

APPENDIX J SOIL SURVEY



SOIL SURVEY REPORT

CULCAIRN SOLAR FARM

MARCH 2019

DM McMahon Pty Ltd

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SOIL SURVEY REPORT**CULCAIRN SOLAR FARM**

March 2019

Project brief

At the request of Erwin Budde of NGH Environmental Pty Ltd, soil sampling, analysis and reporting was carried out to assess the site in February 2019 for a proposed solar farm. The document provides information about the site and soil conditions from field observations and laboratory analysis.

Site identification

Address: 486 & 585 Cummins Road, 2741 Olympic Highway & Weeamera Road Culcairn NSW 2660 and Orange Promise Road, Walla Walla NSW 2659.

Real property description: Lots 9, 10, 11, 45, 46, 47, 53 & 54 (DP 753735), Lots 70, 71, 72, 73 & 86 (DP 153764), Lot 114 (DP664997), Lot B (DP972054), Lot 1 (DP171815), Lot 1 (DP 179854) & Lot 1 (DP 575478).

Centre co-ordinate: 496357E 6049213N MGA GDA z55

Property size: (investigated area) 1395 ha approximately

Owner: c/o NGH Environmental Pty Ltd

Local Council Area: Great Hume Shire Council

Present use: Broadacre Agriculture

Development Application Reference: N/A

Report identification: 5822

Certification

Name	Signed	Date	Revision Number
David McMahon CEnvP BAppSc SA GradDip WRM MEnvMgmt		12/03/19	00

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Log sheets	<i>Attachment A</i>
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1.0 Introduction

The report presents the results of a soil survey carried out by DM McMahon Pty Ltd (McMahon) for the proposed Culcairn Solar Farm near Culcairn, NSW.

The soil and land survey were commissioned by Erwin Budde of NGH Environmental Pty Ltd and was undertaken in general accordance with the provided scope of works as can be seen in **Section 3**. David McMahon, Zach Bradley and James Halse of McMahon conducted a soil survey on 27 and 28 February 2019 using standard soil surveying techniques. The survey was carried out utilising a coring rig to excavate the soil profile to a depth of approximately 1.5 metres. Sampling and classification of in situ soils was carried out as per the Australian Soil and Land Survey Field Handbook (2009) and The Australian Soil Classification (ASC) (Isbell, 1996). Density of investigation boreholes was determined via Guidelines for Surveying Soil and Land Resources (2008) where selection of a 'Moderately High (Detailed)' intensity level was deemed appropriate for satisfying the objectives for detailed project planning.

2.0 Site characteristics

A desktop review and investigation of the topography, hydrology, soil, lithology, geology and hydrogeology of the site has been undertaken and are as follows.

2.1 Topography

The site is located over the Walbundrie 1:50,000 Topographic Map (Sheet 8226-S) at an elevation range of approximately 200m to 220m AHD. The landform of the site consists of extremely low relief and shallow alluvial stream channels forming an alluvial plain. Two widely spaced shallow ephemeral drainages traverse the site, one is Back Creek and the other is unnamed. Both drainages run into the moderately deep and perennial Billabong Creek which borders the northern extent of the site.

2.2 Vegetation

The site is currently used for broad acre agriculture, predominantly grazing and cropping. At the time of the soil survey, the majority of the site was wheat stubble as a result of last year's cropping season, with the lower lying areas consisting of dry pasture being grazed by cattle. Some broadleaf weed species such as thistles were present on site but were not prevalent. There are established eucalypt trees scattered throughout the property, mostly in clumps and along the drainages or property boundaries. A more detailed assessment of vegetation present can be seen in the NGH Environmental Scoping Report for the site.

2.3 Weather

The mean rainfall for the Albury Airport AWS weather station (40 km away) is approximately 614.6 mm per annum. The wettest months are July, August and October; however, the rainfall is spread relatively evenly throughout the year. The mean maximum temperatures range from 13.2 °C in July to 32.5 °C in January and mean minimum temperatures range from 3.1 °C in July to 16.7 °C in February. Historical records the Albury Airport AWS 072160 weather stations, respectively (www.bom.gov.au).

2.4 Hydrology

The site is located within the Murray River catchment. The perennial Billabong Creek forms the northern border of the investigated area with the ephemeral Back Creek, a tributary of Billabong Creek) forming the western boundary. The confluence of Billabong Creek and

Back Creek is to the west of the property. A first order unnamed ephemeral drainage, a tributary of Back Creek, lies in the south of the property. Many dams are present across the site. Many man-made drains have been formed in the southern half of the property designed to shed water to the drainages, assumed to abate water logging in the paddocks.

2.5 Soil & Landform

The site lies within the mapping units **Va17** from the Digital Atlas of Australian Soils (CSIRO, 1991).

"Va17"

"Flat to gently undulating country with some swamps and broken by an occasional low gravelly or stony ridge or hillock: chief soils are hard alkaline yellow mottled soils (Dy3.43) and (Dr2.33), both containing ironstone gravel and sometimes forming soil complexes. Associated are: ridges and hillocks of (Dr2.32, Dr2.42) and (Um4.1) soils similar to unit Qc3; small flat areas of (Dr2.23); and various undescribed soils in local situations, e.g. subjacent to swamps and on stream terraces. Data are limited. Occurs on sheet(s): 3"

2.6 Geology & Lithology

The site geology is dominated by Cainozoic alluvium deposits in the northern half of the site as a result of depositional processes associated with the Billabong Creek. The southern half of the site consists of the Shepparton formation geology with poorly consolidated clay, sand, silt and gravel deposits.

2.7 Hydrogeology

From the Geoscience Australia hydrogeology dataset, the groundwater beneath the site is described as fractured or fissured, extensive aquifers of low to moderate productivity over the majority of the site with the north eastern corner consisting of porous, extensive highly productive aquifers associated with Billabong Creek.

3.0 Investigation scope of works

The specifications for the site investigation and soil survey are as follows, **Table 1**:

Table 1: *Scope of works.*

Item	Description	Description
1.	Where available, review provided plans and other general related documents to gain a comprehensive understanding of the proposed project.	-
2.	Undertake a desktop study of local landform, geological, lithological & hydrogeological conditions.	See Section 2.0
3.	Conduct Dial Before You Dig search.	-
4.	Carry out field investigations by reference to Guidelines for Surveying Soil and Land Resources (2008) & AS1726:1993 Geotechnical Site Investigations.	47 boreholes in total. Samples of topsoils (A1), A2, B, B/C and C horizons taken when present to

		adequately classify soils as per ASC 1996.
5.	Analyse soils in situ and at NATA accredited laboratory to AS/RMS methods.	12 x Representative samples for topsoil analysis – pH, EC, nutrient and cation status. 30 x representative samples for subsoil analysis – pH, EC, dispersion.
6.	Generate laboratory reports and review results.	-
7.	Compile results in report detailing methodology, desktop study, physical conditions, field work results, test locations, bore logs, in-situ test results, laboratory results and discussion.	-
8.	Recommendations for erosion control and prevention measures and management recommendations for earthworks.	-

As follows is a map of the investigated site and investigation borehole locations, **Figure 1**.

