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AGRICULTURAL LAND CAPABILITY STUDY

FOR A PLANNING PROPOSAL

No.1 ABBOTSFORD ROAD, PICTON

Prepared for

Berten Pty Ltd

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Executive Summary

INTRODUCTION

Harvest Scientific Services Pty Ltd (Harvest) was commissioned by Berten Pty Ltd to carry out an Agricultural Land Capability Study for a 70 hectare portion of land (i.e. the 'Study Area') located within No. 1 (part Lot 1 DP 1086066) Abbotsford Road, Picton. This land is located approximately 130 metres to the west of the township of Picton.

This study has been prepared in support of a Planning Proposal to rezone the Study Area to a more intensive residential zoning, thus enabling subdivision applications for smaller lot sizes than currently exist to be lodged and assessed by Wollondilly Shire Council.

The objective of the planning proposal is to rezone the Study Area from '*Zone RU2 Rural Landscape*' to a more intensive residential zoning, such as '*Zone R5 Large Lot Residential*'.

The proposed re-zoning may, depending upon the outcome of the studies, result in the creation of new rural/residential lots, with each having a minimum lot size of 4000m^2. Some lots may be subject to higher Minimum Lot Size (MLS) standards where site constraints, natural features and other environmental constraints dictate.

SPECIALIST STUDY REQUIRMENTS AND OBJECTIVES

Specialist Study Requirements for the Planning Proposal were issued by Wollondilly Shire Council (WSC) in an un-dated document entitled 'Planning Proposal Specialist Study Abbotsford'. That document outlined the output, objectives and task/methodology requirements for each of the Specialist Studies that were to be prepared in support of a re-zoning application for the Study Area.

The objective of this Study was to address the Specialist Study Requirements outlined under the heading '5.9 Agricultural Land Capability'. The conditions issued in relation to the output from an agricultural land capability study are as follows:

"5.9.1 Output

- *An agricultural land capability assessment that broadly examines:*
    - *if there will be any loss of current agricultural potential;*
    - *if there is any loss of future agricultural land potential; and*
    - *if there are any constraints impeding agricultural development within the study area.*
- *Rezoning of land which provides an acceptable level of social, agricultural and economic sustainability and harmony.*

5.9.2 Objectives

- *To identify if there will be any loss of current agricultural development within the study area.*
- *To identify if there is any potential for future agricultural development within the study area.*
- *To identify if there are any constraints impeding agricultural development within the study area.*
- *To determine if there is any edge impact between the study area and adjoining agricultural land.*
- *To determine the appropriate level of development to minimise agricultural land use conflict.*

5.9.3 Tasks/Methodology

- *Examine the capability of the study area to support agricultural production.*
- *Examine potential for future agricultural land uses by reference to Wollondilly Local Environmental Plan 2011.*
- *Prepare constraints and opportunities mapping for any current and future agricultural development based on social, agricultural and economic sustainability.'*

5.9.4 Resources

- *Land Use Conflict Risk Assessment – http://www.dpi.nsw.gov.au/environment/landuse-planning/agriculture/lucra*
- *Farm Subdivision – http://www.dpi.nsw.gov.au/environment/landuse-planning/agriculture/subdivision-guideline"*

To address the above Specialist Study Requirements, this Agricultural Land Capability Study was divided into two parts to reflect the two main output components required to be assessed by WSC, as follows:

- Agricultural Land Capability Assessment; and
- Land Use Conflict Risk Assessment.

The first of the above assessments focuses on the current and future agricultural capacity of the Study Area, whilst the second aims to identify any agricultural land-use conflicts that may arise as a result of the re-zoning proposal.

Both components of this Study have been undertaken with reference to the document entitled 'Farm Subdivision Assessment Guidelines' by the NSW Department of Infrastructure and Investment (2009).

AGRICULTURAL LAND CAPABILITY ASSESSMENT

Results

Agricultural land classifications for the Study Area may be summarised as follows:

- **Specialist Class.** No specialist class agricultural land was identified within the Study Area.
- **Classes 1 and 2.** No high value 'Class 1' or 'Class 2' agricultural lands were identified within the Study Area;
- **Class 3.** Approximately 25 hectares of the Study Area was identified as containing Class 3 agricultural lands. These lands were located on moderate side-slopes and foot-slopes. Portions of this Class are potentially flood affected and sources of water for irrigation purposes are limited.

  Due to site constraints the agricultural value of this land is considered to be low;
- **Class 4.** Approximately 45 hectares of the Study Area was identified as 'Class 4' agricultural grazing land. This class consisted of steep land too steep to cultivate. Potential agricultural uses are limited to extensive grazing. The agricultural value of this land is considered to be low; and
- **Class 5.** No 'Class 5' non-agricultural land was identified.

Recommendations

Based on the findings of this assessment, the following recommendations were made:

- Where site constraints permit, the Study Area should be re-zoned to permit allotments with a minimum allotment size of 4000 m^2 with a related increase in lot density; and
- That the re-zoning of the Study Area should permit the continued use land unsuitable for residential land-uses to be used for grazing purposes. This recommendation is subject to implementation of the land use conflict recommendations.

Conclusion

It is concluded that the re-zoning of the Study Area for residential land-use will:

- Not result in the loss of any high class agricultural lands;
- Result in the loss of some low quality constrained agricultural land, but this loss will reduce pressure to develop more productive less constrained surrounding agricultural lands for residential land-uses; and
- Result in the loss of limited future low quality agricultural lands.

The re-zoning proposal is therefore considered to be in accordance with the NSW DPI (formerly NSW Agriculture) land-use planning objectives for rural lands.

LAND USE CONFLICT RISK ASSESSMENT (LUCRA)

Results

A number of potential land use conflicts were identified in this assessment and these are documented in detail in **Table 13**.

Recommendations

Based on the findings of this Land Use Conflict Risk Assessment (LUCRA), the following recommendations were made:

- Where site constraints permit, the Study Area should be re-zoned to a R5 zone or equivalent zoning;
- Intensive animal enterprises, feedlots and dairies should be prohibited within the Study Area; and
- Animal boarding and training facilities should be prohibited under the Land Use table for the R5 zone (or equivalent zoning within the Study Area).

CONCLUSIONS

With regard to the Specialist Study Requirement's stated objectives, the following conclusions are noted:

- In the context of current agricultural development with the Study Area, the re-zoning proposal will:
    a. not result in the loss of any high class agricultural land (i.e. Class 1 or 2 lands); and

   b. result in the loss of some low quality and constrained agricultural land, but this loss will reduce pressure to develop more productive less constrained surrounding agricultural lands for residential land-uses;

- The potential for future agricultural development within the Study Area is considered to be limited and the re-zoning proposal will therefore have little impact on the future agricultural capacity of this land. This is because the land within the Study Area is generally of low agricultural value, is of insufficient size to provide for viable intensive agricultural enterprises and adjacent residential land-uses may result in land-use conflicts if the Study Area is developed for an intensive agricultural land-use;
- Constraints impeding agricultural development are outlined in this document;
- The land-use conflict assessment identified potential edge impacts between the Study Area and adjacent residential land-uses, but these were considered to be capable of management according to the recommendations outlined in this Study; and
- This Study has considered the appropriate level of development to minimize agricultural land use conflicts. Recommendations to address potential land-use conflicts are outlined in Table 9.

With regard to the three heads of consideration indicated in the brief, the following is noted:

- the capacity of the Study Area to support agricultural production was found to be low;
- under the current zoning, future agricultural potential would be limited to limited grazing and potentially high value, high input intensive horticultural products. The latter use, however, would be constrained by water supply, site constraints and potential land-conflict constraints; and
- an assessment of the constraints and opportunities of the Study Area failed to identify any high quality agricultural land (Class 1 and 2 lands) and found that the major part of the Study Area was 'Class 4' grazing land. Some 'Class 3' grazing land was identified but this land was constrained by water supply, biophysical constraints and potential land-use conflicts.

With regard to land-use conflicts, it is concluded that the proposed land re-zoning will reduce the overall potential for land-use conflicts as it will:

- provide for the creation of a low residential density green belt buffer between the relatively higher density residential area of Picton and rural areas to the west of the township of Picton. This green belt will provide separation between Picton and rural land without the ability of new intensive agricultural enterprises which could not only impact on the Study Area but also the existing residential interface; and
- result in an existing interface between agricultural land and residential land to the south of the Study being re-located to the north of the Study Area. The new interface between residential land and agricultural land will in turn be separated by Abbotsford Road, which will act as a physical barrier between the two land-uses. The provision of a physical barrier will reduce the potential for land-use conflicts between grazing and residential land-uses.

The overall loss of agricultural land as a result of the proposal is low.

No impediments to the re-zoning of the Study Area were identified in this Study.

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ABBREVIATIONS

DA	Development Application
DCP	Development Control Plan
DCP 2011	Wollondilly Shire Council's Development Control Plan 2011
DOFA	NSW Department of Fisheries and Aquaculture
DOP&I	Department of Planning and Infrastructure
FMA 1994	Fisheries Management Act 1994
Harvest	Harvest Scientific Services Pty Ltd
LGA	Local Government Area
LEP	Local Environmental Plan
LEP 2011	Wollondilly Shire Council's Local Environmental Plan 2011
MHRDC	Maximum Harvestable Rights Dam Capacity
NorBE	Neutral or Beneficial Effect
NOW	NSW Office of Water
REA	Riparian Enhancement Activities
SREP 20	State Regional Environmental Plan No. 20 – Hawkesbury-Nepean River
WMA 2000	Water Management Act 2000
WSC	Wollondilly Shire Council

1.0 OVERVIEW

1.1 Introduction

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1.2 Location

The Study Area comprises of a portion of land within Lot 1 DP 1086066 and is located immediately west of the existing residential township of Picton (Figure 1). The Study Area is divided by Fairleys Road and Abbotsford Road on its eastern extremity, with the bulk of the Study Area lying to the west and south of Abbotsford Road.

