erosion (possibly due to the exposure of sodic subsoils), which has in recent years been repaired through earthworks which has self-regenerated with red grass and annual ryegrass.

In 2014, there was some evidence of salinity in the downstream areas of Tarwyn Park Farm Complex. However due to seasonal conditions (wet) experienced in the periods prior to the current field inspection, it was not observed to be impacting pasture growth.

The main land quality impact from NSF on the Tarwyn Park Farm Complex is seasonal waterlogging on the central and eastern areas of the valley floor (mostly on the Dermosols).

The leaky weirs on the section of the Bylong River at Tarwyn Park Farm Complex are assisting in maintaining stream bank and bed stability and the wetland area is providing some runoff and nutrient retention in the area.

The main broadleaf weed species present across most pastures on the Tarwyn Park Farm Complex are catheads, Paterson's curse, wireweed, farmer's friend, saffron thistle and star thistle. African boxthorn occurs around the stand of Coastal Grey Box Woodland and Noogoora burr was observed to be prevalent within and adjacent to the Bylong River riparian zone.

7.2 **Wallings**

Across the Chromosol and Sodosol soils, areas of minor to moderate sheet erosion occur along the footslopes (5-10% slope) throughout the holding, most likely due to historical overgrazing of native pastures.

Areas of stabilised gully erosion occur across the holding along with some stream bank erosion in the east of the Study Area along the Bylong River.

There is no difference in salinity rating between the Tarwyn Park Farm Complex and Wallings (**Section 6.1**). ECe is below 0.3 dS/m on all sites at Wallings excluding Site W6 (0.9), whereas all sites at Tarwyn Park Farm Complex are above 0.3 dS/m.

The main weed species present in these improved pastures are liverseed grass, Paterson's curse, wireweed, khaki weed, saffron thistle, star thistle and farmer's friend. Catheads are prevalent, especially where pastures have thinned out due to overgrazing. The main weed species present in the native pastures are catheads, Paterson's curse, wireweed, farmer's friend, saffron thistle and star thistle.

7.3 **Impacts of NSF on Neighbours**

The streambanks of the Bylong River section traversing the Tarwyn Park Farm Complex are stable, however weed infestation is prevalent throughout the riparian zone, providing a weed seed source for downstream neighbours.

There was some evidence of salinity downstream of the Tarwyn Park Farm Complex, however due to seasonal conditions (wet) it was not impacting pasture growth. NSF does not appear to have had any deleterious erosion and sedimentation impacts on downstream agricultural land or the Bylong River.

While the leaky weirs are assisting in maintaining stream bank and bed stability, they may have a minor impact on downstream water users by providing some stream and overland runoff retention on the Tarwyn Park Farm Complex.

7.4 Property Comparison

7.4.1 Feed Quality

Conversation with KEPCO farm manager (Henry Bosman) during site inspections revealed that a number of paddocks on the Tarwyn Park Farm Complex may have issues with feed quality. Cattle in the KEPCO grazing enterprise are regularly moved from paddock to paddock. Henry noted that with a number of paddocks on the Tarwyn Park Farm Complex (most notable at "Iron Tank"), when the cattle are moved in, they walk a lap of the perimeter of the paddock and then come back to the gate and wait to be moved again, even though there is plenty of standing feed in the paddock. This may be due to seasonal waterlogging of pasture during periods of high rainfall and high flows in the Bylong River.

It is recommended that feed quality testing be carried out in these paddocks and compared to paddocks with similar soil and pasture type on Wallings to determine whether there is a difference in feed quality, such as metabolisable energy, digestibility or protein.

7.4.2 Surface Water

The leaky weirs on the Tarwyn Park Farm Complex would have minimal impact on downstream water users. As the principle behind the leaky weirs is to slow water flow down rather than to stop it completely.

7.4.3 Soil Structure

The best structured soil found in the Study Area was a Dermosol with blocky peds with strong consistence found on Wallings at sites W2 and W3. Although these points are the same soil type and landform element (valley floor) as a number of points on Tarwyn Park Farm Complex, there was a significant difference in their structure. This may be due to seasonal waterlogging (due to NSF) which occurs on the valley floor of Tarwyn Park Farm Complex, resulting in soil structure decline due to anaerobic conditions.

7.4.4 Weed Management

A lack of conventional weed management under the NSF philosophy has resulted in a large weed seed bank on Tarwyn Park Farm Complex (especially Noogoora Burr), which will require a long term control program to ensure weed seeds are not spread down the Bylong River into the lower catchment.

7.4.5 Soil Nutrient Levels

Under the NSF philosophy, the Tarwyn Park Farm Complex relied on nutrients transported from the upper catchment of the Bylong River (and Cousins Creek) to be "caught" on the Tarwyn Park Farm Complex and cycled across the property. However, this does not seem to be the case with Wallings "upstream" Dermosol sites on the Bylong River and Cousins Creek (including W2, W3, W6, W8, W10, W17, and W18) being significantly higher in phosphorus, nitrate nitrogen and sulfur than comparative Dermosol sites on the Tarwyn Park Farm Complex.

8 RAINFALL USE EFFICIENCY

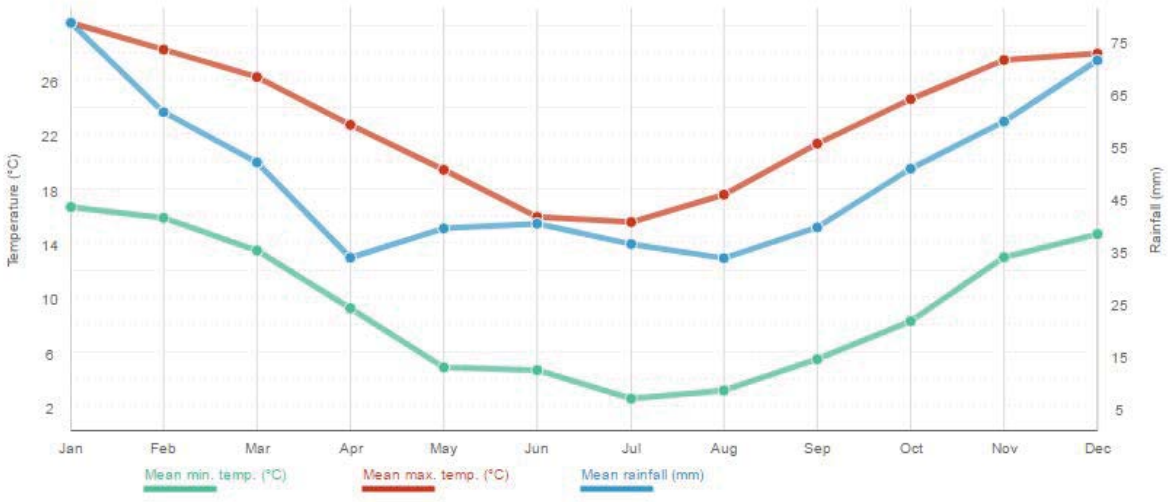
Rainfall use efficiency (RUE) is a measure of kilograms of pasture (or fodder crop) dry matter produced per hectares, per millimetre of rainfall during the growing season (kg DM/ha/mm)

RUE is not easily calculated for grazing systems where the 'growing season' is hard to define, often due to late or early seasonal breaks. However, calculating RUE at the paddock level can be a valuable objective measure of current pasture performance. Average climate data for Bylong is shown in **Table 16** (MLA, 2016).

As a guide, temperate improved pastures, such as at Bylong, generally have a maximum potential water use efficiency of 18 kg DM/ha/mm of rain and native pastures a potential of 10 kg DM/ha/mm of rain. These maximums have been assessed under experimental conditions and it is likely that they overestimate what is achievable in commercial field practice.

Latest research by Meat and Livestock Australia (MLA) suggests that 15 kg DM/ha/mm of rain is a more reasonable target for water use efficiency with temperate improved pastures when all nutrient and species limiting factors have been corrected.

Table 16 Bylong Average Climate Data



Define the start date of the "grazing year", which for temperate pastures at Bylong this would be September, with the "grazing year" ending in May. Pasture mass measurements (kg DM/ha) are to be taken at the start and end of the defined "grazing year".

Calculate the pasture consumed (kg DM/ha) for the defined year from grazing records that estimate total intake by grazing animals. This is calculated from paddock records that include the length of each graze in days; the number of cattle grazing in the mob, and the average predicted daily intake in kilograms per animal. A 320 kilogram 13 month old steer achieving a growth rate of 1.12 kilograms per day will consume a minimum of 2.2 kilograms of improved pasture per day.

Pasture consumed at each graze is calculated by:

Grazing days x number of cattle x daily intake

Pasture consumed at each graze is then added up through the defined year to estimate total consumption for the year.

If constant measurement of pasture mass is impractical, pasture growth rates can be estimated using pasture growth data provided by MLA for the Central Tablelands (MLA, 2013) as shown in **Table 17** as kilograms of dry matter per hectare per day. However pasture mass must be recorded before and after each grazing period.