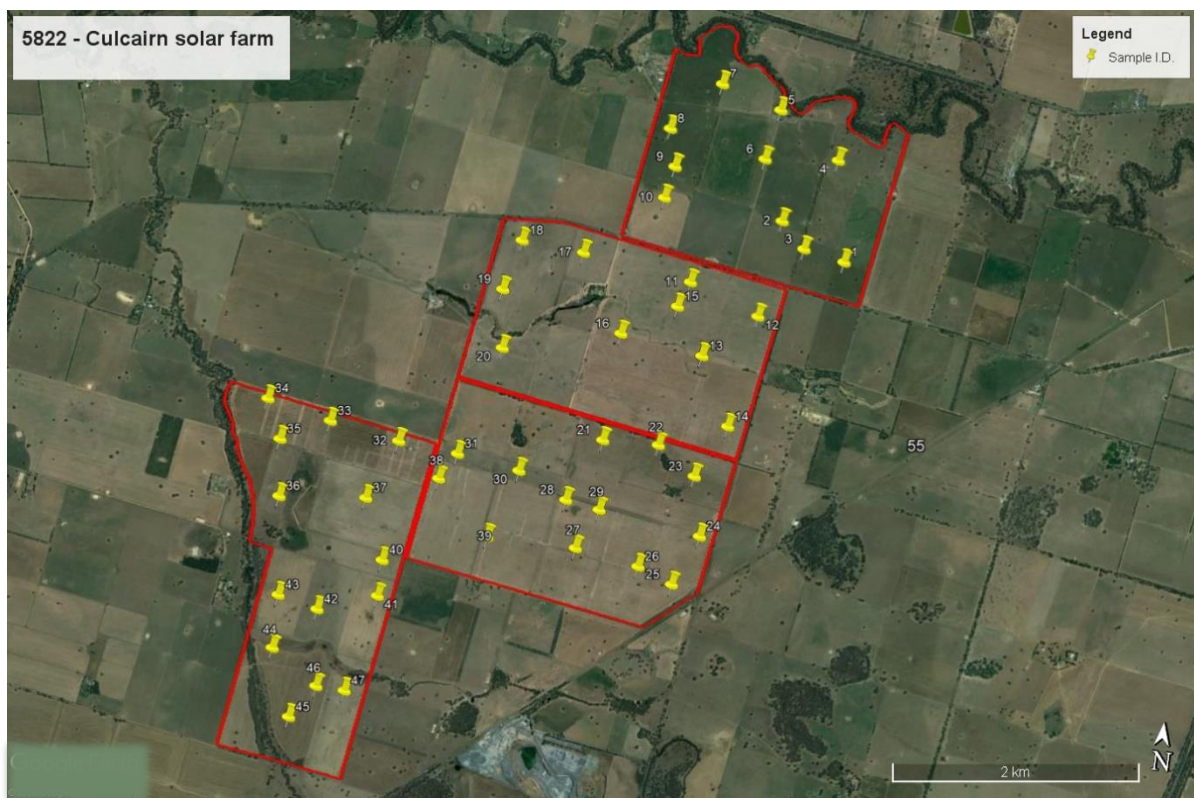


Figure 1: Soil survey investigation borehole locations.

4.0 Results

4.1 Field survey

A soil survey was conducted using standard soil surveying techniques. Sampling and classification of in situ soils was carried out as per the Australian Soil and Land Survey Field

Handbook (2009) and The Australian Soil Classification (Isbell, 1996). Density of investigation boreholes was determined via Guidelines for Surveying Soil and Land Resources (2008) where selection of a 'Moderately High (Detailed)' intensity level was deemed appropriate for satisfying the objectives for detailed project planning. Soils encountered were typical of the locale, generally falling into reconnaissance survey classes. Slight variations in profiles exist due to remnant parent formations, drainage plains and the complex soil sequences that are associated with such. Soil moisture contents varied between soil types but were generally found to be dry in the topsoil and at depth. Free groundwater was not encountered to the investigated depth.

4.2 Typical soil profiles

Soils can be classified into a typical soil profile across the site as per the Australian Soil Classification (ASC) system (Isbell, 1996). Representative photographs from profiles examined on site can be seen below with a brief description of the profile characteristics. All soil boreholes investigated were located on managed agricultural lands. Field soil log sheets can be seen attached. Description of the typical soil type encountered, Chromosols can be seen as follows.

4.2.1 Chromosols

Chromosols have a strong texture contrast between A and B horizons. There is a clear or abrupt textural B horizon in which the upper portion of the horizon (0.2m) is not strongly acid and not sodic. These soils are the most commonly encountered soils under agricultural use in Australia.

Topsoil

Brown fine sandy clay loams, light clays and clay loams, granular. pH (1:5 soil/water) 5.4 – 5.9 in the A horizon; to 20-60cm depth. Pronounced A2 horizon on the lower lying areas. Clear boundary to-

Subsoils

Moderately massive structure across the majority of site and granular in the lower lying areas along Billabong Creek. Hues vary from yellowish-grey to yellowish-red in B and C horizon (where encountered). Light to medium clays and silty clay loams in B horizon and C horizon.

4.3 Laboratory analysis

12 representative topsoil samples were obtained and analysed at a NATA accredited laboratory for the establishment of baseline soil data that may be referred to and used in preparation of a site decommissioning plan. Laboratory COA's can be found in the attachments and topsoil soil parameters can be seen summarised in **Table 2**. 30 subsoil samples were also analysed for pH and EC, and tested for dispersion, **Table 3**.

4.3.1 Topsoil analysis

4.3.1.1 pH & Electrical Conductivity

Topsoil pH (1:5 soil/water) ranged from 5.4 – 5.9 and can be classed as 'Moderately acid' (Bruce & Rayment, 1982). Electrical Conductivity (EC) ranged from 0.07 to 0.20 dS/m and therefore the salinity rating was 'very low' (Agriculture Victoria, 2011).

4.3.1.2 Cation Exchange Capacity, Exchangeable Sodium Percentage & Dispersion

Cation Exchange Capacity (CEC) ranges from 3.1 to 11.6 cmol(+)/kg. CEC of the soils is rated by Hazelton and Murphy (2007), as 'low' (6 – 12) and 'very low' (<6). Exchangeable Sodium Percentage (ESP) ranges from 1.7% to 4.7%. Soils are classified as 'non-sodic' when the ESP is <6%.

4.3.1.3 Colwell Phosphorus and Phosphorus Buffering Index

Colwell P (plant available phosphorus) ranges from 41 to 170mg/kg, which is classed as 'very high' (Hazelton and Murphy, 2007). Phosphorus Buffering Index (PBI) ranged from 33 to 110 and is classed as 'low' (71-140) to 'very very low' (15-35), (Agriculture Victoria, 2011).

4.3.1.4 Calcium: Magnesium Ratio

Ca:Mg ratio ideally should be at least 2:1. Higher calcium contents are acceptable however higher magnesium content may result in soil dispersion. Ca:Mg determined for topsoils returned results ranging from 1.9 – 5.9.

4.3.1.5 Soil infiltration rates and water holding capacity

Water holding capacity is variable across the site with topsoils determined as moderate to high based on available water by percentage (20 - 28%) and moderate permanent wilting point (~16%). Water holding capacity for subsoils is lower due to a higher clay content which has a lower available water percentage (12-13%) and higher permanent wilting point (24-29%), (Hazelton & Murphy 2007).

Topsoil infiltration based on texture and degree of structure for loam and clay loams with evident peds is inferred to be around 50-90mm/h. This is given a moderate to high rating for saturated hydraulic conductivity with rare and occasional runoff (Hazelton & Murphy 2007). Infiltration in subsoils is considered to be very slow with a permeability of less than 5mm per hour. Subsoils are liable to waterlogging where there is a limited topsoil horizon due to the very slow infiltration rates (Hunt & Gilkes 1992).