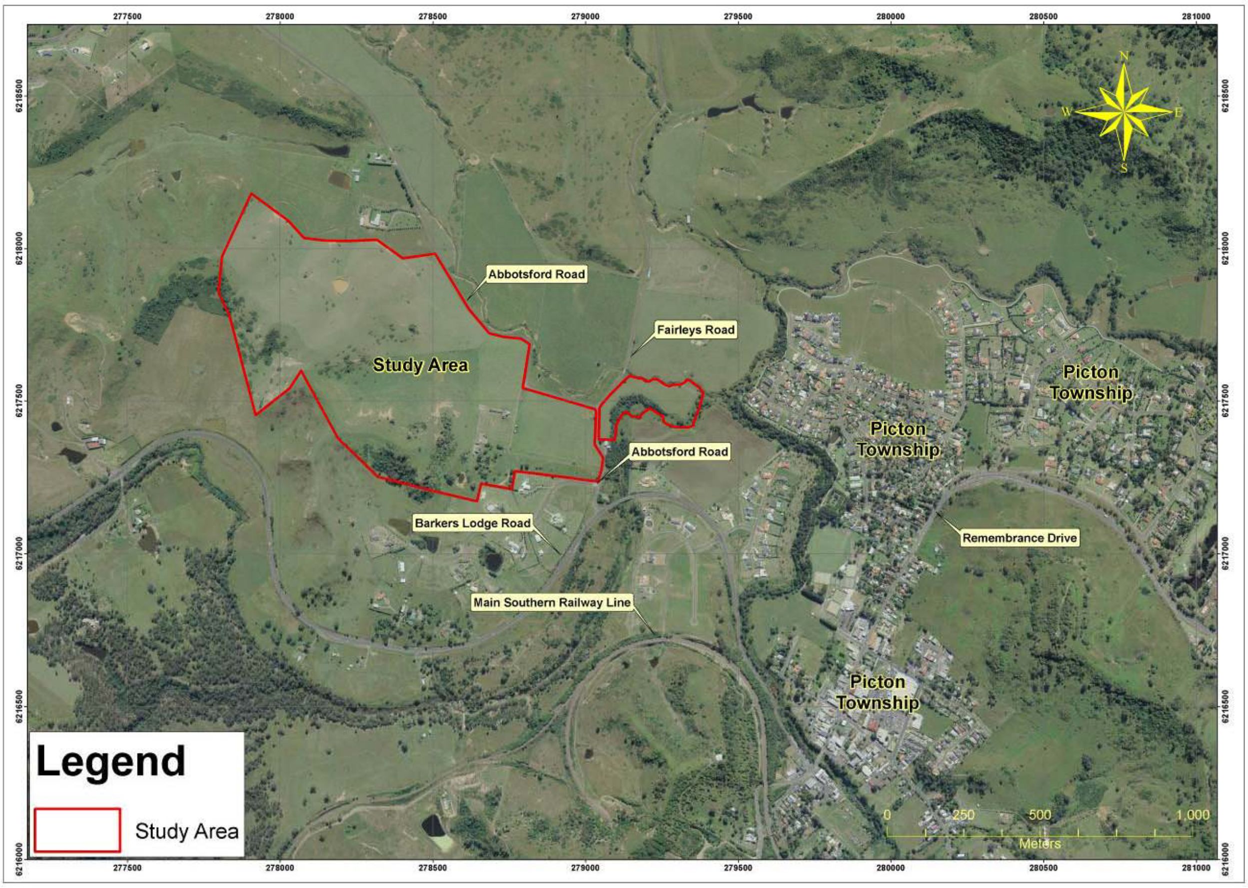

Figure 1: Study Area location. Source of aerial photo: Department of Lands circa 2008.

1.3 Current land-use

The Study Area is currently used for cattle and sheep grazing activities. The land associated with the Study Area consists of relatively flat foot-slopes (Plate 1), side-slopes (Plate 2), steep side-slopes (Plate 3) and hill crests (Plate 4).

1.4 Infrastructure

Infrastructure associated with the Study Area includes:

- A former dairy (Plates 5, 6 and 7)
- A former feed shed (Plates 8 and 9)
- A derelict residence (Plate 10); and
- Stock holding yards and an associated loading ramp (Plate 11).

1.5 Specialist Study Requirements

Specialist Study Requirements for the Planning Proposal were issued by Wollondilly Shire Council (WSC) in an un-dated document entitled 'Planning Proposal Specialist Study Abbotsford'. That document outlined the output, objectives and task/methodology requirements for each of the Specialist Studies that were to be prepared in support of a re-zoning application for the Study Area.

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The first of the above assessments focuses on the current and future agricultural capacity of the Study Area, whilst the second aims to identify any agricultural land-use conflicts that may arise as a result of the re-zoning proposal.

Both components of this Study have been undertaken with reference to the document entitled 'Farm Subdivision Assessment Guidelines' by the NSW Department of Infrastructure and Investment (2009).

2.0 AGRICULTURAL LAND CAPABILITY ASSESSMENT

2.1 Introduction

Land use for agriculture is often taken for granted, with a popular belief being that Australia possesses unlimited resources, including land for agriculture (NSW Agriculture, 2002). But this is not the case and this is reinforced with statements such as the following by NSW Agriculture (2002):

> *"Yet good quality agricultural land is a limited resource, and is under threat from a variety of sources. Urbanisation and land degradation alienate and deplete agricultural land resources. The reduced available ability of lands highly suited to agricultural production may reduce the sustainability of existing agricultural systems by encouraging the use of more marginal land for agriculture."*

Furthermore, the preservation of lands for agriculture that are either not suitable or are highly constrained for agricultural production may result in the areas of relatively higher agricultural capacity being considered for non-agricultural uses. It is therefore better to identify those lands that are highly constrained to agricultural production early in the land-use planning process and aim to use these lands for non-agricultural uses. This will enable the preservation of relatively higher quality agricultural land and utilizing it for agricultural land-uses.

Knowledge of the relative suitability of land for agriculture is therefore required to enable the development of strategic plans which protect land highly suited to agriculture and allow identification of land more suited to non-agricultural activities. This process requires that land be suitably evaluated based upon generally accepted practices.

The NSW DPI 5-class agricultural land classification system (NSW Agriculture, 2002) is one method that allows the relative capacity of lands to be assessed in terms of their constraints to agricultural production. In turn, this system allows for objective planning decisions to be made based upon the resultant agricultural capacity of lands.

2.2 Objectives

In accordance with the relevant WSC Specialist Study Requirements, the objective of this agricultural land capability assessment is to classify the agricultural capacity of the Study Area and in turn:

- identify if there will be any loss of current agricultural development within the Study Area;
- identify if there is any potential for future agricultural development within the Study Area; and
- identify if there are any constraints impeding agricultural development within the Study Area.

2.3 Methodology

2.3.1. Overview

This assessment was subject to the following methodology:

- Field site assessment;
- A review of aerial photographs;
- A review of existing published literature; and
- Classification of the agricultural capacity of the Study Area with reference to the classification system outlined by NSW Agriculture, (2002).

This assessment process included the following specific aspects:

- An examination of the Study Area's ability to support agricultural production;
- An examination of potential for future agricultural land uses with reference to the Wollondilly Local Environmental Plan 2011; and
- Preparation of constraints and opportunities mapping for any current and future agricultural development based on social, agricultural and economic sustainability.

2.3.2. Guidelines

Agricultural Land Capability was assessed based upon the NSW Agriculture (2002) guidelines entitled 'Agricultural Land Classification', Agfact AC.25 and the NSW DPI Farm Subdivision guidelines (http://www.dpi.nsw.gov.au/environment/landuse-planning/agriculture/subdivision-guideline)

The assessment methodology is further outlined in the following sections.

2.3.2.1 An introduction to the five class agricultural classification system

The five class agricultural classification system used by NSW DPI classifies land in terms of its suitability for general agricultural use. This system was developed specifically to meet the objectives of the Environmental Planning and Assessment Act 1979, in particular Section 59(a)(i):

> *'to encourage the proper management, development and conservation of natural and man-made resources, including agricultural land... for the purpose of promoting social and economic welfare of the community and a better environment'.*

Agricultural land is classified by evaluating biophysical, social and economic factors that may constrain the use of land for agriculture. In general terms, the fewer the constraints on the land, the greater it's value for agriculture. Each type of agricultural enterprise has a particular set of constraints affecting production.

A comprehensive list of all the constraints affecting each form of agriculture would be economically prohibitive to compile and unwieldy to use for practical planning purposes. Consequently, agricultural land classification is based on a set of constraining factors common to most agricultural industries.

Some types of agricultural enterprises do not depend on land suitability and so are not included in this system. Such activities include intensive animal industries (poultry, pig and cattle feedlots) as well as nurseries, glasshouse hydroponics and mushroom sheds. NSW Department of Primary Industries and other agencies produce guidelines that address the siting and management issues for these industries. However, many of these industries use agricultural land to manage effluent and provide a buffer zone, so agricultural land classification is still relevant.

It is an inherent feature of agricultural land classification maps that they have a limited life. The life span of the maps depends upon changes to the biophysical, social and economic factors that affect the Study Area. For example, if an area is classified as 'Class 3' agricultural land because of its ability to support occasional cropping becomes affected by salinity (thereby no longer suitable for cropping), it would need to be reclassified as Class 4 agricultural land.

For small areas and detailed classification, it is considered that a quantitative approach is appropriate. In order to use such an approach, the range of agricultural enterprises to be considered needs to be reduced so that the number of biophysical, social and economic factors taken into consideration is manageable.

2.3.2.2 Agricultural land classification classes

Agricultural land classification maps place land into one of five classes according to it's suitability for a wide range of agricultural activities. The most valuable agricultural land, Class 1, is defined as having few constraints to agricultural production, so a wide range of crops can be profitably grown. And the least valuable land, Class 5 land, is defined as having severe constraints and is, in general, unsuited to agriculture. Agricultural Classes 2 to 4 consequently represent a continuum between classes 1 and 5 in terms of agricultural value. The essential characteristics of each of these 5 classes are described in Table 1.

In addition to the above 5 classes, an additional class may be added in specific circumstances. This class is referred to as a 'Specialist Class' and applies to lands that by virtue of a specific set of unique circumstances lends itself to a particular type of agricultural production, such as specialist crops that may only be grown in certain combinations of climatic and/or soil conditions. This class should be carefully considered on a case-by-case basis when making land-use planning decisions.

Table 1: Summary of the five agricultural classes as described by NSW Agriculture (2002).

Class	Definition
1	Arable land suitable for intensive cultivation where constraints to sustained high levels of agricultural production are minor or absent.
2	Arable land suitable for regular cultivation for crops but not suited to continuous cultivation. It has moderate to high suitability for agriculture, but edaphic (soil factors) or environmental constraints reduce the overall level of production and may limit the cropping phase to a rotation with sown pastures.
3	Grazing land or land well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture. The overall production level is moderate because of edaphic or environmental constraints. Erosion hazard, soil structural breakdown and other factors including climate may limit the capacity for cultivation; and soil conservation or drainage works may be required.
4	Land suitable for grazing but not cultivation. Agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be seasonally high but the overall production level is low as a result of major environmental constraints.
5	Land not suitable for agriculture or at best suited to only light grazing. Agricultural production is very low to zero as a result of severe constraints, including economic factors, which preclude land improvement.