Table 17 Seasonal Pasture Growth Rates

Pasture Type	J	F	M	A	M	J	J	A	S	O	N	D
Temperate Grass + Clover	15	12	16	20	20	10	6	10	27	61	69	45
Red Grass + Clover	24	10	15	16	12	7	4	8	28	38	25	23

Pasture growth as kg DM/ha is calculated by adding the pasture mass at the end of the grazing period and the estimated consumption and then subtraction the pasture mass at the start of grazing.

Pasture growth = pasture mass at end of grazing + consumption – pasture mass at start of grazing.

RUE is then determined by dividing pasture growth by grazing period (or growing season) rainfall.

RUE = pasture growth (kg DM/ha) / rainfall (mm) = kg DM/ha/mm of rain.

It should be noted that this calculation does not include pasture decay or wastage from trampling my stock, as these categories so not represent available dry matter for livestock utilisation.

Sites for comparison at the Tarwyn Park Farm Complex and Wallings should be selected according to the comparative sites (paddocks) in **Appendix A**, with consideration already having been given to soil type, landform and pasture type.

Fodder testing is recommended to determine why cattle will not graze certain paddocks on the Tarwyn Park Farm Complex, as observed by the KEPCO farm manager.

9 CONCLUSION

Overall, there is very little difference between the potential productivity of the Tarwyn Park Farm Complex and Wallings properties. However comparison of soil analytes between the two properties using both the “traffic light” rating and overall laboratory results highlighted the following differences in agricultural productivity potential:

- There was a major difference in calcium to magnesium ratio, with Wallings having 12 sites rated green and the Tarwyn Park Farm Complex only two. Calcium to magnesium ratio at Wallings is generally higher.
- While both properties have 18 sites rated green for exchangeable calcium, levels of exchangeable calcium at Wallings are generally higher.
- There was a minor difference in exchangeable magnesium with the Tarwyn Park Farm Complex being generally higher, which gives a higher potential for erosion.
- There was a minor difference in exchangeable potassium with Wallings being slightly lower.
- Exchangeable sodium levels were slightly higher on the Tarwyn Park Farm Complex, although all sites besides TP32 rated green.
- There was little overall difference in the average phosphorous levels between the two properties, however the potentially highly productive Dermosols at Wallings had significantly higher phosphorus levels compared to the Dermosols at the Tarwyn Park Farm Complex.
- All sites at Wallings were rated green for nitrate nitrogen, while only thirteen on the Tarwyn Park Farm Complex were green. In addition the average nitrate nitrogen levels at Wallings were significantly higher than the Tarwyn Park Farm Complex.
- Sulfur levels on the Dermosols at Wallings were slightly higher than the corresponding Dermosols areas at the Tarwyn Park Farm Complex
- All sites at Wallings were rated green for zinc, while only twelve at the Tarwyn Park Farm Complex were green.
- All sites at the Tarwyn Park Farm Complex were rated green for manganese, while fifteen sites at Wallings were green. Manganese levels on Wallings were significantly higher than at the Tarwyn Park Farm Complex, though no signs of manganese toxicity were evident in pastures.
- All sites at the Tarwyn Park Farm Complex were rated green for iron, while only seven sites at Wallings were green. Iron levels on Wallings were significantly higher than at the Tarwyn Park Farm Complex, though no signs of iron toxicity were evident in pastures.

Overall ratings between both properties were very similar, with both properties having 68% of soil analytes rated green. There was only 1% difference between both properties orange and red ratings.

The main land degradation impact of NSF philosophy on the Tarwyn Park Farm Complex and downstream neighbours was the heavy infestation of Noogoora burr, especially along the riparian areas.

The Dermosol area on Wallings is not subject to seasonal waterlogging and as such may have a higher potential feed quality compared to the Dermosol area at the Tarwyn Park Farm Complex. It is recommended that comparative feed quality testing be undertaken using the comparison sites in Appendix A as a baseline for paddock selection.

Within the soil nutrient analysis, the Dermosols on Wallings have a higher potential productivity due to higher average phosphorus, sulfur and nitrogen levels compared to the Tarwyn Park Farm Complex, noting that nitrogen was higher on average across all sample sites at Wallings. These lower nutrient levels at the Tarwyn Park Farm Complex are due to the NSF philosophy relying on nutrient capture from areas higher in the catchment. By not regularly applying fertiliser, nutrients are being removed from the property in the form of bone and muscle, every time cattle are sold. It appears that net nutrient capture from the upstream catchment at Tarwyn Park Farm Complex is not replacing the nutrients being removed by the cattle grazing operation.

This assessment concludes there is little difference in potential productivity between the Tarwyn Park Farm Complex, which had been operated under NSF principles, and Wallings which continues to be operated as what is considered a “traditional” cattle grazing enterprise.

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Appendix A

Comparative Site Descriptions

Site Comparison W2 & TP36

Table 1 Site Comparison W2 & TP36

Wallings Site 2	Site Descriptor	Tarwyn Park Site 36	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Remnant Lucerne	Pasture Type	Remnant Lucerne
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	19	PAWC 0-10 cm	24
PAWC 10-20 cm	19	PAWC 10-20 cm	23
pH (CaCl2)	5.3	pH (CaCl2)	6.1
Ca:Mg	2.6	Ca:Mg	2.4
Organic Carbon	3.2	Organic Carbon	3.3
Phosphorus	25.6	Phosphorus	20.4
Nitrate Nitrogen	36.8	Nitrate Nitrogen	13.8
Sulfur	6.5	Sulfur	6.7

Site Comparison W3 & TP5

Table 2 Site Comparison W3 & TP5

Wallings Site 3	Site Descriptor	Tarwyn Park Site 5	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Remnant Lucerne	Pasture Type	Remnant Lucerne
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	19	PAWC 0-10 cm	11
PAWC 10-20 cm	18	PAWC 10-20 cm	5
pH (CaCl2)	5.5	pH (CaCl2)	6.7
Ca:Mg	1.8	Ca:Mg	3.0
Organic Carbon	3.4	Organic Carbon	3.0
Phosphorus	26.7	Phosphorus	16.6
Nitrate Nitrogen	46.0	Nitrate Nitrogen	23.0
Sulfur	7.1	Sulfur	5.2

Site Comparison W4 & TP1

Table 3 Site Comparison W4 & TP1

Wallings Site 4	Site Descriptor	Tarwyn Park Site 1	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Lucerne	Pasture Type	Remnant Lucerne
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	17	PAWC 0-10 cm	13
PAWC 10-20 cm	16	PAWC 10-20 cm	9
pH (CaCl2)	5.3	pH (CaCl2)	7.1
Ca:Mg	1.5	Ca:Mg	2.6
Organic Carbon	3.3	Organic Carbon	3.3
Phosphorus	20.5	Phosphorus	27.6
Nitrate Nitrogen	36.8	Nitrate Nitrogen	6.9
Sulfur	6.7	Sulfur	7.8

Site Comparison W6 & TP3

Table 4 Site Comparison W6 & TP3

Wallings Site 6	Site Descriptor	Tarwyn Park Site 3	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	19	PAWC 0-10 cm	23
PAWC 10-20 cm	14	PAWC 10-20 cm	14
pH (CaCl2)	5.7	pH (CaCl2)	6.2
Ca:Mg	2.5	Ca:Mg	2.5
Organic Carbon	3.4	Organic Carbon	3.1
Phosphorus	28.5	Phosphorus	13.6
Nitrate Nitrogen	18.4	Nitrate Nitrogen	2.3
Sulfur	7.5	Sulfur	4.2

Site Comparison W8 & TP6

Table 5 W8 & TP6

Wallings Site 8	Site Descriptor	Tarwyn Park Site 6	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Remnant Lucerne	Pasture Type	Remnant Lucerne
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	13	PAWC 0-10 cm	16
PAWC 10-20 cm	16	PAWC 10-20 cm	8
pH (CaCl2)	5.5	pH (CaCl2)	5.8
Ca:Mg	3.1	Ca:Mg	3.3
Organic Carbon	3.1	Organic Carbon	2.9
Phosphorus	23.2	Phosphorus	15.4
Nitrate Nitrogen	41.4	Nitrate Nitrogen	9.2
Sulfur	7.2	Sulfur	5.3

Site Comparison W10 & TP8

Table 6 Site Comparison W10 & TP8

Wallings Site 10	Site Descriptor	Tarwyn Park Site 8	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Fodder Oats	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	10	PAWC 0-10 cm	17
PAWC 10-20 cm	9	PAWC 10-20 cm	17
pH (CaCl2)	5.4	pH (CaCl2)	6.3
Ca:Mg	3.0	Ca:Mg	2.4
Organic Carbon	3.2	Organic Carbon	3.7
Phosphorus	25.4	Phosphorus	15.0
Nitrate Nitrogen	36.8	Nitrate Nitrogen	27.6
Sulfur	7.9	Sulfur	6.4