5.0 Summary of test results

Please see next page.

Table 2: Topsoil - Results of laboratory testing

Parameter	Units	Sample Identification											
		45, 46, 47	35, 42, 43	39, 40, 41, 44	36, 37, 38	29, 32, 33, 34	26, 28, 30, 31	21, 24, 25	17, 18, 19, 20	13, 22, 23, 27	12, 14, 15, 16	4, 6, 7, 8, 9	1, 2, 3, 5, 10, 11,
pH (1:5 Water)		5.8	5.8	5.9	5.4	5.4	5.9	5.8	5.6	5.8	5.6	5.9	5.8
pH (1:5 CaCl2)		5.1	5.3	5.3	4.7	4.6	5.2	5.0	4.7	5.0	4.9	5.2	5.2
Electrical Conductivity	dS/m	0.19	0.26	0.16	0.13	0.07	0.12	0.09	0.08	0.08	0.18	0.20	0.16
Chloride	mg/kg	36	69	57	45	15	19	15	20	10	45	76	20
Nitrate Nitrogen	mg/kg	29	51	33	18	16	31	21	11	20	38	45	32
Ammonium Nitrogen	mg/kg	15	14	9	23	6	13	19	17	11	18	35	21
Phosphorus (Colwell)	mg/kg	59	73	47	89	44	95	51	69	41	78	73	170
PBI		110	88	75	69	48	68	49	88	33	71	37	86
Sulphur (KCl40)	mg/kg	32	74	16	27	6	9	8	11	7	27	15	27
CEC	cmol(+)/kg	11.6	11.4	7	4.7	3.9	6.1	4	5.9	3.1	6.4	5.4	7.7
Calcium (Amm-acet.)	cmol(+)/kg	6.8	7.4	4.7	2.9	1.9	3.9	2.6	3.2	1.9	3.5	3.7	5.4
Magnesium (Amm-acet.)	cmol(+)/kg	3.1	2.3	1.2	0.7	1	1.2	0.6	1.5	0.4	1.5	0.6	1
Sodium (Amm-acet.)	cmol(+)/kg	0.5	0.31	0.28	0.16	0.19	0.14	0.09	0.27	0.05	0.18	0.15	0.14
Potassium (Amm-acet.)	cmol(+)/kg	1.2	1.4	0.94	0.81	0.59	0.9	0.73	0.69	0.75	1.2	0.94	1.2
Available Potassium	mg/kg	470	560	370	320	230	350	290	270	290	470	370	480
Aluminium (KCl)	cmol(+)/kg	<0.1	<0.1	<0.1	0.2	0.3	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1
Aluminium % Cations	%	<1.0	<1.0	<1.0	3.6	6.7	<1.0	<1.0	4.5	<1.0	<1.0	<1.0	<1.0
Calcium % Cations	%	59	65	66	61	47	63	65	54	61	55	68	70
Magnesium % Cations	%	27	20	17	15	26	19	15	25	13	23	12	13
ESP	%	4.3	2.7	4	3.3	4.7	2.3	2.2	4.6	1.7	2.8	2.9	1.8
Potassium % Cations	%	10	13	13	17	15	15	18	12	24	19	17	16
Cal/Mg Ratio		2.2	3.2	3.9	4.1	1.9	3.3	4.5	2.1	4.9	2.3	5.9	5.6

Table 3: Subsoil – Results of laboratory testing.

⁺Dispersion testing results were rated N, P or C being Nil, Partial or Complete dispersion.

Pit/Sample	Horizon	pH (1:5 soil/water)	Electrical Conductivity	Dispersion ⁺
Units	-	-	µS/cm	-
1/3	B/C	6.4	0.03	P
2/2	A2	4.7	0.04	C
3/3	B/C	6.0	0.08	*
4/3	B/C	5.4	0.04	*
6/3	C	4.9	0.03	*
7/3	B/C	5.0	0.03	*
8/3	B/C	5.1	0.06	*
10/3	B/C	5.5	0.07	P
13/3	C	5.4	0.03	*
14/2	B	5.7	0.06	*
16/2	B	5.2	0.06	P
21/3	B/C	5.3	0.04	P
22/2	A2	4.6	0.03	*
22/3	B/C	4.8	0.02	*
23/3	B/C	4.8	0.04	*
26/2	B	5.3	0.07	N
27/3	B/C	4.9	0.05	*
31/2	B	5.7	0.04	P
32/3	B/C	5.7	0.03	C
33/3	B/C	5.6	0.10	N
34/3	B/C	6.2	0.02	P
35/2	B	5.4	0.10	N
36/3	B/C	5.7	0.04	P
41/2	A2	5.3	0.13	P
41/3	B/C	5.7	0.06	P
42/2	B	5.6	0.13	P
44/3	B/C	5.9	0.05	P
46/2	B	6.4	0.07	P
47/2	B	5.9	0.05	P

* Denotes slaking but no dispersion.

6.0 Comments and recommendations

The discussion and recommendations provided below are based on field observations and testing at discrete locations.

6.1 Potential limitations

Potential landscape limitations have been summarised below, **Table 4**.

Table 4: *Potential landscape limitation assessment.*

Soil Type	Erosion Hazard	Salinity Risk	Acid Soil	Waterlogging Risk	Acid Sulphate Soils	Infrastructure
Chromosol	LOW	LOW	YES	MODERATE	NO	LOW

As follows is the soil landscape map (eSpade, 2018) which has been generally validated by the soil survey through laboratory and field techniques. As such, management practices can be grouped into management classes of Australian Soil Classification (ASC) units with Chromosols being represented across the Va17 soil type, **Figure 2**. This report identifies management practices for ASC units in Section 6.5 below.