2.3.2.3 Use of agricultural land classification maps for land-use planning

NSW Agriculture's agricultural land classification maps can be used to recommend the quality and quantity of rural land that should be zoned for agricultural production and protection from incompatible development.

Higher quality lands (Classes 1 and 2) have fewer constraints and a greater versatility for agriculture than the poorer quality lands and their long-term value to the State is often greater than a strict economic appraisal might indicate. Their relative lack of constraints allows greater flexibility in management and enables farmers to more easily adapt to changing economic conditions. The high suitability of these lands can at the same time significantly reduce the potential for environmental damage from agricultural activities.

Land use planning recommendations need to be drawn up on the basis of local government areas using the principle of protecting the land of greatest agricultural value and directing non-agricultural uses onto lands less suitable for agriculture. Some general principles adopted from guidelines provided by the NSW Agriculture (2002), which may help in formulating land use planning recommendations follow:

- Identify the main agricultural industries and their land requirements within the local government area;
- Many agricultural industries require access to a range of agricultural land classes for good management to ensure diversity of enterprise and security of production. For example, land used for dairy cattle on the coastal plains is often a mix of Class 2 and/or 3 as well as Class 4 agricultural land. The Class 2 and 3 land is used for production of high value pastures or fodder crops, while the Class 4 land is used as the dry run country. The mixture of land classes used by these industries should be protected;
- Protect highly productive agricultural land (Classes 1, 2, 3 and Specialist Class) from competing land uses. It is preferable to use land of lower agricultural quality for incompatible developments where this is available and suitable for the purpose;
- Give priority to protection of Class 1 lands from incompatible development. They are elite, of limited extent and considered to be of significance to the state;
- Class 2 lands are also of superior quality and of limited extent. They are worthy of protection and retention for agriculture because of their state and regional importance;
- Protect Class 3 lands for agricultural production if adequate and suitable areas of Classes 4 and 5 are available for competing uses;
- Specialist Class lands which, by their nature, are unique in the state for agricultural activity need to be protected unless there are strong economic reasons for not doing so. This includes areas which, by virtue of their remoteness or special location, are under cultivation for foundation seed, bud stock or root stock production, or used as quarantine zones;
- Take into consideration social and economic factors when making recommendations about changes to land use in areas of Class 3 or lower quality land currently used for full time agriculture;
- Class 4 lands play an important role in some agricultural industries: for example, fine wool production on the tablelands of New South Wales depends on comparatively large areas of Class 4 agricultural land;
- Class 5 land can be of some value for agriculture: for example it may provide shelter for livestock, or offer flood-free refuge areas;

- When recommending rural lands for non-agricultural uses, the particular requirements for use need to be considered so that land is not inappropriately lost from agriculture. For example, rural residential use may best be located on non-productive land, preferably with trees, (usually Class 4 or 5), while hobby farms may require land with pastures suitable for year round grazing (land of Class 4 may often be suitable). Because of the environmental fragility of Classes 4 and 5 land, care is needed when proposing more intensive uses;
- Irrigated areas are generally recommended for retention in agriculture because of the existing infrastructure (channels, pipes, dams etc.) and relatively high production potential;
- Some farm forestry enterprises require good quality agricultural land, and may need to be situated on agricultural land;
- Agricultural lands that can use organic wastes need to be identified so that agricultural industries are able to use these wastes sustainably; and
- Around the perimeter of urban areas where high land prices and small lot sizes are common, even the best agricultural land may have potential conflict with urban neighbours as one constraint, limiting versatility and affecting productivity. However, close proximity to urban markets may outweigh the constraints.

2.3.2.4 Assumptions

In classifying agricultural land the following assumptions are made about agricultural land use:

- Land is managed using a moderate to high level of agricultural management practice;
- Land with constraints that have been modified or removed is assessed on its present status eg. irrigation areas, flood mitigation areas, cleared land;
- Land with constraints that could be economically removed (eg. soil acidity, low chemical fertility) is assessed as if they have been removed provided there are no regulatory or legislative constraints.
- Land suited for intensive uses such as cropping is also suited to less intensive land uses such as grazing, forestry etc;
- The assessment reflects long term capacity for sustainable agricultural productivity;
- The assessment reflects the versatility of the land for various agricultural activities (Class 1 is the most versatile, Class 5 the least versatile);
- The assessment may need to be reviewed if technological advances later permanently change the productive potential of the land e.g. development of an irrigation area;
- Given the above assumptions, existing land use may not always be a good indicator of appropriate land use and hence land class. The system of land classification is aimed at assessing physical, social and economic attributes of land rather than its current use. Nevertheless it must be noted that current land use often reflects land suitability; and
- Where land is used beyond its physical capability land degradation is often evident.

2.3.2.5 Factors that influence agricultural suitability

Biophysical, social and economic factors are all considered when determining agricultural land classification. These determine the types of agricultural enterprises that need to be considered in every assessment, and in some situations key factors may need to be considered in more detail.

It must be recognised that the process of agricultural land classification relies upon interpretation of information by an expert and that any resultant classification map marks a point in time reflecting the current understanding of agricultural systems, infrastructure, and their relationship to market and resource conditions.

The relevant factors considered when classifying agricultural suitability is outlined in Table 2, but it is noted that this list is not comprehensive.

Table 2: Factors influencing agricultural suitability (adapted from NSW Agriculture (2002))

Factor	***Consideration/s***
Biophysical	• environmental impact: fertilisers, pesticides, wastes, erosion, salinisation, siltation, vegetation clearing; • topography: slope (angle and length), erosion hazard, aspect, altitude, flood liability, exposure, land slip;. • surface drainage;. • soil physics: texture, structure, erodibility, depth, water holding capacity, internal and surface drainage; • rockiness, stoniness, depth to watertable, permeability, clay type, colour, surface crusting, density, aeration, trafficability, stability under irrigation; • soil chemistry: fertility, toxicity, organic matter, soil reaction, cation exchange capacity, salinity, sodicity, rates of fixation, dispersibility; and • climate: length of growing season, temperatures, rainfall, evaporation, wind, humidity, frost occurrence, irrigation, hail, exposure to pests and diseases: presence of noxious or pest animals, noxious weeds, insects, plant or animal pathogens (field and storage)
Social factors	• legislative and/or regulatory constraints; • potential conflict with other land users: eg. noise, odour, dust; and • availability of permanent or seasonal, skilled or unskilled labour.
Economic	• regional and local infrastructure to support agriculture; • geographic location; • accessibility and location with respect to transport requirements and costs; • accessibility to local and export markets; and • presence of any comparative market advantage.

2.3.2.6 Limitations of scale

When using agricultural land classification maps it is important to note the limitations of the scale at which the maps were produced. For example, biophysical features usually have transitional zones between unique groups or classes. In the field, there are few instances where a sharp boundary line divides classes. On any land classification map, the boundary line between classes represents the best-fit position or a halfway point.

Whilst the final map show areas as being divided into discrete classes, in practice nature usually presents a mix of geology, terrain and soils and sudden changes are unusual. Any map unit will therefore contain areas whose characteristics differ from those of the dominant class.

2.3.3. The mapping process

Agricultural capability mapping of the Study Area was undertaken by an Environmental Scientist experienced in agricultural mapping techniques.

2.4 Assessment of the Study Area

2.4.1. Biophysical constraints to agricultural production

2.4.1.1 Geology

Based on the 1:100,000 Wollongong to Port Hacking Map Sheet, the Study Area is underlain by the three geological units that are classified as Bringelly Shale, Ashfield Shale and Quaternary Alluvium (Sherwin and Holmes, 1982). The distribution of these units within the Study Area and in the immediate surrounds in illustrated on Figure 2.

The ridgetops within the Study Area are generally dominated by Bringelly Shale which is composed of shales, carbonaceous claystone, lithic sandstones and laminates.

The Ashfield Shale geological unit occurs below Bringelly Shale and is the dominant geological unit occurring within the major part of the Study Area. Ashfield Shale forms part of the Winamatta Group which consists of laminite and dark grey siltstones. A thin layer of sandstone (Minchinbury Sandstone) often separates the Bringelly Shales from the Ashfield Shales.

Quaternary alluvial sediments occupy the low lying drainage areas of the Study Area and are associated with Stonequarry Creek and an un-named tributary.