Site Comparison W12 & TP9

Table 7 Site Comparison W12 & TP9

Wallings Site 12	Site Descriptor	Tarwyn Park Site 9	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	22	PAWC 0-10 cm	25
PAWC 10-20 cm	20	PAWC 10-20 cm	36
pH (CaCl2)	5.6	pH (CaCl2)	5.8
Ca:Mg	3.0	Ca:Mg	2.4
Organic Carbon	3.6	Organic Carbon	3.5
Phosphorus	16.7	Phosphorus	13.0
Nitrate Nitrogen	50.6	Nitrate Nitrogen	11.5
Sulfur	6.0	Sulfur	5.5

Site Comparison W14 & TP19

Table 8 Site Comparison W14 & TP19

Wallings Site 14	Site Descriptor	Tarwyn Park Site 19	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	9	PAWC 0-10 cm	12
PAWC 10-20 cm	11	PAWC 10-20 cm	9
pH (CaCl2)	5.0	pH (CaCl2)	5.8
Ca:Mg	3.4	Ca:Mg	2.4
Organic Carbon	3.1	Organic Carbon	2.8
Phosphorus	18.3	Phosphorus	31.3
Nitrate Nitrogen	18.4	Nitrate Nitrogen	11.5
Sulfur	6.8	Sulfur	8.5

Site Comparison W15 & TP32

Table 9 Site Comparison W15 & TP32

Wallings Site 15	Site Descriptor	Tarwyn Park Site 32	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Lucerne	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	11	PAWC 0-10 cm	23
PAWC 10-20 cm	9	PAWC 10-20 cm	17
pH (CaCl2)	5.1	pH (CaCl2)	7.7
Ca:Mg	3.5	Ca:Mg	1.9
Organic Carbon	3.2	Organic Carbon	3.4
Phosphorus	13.1	Phosphorus	13.0
Nitrate Nitrogen	41.4	Nitrate Nitrogen	11.5
Sulfur	5.7	Sulfur	4.3

Site Comparison W17 & TP17

Table 10 Site Comparison W17 & TP17

Wallings Site 17	Site Descriptor	Tarwyn Park Site 17	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	19	PAWC 0-10 cm	16
PAWC 10-20 cm	16	PAWC 10-20 cm	21
pH (CaCl2)	5.4	pH (CaCl2)	5.0
Ca:Mg	3.4	Ca:Mg	1.9
Organic Carbon	3.4	Organic Carbon	3.0
Phosphorus	20.4	Phosphorus	19.3
Nitrate Nitrogen	64.4	Nitrate Nitrogen	23.0
Sulfur	6.9	Sulfur	6.3

Site Comparison W18 & TP15

Table 11 Site Comparison W18 & TP15

Wallings Site 18	Site Descriptor	Tarwyn Park Site 15	Site Descriptor
Soil Type	Dermosol	Soil Type	Dermosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Remnant Lucerne	Pasture Type	Remnant Lucerne
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	20	PAWC 0-10 cm	11
PAWC 10-20 cm	17	PAWC 10-20 cm	31
pH (CaCl2)	6.0	pH (CaCl2)	5.7
Ca:Mg	2.2	Ca:Mg	2.4
Organic Carbon	3.2	Organic Carbon	2.3
Phosphorus	27.1	Phosphorus	18.7
Nitrate Nitrogen	73.6	Nitrate Nitrogen	4.6
Sulfur	7.6	Sulfur	7.4

Site Comparison W7 & TP38

Table 12 Site Comparison W7 & TP38

Wallings Site 7	Site Descriptor	Tarwyn Park Site 38	Site Descriptor
Soil Type	Chromosol	Soil Type	Chromosol
Topography	Lower Slope	Topography	Lower Slope
Slope	6-10%	Slope	6-10%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	17	PAWC 0-10 cm	14
PAWC 10-20 cm	14	PAWC 10-20 cm	11
pH (CaCl2)	5.3	pH (CaCl2)	5.9
Ca:Mg	2.9	Ca:Mg	2.4
Organic Carbon	3.0	Organic Carbon	2.7
Phosphorus	19.3	Phosphorus	14.0
Nitrate Nitrogen	13.8	Nitrate Nitrogen	23.0
Sulfur	6.7	Sulfur	6.1

Site Comparison W9 & TP27

Table 13 Site Comparison W9 & TP27

Wallings Site 9	Site Descriptor	Tarwyn Park Site 27	Site Descriptor
Soil Type	Chromosol	Soil Type	Chromosol
Topography	Lower Slope	Topography	Lower Slope
Slope	3-5%	Slope	3-5%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	14	PAWC 0-10 cm	22
PAWC 10-20 cm	12	PAWC 10-20 cm	12
pH (CaCl2)	4.8	pH (CaCl2)	5.6
Ca:Mg	3.0	Ca:Mg	2.3
Organic Carbon	3.0	Organic Carbon	3.0
Phosphorus	11.1	Phosphorus	17.3
Nitrate Nitrogen	18.4	Nitrate Nitrogen	11.5
Sulfur	5.1	Sulfur	5.7

Site Comparison W20 & TP23

Table 14 Site Comparison W20 & TP23

Wallings Site 20	Site Descriptor	Tarwyn Park Site 23	Site Descriptor
Soil Type	Chromosol	Soil Type	Chromosol
Topography	Mid Slope	Topography	Mid Slope
Slope	6-10%	Slope	6-10%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Remnant Lucerne
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	15	PAWC 0-10 cm	14
PAWC 10-20 cm	15	PAWC 10-20 cm	13
pH (CaCl2)	5.3	pH (CaCl2)	5.7
Ca:Mg	3.0	Ca:Mg	2.3
Organic Carbon	3.0	Organic Carbon	2.8
Phosphorus	14.5	Phosphorus	21.9
Nitrate Nitrogen	32.2	Nitrate Nitrogen	16.1
Sulfur	5.8	Sulfur	7.2

Site Comparison W21 & TP21

Table 15 W21& TP21

Wallings Site 21	Site Descriptor	Tarwyn Park Site 21	Site Descriptor
Soil Type	Chromosol	Soil Type	Chromosol
Topography	6-10%	Topography	6-10%
Slope	Mid Slope	Slope	Mid Slope
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	13	PAWC 0-10 cm	19
PAWC 10-20 cm	8	PAWC 10-20 cm	14
pH (CaCl2)	5.2	pH (CaCl2)	5.7
Ca:Mg	3.6	Ca:Mg	2.6
Organic Carbon	2.8	Organic Carbon	3.1
Phosphorus	14.4	Phosphorus	14.0
Nitrate Nitrogen	36.8	Nitrate Nitrogen	13.8
Sulfur	6.2	Sulfur	4.6

Site Comparison W22 & TP13

Table 16 Site Comparison W22 & TP13

Wallings Site 22	Site Descriptor	Tarwyn Park Site 13	Site Descriptor
Soil Type	Chromosol	Soil Type	Chromosol
Topography	Mid Slope	Topography	Mid Slope
Slope	6-10%	Slope	6-10%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	13	PAWC 0-10 cm	21
PAWC 10-20 cm	11	PAWC 10-20 cm	22
pH (CaCl2)	5.4	pH (CaCl2)	5.6
Ca:Mg	3.2	Ca:Mg	2.1
Organic Carbon	2.6	Organic Carbon	3.0
Phosphorus	8.1	Phosphorus	13.8
Nitrate Nitrogen	23.0	Nitrate Nitrogen	6.9
Sulfur	5.3	Sulfur	5.7

Site Comparison W23 & TP34

Table 17 Site Comparison W23 & TP34

Wallings Site 23	Site Descriptor	Tarwyn Park Site 34	Site Descriptor
Soil Type	Chromosol	Soil Type	Chromosol
Topography	Lower Slope	Topography	Lower Slope
Slope	3-5%	Slope	3-5%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Tropical Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	11	PAWC 0-10 cm	16
PAWC 10-20 cm	11	PAWC 10-20 cm	11
pH (CaCl2)	5.4	pH (CaCl2)	5.3
Ca:Mg	3.3	Ca:Mg	2.8
Organic Carbon	2.4	Organic Carbon	2.4
Phosphorus	11.2	Phosphorus	15.1
Nitrate Nitrogen	18.4	Nitrate Nitrogen	18.4
Sulfur	6.2	Sulfur	6.3

Site Comparison W5 & TP12

Table 18 Site Comparison W5 & TP12

Wallings Site 5	Site Descriptor	Tarwyn Park Site 12	Site Descriptor
Soil Type	Chromosol	Soil Type	Chromosol
Topography	Mid Slope	Topography	Mid Slope
Slope	3-5%	Slope	3-5%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Lucerne (Old Irrigation)	Pasture Type	Remnant Lucerne
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	21	PAWC 0-10 cm	12
PAWC 10-20 cm	13	PAWC 10-20 cm	9
pH (CaCl2)	5.6	pH (CaCl2)	5.8
Ca:Mg	2.6	Ca:Mg	2.2
Organic Carbon	2.9	Organic Carbon	1.9
Phosphorus	12.9	Phosphorus	14.0
Nitrate Nitrogen	27.6	Nitrate Nitrogen	9.2
Sulfur	5.3	Sulfur	5.2