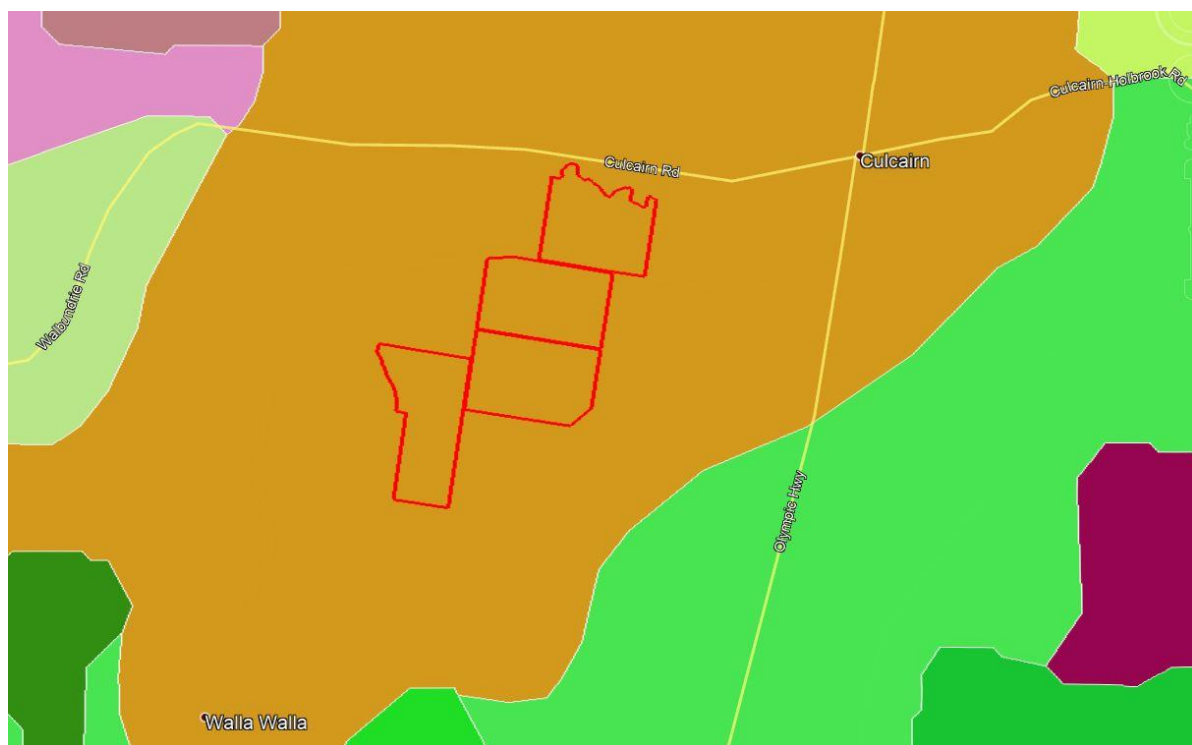


Figure 2: *Digital Atlas of Australian Soils mapping units with site overlay (Va16, Va17, My9 and Va14).*

6.2 Erosion control

To mitigate the occurrence of erosion the following primary principles should be adhered to, particularly throughout the construction period of the project. Best Management Practices (BMPs) should be employed where applicable to further reduce the risk of potential erosion and sediment control.

- Integrate project design with any site constraints.
- Preserve and stabilise drainageways.

- Minimise the extent and duration of disturbance.
- Control stormwater flows onto, through and from the site in stable drainage structures.
- Install perimeter controls.
- Stabilise disturbed areas promptly.
- Protect steep slopes.
- Employ the use of sediment control measures to prevent off and on-site damage.
- Protect inlets, storm drain outlets and culverts.
- Provide access and general construction controls.
- Inspect and maintain sediment and erosion control measures regularly.

The risk of erosion on site due to construction activities is considered low due to the low relief and generally low salinity and sodicity of topsoils and subsoils. Excavation of subsoils should be limited where possible, and excavated subsoils should be stockpiled and contained to avoid potential dispersion and sediment transfer. Ground cover around the structures should be maintained where possible. Maintenance of ground cover will also aid in the prevention of topsoil losses from wind erosion. Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004) and Volume 2A & 2C (DECC, 2008) should be consulted further in the development of an Erosion and Sediment Control Plan (ESCP).

6.3 Acid sulphate soils

Acid sulphate soils is the common name given to naturally occurring soils containing iron sulphides. Exposure of the sulphides present in these soils to oxygen from drainage or excavation will lead to the generation of sulphuric acid. Field pH of these soils in their undisturbed state is generally pH 4 or less.

Landscape characteristics such as; the dominance of mangroves, reeds, rushes and other marine/estuarine or swamp-tolerant vegetation, low lying areas, back swamps or scalded areas of coastal estuaries and floodplains and sulphurous smell following rain after prolonged dry periods (Stone *et al*, 1998) after soil disturbance were not observed. There was no evidence of a jarositic horizon or jarosite precipitates or coatings on any root channels or cracks in the soil.

From the soil survey conducted, it has been assessed that acid sulphate soils are not present on site.

6.4 Potential impacts on salinity, groundwater resources and hydrology

Current operational procedures include dryland cropping and grazing. Associated water features across the investigated area include at least 19 dams and various open drainage channels and depressions. There are 8 registered groundwater bores on site and a further 4 registered bores within 500 metres of the site boundary. Most of the paddocks on the higher ground excluding those on the northern side of Cummins Road had maintained stubble at the time of the investigation. Given the majority of soils on site are classified as 'non-sodic' and are of low salinity, the risk of salt build-up in discharge areas is low. However, changing direction of surface waters and any run-on should be avoided as local changes in the water regime are likely to mobilise any salts stores, however low, in the soil. Deep rooted vegetation should be maintained where present and established where absent, ground clearing should be minimised.

6.5 Soil characteristics and management responses

6.5.1 Chromosols

Table 5: Chromosol characteristics and management responses.

Soil property	Behaviour of soil to activity or environment	Management responses/measures
Soil surface		
These soils generally have a moderate to weak structure in the surface with a firm to hard setting surface condition.	A firm to hard setting surface will generally have poor initial infiltration resulting in a large proportion of water running off causing erosion.	Surface infiltration rate can be increased through the incorporation of composted organic matter and by maintaining vegetative cover.
	A hard setting surface will also cause poor germination and seedling emergence.	Soil structure and moisture holding capacity can be improved through the incorporation of composted organic matter leading to better seedling establishment.
	A sandy to loamy surface with poor structure can have low soil strength causing trafficability issues.	Trafficability of these soils may be difficult when wet, however the use of gravel road surfaces may improve site access.
	If sandy to loamy surface soil with poor structure and low soil strength is overworked or excessively trafficked there is a high potential to generate dust.	Limit traffic and do not disturb unless necessary to avoid destruction of the limited soil structure. Construct gravel roads on site and limit access off these roads. Consider the use of stabilisation products.
Expansive clays		
These soils contain little to no expansive clays.	-	-
Clay subsoils		
These soils contain non-sodic, slightly acidic to slightly alkaline clay subsoils that may be mottled.	These soils have imperfect drainage and lower landscape positions and can stay wet for extended periods of time. Subsoil permeability is moderate.	Subsoil material is unsuitable for use on the soil surface and should be adequately covered with topsoil. Appropriate drainage design and materials (i.e. sand and gravel) can improve site access for construction. Depending on subsoil structure, plant roots are generally able to extend into the subsoil material without restriction. Gypsum additions can be used to assist structure improvement where required.

Soil property	Behaviour of soil to activity or environment	Management responses/measures
Dispersion		
These soils are generally non-dispersive; however, testing will be needed to confirm.	Although not generally dispersive, these soils are still susceptible to rill, sheet and stream bank erosion.	Maintain cover to reduce sheet and rill erosion. Stream bank erosion managed by maintaining vegetative cover and encouraging plants with fibrous root systems. Do not concentrate water flow unless using appropriate erosion and sediment control treatments. Erosion and sediment controls may need to be installed to manage drainage, erosion and prevent movement of sediment off-site.
Salinity		
These soils can have high salt levels (depending on parent material and landscape practices) particularly on lower slopes.	High salt levels will affect plant growth and will also impact water quality if leached or washed off.	If irrigating salty soils, maintain a leaching profile to reduce salt levels (salinity management handbook (DERM 2011) contains thresholds for different plants). Treat salty soils as dispersive soils, even if field testing results are negative, because salt can mask dispersion.
	Salt can cause scalding, erosion and damage to infrastructure.	Discharge salinity expressions can be managed by reducing water inputs and by increasing soil water use at the site or upslope if possible. Soil amelioration with gypsum and planting salt tolerant species may assist scald areas.
Fertility		
These soils generally have a low to moderate fertility.	The sandy surface and pale subsurface layers (where present) generally mean that nutrient content is low in these soils, as is their ability to hold onto nutrients.	Fertiliser additions may improve plant growth, particularly nitrogen, phosphorus, and potassium. To limit leaching/loss of nutrients, specific fertiliser rates should be divided up into regular smaller applications during the growing season, rather than one single application. Increasing organic matter content with composted organics will improve the fertility and assist nutrient retention in these soils.