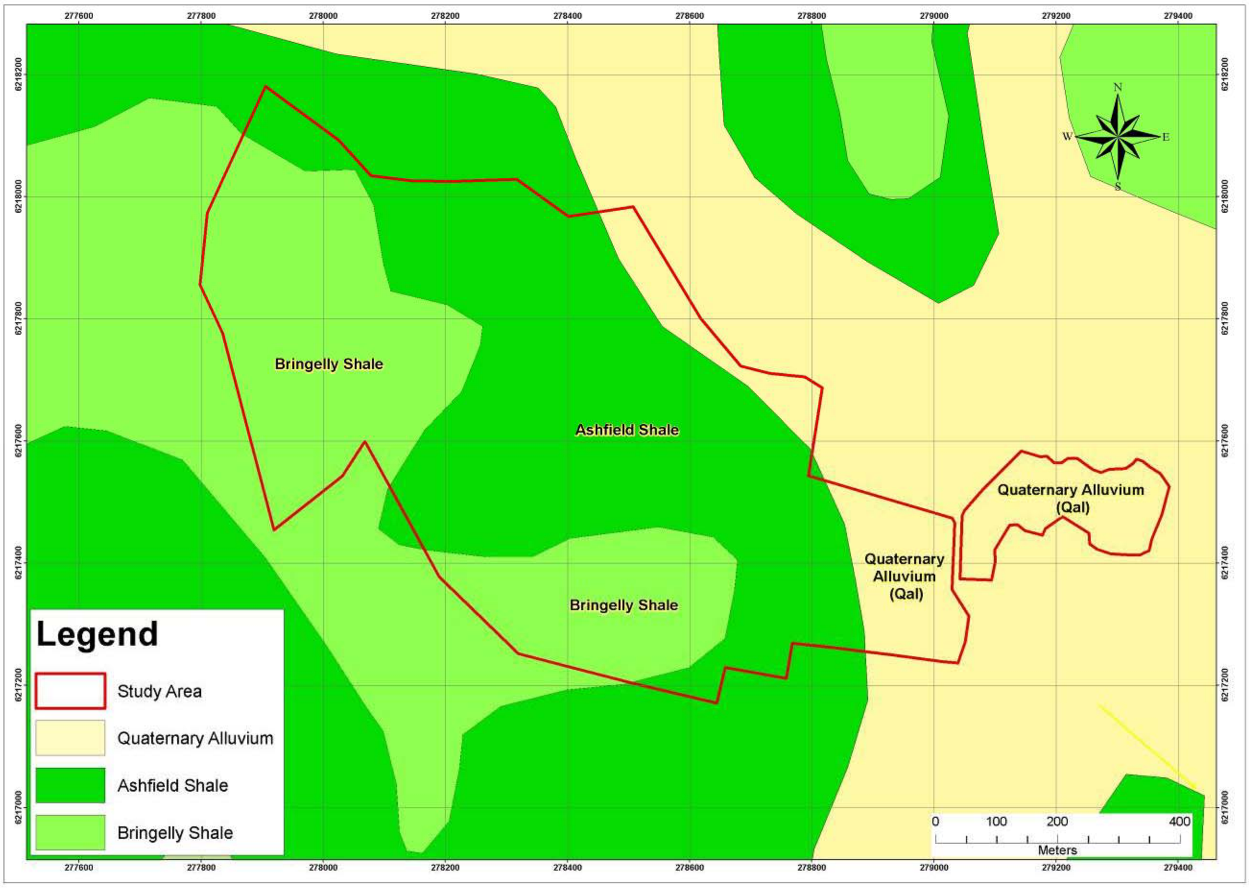


Figure 2: Geology (Sherwin and Holmes, 1982).

2.4.1.2 Regional Soil Landscape mapping

Based on the Wollongong 1:100,000 Soil Landscape Group map (Hazelton and Tille, 1990), the Picton and Monkey Creek Soil Landscape Groups are mapped as occurring within the Study Area. The spatial distribution of these soil landscape groups are illustrated in Figure 3.

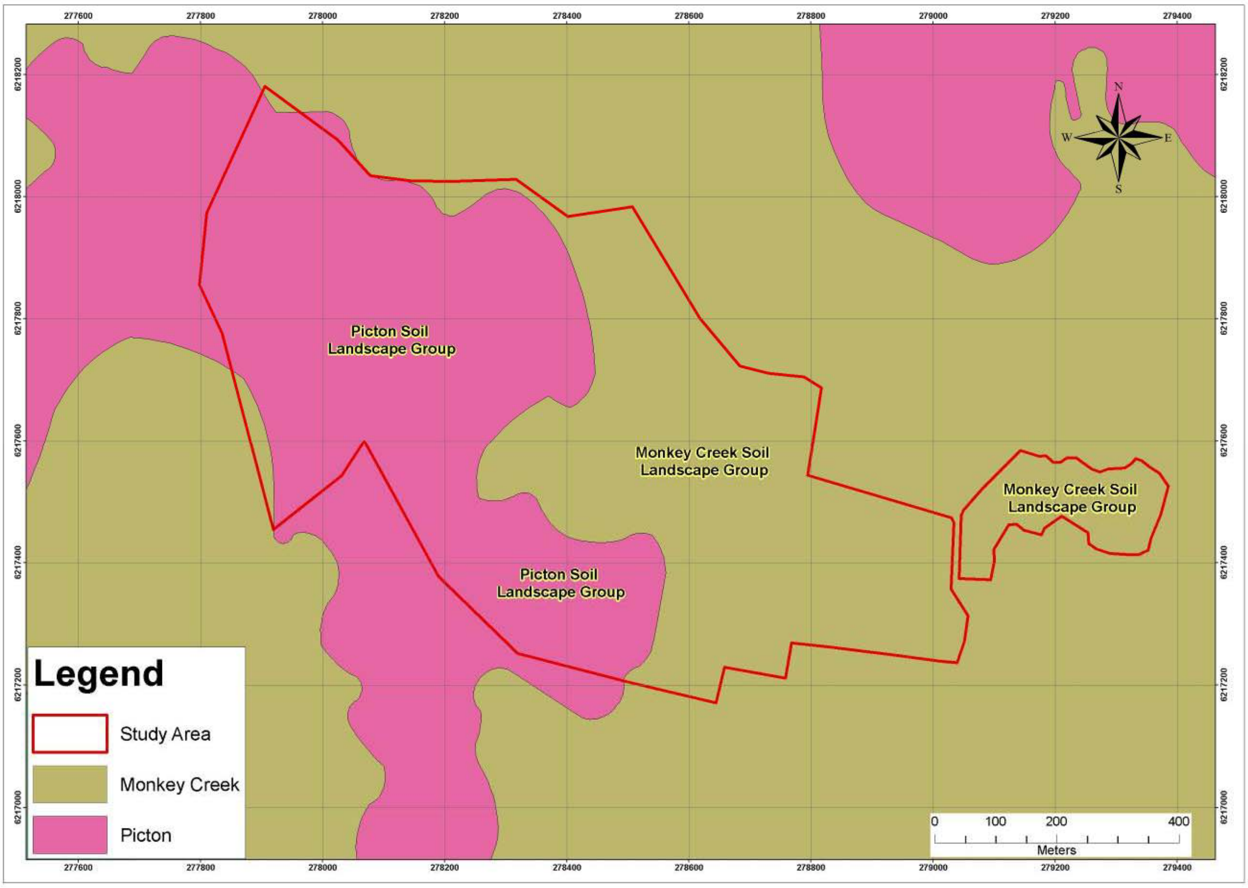


Figure 3: Soil Landscape Groups (Hazelton and Tille, 1990).

General characteristics/constraints of each soil landscape group as described by Hazelton and Tille (1990) are outlined in Table 4, but it should be noted that all constraints as summarised in Table 3 do not occur at all locations within a mapped Soil Landscape Unit. Conversely, additional constraints may be identified in site-specific assessments that were not identified in the regional soil landscape map.

The Picton Soil Landscape Group generally has a very low agricultural capacity and this is due to soil, geotechnical instability and landscape limitations.

The Monkey Creek Soil Landscape Group generally has a low agricultural capacity and this is due soil, groundwater and flooding limitations.

Table 3: Summary of Soil Landscape characteristics (adapted from Hazelton and Tille, 1990).

Soil Landscape Group	Aspect	Characteristics
Picton	Fertility	Moderate to low fertility. Top soil is moderately fertile. Subsoils are not fertile and have a low nutrient content. Soils can be deep but with poor soil structure which inhibits root penetration.
	Erodibity	Moderate to highly erodible, particularly the sub-soil. Slope failure due to through-flow and development of percolines is common.
	Erosion hazard	For non-concentrated flows, the erosion hazard is considered to be extreme. Calculated soil loss for the first 12 months of urban development ranges from 300 tonnes/ha for topsoil on steeper slopes to 170 tonnes/ha for exposed sub-soil. Steep slopes are subject to mass movement when saturated. Soil erosion for concentrated flows is high to very high.
	Mass movement potential	High. Special foundation designs may be required.
	Landscape limitations	Include steep slopes, mass movement hazard, seasonal waterlogging, water erosion, surface movement and rock fall.
	Urban capability	Not recommended for urban development. Has limited rural capability unless strict management practices are adhered.
Monkey Creek	Fertility	Soils of the Monkey Creek Soil Landscape Group are considered to have a moderate to low fertility. Soils are sodic (locally) and are not suitable for penetration by dee roots, but have good moisture storage.
	Erodibity	The soils are considered to highly erodible. Soil materials have a high percentage of fine sand and subsoils are low in organic matter.
	Erosion hazard	For non-concentrated flows, the erosion hazard is considered to be very high. Calculated soil loss for the first 12 months of urban development ranges up to 55 tonnes /ha for topsoil and 70 tonnes/ha for exposed sub-soil. Soil erosion for concentrated flows is very high.
	Mass movement potential	Considered to be moderately to slightly reactive. Soils are deep and have high clay content.
	Landscape limitations	Include flood hazard, permanently high watertables and seasonal waterlogging.
	Urban capability	Not recommended for urban development due to flood hazard.

2.4.1.3 Soil survey

Sub-surface soil features within the Study Area were investigated via an electromagnetic induction survey and an invasive soil survey. The objective of the invasive soil survey was to confirm surface features, to investigate the electromagnetic features of the Study Area and describe sub-surface soil features in sufficient detail to assess potential constraints to agricultural production.

A total of fourteen (14) test-pits were excavated with a mechanical excavator and soil profiles were logged. Test-pit locations are depicted on Figure 4 and soil profile logs are included in Appendix 1.

Sixteen (16) soil samples were collected and analysed in a NATA accredited laboratory for texture, pH, Cation Exchange Capacity (CEC), Exchangeable Sodium Percentage (ESP%), phosphorus retention index (PRI), $EC_{1:5}$ and pH.

An additional eight (8) sub-soil samples were collected and analysed in the laboratory for texture, pH, Cation Exchange Capacity (CEC), Exchangeable Sodium Percentage (ESP%), $EC_{1:5}$ and pH.

Laboratory analysis was undertaken by Sydney Environmental and Soil Laboratory (SESL) located at Thornleigh, NSW.