Site Comparison W24 & TP25

Table 19 Site Comparison W24 & TP25

Wallings Site 24	Site Descriptor	Tarwyn Park Site 25	Site Descriptor
Soil Type	Sodosol	Soil Type	Sodosol
Topography	Mid Slope	Topography	Mid Slope
Slope	6-10%	Slope	6-10%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Grass Pasture
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	11	PAWC 0-10 cm	15
PAWC 10-20 cm	12	PAWC 10-20 cm	13
pH (CaCl2)	5.1	pH (CaCl2)	6.0
Ca:Mg	2.2	Ca:Mg	2.5
Organic Carbon	1.8	Organic Carbon	2.9
Phosphorus	6.9	Phosphorus	15.7
Nitrate Nitrogen	18.4	Nitrate Nitrogen	13.8
Sulfur	5.0	Sulfur	5.7

Site Comparison W11 & TP11

Table 20 Site Comparison W11 & TP11

Wallings Site 11	Site Descriptor	Tarwyn Park Site 11	Site Descriptor
Soil Type	Rudosol	Soil Type	Rudosol
Topography	Valley Floor	Topography	Valley Floor
Slope	1-2%	Slope	1-2%
Current Land Use	Cattle Grazing	Current Land Use	Cattle Grazing
Pasture Type	Grass Pasture	Pasture Type	Remnant Lucerne
Soil Element	**Rating**	**Soil Element**	**Rating**
PAWC 0-10 cm	6	PAWC 0-10 cm	2
PAWC 10-20 cm	1	PAWC 10-20 cm	7
pH (CaCl2)	5.8	pH (CaCl2)	5.3
Ca:Mg	3.3	Ca:Mg	2.2
Organic Carbon	2.9	Organic Carbon	3.5
Phosphorus	9.5	Phosphorus	26.2
Nitrate Nitrogen	18.4	Nitrate Nitrogen	6.9
Sulfur	5.6	Sulfur	6.4

Appendix B

Laboratory Soil Test Results

SOILTEC

SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (1)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W2 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.13	<0.15
pH	(1:5 $CaCl_2$)		5.26	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		9.96	See Percentage
Magnesium:	(Mg)(meq/100g)		3.88	See Percentage
Potassium:	(K)(meq/100g)		0.36	0.5-1.0
Sodium:	(Na)(meq/100g)		0.05	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**14.25**	
Exchangeable Cations (as a % of Total)				
Calcium:			69.89	65-80%
Magnesium:			27.23	15-20%
Potassium:			2.53	2-5%
Sodium:			0.35	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	25.6	
Sulphur	(mg/kg)	(KCl 40 S)	6.5	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	36.8	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.2	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.7	
Zinc	(mg/kg)	(DTPA)	0.9	
Manganese	(mg/kg)	(DTPA)	46.9	
Iron	(mg/kg)	(DTPA)	59.6	
Boron	(mg/kg)	(Hot CaCl)	0.8	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.57	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (2)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W3 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.15	<0.15
pH	(1:5 $CaCl_2$)		5.47	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	11.85	See Percentage
Magnesium:		(Mg)(meq/100g)	6.77	See Percentage
Potassium:		(K)(meq/100g)	0.31	0.5-1.0
Sodium:		(Na)(meq/100g)	0.08	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**19.01**	
Exchangeable Cations (as a % of Total)				
Calcium:			62.34	65-80%
Magnesium:			35.61	15-20%
Potassium:			1.63	2-5%
Sodium:			0.42	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	26.7	
Sulphur	(mg/kg)	(KCl 40 S)	7.1	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	46.0	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.4	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.1	
Zinc		(mg/kg) (DTPA)	0.9	
Manganese		(mg/kg) (DTPA)	52.7	
Iron		(mg/kg) (DTPA)	62.9	
Boron		(mg/kg) (Hot CaCl)	0.8	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			1.75	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (3)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W4 **INTENDED USE:**
TEXTURE

			RESULT		OPTIMAL
Conductivity (dS/m)(1:5 water)			0.17	<0.15	
pH	(1:5 $CaCl_2$)		5.29		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	10.05	See Percentage	
Magnesium:		(Mg)(meq/100g)	6.52	See Percentage	
Potassium:		(K)(meq/100g)	0.33	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.04	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**16.94**		
Exchangeable Cations (as a % of Total)					
Calcium:			59.33		65-80%
Magnesium:			38.49		15-20%
Potassium:			1.95		2-5%
Sodium:			0.24		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	20.5		
Sulphur	(mg/kg)	(KCl 40 S)	6.7		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	36.8		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.3		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	1.1		
Zinc		(mg/kg) (DTPA)	0.8		
Manganese		(mg/kg) (DTPA)	55.3		
Iron		(mg/kg) (DTPA)	63.7		
Boron		(mg/kg) (Hot CaCl)	0.9		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			1.54		3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (4)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W5 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.13	<0.15
pH	(1:5 $CaCl_2$)		5.55	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	5.93	See Percentage
Magnesium:		(Mg)(meq/100g)	2.24	See Percentage
Potassium:		(K)(meq/100g)	0.24	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**8.43**	
Exchangeable Cations (as a % of Total)				
Calcium:			70.34	65-80%
Magnesium:			26.57	15-20%
Potassium:			2.85	2-5%
Sodium:			0.24	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	12.9	
Sulphur	(mg/kg)	(KCl 40 S)	5.3	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	27.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.9	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.7	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	32.1	
Iron		(mg/kg) (DTPA)	53.1	
Boron		(mg/kg) (Hot CaCl)	0.6	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.65	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (5)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W6 **INTENDED USE:**
TEXTURE

			RESULT		OPTIMAL
Conductivity (dS/m)(1:5 water)			0.86	<0.15	
pH	(1:5 $CaCl_2$)		5.65		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	9.57	See Percentage	
Magnesium:		(Mg)(meq/100g)	3.89	See Percentage	
Potassium:		(K)(meq/100g)	0.28	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.04	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**13.78**		
Exchangeable Cations (as a % of Total)					
Calcium:			69.45		65-80%
Magnesium:			28.23		15-20%
Potassium:			2.03		2-5%
Sodium:			0.29		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	28.5		
Sulphur	(mg/kg)	(KCl 40 S)	7.5		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	18.4		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.4		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	1.0		
Zinc		(mg/kg) (DTPA)	0.9		
Manganese		(mg/kg) (DTPA)	45.4		
Iron		(mg/kg) (DTPA)	58.6		
Boron		(mg/kg) (Hot CaCl)	0.8		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			2.46		3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (6)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W7 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.07	<0.15
pH	(1:5 $CaCl_2$)		5.34	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	5.36	See Percentage
Magnesium:		(Mg)(meq/100g)	1.83	See Percentage
Potassium:		(K)(meq/100g)	0.23	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**7.44**	
Exchangeable Cations (as a % of Total)				
Calcium:			72.04	65-80%
Magnesium:			24.60	15-20%
Potassium:			3.09	2-5%
Sodium:			0.27	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	19.3	
Sulphur	(mg/kg)	(KCl 40 S)	6.7	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	13.8	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.0	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.9	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	35.7	
Iron		(mg/kg) (DTPA)	49.2	
Boron		(mg/kg) (Hot CaCl)	0.6	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.93	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (7)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W8 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.12	<0.15
pH	(1:5 $CaCl_2$)		5.49	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	8.79	See Percentage
Magnesium:		(Mg)(meq/100g)	2.86	See Percentage
Potassium:		(K)(meq/100g)	0.32	0.5-1.0
Sodium:		(Na)(meq/100g)	0.03	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**12.00**	
Exchangeable Cations (as a % of Total)				
Calcium:			73.25	65-80%
Magnesium:			23.83	15-20%
Potassium:			2.67	2-5%
Sodium:			0.25	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	23.2	
Sulphur	(mg/kg)	(KCl 40 S)	7.2	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	41.4	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.1	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.1	
Zinc		(mg/kg) (DTPA)	0.9	
Manganese		(mg/kg) (DTPA)	42.8	
Iron		(mg/kg) (DTPA)	53.6	
Boron		(mg/kg) (Hot CaCl)	0.7	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			3.07	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (8)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W9 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.08	<0.15
pH	(1:5 $CaCl_2$)		4.78	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	5.94	See Percentage
Magnesium:		(Mg)(meq/100g)	1.95	See Percentage
Potassium:		(K)(meq/100g)	0.35	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.11	Zero
Total Cation Exchange Capacity (CEC):			**8.37**	
Exchangeable Cations (as a % of Total)				
Calcium:			70.96	65-80%
Magnesium:			23.29	15-20%
Potassium:			4.18	2-5%
Sodium:			0.24	<3%
Aluminium:			1.33	<5%
Phosphorus:	(mg/kg)	(Bray-1)	11.1	
Sulphur	(mg/kg)	(KCl 40 S)	5.1	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	18.4	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.0	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.7	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	33.9	
Iron		(mg/kg) (DTPA)	48.6	
Boron		(mg/kg) (Hot CaCl)	0.6	
Calculations:				
Lime Requirement (Cregan)			0.14	(see notes on page 2)
Calcium/Magnesium Ratio:			3.05	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (9)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W10 **INTENDED USE:**
TEXTURE