Soil property	Behaviour of soil to activity or environment	Management responses/measures
Revegetation		
These soils are poorly to imperfectly drained with low to moderate fertility, highly alkaline subsoils and low plant available water holding capacity.	Plant species need be selected that are adapted to these conditions.	Addition of gypsum may be required to alleviate dispersion risk. Increasing organic matter content with composted organics will improve fertility, assist nutrient retention and improve moisture holding capacity of these soils. Relieve any compaction present and ensure adequate fertility for quick establishment. These soils will require frequent, low volume watering due to the dense subsoils. Protect surface with mulch material to reduce raindrop induced crusted or hard setting surface. Fertiliser additions should be divided up into regular smaller applications during the growing season to limit leaching of nutrients. Dense subsoil material significantly restricts plant root extension into the subsoil. Stabilisation and revegetation targets and timeframes should be in accordance with IECA (2008) guidelines.
Soil Handling		
Some of these soils have very salty and/ or dispersive subsoils and potentially dusty topsoil.	The objective of soil handling is to minimise off site impacts and maximise the productive capacity of the soil on site consistent with the intended use.	Topsoil stripping should maximise available reserves and should avoid mixing with alkaline, salty and/or sodic subsoils – a simple survey of the site is recommended. Topsoil and subsoil stockpiles should be kept separate. Reinststate soil in the order they were removed (i.e. deeper subsoil below upper subsoil). Final placement of dispersive materials should be covered with adequate topsoil material to protect from erosion. Installation of erosion and sediment control structures may be required where soil is exposed. Trafficability of these soils may be difficult when wet, the use of gravel road surfaces may improve site access. Minimise the handling of topsoil material and ensure traffic is concentrated on constructed road surfaces.

7.0 Notes relating to results

Groundwater

No free groundwater was encountered during the investigation. A groundwater table or seepage may be present at other times and fluctuations in groundwater levels and seepage could occur due to rainfall, changes in temperature and other factors.

Bore hole / test borehole logging

The information supplied in the log sheets is based on a visual and tactile assessment with consideration given to field conditions at the time of testing. The log sheets can include inferred data based on the experience of the geotechnician as well as factual data from in situ testing.

8.0 Disclaimer

The information contained in this report has been extracted from field and laboratory sources believed to be reliable and accurate. DM McMahon Pty Ltd will not assume any responsibility for the misinterpretation of information supplied in this report. The accuracy and reliability of recommendations identified in this report need to be evaluated with due care according to individual circumstances. It should be noted that the recommendations and findings in this report are based solely upon the said site location and the ground level conditions at the time of testing. The results of the said investigations undertaken are an overall representation of the conditions encountered. The properties of the soil within the location may change due to variations in ground conditions outside of the tested area. The author has no control or liability over site variability that may warrant further investigation that may lead to significant design changes.

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10.0 Attachments

Attachment	Details
A. Log sheets	7 pages
B. Laboratory reports	24 pages



DOCUMENT ATTACHMENTS

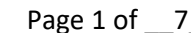
REPORT 2019

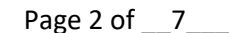
DM McMahon Pty Ltd
6 Jones Street, (PO Box 6118)
Wagga Wagga NSW 2650

t (02) 6931 0510
www.dmmcmahon.com.au

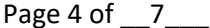


Attachment A : *Log sheets*

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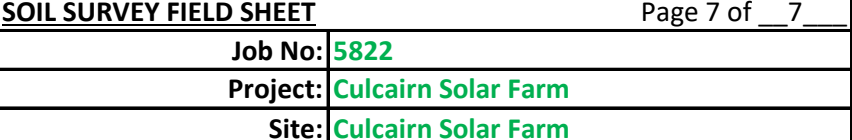
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																Job No: 5822			
																Project: Culcairn Solar Farm			
																Site: Culcairn Solar Farm			
Site Identity	Sample	Co-ordinates MGA GDA94 z55	Layer	Layer Top (m)	Layer Bottom (m)	Horizon	Boundary	Colour	Munsell Code	Texture	Moisture	Consistence	Mottles	Mottle Type	Structure	Coarse Fragments	Fragment Size (mm)	Fragment (%)	Comments
13	1	498163 E	1	0.0	0.20	A	-	B	10YR 3/2	CL	D	5	-	-	GR	-	-	-	BH120
	2	6049904 N	2	0.20	0.50	B	C	YR	5YR 4/6	CL	D	5	-	-	GR	-	-	-	
	3		3	0.50	1.50	C	S	YR	5YR 4/6	MC	D	6	-	-	MASS	-	-	-	
14	1	498445 E	1	0.00	0.40	A	-	+ B	7.5YR 4/6	LC	D	5	-	-	MASS	-	-	-	TP104
	2	604944 N	2	0.40	1.50	B	S	YG	10YR 5/4	MC	D	6	-	-	MASS	-	-	-	
15	1	497914 E	1	0.00	0.30	1/A	-	B	10YR 3/2	CL	D	6	-	-	GR	-	-	-	ERT104
	2	6050363 N	2	0.30	1.50	B	S	YR	5YR 4/6	MC	D	5	-	-	MASS	-	-	-	
16	1	497484 E	1	0.00	0.10	1/A	-	B	10YR 3/2	CL	D	5	-	-	GR	-	-	-	TP119
	2	6050086 N	2	0.10	1.50	B	S	YG	10YR 5/4	MC	D	6	-	-	MASS	-	-	-	
17	1	497097 E	1	0.00	0.30	1/A	-	B	10YR 3/2	CL	D	5	-	-	GR	-	-	-	BH107
	2	6050698 N	2	0.30	1.50	B	S	YG	5YR 4/6	MC	D	6	-	-	MASS	-	-	-	
18	1	496587 E	1	0.00	0.30	1/A	-	B	10YR 3/2	CL	D	5	-	-	GR	-	-	-	TP101
	2	6050733 N	2	0.30	1.50	B	S	YG	5YR 4/6	MC	D	6	-	-	MASS	-	-	-	
19	1	496587 E	1	0.00	0.20	A	-	+ B	7.5YR 4/6	LC	D	5	-	-	MASS	-	-	-	ERT107
	2	6050733 N	2	0.20	1.50	B	S	YG	10YR 5/4	MC	D	6	-	-	MASS	-	-	-	
20	1	496538 E	1	0.00	0.20	A	-	+ B	7.5YR 4/6	LC	D	5	-	-	MASS	-	-	-	TP120
	2	6049847 N	2	0.20	1.50	B	S	YG	10YR 5/4	MC	D	6	-	-	MASS	-	-	-	

[illegible]