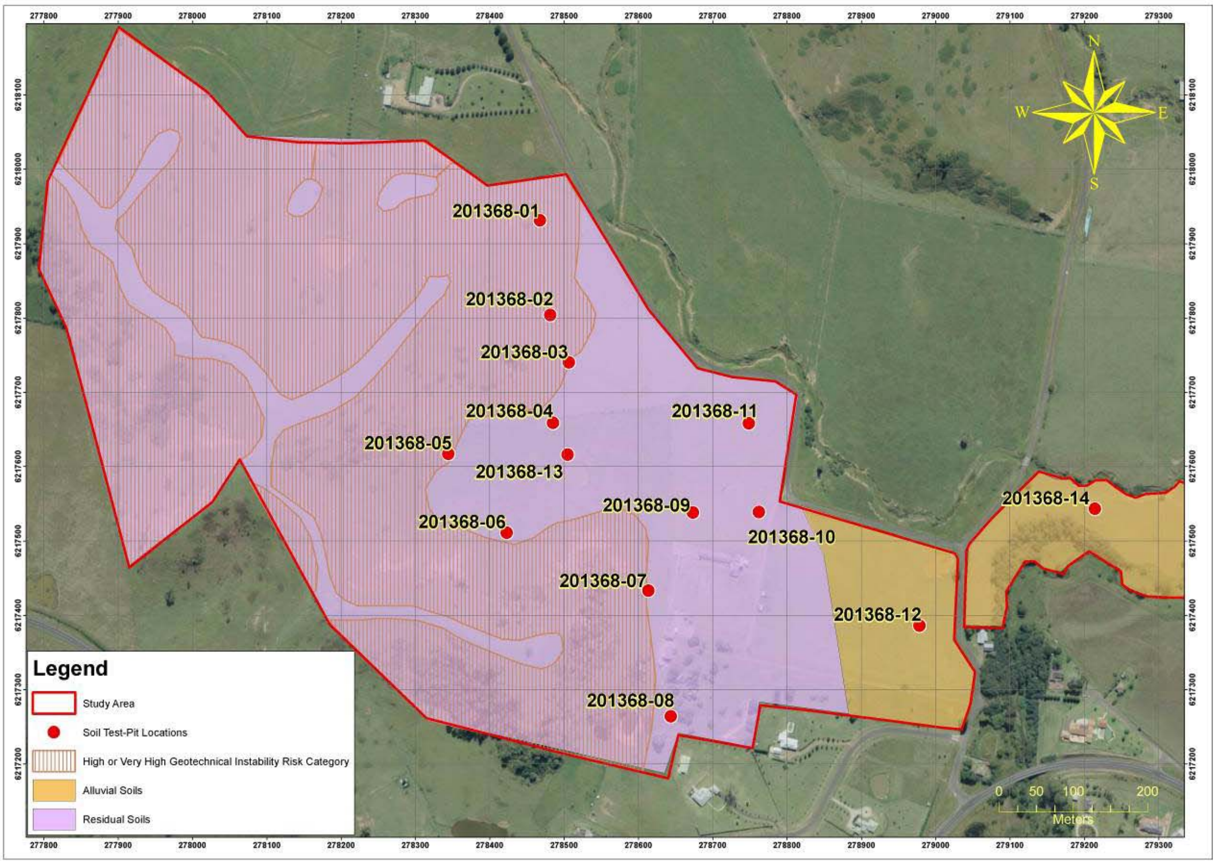


Figure 4: Soil test-pit locations

Results

Soil Profile Types

Two main soil profile types were identified within the Study Area and these were broadly divided into residual soil profiles formed from the weathering of the underlying bedrock (i.e. Residual Soils) and soils formed as a result of the deposition of alluvial sediments (i.e. Alluvial Soils).

Alluvial Soils were found on the relatively flat and associated with the lower lying portions of the Study Area. These soils are derived from the deposition of quaternary sediments associated with Stonequarry Creek and the adjacent un-named tributary of Stonequarry Creek.

Residual Soils occur over the remaining portions of the Study Area and are derived from the weathering of underlying bedrock, which consists of Ashfield Shale on the side-slopes and lower slopes and Bringelly Shale on the more elevated portions and hill crests.

The approximate location and boundary of these two soil types are illustrated in Figure 4.

Soil Physical Properties

Soil physical characteristics are summarised in Table 4.

Topsoil depth was variable, with deeper coarser textured (i.e. higher sand content) topsoils typically associated with Alluvial Soils and shallower fine-textured soils associated with Residual soils.

Alluvial Soils also included a bleached A2 horizon (location 201368-12), indicating that significant lateral water movement may occur after rain, which may cause water-logging and resulting in nutrient management difficulties if these soils are utilised for intensive agricultural production.

Shale bedrock was not encountered within the Alluvial Soil profiles but was encountered at a depth of ranging from 1.1 metres (location 201368-01) to 4 metres (location 201368-07) within the zone containing Residual Soils.

Sub-soils across the Study Area typically contained relatively high clay content with an associated low inferred permeability which, which in turn may result in water-logging after periods of heavy rain. Onsite soils are therefore generally not suited to agricultural crops that are susceptible to water-logging.

The soil structure was poorly developed within all soils of the Study Area, with Alluvial soils being massive and Residual Soils having slightly improved structure but still only weak to moderate at best.

Overall, the physical properties of the onsite soils are not favourable to intensive agricultural production or regular cultivation. The main physical limitations may be summarised as follows:

- Alluvial Soils:
    - Water-logging;
    - Soil structural constraints; and
    - Lateral water movement and nutrient management constraints.
- Residual Soils:
    - Water-logging;
    - Soil structural constraints; and
    - Soil depth constraints.

TABLE 4: Summary of soil physical characteristics

Soil Type	Soil horizon	Depth[1] (mm)	Texture/s	Structure	Inferred permeability (m/day)
Alluvial Soils	A	0-1200	Fine Sandy Clay Loam, Clayey Sand	Massive	0.06– 3.0
	B	600-3200	Sandy Clay	Massive, Weak	<0.06
	B/C	Not encountered			
	C				
Residual Soils	A	0-900	Clay Loam	Weak, Moderate	0.06– 1.5
	B	250-4300	Light Clay, Medium Clay	Weak, Moderate	<0.06 – 0.5
	B/C	750-2700	Light Clay, Medium Clay	Weak	<0.06 – 0.5
	C	1100	Shale	N/A	N/A

Notes:

1. Permeability was inferred based on soil texture and structure with reference to Table 4.2A4 on page 125 of AS/NZ 1547:2000.

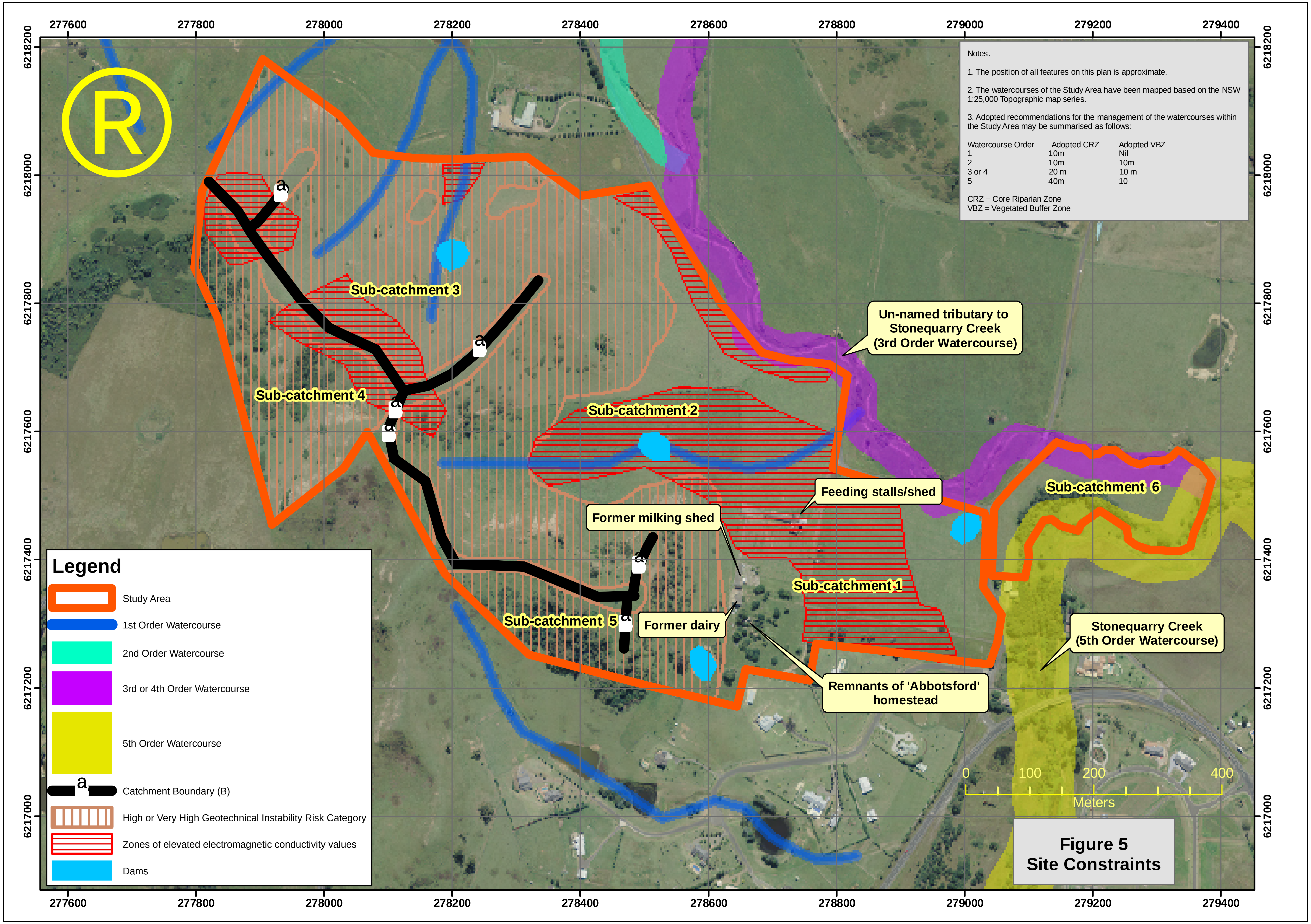


Figure 5
Site Constraints

Soil Chemical Properties

Soil pH, Salinity and Phosphorus Retention (PRI) characteristics are summarised in Table 5 and laboratory analysis results are appended as Appendix 2.

Alluvial Soils have similar topsoil and subsoil chemical properties and contain a slightly acidic to neutral pH, are non-saline and have a very low capacity to retain phosphorus. Salinity and pH are not a limitation to agricultural production, but due to the low capacity of these soils to hold phosphorus, fertiliser applications will need to be carefully managed to maximise production and minimise environmental impacts due to the leaching of nutrients.

Topsoils of the Residual Soils exhibit a slightly acidic to neutral pH, are non-saline and have a low capacity to retain phosphorus. Subsoils exhibit a slightly acidic to alkaline pH, range from non-saline to moderately saline and have a low capacity to retain phosphorus.

pH is not a limitation to agricultural production in either soil type.

Salinity is not a constraint within the Alluvial Soils but moderately high sub-soil salinity levels within the Residual Soils will pose a constraint to agricultural production at some locations. The areas delineated on Figure 5 as zones of elevated electromagnetic conductivity values are potentially affected by saline sub-soils. These areas are considered to be constrained for the purposes of agricultural production.