			RESULT		OPTIMAL
Conductivity (dS/m)(1:5 water)			0.13	<0.15	
pH	(1:5 $CaCl_2$)		5.38		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	8.99	See Percentage	
Magnesium:		(Mg)(meq/100g)	3.02	See Percentage	
Potassium:		(K)(meq/100g)	0.37	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.02	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**12.40**		
Exchangeable Cations (as a % of Total)					
Calcium:			72.50		65-80%
Magnesium:			24.35		15-20%
Potassium:			2.98		2-5%
Sodium:			0.16		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	25.4		
Sulphur	(mg/kg)	(KCl 40 S)	7.9		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	36.8		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.2		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	1.0		
Zinc		(mg/kg) (DTPA)	0.9		
Manganese		(mg/kg) (DTPA)	40.8		
Iron		(mg/kg) (DTPA)	55.1		
Boron		(mg/kg) (Hot CaCl)	0.7		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			2.98		3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (10)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W11 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.06	<0.15
pH	(1:5 $CaCl_2$)		5.75	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	4.82	See Percentage
Magnesium:		(Mg)(meq/100g)	1.45	See Percentage
Potassium:		(K)(meq/100g)	0.24	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**6.53**	
Exchangeable Cations (as a % of Total)				
Calcium:			73.81	65-80%
Magnesium:			22.21	15-20%
Potassium:			3.68	2-5%
Sodium:			0.31	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	9.5	
Sulphur	(mg/kg)	(KCl 40 S)	5.6	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	18.4	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.9	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.6	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	34.2	
Iron		(mg/kg) (DTPA)	43.9	
Boron		(mg/kg) (Hot CaCl)	0.6	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			3.32	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
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Soil Test Report #s17-0134 (11)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W12 **INTENDED USE:**
TEXTURE

			RESULT		OPTIMAL
Conductivity (dS/m)(1:5 water)			0.17	<0.15	
pH	(1:5 $CaCl_2$)		5.64		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	11.92	See Percentage	
Magnesium:		(Mg)(meq/100g)	4.03	See Percentage	
Potassium:		(K)(meq/100g)	0.43	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.04	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**16.42**		
Exchangeable Cations (as a % of Total)					
Calcium:			72.59		65-80%
Magnesium:			24.54		15-20%
Potassium:			2.62		2-5%
Sodium:			0.24		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	16.7		
Sulphur	(mg/kg)	(KCl 40 S)	6.0		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	50.6		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.6		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	1.4		
Zinc		(mg/kg) (DTPA)	1.0		
Manganese		(mg/kg) (DTPA)	56.2		
Iron		(mg/kg) (DTPA)	62.9		
Boron		(mg/kg) (Hot CaCl)	0.9		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			2.96		3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
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Soil Test Report #s17-0134 (12)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W14 **INTENDED USE:**
TEXTURE

			RESULT		OPTIMAL
Conductivity (dS/m)(1:5 water)			0.08	<0.15	
pH	(1:5 $CaCl_2$)		4.96		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	6.91	See Percentage	
Magnesium:		(Mg)(meq/100g)	2.04	See Percentage	
Potassium:		(K)(meq/100g)	0.40	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.02	Zero	
Aluminium:		(Al)(meq/100g)	0.05	Zero	
Total Cation Exchange Capacity (CEC):			**9.42**		
Exchangeable Cations (as a % of Total)					
Calcium:			73.35		65-80%
Magnesium:			21.66		15-20%
Potassium:			4.25		2-5%
Sodium:			0.21		<3%
Aluminium:			0.53		<5%
Phosphorus:	(mg/kg)	(Bray-1)	18.3		
Sulphur	(mg/kg)	(KCl 40 S)	6.8		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	18.4		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.1		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	1.1		
Zinc		(mg/kg) (DTPA)	0.9		
Manganese		(mg/kg) (DTPA)	42.7		
Iron		(mg/kg) (DTPA)	56.7		
Boron		(mg/kg) (Hot CaCl)	0.8		
Calculations:					
Lime Requirement (Cregan)			0.06	(see notes on page 2)	
Calcium/Magnesium Ratio:			3.39		3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
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Soil Test Report #s17-0134 (13)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W15 **INTENDED USE:**
TEXTURE

			RESULT		OPTIMAL
Conductivity (dS/m)(1:5 water)			0.15	<0.15	
pH	(1:5 $CaCl_2$)		5.06		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	7.56	See Percentage	
Magnesium:		(Mg)(meq/100g)	2.14	See Percentage	
Potassium:		(K)(meq/100g)	0.37	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.02	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**10.09**		
Exchangeable Cations (as a % of Total)					
Calcium:			74.93		65-80%
Magnesium:			21.21		15-20%
Potassium:			3.67		2-5%
Sodium:			0.20		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	13.1		
Sulphur	(mg/kg)	(KCl 40 S)	5.7		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	41.4		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.2		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	1.0		
Zinc		(mg/kg) (DTPA)	0.8		
Manganese		(mg/kg) (DTPA)	45.5		
Iron		(mg/kg) (DTPA)	58.2		
Boron		(mg/kg) (Hot CaCl)	0.7		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			3.53		3-5

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SOIL AND PLANT ANALYSIS

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Soil Test Report #s17-0134 (14)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W17 **INTENDED USE:**
TEXTURE

			RESULT		OPTIMAL
Conductivity (dS/m)(1:5 water)			0.14	<0.15	
pH	(1:5 $CaCl_2$)		5.35		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	10.81	See Percentage	
Magnesium:		(Mg)(meq/100g)	3.17	See Percentage	
Potassium:		(K)(meq/100g)	0.39	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.04	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**14.41**		
Exchangeable Cations (as a % of Total)					
Calcium:			75.02		65-80%
Magnesium:			22.00		15-20%
Potassium:			2.71		2-5%
Sodium:			0.28		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	20.4		
Sulphur	(mg/kg)	(KCl 40 S)	6.9		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	64.4		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.4		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	1.2		
Zinc		(mg/kg) (DTPA)	0.9		
Manganese		(mg/kg) (DTPA)	49.2		
Iron		(mg/kg) (DTPA)	59.1		
Boron		(mg/kg) (Hot CaCl)	0.8		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			3.41		3-5

SOILTEC SOIL AND PLANT ANALYSIS

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Soil Test Report #s17-0134 (15)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W18 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.20	<0.15
pH	(1:5 $CaCl_2$)		6.02	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	11.38	See Percentage
Magnesium:		(Mg)(meq/100g)	5.14	See Percentage
Potassium:		(K)(meq/100g)	0.33	0.5-1.0
Sodium:		(Na)(meq/100g)	0.04	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**16.89**	
Exchangeable Cations (as a % of Total)				
Calcium:			67.38	65-80%
Magnesium:			30.43	15-20%
Potassium:			1.95	2-5%
Sodium:			0.24	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	27.1	
Sulphur	(mg/kg)	(KCl 40 S)	7.6	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	73.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.2	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.3	
Zinc		(mg/kg) (DTPA)	1.0	
Manganese		(mg/kg) (DTPA)	52.9	
Iron		(mg/kg) (DTPA)	60.9	
Boron		(mg/kg) (Hot CaCl)	0.9	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.21	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
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Soil Test Report #s17-0134 (16)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W20 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.09	<0.15
pH	(1:5 $CaCl_2$)		5.29	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	6.45	See Percentage
Magnesium:		(Mg)(meq/100g)	2.18	See Percentage
Potassium:		(K)(meq/100g)	0.30	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**8.95**	
Exchangeable Cations (as a % of Total)				
Calcium:			72.07	65-80%
Magnesium:			24.36	15-20%
Potassium:			3.35	2-5%
Sodium:			0.22	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	14.5	
Sulphur	(mg/kg)	(KCl 40 S)	5.8	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	32.2	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.0	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.7	
Zinc	(mg/kg)	(DTPA)	0.7	
Manganese	(mg/kg)	(DTPA)	38.5	
Iron	(mg/kg)	(DTPA)	48.2	
Boron	(mg/kg)	(Hot CaCl)	0.7	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.96	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
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Soil Test Report #s17-0134 (17)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W21 **INTENDED USE:**
TEXTURE