																Job No: 5822			
																Project: Culcairn Solar Farm			
																Site: Culcairn Solar Farm			
Site Identity	Sample	Co-ordinates MGA GDA94 z55	Layer	Layer Top (m)	Layer Bottom (m)	Horizon	Boundary	Colour	Munsell Code	Texture	Moisture	Consistence	Mottles	Mottle Type	Structure	Coarse Fragments	Fragment Size (mm)	Fragment (%)	Comments
27	1	497340 E	1	0.0	0.05	A1	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	X MARKED
	2	6048313 N	2	0.05	0.40	A2	C	YB	10YR 5/4	ZCL	D	2	-	-	GR	-	-	-	
	3		3	0.40	1.50	B/C	S	YR	5YR 6/4	MC	D	5	-	-	MASS	-	-	-	
28	1	497340 E	1	0.00	0.30	A	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	TP118
	2	6048313 N	2	0.30	1.50	B	C	YB	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	
29	1	497492 E	1	0.00	0.05	A1	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	TP106
	2	6048645 N	2	0.05	0.30	A2	C	YB	10YR 5/4	ZCL	D	2	-	-	GR	-	-	-	
	3		3	0.30	1.50	B/C	S	YR	5YR 6/4	MC	D	5	-	-	MASS	-	-	-	
30	1	496802 E	1	0.00	0.30	A	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	
	2	6048876 N	2	0.30	1.50	B	C	YB	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	
31	1	496287 E	1	0.00	0.30	A	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	
	2	6048949 N	2	0.30	1.50	B	C	YB	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	
32	1	495797 E	1	0.00	0.10	A1	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	
	2	6048990 N	2	0.10	0.40	A2	C	YB	10YR 5/4	ZCL	D	2	-	-	GR	-	-	-	MARKED X
	3		3	0.40	1.50	B/C	S	YG	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	
33	1	495222 E	1	0.00	0.10	A1	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	MARKED X
	2	6049081 N	2	0.10	0.40	A2	C	YB	10YR 5/4	ZCL	D	2	-	-	GR	-	-	-	
	3		3	0.40	1.50	B/C	S	YG	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	

																Job No: 5822			
																Project: Culcairn Solar Farm			
																Site: Culcairn Solar Farm			
Site Identity	Sample	Co-ordinates MGA GDA94 z55	Layer	Layer Top (m)	Layer Bottom (m)	Horizon	Boundary	Colour	Munsell Code	Texture	Moisture	Consistence	Mottles	Mottle Type	Structure	Coarse Fragments	Fragment Size (mm)	Fragment (%)	Comments
34	1	494692 E	1	0.0	0.10	A1	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	X MARKED
	2	6049196 N	2	0.10	0.70	A2	C	YB	10YR 5/4	ZCL	D	2	-	-	GR	-	-	-	
	3		3	0.70	1.50	B/C	S	YG	10YR 5/4	MC	D	5	1	R	MASS	-	-	-	
35	1	494832 E	1	0.00	0.20	A	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	ERT109
	2	6048883 N	2	0.20	1.50	B	C	YB	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	
36	1	494884 E	1	0.00	0.05	A1	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	BH112
	2	6048497 N	2	0.05	0.40	A2	C	YB	10YR 5/4	ZCL	D	2	-	-	GR	-	-	-	
	3		3	0.40	1.50	B/C	S	YG	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	
37	1	495590 E	1	0.00	0.10	A1	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	X MARKED
	2	6048497 N	2	0.10	0.30	A2	C	YB	10YR 5/4	ZCL	D	2	-	-	GR	-	-	-	
	3		3	0.30	1.50	B/C	S	YG	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	
38	1	496161 E	1	0.00	0.10	A1	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	TP111
	2	6048729 N	2	0.10	0.40	A2	C	YB	10YR 5/4	ZCL	D	2	-	-	GR	-	-	-	
	3		3	0.40	1.50	B/C	S	YG	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	
39	1	496612 E	1	0.00	0.40	A	-	B	10YR 3/2	CL	D	5	-	-	GR	-	-	-	TP115
	2	6048312 N	2	0.40	1.50	B	S	RB	7.5YR 5/4	MC	D	6	-	-	MASS	-	-	-	
40	1	495787 E	1	0.00	0.30	A	-	B	10YR 3/2	FSCL	D	4	-	-	GR	-	-	-	ERT102
	2	6048014 N	2	0.30	1.50	B	C	YB	10YR 5/4	MC	D	5	-	-	MASS	-	-	-	

[illegible]



Attachment B : *Laboratory reports*



Nutrient Advantage®

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Nutrient Report

DM McMahon Pty Ltd
PO BOX 6118

WAGGA WAGGA
NSW 2650

Report Print Date: 08/03/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018928
Paddock Name: SAMPLES 45 46 47
Sample Name: SAMPLES 45 46 47
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.8
pH (1:5 CaCl ₂)		5.1
Electrical Conductivity (1:5 water)	dS/m	0.19
Chloride	mg/kg	36
Nitrate Nitrogen	mg/kg	29
Ammonium Nitrogen	mg/kg	15
Phosphorus (Colwell)	mg/kg	59
Phosphorus Buffer Index		110
Sulphur (KCl40)	mg/kg	32
Cation Exch. Cap. (CEC)	cmol(+)/kg	11.6
Calcium (Amm-acet.)	cmol(+)/kg	6.8
Magnesium (Amm-acet.)	cmol(+)/kg	3.1
Sodium (Amm-acet.)	cmol(+)/kg	0.50
Potassium (Amm-acet.)	cmol(+)/kg	1.20
Available Potassium	mg/kg	470
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	59.0
Magnesium % of Cations	%	27.0
Sodium % of Cations (ESP)	%	4.30
Potassium % of Cations	%	10.00
Calcium/Magnesium Ratio		2.2



Analyses conducted by **Nutrient Advantage Laboratory Services**

NATA Accreditation No: 11958

Certificate of Analysis is available upon request.

8 South Road, Werribee VIC 3030

Tel: 1800 803 453

Email: lab.feedback@incitecpivot.com.au





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Nutrient Report

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018928
Paddock Name: SAMPLES 45 46 47
Sample Name: SAMPLES 45 46 47
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

The results reported pertain only to the sample submitted.

Analyses performed on soil dried at 40 degrees Celsius and ground to <2mm (excluding moisture assay)

* One or more components of this test are below their detection limit. The value used is indicative only.

Disclaimer: Laboratory analyses and fertiliser recommendations are made in good faith, based on the best technical information available as at the date of this report. Incitec Pivot Limited, its officers, employees, consultants, Agents and Dealers do not accept any liability whatsoever arising from or in connection with the analytical results, interpretations and recommendations provided, and the client takes the analytical results, interpretations and recommendations on these terms. In respect of liability which cannot be excluded by law, Incitec Pivot's liability is restricted to the re-supply of the laboratory analysis or the cost of having the analysis re-supplied.





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PO BOX 6118

WAGGA WAGGA
NSW 2650

Report Print Date: 08/03/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018929
Paddock Name: SAMPLES 35 42 43
Sample Name: SAMPLES 35 42 43
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.8
pH (1:5 CaCl ₂)		5.3
Electrical Conductivity (1:5 water)	dS/m	0.26
Chloride	mg/kg	69
Nitrate Nitrogen	mg/kg	51
Ammonium Nitrogen	mg/kg	14
Phosphorus (Colwell)	mg/kg	73
Phosphorus Buffer Index		88
Sulphur (KCl40)	mg/kg	74
Cation Exch. Cap. (CEC)	cmol(+)/kg	11.4
Calcium (Amm-acet.)	cmol(+)/kg	7.4
Magnesium (Amm-acet.)	cmol(+)/kg	2.3
Sodium (Amm-acet.)	cmol(+)/kg	0.31
Potassium (Amm-acet.)	cmol(+)/kg	1.40
Available Potassium	mg/kg	560
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	65.0
Magnesium % of Cations	%	20.0
Sodium % of Cations (ESP)	%	2.70
Potassium % of Cations	%	13.00
Calcium/Magnesium Ratio		3.2



Analyses conducted by **Nutrient Advantage Laboratory Services**

NATA Accreditation No: 11958

Certificate of Analysis is available upon request.