TABLE 5: Summary of pH, Salinity (EC_e) and Phosphorus Retention Index

Soil Type	Soil horizon	pH	EC_E	Salinity Classification	Phosphorus Retention Index (PRI) (mg/kg)
Alluvial Soils	A	6.5-6.7	0.3	Non-saline	535.4-640
	B	6.6-6.7	0.2	Non-saline	126-795
	B/C	Not encountered			
	C				
Residual Soils	A	6.1-7.4	0.2-1.0	Non-saline	382-1120
	B	6-8.8	0.1-4.8	Moderately saline	841-1662
	B/C	5.4-8.5	0.3-7.0	Moderately saline	-

Notes:

1. Salinity classifications are based on Table 6.2 of NSW DLWC (2002) publication entitled '*Site Investigations for Urban Salinity*'.
2. Values highlighted by shading are outside the range non-saline.

Sodicity and Cation Exchange Capacity characteristics are summarised in Table 6 and laboratory analysis results are appended as Appendix 2.

Alluvial Soils have similar topsoil and subsoil characteristics and are non-sodic with a low cation exchange capacity. Sodicity levels are not a limitation to agricultural production, but due to the low capacity of these soils to hold cations, fertiliser applications would need to be carefully managed to maximise production and minimise environmental impacts due to the leaching of nutrients.

Topsoils of the Residual Soil type are non-sodic but sub-soils are sodic to highly sodic. The high levels of sodicity within these sub-soils presents an erosion hazard risk if the topsoils are disturbed and the sub-soils are exposed. The Cation Exchange Capacity of topsoils and sub-soils of the

Residual Soils is low, indicating a low capacity to hold plant nutrients and therefore poses a constraint to intensive agricultural land-uses.

TABLE 6: Summary of Sodicity and Cation Exchange Capacity

Soil Type	Soil horizon	Exchangeable Sodium Percentage (ESP) (%)	Sodicity Classification	Cation Exchange Capacity
Alluvial Soils	A	0.8	Non-sodic	4.9-5.7
	B	1.4-1.6	Non-sodic	1.6-4.8
	B/C	Not encountered		
	C			
Residual Soils	A	0.5-5.1	Non-sodic	0.2-10.2
	B	1.5-35.2	Non-sodic to highly sodic	12.2-18.3
	B/C	6.7-27.5	Sodic to highly sodic	8.2-24.5

Notes:

1. Sodicity classifications are based on classifications presented on page 14 of NSW DLWC (2002) publication entitled '*Site Investigations for Urban Salinity*'.
2. Values highlighted by shading are outside the range non-sodic.

2.4.1.4 Topography and slope

The slope and topography of the Study Area is dominated by a northwest-southeast trending ridge line with a centrally located and northerly trending sub-ridge line. The maximum vertical relief across the Study Area is approximately 60 metres.

Slopes that are excessively steep predominate in the western half of the Study Area.

2.4.1.5 Groundwater

Five (5) piezometers were installed within the Study Area and the locations of these are depicted on Figure 6. Drillers logs are included in Appendix 1.

Groundwater samples collected and analysed in the laboratory are summarised as follows:

- Two (2) groundwater samples were collected on 28 February 2013 from locations 201368-15 and 201368-16;
- A single groundwater sample was collected from location 201368-13 during the soil sampling regime on 9 January 2013; and
- A single groundwater sample was collected on 20 March 2013 from location 201368-17.

Groundwater samples analysed in the laboratory were analysed for pH, EC, sulphate and chloride content. Laboratory analysis was undertaken by Sydney Environmental and Soil Laboratory (SESL) located at Thornleigh, NSW. SESL is a NATA accredited laboratory.

All groundwater piezometers were pumped empty on 19 March 2013 and groundwater depth was re-measured 24 hours later on 20 March 2013. This measurement was taken approximately 1 week after an extended period of heavy rain.

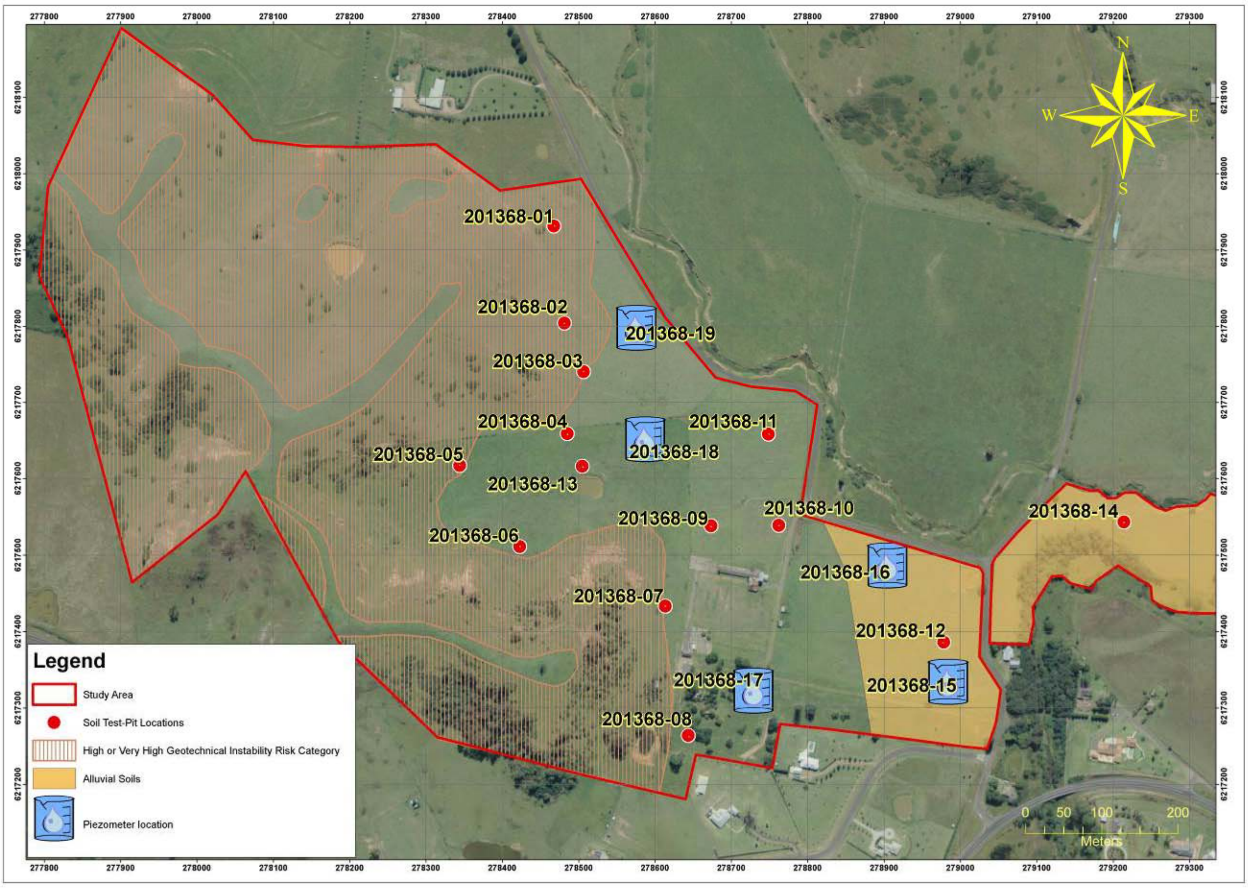


FIGURE 6: Groundwater piezometer locations

Results of groundwater monitoring are summarised in Table 7.

TABLE 7: Summary of groundwater depth and laboratory analysis results

Soil Type	Location	Depth (m) (22/01/2013)[5]	Depth (m) (28/02/2013)	Depth (m)[3] (20/03/2013)	Salinity (mS/cm)	pH	Sulphate ($mgSO_4/L$)	Chloride (mgCl/L)
Alluvial Soils	201368-15	Not intercepted	0.5	0.9	0.48 (Moderate)	6.5	18.4 (Low)	88.6 (Low)
	201368-16	Not intercepted	2.0	2.2	0.56 (Moderate)	6.6	12.9 (Low)	111.8 (Low)
Residual Soils	201368-17	Not intercepted	NM	0.9	0.27 (Low)	6.0	7.8 (low)	8.3 (Low)
	201368-18	Not intercepted	NM	3.2	NM	NM	NM	NM
	201368-19	Not intercepted	NM	3.1	NM	NM	NM	NM
	201368-13	Not intercepted	~4.3	~4.3	2.73 (very high)	8.0	340	4020

Notes:

1. Salinity classifications are based on classifications presented on page 5-8 of National Water Quality Management Strategy (1992) publication entitled '*Australian Water Quality Guidelines for Fresh and Marine Waters*''.
2. Values highlighted by shading are outside the range low-salinity.
3. All piezometers were pumped empty on 19/03/2013 and groundwater depth was measured 24 hours later on 20/03/2013.
4. NM = Not measured.
5. Piezometers were installed on 21/01/2013

Groundwater regime within Alluvial Soils

Groundwater within Alluvial soils was found to be rated as Medium Salinity and is only suitable for irrigation purposes on soils that are well drained.

Whilst all piezometers were at the time of installation initially dry, after an extended period of heavy rain, shallow groundwater was detected and ranged in depth from within 0.5 metres of the soil surface on 28/02/2013 at location 201368-15 to 2.2 metres at location 201368-16 approximately one week after the extended period of heavy rain ended.

Groundwater regime within Residual Soils

Groundwater within the residual soils was found to range from Low Salinity at location 201368-17 to High Salinity at location 201368-13. The low salinity level at location 201368 was likely as a result of surficial seepage from recent rain saturating the soil profile rather than an interaction with a deeper groundwater regime as a more elevated salinity level would have been anticipated. The higher salinity levels at location 201368-17 are considered to be more typical of the deeper groundwater regime of the Study Area.

High Salinity groundwater is not suitable for irrigation purposes.

Whilst all piezometers were at the time of installation initially dry, after an extended period of heavy rain, shallow groundwater was detected and ranged in depth from within 0.9 metres of the soil surface at location 201368-17 to 3.2 metres at location 201368-18.

2.4.1.6 Geotechnical constraints

The geotechnical instability of the Study Area was assessed by Harvest Scientific Services Pty Ltd (2013). The areas that were identified in that assessment as being un-suitable for residential development were classified as having either a '*High'* or *'Very High'* Geotechnical Instability Risk Category. The location of these areas is delineated on Figure 5. A limited portion of these areas is considered to be suitable for grazing purposes only with low stocking density.

2.4.1.7 Flooding

The extent of flooding within the Study Area is currently un-known and it is understood that this constraint is to be delineated by the Applicant with the aid of a separate flood study. Nonetheless, it is considered that flood constraints are potentially associated with the lower lying portions of the site particularly in the vicinity of the existing watercourses.