			RESULT		OPTIMAL
Conductivity (dS/m)(1:5 water)			0.10	<0.15	
pH	(1:5 $CaCl_2$)		5.19		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	4.75	See Percentage	
Magnesium:		(Mg)(meq/100g)	1.33	See Percentage	
Potassium:		(K)(meq/100g)	0.24	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.02	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**6.34**		
Exchangeable Cations (as a % of Total)					
Calcium:			74.92		65-80%
Magnesium:			20.98		15-20%
Potassium:			3.79		2-5%
Sodium:			0.32		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	14.4		
Sulphur	(mg/kg)	(KCl 40 S)	6.2		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	36.8		At least 10
Organic Carbon	(%)	(Walkely & Black)	2.8		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.6		
Zinc		(mg/kg) (DTPA)	0.7		
Manganese		(mg/kg) (DTPA)	32.7		
Iron		(mg/kg) (DTPA)	42.9		
Boron		(mg/kg) (Hot CaCl)	0.6		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			3.57		3-5

SOILTEC SOIL AND PLANT ANALYSIS

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Soil Test Report #s17-0134 (18)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W22 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.09	<0.15
pH	(1:5 $CaCl_2$)		5.44	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	4.57	See Percentage
Magnesium:		(Mg)(meq/100g)	1.42	See Percentage
Potassium:		(K)(meq/100g)	0.20	0.5-1.0
Sodium:		(Na)(meq/100g)	0.03	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**6.22**	
Exchangeable Cations (as a % of Total)				
Calcium:			73.47	65-80%
Magnesium:			22.83	15-20%
Potassium:			3.22	2-5%
Sodium:			0.48	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	8.1	
Sulphur	(mg/kg)	(KCl 40 S)	5.3	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	23.0	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.6	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.7	
Zinc		(mg/kg) (DTPA)	0.7	
Manganese		(mg/kg) (DTPA)	34.5	
Iron		(mg/kg) (DTPA)	45.7	
Boron		(mg/kg) (Hot CaCl)	0.7	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			3.22	3-5

SOILTEC SOIL AND PLANT ANALYSIS

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Soil Test Report #s17-0134 (19)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W23 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.05	<0.15
pH	(1:5 $CaCl_2$)		5.35	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	4.24	See Percentage
Magnesium:		(Mg)(meq/100g)	1.27	See Percentage
Potassium:		(K)(meq/100g)	0.19	0.5-1.0
Sodium:		(Na)(meq/100g)	0.02	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**5.72**	
Exchangeable Cations (as a % of Total)				
Calcium:			74.13	65-80%
Magnesium:			22.20	15-20%
Potassium:			3.32	2-5%
Sodium:			0.35	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	11.2	
Sulphur	(mg/kg)	(KCl 40 S)	6.2	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	18.4	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.4	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.6	
Zinc		(mg/kg) (DTPA)	0.6	
Manganese		(mg/kg) (DTPA)	26.9	
Iron		(mg/kg) (DTPA)	39.2	
Boron		(mg/kg) (Hot CaCl)	0.6	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	3.34	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s17-0134 (20)

Client: ***SLR Consulting***
Account:

Sample Received: Report Reply:
SAMPLE I.D: W24 **INTENDED USE:**
TEXTURE

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.09	<0.15
pH	(1:5 $CaCl_2$)		5.10	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	10.99	See Percentage
Magnesium:		(Mg)(meq/100g)	4.92	See Percentage
Potassium:		(K)(meq/100g)	0.39	0.5-1.0
Sodium:		(Na)(meq/100g)	0.04	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**16.34**	
Exchangeable Cations (as a % of Total)				
Calcium:			67.26	65-80%
Magnesium:			30.11	15-20%
Potassium:			2.39	2-5%
Sodium:			0.24	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	6.9	
Sulphur	(mg/kg)	(KCl 40 S)	5.0	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	18.4	At least 10
Organic Carbon	(%)	(Walkely & Black)	1.8	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	1.0	
Zinc		(mg/kg) (DTPA)	0.9	
Manganese		(mg/kg) (DTPA)	50.8	
Iron		(mg/kg) (DTPA)	59.1	
Boron		(mg/kg) (Hot CaCl)	0.7	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.23	3-5

Inspection Sites and Soiltec Test Correlation

Inspection Site	Soiltec Test
TP1	B6
TP3	B4
TP5	B8
TP6	B9
TP8	B11
TP9	B15
TP11	B2
TP12	B23
TP13	B22
TP15	B21
TP17	B20
TP19	B31
TP21	B36
TP23	B34
TP35	B32
TP27	B44
TP32	B40
TP34	B28
TP36	B42
TP38	B29

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (1)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B2 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.04	<0.15
pH	(1:5 $CaCl_2$)		5.31	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		6.25	See Percentage
Magnesium:	(Mg)(meq/100g)		2.84	See Percentage
Potassium:	(K)(meq/100g)		0.36	0.5-1.0
Sodium:	(Na)(meq/100g)		0.09	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**9.54**	
Exchangeable Cations (as a % of Total)				
Calcium:			65.51	65-80%
Magnesium:			29.77	15-20%
Potassium:			3.77	2-5%
Sodium:			0.94	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	26.2	
Sulphur	(mg/kg)	(KCl 40 S)	6.4	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	6.9	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.5	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.7	
Zinc	(mg/kg)	(DTPA)	0.7	
Manganese	(mg/kg)	(DTPA)	19.2	
Iron	(mg/kg)	(DTPA)	23.5	
Boron	(mg/kg)	(Hot CaCl)	0.5	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.20	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (2)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B4 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.05	<0.15
pH	(1:5 $CaCl_2$)		6.22	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		5.46	See Percentage
Magnesium:	(Mg)(meq/100g)		2.15	See Percentage
Potassium:	(K)(meq/100g)		0.32	0.5-1.0
Sodium:	(Na)(meq/100g)		0.04	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**7.97**	
Exchangeable Cations (as a % of Total)				
Calcium:			68.51	65-80%
Magnesium:			26.98	15-20%
Potassium:			4.02	2-5%
Sodium:			0.50	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	13.6	
Sulphur	(mg/kg)	(KCl 40 S)	4.2	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	2.3	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.1	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.7	
Zinc	(mg/kg)	(DTPA)	0.6	
Manganese	(mg/kg)	(DTPA)	15.6	
Iron	(mg/kg)	(DTPA)	17.6	
Boron	(mg/kg)	(Hot CaCl)	0.5	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.54	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (3)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B6

Report Reply:
INTENDED USE:

			RESULT		*OPTIMAL*
Conductivity (dS/m)(1:5 water)			0.06	<0.15	
pH	(1:5 $CaCl_2$)		7.14		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	5.89	See Percentage	
Magnesium:		(Mg)(meq/100g)	2.23	See Percentage	
Potassium:		(K)(meq/100g)	0.34	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.02	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**8.48**		
Exchangeable Cations (as a % of Total)					
Calcium:			69.46		65-80%
Magnesium:			26.30		15-20%
Potassium:			4.01		2-5%
Sodium:			0.24		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	27.6		
Sulphur	(mg/kg)	(KCl 40 S)	7.8		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	6.9		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.3		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.8		
Zinc		(mg/kg) (DTPA)	0.7		
Manganese		(mg/kg) (DTPA)	16.8		
Iron		(mg/kg) (DTPA)	19.1		
Boron		(mg/kg) (Hot CaCl)	0.6		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			2.64		3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (4)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B8

Report Reply:
INTENDED USE:

			RESULT		*OPTIMAL*
Conductivity (dS/m)(1:5 water)			0.07	<0.15	
pH	(1:5 $CaCl_2$)		6.66		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	4.88	See Percentage	
Magnesium:		(Mg)(meq/100g)	1.62	See Percentage	
Potassium:		(K)(meq/100g)	0.26	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.03	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**6.79**		
Exchangeable Cations (as a % of Total)					
Calcium:			71.87		65-80%
Magnesium:			23.86		15-20%
Potassium:			3.83		2-5%
Sodium:			0.44		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	16.6		
Sulphur	(mg/kg)	(KCl 40 S)	5.2		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	23.0		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.0		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.7		
Zinc		(mg/kg) (DTPA)	0.6		
Manganese		(mg/kg) (DTPA)	14.8		
Iron		(mg/kg) (DTPA)	12.3		
Boron		(mg/kg) (Hot CaCl)	0.6		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			3.01		3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (5)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B9 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.06	<0.15
pH	(1:5 $CaCl_2$)		5.79	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		5.09	See Percentage
Magnesium:	(Mg)(meq/100g)		1.52	See Percentage
Potassium:	(K)(meq/100g)		0.29	0.5-1.0
Sodium:	(Na)(meq/100g)		0.02	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**6.92**	
Exchangeable Cations (as a % of Total)				
Calcium:			73.55	65-80%
Magnesium:			21.97	15-20%
Potassium:			4.19	2-5%
Sodium:			0.29	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	15.4	
Sulphur	(mg/kg)	(KCl 40 S)	5.3	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	9.2	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.9	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.6	
Zinc	(mg/kg)	(DTPA)	0.6	
Manganese	(mg/kg)	(DTPA)	15.9	
Iron	(mg/kg)	(DTPA)	14.2	
Boron	(mg/kg)	(Hot CaCl)	0.6	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			3.35	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (6)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B11

Report Reply:
INTENDED USE:

			RESULT	*OPTIMAL*
Conductivity (dS/m)(1:5 water)			0.15	<0.15
pH	(1:5 $CaCl_2$)		6.32	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		6.74	See Percentage
Magnesium:	(Mg)(meq/100g)		2.77	See Percentage
Potassium:	(K)(meq/100g)		0.35	0.5-1.0
Sodium:	(Na)(meq/100g)		0.11	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**9.97**	
Exchangeable Cations (as a % of Total)				
Calcium:			67.60	65-80%
Magnesium:			27.78	15-20%
Potassium:			3.51	2-5%
Sodium:			1.10	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	15.0	
Sulphur	(mg/kg)	(KCl 40 S)	6.4	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	27.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.7	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.8	
Zinc	(mg/kg)	(DTPA)	0.7	
Manganese	(mg/kg)	(DTPA)	21.2	
Iron	(mg/kg)	(DTPA)	18.9	
Boron	(mg/kg)	(Hot CaCl)	0.7	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.43	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (7)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B15

Report Reply:
INTENDED USE:

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.10	<0.15
pH	(1:5 $CaCl_2$)		5.80	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		4.61	See Percentage
Magnesium:	(Mg)(meq/100g)		1.92	See Percentage
Potassium:	(K)(meq/100g)		0.25	0.5-1.0
Sodium:	(Na)(meq/100g)		0.02	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**6.80**	
Exchangeable Cations (as a % of Total)				
Calcium:			67.79	65-80%
Magnesium:			28.24	15-20%
Potassium:			3.68	2-5%
Sodium:			0.29	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	13.0	
Sulphur	(mg/kg)	(KCl 40 S)	5.6	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	11.5	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.5	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.6	
Zinc	(mg/kg)	(DTPA)	0.6	
Manganese	(mg/kg)	(DTPA)	13.3	
Iron	(mg/kg)	(DTPA)	10.5	
Boron	(mg/kg)	(Hot CaCl)	0.6	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.40	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (8)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B20

Report Reply:
INTENDED USE:

			RESULT		***OPTIMAL***
Conductivity (dS/m)(1:5 water)			0.09	<0.15	
pH	(1:5 $CaCl_2$)		5.04		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	3.56	See Percentage	
Magnesium:		(Mg)(meq/100g)	1.85	See Percentage	
Potassium:		(K)(meq/100g)	0.18	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.04	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**5.63**		
Exchangeable Cations (as a % of Total)					
Calcium:			63.23		65-80%
Magnesium:			32.86		15-20%
Potassium:			3.20		2-5%
Sodium:			0.71		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	19.3		
Sulphur	(mg/kg)	(KCl 40 S)	6.3		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	23.0		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.0		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.6		
Zinc		(mg/kg) (DTPA)	0.5		
Manganese		(mg/kg) (DTPA)	13.1		
Iron		(mg/kg) (DTPA)	8.6		
Boron		(mg/kg) (Hot CaCl)	0.5		

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:	1.92		3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (9)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B21

Report Reply:
INTENDED USE:

			RESULT	*OPTIMAL*
Conductivity (dS/m)(1:5 water)			0.05	<0.15
pH	(1:5 $CaCl_2$)		5.66	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		2.08	See Percentage
Magnesium:	(Mg)(meq/100g)		0.88	See Percentage
Potassium:	(K)(meq/100g)		0.08	0.5-1.0
Sodium:	(Na)(meq/100g)		0.07	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**3.11**	
Exchangeable Cations (as a % of Total)				
Calcium:			66.88	65-80%
Magnesium:			28.30	15-20%
Potassium:			2.57	2-5%
Sodium:			2.25	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	18.7	
Sulphur	(mg/kg)	(KCl 40 S)	7.4	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	4.6	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.3	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.5	
Zinc	(mg/kg)	(DTPA)	0.5	
Manganese	(mg/kg)	(DTPA)	6.9	
Iron	(mg/kg)	(DTPA)	4.8	
Boron	(mg/kg)	(Hot CaCl)	0.3	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.36	3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (10)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B22

Report Reply:
INTENDED USE:

			RESULT		***OPTIMAL***
Conductivity (dS/m)(1:5 water)			0.07	<0.15	
pH	(1:5 $CaCl_2$)		5.64		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	9.94	See Percentage	
Magnesium:		(Mg)(meq/100g)	4.83	See Percentage	
Potassium:		(K)(meq/100g)	0.38	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.22	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**15.37**		
Exchangeable Cations (as a % of Total)					
Calcium:			64.67		65-80%
Magnesium:			31.42		15-20%
Potassium:			2.47		2-5%
Sodium:			1.43		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	13.8		
Sulphur	(mg/kg)	(KCl 40 S)	5.7		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	6.9		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.0		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.9		
Zinc		(mg/kg) (DTPA)	0.9		
Manganese		(mg/kg) (DTPA)	23.8		
Iron		(mg/kg) (DTPA)	26.9		
Boron		(mg/kg) (Hot CaCl)	0.8		

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:	2.06		3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (11)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B23

Report Reply:
INTENDED USE:

			RESULT		*OPTIMAL*
Conductivity (dS/m)(1:5 water)			0.04	<0.15	
pH	(1:5 $CaCl_2$)		5.82		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	1.74	See Percentage	
Magnesium:		(Mg)(meq/100g)	0.78	See Percentage	
Potassium:		(K)(meq/100g)	0.09	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.05	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**2.66**		
Exchangeable Cations (as a % of Total)					
Calcium:			65.41		65-80%
Magnesium:			29.32		15-20%
Potassium:			3.38		2-5%
Sodium:			1.88		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	14.0		
Sulphur	(mg/kg)	(KCl 40 S)	5.2		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	9.2		At least 10
Organic Carbon	(%)	(Walkely & Black)	1.9		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.4		
Zinc		(mg/kg) (DTPA)	0.4		
Manganese		(mg/kg) (DTPA)	4.3		
Iron		(mg/kg) (DTPA)	4.1		
Boron		(mg/kg) (Hot CaCl)	0.3		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			2.23		3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (12)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B28

Report Reply:
INTENDED USE:

			RESULT		***OPTIMAL***
Conductivity (dS/m)(1:5 water)			0.05	<0.15	
pH	(1:5 $CaCl_2$)		5.31		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	5.14	See Percentage	
Magnesium:		(Mg)(meq/100g)	1.85	See Percentage	
Potassium:		(K)(meq/100g)	0.27	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.03	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**7.29**		
Exchangeable Cations (as a % of Total)					
Calcium:			70.51		65-80%
Magnesium:			25.38		15-20%
Potassium:			3.70		2-5%
Sodium:			0.41		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	15.1		
Sulphur	(mg/kg)	(KCl 40 S)	6.3		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	18.4		At least 10
Organic Carbon	(%)	(Walkely & Black)	2.4		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.6		
Zinc		(mg/kg) (DTPA)	0.7		
Manganese		(mg/kg) (DTPA)	11.2		
Iron		(mg/kg) (DTPA)	9.3		
Boron		(mg/kg) (Hot CaCl)	0.5		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			2.78		3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (13)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B29 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.06	<0.15
pH	(1:5 $CaCl_2$)		5.86	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		7.83	See Percentage
Magnesium:	(Mg)(meq/100g)		3.24	See Percentage
Potassium:	(K)(meq/100g)		0.36	0.5-1.0
Sodium:	(Na)(meq/100g)		0.08	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**11.51**	
Exchangeable Cations (as a % of Total)				
Calcium:			68.03	65-80%
Magnesium:			28.15	15-20%
Potassium:			3.13	2-5%
Sodium:			0.70	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	14.0	
Sulphur	(mg/kg)	(KCl 40 S)	6.1	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	23.0	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.7	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.7	
Zinc	(mg/kg)	(DTPA)	0.8	
Manganese	(mg/kg)	(DTPA)	15.6	
Iron	(mg/kg)	(DTPA)	19.2	
Boron	(mg/kg)	(Hot CaCl)	0.7	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.42	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (14)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B31 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.04	<0.15
pH	(1:5 $CaCl_2$)		5.76	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		5.04	See Percentage
Magnesium:	(Mg)(meq/100g)		2.14	See Percentage
Potassium:	(K)(meq/100g)		0.29	0.5-1.0
Sodium:	(Na)(meq/100g)		0.04	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**7.51**	
Exchangeable Cations (as a % of Total)				
Calcium:			67.11	65-80%
Magnesium:			28.50	15-20%
Potassium:			3.86	2-5%
Sodium:			0.53	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	31.3	
Sulphur	(mg/kg)	(KCl 40 S)	8.5	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	11.5	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.8	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.6	
Zinc	(mg/kg)	(DTPA)	0.6	
Manganese	(mg/kg)	(DTPA)	12.9	
Iron	(mg/kg)	(DTPA)	8.5	
Boron	(mg/kg)	(Hot CaCl)	0.6	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.36	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (15)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B32 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.05	<0.15
pH	(1:5 $CaCl_2$)		5.98	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		5.87	See Percentage
Magnesium:	(Mg)(meq/100g)		2.37	See Percentage
Potassium:	(K)(meq/100g)		0.33	0.5-1.0
Sodium:	(Na)(meq/100g)		0.05	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**8.62**	
Exchangeable Cations (as a % of Total)				
Calcium:			68.10	65-80%
Magnesium:			27.49	15-20%
Potassium:			3.83	2-5%
Sodium:			0.58	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	15.7	
Sulphur	(mg/kg)	(KCl 40 S)	5.7	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	13.8	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.9	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.7	
Zinc	(mg/kg)	(DTPA)	0.7	
Manganese	(mg/kg)	(DTPA)	16.3	
Iron	(mg/kg)	(DTPA)	11.2	
Boron	(mg/kg)	(Hot CaCl)	0.7	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.48	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (16)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B34 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.07	<0.15
pH	(1:5 $CaCl_2$)		5.65	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		4.82	See Percentage
Magnesium:	(Mg)(meq/100g)		1.82	See Percentage
Potassium:	(K)(meq/100g)		0.37	0.5-1.0
Sodium:	(Na)(meq/100g)		0.04	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**7.05**	
Exchangeable Cations (as a % of Total)				
Calcium:			68.37	65-80%
Magnesium:			25.82	15-20%
Potassium:			5.25	2-5%
Sodium:			0.57	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	21.9	
Sulphur	(mg/kg)	(KCl 40 S)	7.2	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	16.1	At least 10
Organic Carbon	(%)	(Walkely & Black)	2.8	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.6	
Zinc	(mg/kg)	(DTPA)	0.7	
Manganese	(mg/kg)	(DTPA)	15.2	
Iron	(mg/kg)	(DTPA)	7.8	
Boron	(mg/kg)	(Hot CaCl)	0.6	
Calculations:				
Lime Requirement (Cregan)			0.00	(see notes on page 2)
Calcium/Magnesium Ratio:			2.65	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (17)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B36 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.05	<0.15
pH	(1:5 $CaCl_2$)		5.65	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium		(Ca)(meq/100g)	8.06	See Percentage
Magnesium:		(Mg)(meq/100g)	3.08	See Percentage
Potassium:		(K)(meq/100g)	0.39	0.5-1.0
Sodium:		(Na)(meq/100g)	0.05	Zero
Aluminium:		(Al)(meq/100g)	0.00	Zero
Total Cation Exchange Capacity (CEC):			**11.58**	
Exchangeable Cations (as a % of Total)				
Calcium:			69.60	65-80%
Magnesium:			26.60	15-20%
Potassium:			3.37	2-5%
Sodium:			0.43	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	14.0	
Sulphur	(mg/kg)	(KCl 40 S)	4.6	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	13.8	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.1	2% or more
Trace Elements				
Copper		(mg/kg) (DTPA)	0.8	
Zinc		(mg/kg) (DTPA)	0.8	
Manganese		(mg/kg) (DTPA)	19.6	
Iron		(mg/kg) (DTPA)	16.5	
Boron		(mg/kg) (Hot CaCl)	0.8	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.62	3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (18)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received:
SAMPLE I.D: B40

Report Reply:
INTENDED USE:

			RESULT		***OPTIMAL***
Conductivity (dS/m)(1:5 water)			0.18	<0.15	
pH	(1:5 $CaCl_2$)		7.68		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	11.62	See Percentage	
Magnesium:		(Mg)(meq/100g)	5.99	See Percentage	
Potassium:		(K)(meq/100g)	0.43	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.82	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**18.86**		
Exchangeable Cations (as a % of Total)					
Calcium:			61.61		65-80%
Magnesium:			31.76		15-20%
Potassium:			2.28		2-5%
Sodium:			4.35		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	13.0		
Sulphur	(mg/kg)	(KCl 40 S)	4.3		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	11.5		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.4		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.8		
Zinc		(mg/kg) (DTPA)	0.9		
Manganese		(mg/kg) (DTPA)	24.2		
Iron		(mg/kg) (DTPA)	20.2		
Boron		(mg/kg) (Hot CaCl)	0.8		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			1.94		3-5

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SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (19)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply: 26.8.2016
SAMPLE I.D: B42 **INTENDED USE:**

			RESULT		*OPTIMAL*
Conductivity (dS/m)(1:5 water)			0.07	<0.15	
pH	(1:5 $CaCl_2$)		6.13		5.2-5.5
Exchangeable Cations: (Measured)					
Calcium		(Ca)(meq/100g)	7.43	See Percentage	
Magnesium:		(Mg)(meq/100g)	3.10	See Percentage	
Potassium:		(K)(meq/100g)	0.37	0.5-1.0	
Sodium:		(Na)(meq/100g)	0.21	Zero	
Aluminium:		(Al)(meq/100g)	0.00	Zero	
Total Cation Exchange Capacity (CEC):			**11.11**		
Exchangeable Cations (as a % of Total)					
Calcium:			66.88		65-80%
Magnesium:			27.90		15-20%
Potassium:			3.33		2-5%
Sodium:			1.89		<3%
Aluminium:			0.00		<5%
Phosphorus:	(mg/kg)	(Bray-1)	20.4		
Sulphur	(mg/kg)	(KCl 40 S)	6.7		8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	13.8		At least 10
Organic Carbon	(%)	(Walkely & Black)	3.3		2% or more
Trace Elements					
Copper		(mg/kg) (DTPA)	0.8		
Zinc		(mg/kg) (DTPA)	0.7		
Manganese		(mg/kg) (DTPA)	18.7		
Iron		(mg/kg) (DTPA)	17.5		
Boron		(mg/kg) (Hot CaCl)	0.7		
Calculations:					
Lime Requirement (Cregan)			0.00	(see notes on page 2)	
Calcium/Magnesium Ratio:			2.40		3-5

SOILTEC SOIL AND PLANT ANALYSIS

2/37 OWENS CR (PO BOX 374) ALSTONVILLE NSW 2477
PHONE 02 66281411 FAX 02 66285868 EMAIL : chemist@soiltec.com.au

Soil Test Report #s16-0507 (20)

Client: ***SLR***
Account: **Tarwyn Park**
10 Kings Rd
New Hampton NSW 2305

Sample Received: Report Reply:
SAMPLE I.D: B44 **INTENDED USE:**

			RESULT	OPTIMAL
Conductivity (dS/m)(1:5 water)			0.05	<0.15
pH	(1:5 $CaCl_2$)		5.60	5.2-5.5
Exchangeable Cations: (Measured)				
Calcium	(Ca)(meq/100g)		5.75	See Percentage
Magnesium:	(Mg)(meq/100g)		2.46	See Percentage
Potassium:	(K)(meq/100g)		0.31	0.5-1.0
Sodium:	(Na)(meq/100g)		0.11	Zero
Aluminium:	(Al)(meq/100g)		0.00	Zero
Total Cation Exchange Capacity (CEC):			**8.63**	
Exchangeable Cations (as a % of Total)				
Calcium:			66.63	65-80%
Magnesium:			28.51	15-20%
Potassium:			3.59	2-5%
Sodium:			1.27	<3%
Aluminium:			0.00	<5%
Phosphorus:	(mg/kg)	(Bray-1)	17.3	
Sulphur	(mg/kg)	(KCl 40 S)	5.7	8-10
Nitrate Nitrogen	(mg/kg)	(water extract)	11.5	At least 10
Organic Carbon	(%)	(Walkely & Black)	3.0	2% or more
Trace Elements				
Copper	(mg/kg)	(DTPA)	0.7	
Zinc	(mg/kg)	(DTPA)	0.6	
Manganese	(mg/kg)	(DTPA)	14.7	
Iron	(mg/kg)	(DTPA)	15.2	
Boron	(mg/kg)	(Hot CaCl)	0.7	

Calculations:

Lime Requirement (Cregan)	0.00	(see notes on page 2)
Calcium/Magnesium Ratio:	2.34	3-5

Appendix C

Land Degradation Inspection Sites

Site1 Upper reaches of Bylong River (Wallings), stable stream banks are protected by Casuarina and understorey (including weeds).

Site 2 Bylong River at Tarwyn Park Farm Complex and Wallings boundary, stable stream banks are protected by Casuarina and understorey (including weeds).

Site 3 Leaky weir in Bylong River, stream banks and bed are stable, assisted by kikuyu encroachment. Heavy infestation of Noogoora burr.

Site 3 "Stilling pond" below leaky weir assisting in bank stability.

Site 3 River flay adjacent to leak weir with heavy infestation of Noogoora burr.

Site 4 Leaky weir in Bylong River, stream banks are stable assisted by kikuyu encroachment and Casuarina's. Heavy infestation of Noogoora burr.

Site 4 "Stilling pond" below leaky weir assisting in bank stability.

Site 5 Wetland area, assisting with overland run-off and nutrient retention.

Site 6 Bylong River at Wallings (downstream of Tarwyn Park Farm Complex), stable stream banks protected by Casuarina and understorey (including weeds).