8 South Road, Werribee VIC 3030

Tel: 1800 803 453

Email: lab.feedback@incitecpivot.com.au





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Nutrient Report

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018929
Paddock Name: SAMPLES 35 42 43
Sample Name: SAMPLES 35 42 43
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

The results reported pertain only to the sample submitted.

Analyses performed on soil dried at 40 degrees Celsius and ground to <2mm (excluding moisture assay)

* One or more components of this test are below their detection limit. The value used is indicative only.

Disclaimer: Laboratory analyses and fertiliser recommendations are made in good faith, based on the best technical information available as at the date of this report. Incitec Pivot Limited, its officers, employees, consultants, Agents and Dealers do not accept any liability whatsoever arising from or in connection with the analytical results, interpretations and recommendations provided, and the client takes the analytical results, interpretations and recommendations on these terms. In respect of liability which cannot be excluded by law, Incitec Pivot's liability is restricted to the re-supply of the laboratory analysis or the cost of having the analysis re-supplied.





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DM McMahon Pty Ltd
PO BOX 6118

WAGGA WAGGA
NSW 2650

Report Print Date: 08/03/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018930
Paddock Name: SAMPLES 39 40 41 44
Sample Name: SAMPLES 39 40 41 44
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.9
pH (1:5 CaCl ₂)		5.3
Electrical Conductivity (1:5 water)	dS/m	0.16
Chloride	mg/kg	57
Nitrate Nitrogen	mg/kg	33
Ammonium Nitrogen	mg/kg	9
Phosphorus (Colwell)	mg/kg	47
Phosphorus Buffer Index		75
Sulphur (KCl40)	mg/kg	16
Cation Exch. Cap. (CEC)	cmol(+)/kg	7.0
Calcium (Amm-acet.)	cmol(+)/kg	4.7
Magnesium (Amm-acet.)	cmol(+)/kg	1.2
Sodium (Amm-acet.)	cmol(+)/kg	0.28
Potassium (Amm-acet.)	cmol(+)/kg	0.94
Available Potassium	mg/kg	370
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	66.0
Magnesium % of Cations	%	17.0
Sodium % of Cations (ESP)	%	4.00
Potassium % of Cations	%	13.00
Calcium/Magnesium Ratio		3.9



Analyses conducted by **Nutrient Advantage Laboratory Services**

NATA Accreditation No: 11958

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Tel: 1800 803 453

Email: lab.feedback@incitecpivot.com.au





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Nutrient Report

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018930
Paddock Name: SAMPLES 39 40 41 44
Sample Name: SAMPLES 39 40 41 44
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

The results reported pertain only to the sample submitted.

Analyses performed on soil dried at 40 degrees Celsius and ground to <2mm (excluding moisture assay)

* One or more components of this test are below their detection limit. The value used is indicative only.

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Nutrient Report

DM McMahon Pty Ltd
PO BOX 6118

WAGGA WAGGA
NSW 2650

Report Print Date: 08/03/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018931
Paddock Name: SAMPLES 36 37 38
Sample Name: SAMPLES 36 37 38
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.4
pH (1:5 CaCl ₂)		4.7
Electrical Conductivity (1:5 water)	dS/m	0.13
Chloride	mg/kg	45
Nitrate Nitrogen	mg/kg	18
Ammonium Nitrogen	mg/kg	23
Phosphorus (Colwell)	mg/kg	89
Phosphorus Buffer Index		69
Sulphur (KCl40)	mg/kg	27
Cation Exch. Cap. (CEC)	cmol(+)/kg	4.7
Calcium (Amm-acet.)	cmol(+)/kg	2.9
Magnesium (Amm-acet.)	cmol(+)/kg	0.7
Sodium (Amm-acet.)	cmol(+)/kg	0.16
Potassium (Amm-acet.)	cmol(+)/kg	0.81
Available Potassium	mg/kg	320
Aluminium (KCl)	cmol(+)/kg	0.2
Aluminium % of Cations	%	3.6
Calcium % of Cations	%	61.0
Magnesium % of Cations	%	15.0
Sodium % of Cations (ESP)	%	3.30
Potassium % of Cations	%	17.00
Calcium/Magnesium Ratio		4.1



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NATA Accreditation No: 11958

Certificate of Analysis is available upon request.

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Email: lab.feedback@incitecpivot.com.au





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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018931
Paddock Name: SAMPLES 36 37 38
Sample Name: SAMPLES 36 37 38
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

The results reported pertain only to the sample submitted.

Analyses performed on soil dried at 40 degrees Celsius and ground to <2mm (excluding moisture assay)

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NSW 2650

Report Print Date: 08/03/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018932
Paddock Name: SAMPLES 29 32 33 34
Sample Name: SAMPLES 29 32 33 34
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.4
pH (1:5 CaCl ₂)		4.6
Electrical Conductivity (1:5 water)	dS/m	0.07
Chloride	mg/kg	15
Nitrate Nitrogen	mg/kg	16
Ammonium Nitrogen	mg/kg	6
Phosphorus (Colwell)	mg/kg	44
Phosphorus Buffer Index		48
Sulphur (KCl40)	mg/kg	6
Cation Exch. Cap. (CEC)	cmol(+)/kg	3.9
Calcium (Amm-acet.)	cmol(+)/kg	1.9
Magnesium (Amm-acet.)	cmol(+)/kg	1.0
Sodium (Amm-acet.)	cmol(+)/kg	0.19
Potassium (Amm-acet.)	cmol(+)/kg	0.59
Available Potassium	mg/kg	230
Aluminium (KCl)	cmol(+)/kg	0.3
Aluminium % of Cations	%	6.7
Calcium % of Cations	%	47.0
Magnesium % of Cations	%	26.0
Sodium % of Cations (ESP)	%	4.70
Potassium % of Cations	%	15.00
Calcium/Magnesium Ratio		1.9



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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018932
Paddock Name: SAMPLES 29 32 33 34
Sample Name: SAMPLES 29 32 33 34
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

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Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018933
Paddock Name: SAMPLES 26 28 30 31
Sample Name: SAMPLES 26 28 30 31
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.9
pH (1:5 CaCl ₂)		5.2
Electrical Conductivity (1:5 water)	dS/m	0.12
Chloride	mg/kg	19
Nitrate Nitrogen	mg/kg	31
Ammonium Nitrogen	mg/kg	13
Phosphorus (Colwell)	mg/kg	95
Phosphorus Buffer Index		68
Sulphur (KCl40)	mg/kg	9
Cation Exch. Cap. (CEC)	cmol(+)/kg	6.1
Calcium (Amm-acet.)	cmol(+)/kg	3.9
Magnesium (Amm-acet.)	cmol(+)/kg	1.2
Sodium (Amm-acet.)	cmol(+)/kg	0.14
Potassium (Amm-acet.)	cmol(+)/kg	0.90
Available Potassium	mg/kg	350
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	63.0
Magnesium % of Cations	%	19.0
Sodium % of Cations (ESP)	%	2.30
Potassium % of Cations	%	15.00
Calcium/Magnesium Ratio		3.3



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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018933
Paddock Name: SAMPLES 26 28 30 31
Sample Name: SAMPLES 26 28 30 31
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