2.4.1.8 Regional catchment

The Study Area is located within the Hawkesbury-Nepean catchment, with the Nepean River being located approximately five kilometres to the southeast of the Study Area.

2.4.1.9 Natural drainage watercourses

The natural drainage of the Study Area was investigated via a field assessment in early 2013 as well as a review of the 1:25,000 topographic map series with the objective of classifying it according to the generally accepted Strahler stream Order classification system (**Strahler, 1952**). The watercourses associated with the Study Area are summarised as follows:

- 4 un-named 1st order watercourses were identified within the bounds of the Study Area;
- A further 1st Order watercourse was identified immediately to the south of the southern boundary of the Study Area;
- An un-named 2nd order watercourse was identified to the north of the Study Area;
- An un-named 3nd order watercourse was identified to the north of the Study Area; and
- Stonequarry Creek, a 5th Order watercourse was identified to the east of Study Area.

The location of these features is depicted on Figure 5**.**

2.4.1.10 Anthropogenic (man-made) drainage systems

With the exception of road drain systems and a number of farm dams, no other anthropogenic (man-made) drainage systems were identified within the Study Area.

2.4.1.11 Vegetative constraints

The Study Area is predominantly cleared with only limited vegetative constraints.

2.4.1.12 Water availability for agricultural purposes

The amount of water available to be harvested for agricultural purposes is governed by Maximum Harvestable Rights Dam Capacity (MHRDC) (**NSW Office of Water, 2012)** provisions, which in turn are based on the total lot area.

The Study Area is host to three farm dams and these are able to support a low water use activity such as grazing.

If a high water demand agricultural activity is proposed (such as market gardening or horticulture) water would need to be supplied via a reticulated water supply, which would thus limit agricultural activities to only high value agricultural enterprises due to the associated high irrigation costs.

Onsite shallow groundwater tables are generally not suitable for agricultural irrigation purposes.

2.4.2. Social

2.4.2.1 Land zoning

Land zoning is depicted on Figure 7 and a summary of the allowable land-use planning requirements is outlined in Appendix 4.

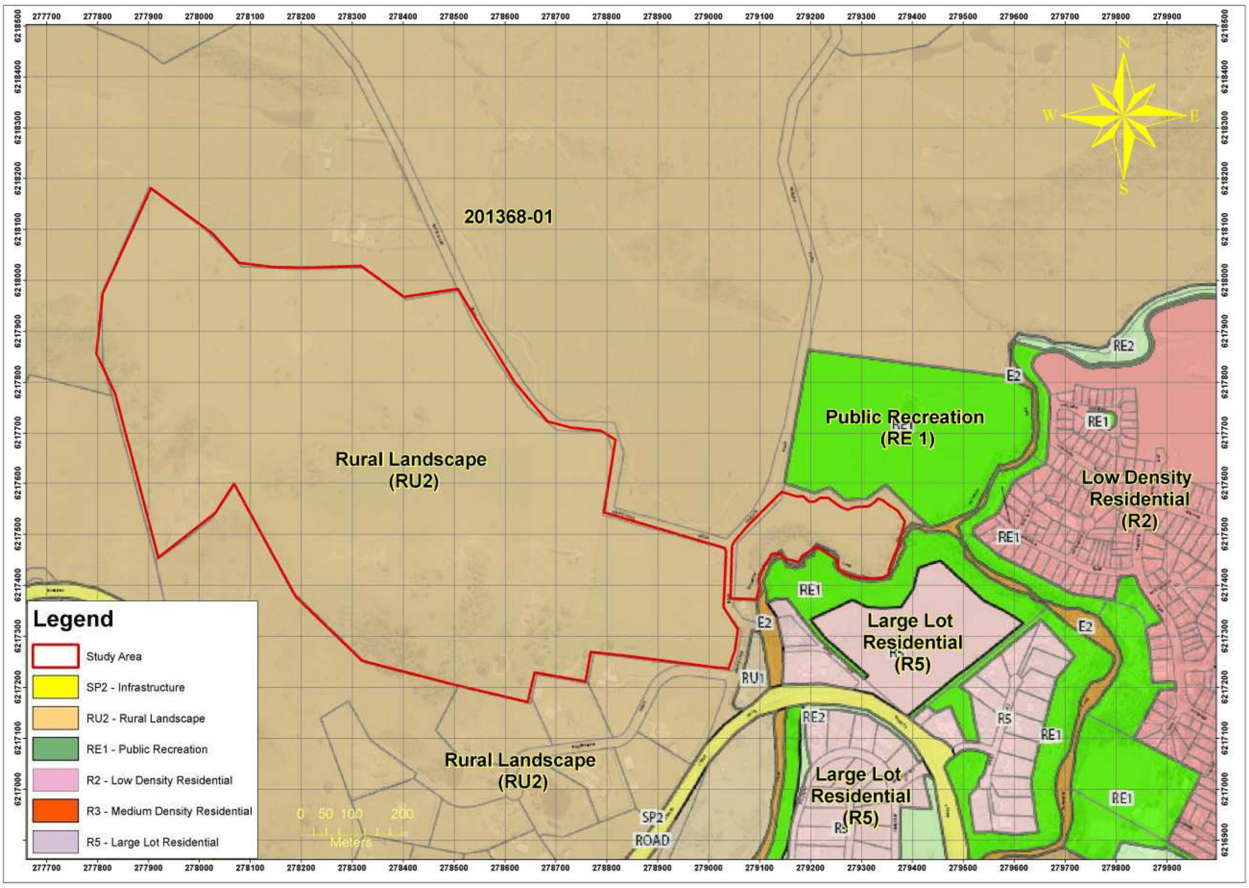


Figure 7: Land zoning map.

The Study Area is currently zoned as 'RU2 Rural Landscape' and permissible agricultural land-uses may be summarised as follows:

- Extensive agriculture (grazing, bee keeping, pasture based dairy) are permitted without Consent;
- With the exception of turf farming, intensive plant production activities (e.g. horticulture, etc) are permitted with Consent;
- Animal boarding and training establishments are permitted with Consent;
- Intensive livestock agriculture activities (e.g. poultry farms, feedlots) are permitted with Consent; and.
- Forestry is prohibited.

The land zoning surrounding the Study Area may be summarised as follows:

- Immediately to the south, west and north of the investigation area is 'RU2 Rural Landscape';

- 'RE1 – Public Recreation' and 'R5 – Large Lot Residential' to the east;
- 'R2 Low Density Residential' – further to the east; and
- A small island of 'RU1' Primary Production immediately to the south-east, which then extends in an arc further to the south.

2.4.2.2 Availability of labour

There is sufficient local labour available to meet any labour needs.

2.4.3. Economic

2.4.3.1 Local and regional infrastructure to support agriculture

The types of potential agricultural enterprises that may occur within the Study Area do not require any significant local or regional infrastructure.

2.4.3.2 Geographic location

The Study Area is located in a geographic region that is known to be used predominantly for grazing, with some/limited horticultural enterprises in the form of market gardens and associated agricultural land-uses.

2.4.3.3 Accessibility and location with respect to transport requirements and costs

Local road access for the transportation of produce and stock is available via road access through the residential township of Picton to the east. Produce may then be transported to local markets or the Sydney market via existing arterial roads.

With the exception of a potential land-use conflict with the transportation of agricultural produce through residential areas due to potential noise, odour and dust nuisance issues, transportation infrastructure is not a significant impediment to the use of the land within the Study Area for agricultural activities.

2.4.3.4 Accessibility to local markets

Local produce may be sold locally to shops and/or markets. Sydney produce markets are located within an economic traveling distance.

Markets for the sale of livestock and abattoirs are locally available.

2.4.3.5 Presence of any comparative market advantage

There are no apparent comparative market advantages for any agricultural activities within the Study Area.

2.5 Results of assessment

2.5.1. Agricultural Classification – Constraints and opportunities mapping

Based on the methodology and assumptions outlined in this report, the assessed agricultural land classification for the Study Area is illustrated on Figure 8. Land areas associated with each agricultural classification summarised in Table 8.

Table 8: Summary of agricultural classifications within the Study Area (ha)

Agricultural Classification	Area (ha)
1	0
2	0
3	25 (36% of Study Area)
4	45 (64% of Study Area)
5	0
Total	**70**

Agricultural land classifications for the Study Area may be summarised as follows:

- **Specialist Class.** No specialist class agricultural land was identified within the Study Area.
- **Classes 1 and 2.** No high value 'Class 1' or 'Class 2' agricultural lands were identified within the Study Area;
- **Class 3.** Approximately 25 hectares of the Study Area was identified as containing Class 3 agricultural lands. These lands were located on moderate side-slopes and foot-slopes. Portions of this Class are potentially flood affected and sources of water for irrigation purposes are limited.