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Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018934
Paddock Name: SAMPLES 21 24 25
Sample Name: SAMPLES 21 24 25
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.8
pH (1:5 CaCl ₂)		5.0
Electrical Conductivity (1:5 water)	dS/m	0.09
Chloride	mg/kg	15
Nitrate Nitrogen	mg/kg	21
Ammonium Nitrogen	mg/kg	19
Phosphorus (Colwell)	mg/kg	51
Phosphorus Buffer Index		49
Sulphur (KCl40)	mg/kg	8
Cation Exch. Cap. (CEC)	cmol(+)/kg	4.0
Calcium (Amm-acet.)	cmol(+)/kg	2.6
Magnesium (Amm-acet.)	cmol(+)/kg	0.6
Sodium (Amm-acet.)	cmol(+)/kg	0.09
Potassium (Amm-acet.)	cmol(+)/kg	0.73
Available Potassium	mg/kg	290
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	65.0
Magnesium % of Cations	%	15.0
Sodium % of Cations (ESP)	%	2.20
Potassium % of Cations	%	18.00
Calcium/Magnesium Ratio		4.5



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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018934
Paddock Name: SAMPLES 21 24 25
Sample Name: SAMPLES 21 24 25
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

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Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018935
Paddock Name: SAMPELS 17 18 19 20
Sample Name: SAMPELS 17 18 19 20
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.6
pH (1:5 CaCl ₂)		4.7
Electrical Conductivity (1:5 water)	dS/m	0.08
Chloride	mg/kg	20
Nitrate Nitrogen	mg/kg	11
Ammonium Nitrogen	mg/kg	17
Phosphorus (Colwell)	mg/kg	69
Phosphorus Buffer Index		88
Sulphur (KCl40)	mg/kg	11
Cation Exch. Cap. (CEC)	cmol(+)/kg	5.9
Calcium (Amm-acet.)	cmol(+)/kg	3.2
Magnesium (Amm-acet.)	cmol(+)/kg	1.5
Sodium (Amm-acet.)	cmol(+)/kg	0.27
Potassium (Amm-acet.)	cmol(+)/kg	0.69
Available Potassium	mg/kg	270
Aluminium (KCl)	cmol(+)/kg	0.3
Aluminium % of Cations	%	4.5
Calcium % of Cations	%	54.0
Magnesium % of Cations	%	25.0
Sodium % of Cations (ESP)	%	4.60
Potassium % of Cations	%	12.00
Calcium/Magnesium Ratio		2.1



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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018935
Paddock Name: SAMPELS 17 18 19 20
Sample Name: SAMPELS 17 18 19 20
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

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Agent/Dealer:
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Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018936
Paddock Name: SAMPLES 13 22 23 27
Sample Name: SAMPLES 13 22 23 27
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.8
pH (1:5 CaCl ₂)		5.0
Electrical Conductivity (1:5 water)	dS/m	0.08
Chloride	mg/kg	10
Nitrate Nitrogen	mg/kg	20
Ammonium Nitrogen	mg/kg	11
Phosphorus (Colwell)	mg/kg	41
Phosphorus Buffer Index		33
Sulphur (KCl40)	mg/kg	7
Cation Exch. Cap. (CEC)	cmol(+)/kg	3.1
Calcium (Amm-acet.)	cmol(+)/kg	1.9
Magnesium (Amm-acet.)	cmol(+)/kg	0.4
Sodium (Amm-acet.)	cmol(+)/kg	0.05
Potassium (Amm-acet.)	cmol(+)/kg	0.75
Available Potassium	mg/kg	290
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	61.0
Magnesium % of Cations	%	13.0
Sodium % of Cations (ESP)	%	1.70
Potassium % of Cations	%	24.00
Calcium/Magnesium Ratio		4.9



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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018936
Paddock Name: SAMPLES 13 22 23 27
Sample Name: SAMPLES 13 22 23 27
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

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Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018937
Paddock Name: SAMPLES 12 14 15 16
Sample Name: SAMPLES 12 14 15 16
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.6
pH (1:5 CaCl2)		4.9
Electrical Conductivity (1:5 water)	dS/m	0.18
Chloride	mg/kg	45
Nitrate Nitrogen	mg/kg	38
Ammonium Nitrogen	mg/kg	18
Phosphorus (Colwell)	mg/kg	78
Phosphorus Buffer Index		71
Sulphur (KCl40)	mg/kg	27
Cation Exch. Cap. (CEC)	cmol(+)/kg	6.4
Calcium (Amm-acet.)	cmol(+)/kg	3.5
Magnesium (Amm-acet.)	cmol(+)/kg	1.5
Sodium (Amm-acet.)	cmol(+)/kg	0.18
Potassium (Amm-acet.)	cmol(+)/kg	1.20
Available Potassium	mg/kg	470
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	55.0
Magnesium % of Cations	%	23.0
Sodium % of Cations (ESP)	%	2.80
Potassium % of Cations	%	19.00
Calcium/Magnesium Ratio		2.3



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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018937
Paddock Name: SAMPLES 12 14 15 16
Sample Name: SAMPLES 12 14 15 16
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

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Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018938
Paddock Name: SAMPLES 4 6 7 8 9
Sample Name: SAMPLES 4 6 7 8 9
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.9
pH (1:5 CaCl ₂)		5.2
Electrical Conductivity (1:5 water)	dS/m	0.20
Chloride	mg/kg	76
Nitrate Nitrogen	mg/kg	45
Ammonium Nitrogen	mg/kg	35
Phosphorus (Colwell)	mg/kg	73
Phosphorus Buffer Index		37
Sulphur (KCl40)	mg/kg	15
Cation Exch. Cap. (CEC)	cmol(+)/kg	5.4
Calcium (Amm-acet.)	cmol(+)/kg	3.7
Magnesium (Amm-acet.)	cmol(+)/kg	0.6
Sodium (Amm-acet.)	cmol(+)/kg	0.15
Potassium (Amm-acet.)	cmol(+)/kg	0.94
Available Potassium	mg/kg	370
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	68.0
Magnesium % of Cations	%	12.0
Sodium % of Cations (ESP)	%	2.90
Potassium % of Cations	%	17.00
Calcium/Magnesium Ratio		5.9



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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018938
Paddock Name: SAMPLES 4 6 7 8 9
Sample Name: SAMPLES 4 6 7 8 9
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

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Report Print Date: 08/03/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5822

Grower Name : D M MCMAHON PTY LTD
Sample No: 022018939
Paddock Name: SAMPLES 1 2 3 5 10 11
Sample Name: SAMPLES 1 2 3 5 10 11
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

Analyte / Assay	Units	Value
pH (1:5 Water)		5.8
pH (1:5 CaCl ₂)		5.2
Electrical Conductivity (1:5 water)	dS/m	0.16
Chloride	mg/kg	20
Nitrate Nitrogen	mg/kg	32
Ammonium Nitrogen	mg/kg	21
Phosphorus (Colwell)	mg/kg	170
Phosphorus Buffer Index		86
Sulphur (KCl40)	mg/kg	27
Cation Exch. Cap. (CEC)	cmol(+)/kg	7.7
Calcium (Amm-acet.)	cmol(+)/kg	5.4
Magnesium (Amm-acet.)	cmol(+)/kg	1.0
Sodium (Amm-acet.)	cmol(+)/kg	0.14
Potassium (Amm-acet.)	cmol(+)/kg	1.20
Available Potassium	mg/kg	480
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	70.0
Magnesium % of Cations	%	13.0
Sodium % of Cations (ESP)	%	1.80
Potassium % of Cations	%	16.00
Calcium/Magnesium Ratio		5.6



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Grower Name : D M MCMAHON PTY LTD
Sample No: 022018939
Paddock Name: SAMPLES 1 2 3 5 10 11
Sample Name: SAMPLES 1 2 3 5 10 11
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E11
Sample Type: Soil
Sampling Date: 7/03/2019

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