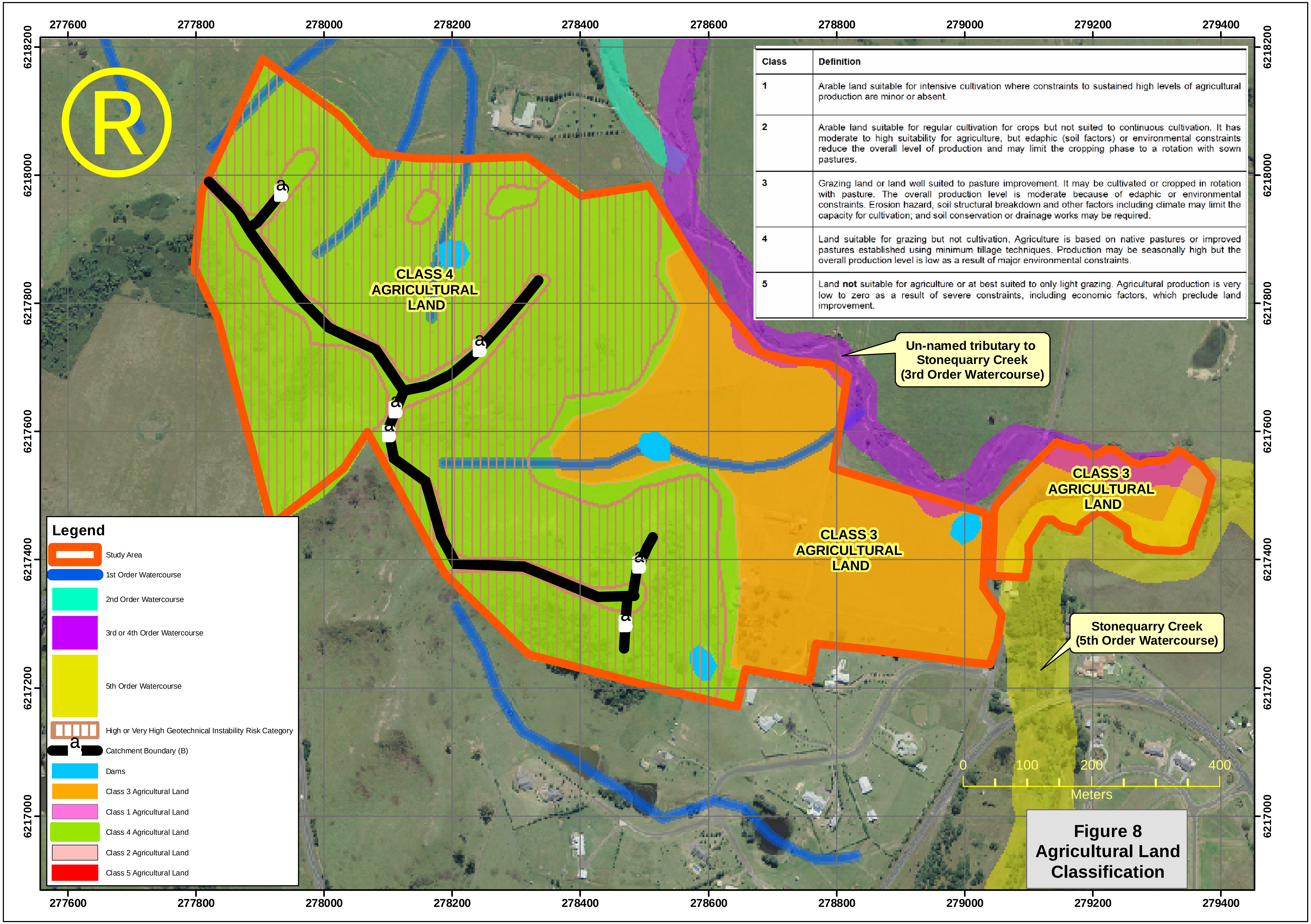
  Due to site constraints the agricultural value of this land is considered to be low;
- **Class 4.** Approximately 45 hectares of the Study Area was identified as 'Class 4' agricultural grazing land. This class consisted of steep land too steep to cultivate. Potential agricultural uses are limited to extensive grazing. The agricultural value of this land is considered to be low; and
- **Class 5.** No 'Class 5' non-agricultural land was identified.

2.6 Summary of impacts of the rezoning proposal

2.6.1. Loss of current agricultural potential

For land use planning purposes, **NSW Agriculture (2002)** recommends protecting highly productive agricultural land (Classes 1, 2 and 3 and Specialist Class) from competing land-uses such as urban development with a preference given to the protection of Class 1 and Class 2 lands over Class 3 lands.

With regard to Class 3 land, **NSW Agriculture (2002)** recommends taking into consideration social and economic factors when making recommendations for changes to land-use. Furthermore, it is preferable to use land of lower agricultural quality (i.e. Class 4 and 5) for competing land-uses. **NSW Agriculture (2002)** also generally recommends the retention of irrigated lands for agriculture because of existing infrastructure and the relatively high production potential.



Class	Definition
1	Arable land suitable for intensive cultivation where constraints to sustained high levels of agricultural production are minor or absent.
2	Arable land suitable for regular cultivation for crops but not suited to continuous cultivation. It has moderate to high suitability for agriculture, but edaphic (soil factors) or environmental constraints reduce the overall level of production and may limit the cropping phase to a rotation with sown pastures.
3	Grazing land or land well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture. The overall production level is moderate because of edaphic or environmental constraints. Erosion hazard, soil structural breakdown and other factors including climate may limit the capacity for cultivation; and soil conservation or drainage works may be required.
4	Land suitable for grazing but not cultivation. Agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be seasonally high but the overall production level is low as a result of major environmental constraints.
5	Land **not** suitable for agriculture or at best suited to only light grazing. Agricultural production is very low to zero as a result of severe constraints, including economic factors, which preclude land improvement.

Figure 8 Agricultural Land Classification

Within the Study Area, no Class 1 or 2 or Specialist Class lands were identified and therefore none of these lands will be lost as part of the re-zoning proposal.

Approximately 25 hectares of 'Class 3' lands was identified. However, these lands are constrained by a number of biophysical constraints, including flooding, soil salinity, water-logging and soil fertility and sodicity constraints. As a result the agricultural value of this land is considered to be low.

There is currently only limited infrastructural development of the land within the Study Area for agricultural land-uses other than grazing type operations. Much of this infrastructure is antiquated and poses a human and animal health risk from factors such as asbestos contamination.

As the Study Area has only limited agricultural development potential, the loss of agricultural development within the Study Area is considered to be limited.

2.6.2. Loss of future agricultural land potential

Agricultural lands within the Study Area are constrained by soil, flooding, water supply and groundwater constraints and these constraints make the land within the Study Area not suitable for sustainable agricultural production. This finding is consistent with the Wollondilly Agricultural Land Review findings from 1998 that concluded that the minimum allotment size required for sustainable agriculture was 20 hectares. There is no portion of un-constrained land within the Study Area that is sufficient in area to satisfy this criteria.

The Study Area is generally surrounded by residential land-uses to the south and to the east (Picton Village). Significant development of this land for agricultural purposes is therefore considered to be unlikely due to potentially un-manageable land-use conflicts (noise, dust, odour, ecological etc).

Furthermore, considering the requirements of the Wollondilly LEP 2011, the potential agricultural land-uses of the Study Area are limited to high value, high input intensive horticultural production and/or limited grazing. Given the need to obtain development consent under the LEP for intensive agricultural enterprises and the associated potential land-use conflicts, it is considered that there is only limited potential for future agricultural development of the Study Area.

Given the constraints and agricultural classifications identified in this Study it is considered that the Study Area is likely to already be developed to near it's agricultural capacity and therefore the loss of future agricultural land potential is limited.

2.7 Constraints impeding agricultural development

Constraints impeding agricultural development are outlined in **Section 2.4** of this report.

2.8 Recommendations

Based on the findings of this assessment, it has been recommended that the Study Area be rezoned to allow for a minimum allotment size of 4000m^2. The basis for this recommendation is detailed in Table 9.

Table 9: Land capability assessment recommendations

Aspect	Recommendation/s	Basis for recommendation
Land zoning	The entire Study Area should be re-zoned to permit allotments that within the individual site capacity of the existing allotments allowing for a minimum allotment size of 4000 m^2 with a related increase in lot density.	The basis for this recommendation is as follows: • No high value 'Class 1' or 'Class 2' lands were identified within the Study Area. • The major part of the Study Area (65 per cent) was assessed to be 'Class 4' grazing land. The agricultural capacity of this land does not warrant it's retention for agricultural purposes. • A minor part (35 per cent) of the Study Area was assessed to be 'Class 3' agricultural land. This land class, however, was constrained and is generally of insufficient size to support economically viable agricultural enterprises. This finding is supported by only limited development of commercial agricultural enterprises within the investigation area. • This land is generally surrounded by residential land-uses to the south (Large Lot Residential within RU2 zoning), to the east (Picton Village – R2 Residential) and to the south-east (large lot residential – R5 zoning). Significant development of this land for agricultural purposes is therefore considered to be unlikely do to potential urban/rural interface land-use conflicts (noise, dust, odour, ecological etc). • Rezoning the Study Area will enable an interface buffer zone of large lot residential land between land of an agricultural zoning an existing residential area, with R5 zoned residential land to reduce potential agricultural urban / rural land-use conflicts (**refer to the Land Use Risk Assessment section of this report for further details).** The rezoning the Study Area for a R5 residential land-use and it's subsequent development will result in a reduced pressure to develop surrounding higher value large-lot size agricultural lands that are better suited to agricultural uses. Furthermore, the Wollondilly Agricultural Land Review in 1998 concluded that the minimum allotment size required for sustainable agriculture was 20 hectares. Site constraints would not permit the creation of an allotment within the Study Area with sufficient unconstrained agricultural land to satisfy this criterion.

2.9 Conclusion

It is concluded that the re-zoning of the Study Area for residential land-use will:

- Not result in the loss of any high class agricultural lands;
- Result in the loss of some low quality fragmented agricultural land, but this loss will reduce pressure to develop more productive less fragmented surrounding agricultural lands for residential land-uses; and
- Result in the loss of limited future low quality agricultural lands.

The re-zoning proposal is therefore considered to be in accordance with the NSW DPI (formerly NSW Agriculture) land-use planning objectives for rural lands.

3.0 LAND USE CONFLICT RISK ASESSMENT (LUCRA)

3.1 Introduction

Land use conflicts occur when one land user is perceived to infringe upon the rights, values or amenity of another. In rural areas, land use conflicts commonly occur between agricultural and residential uses. However, land use conflicts can also occur between different agricultural enterprises and other primary industries including mining, forestry, aquaculture and fishing enterprises (NSW DPI, 2011).

Rural amenity issues are the most common land-use conflict issues, followed by environmental protection issues. Rural amenity issues include impacts to:

- air quality due to agricultural and rural industry (odour, pesticides, dust, smoke and particulates);
- use and enjoyment of neighbouring land e.g. noise from machinery; and
- visual amenity associated with rural industry e.g. the use of netting, planting of monocultures and impacts on views.

Environmental protection issues include:

- soil erosion leading to land and water pollution;
- clearing of native vegetation, and
- stock access to waterways.

Direct impacts from neighbouring land uses on farming operations can also cause conflict, such as:

- harassment of livestock from straying domestic animals
- trespass;
- changes to storm water flows or water availability; and
- poor management of pest animals and weeds.

3.2 Assessment objectives

The objectives of this Land Use Conflict Assessment are as follows:

- To determine if there is any edge impacts between the Study Area and adjoining agricultural land; and
- To determine an appropriate level of development to minimise agricultural land-use conflict.

3.3 Methodology

3.3.1. Land Use Conflict Risk Assessment (LUCRA)

Land Use Conflict Risk Assessment (LUCRA) is a system developed by the NSW Department of Primary Industries (NSW DPI, 2011) to identify and assess the potential for land use conflict to occur between neighbouring land uses. It helps land managers and consent authorities to assess the possibility for and potential level of future land use conflict. LUCRA aims to:

- accurately identify and address potential land use conflict issues and risk of occurrence strategies before a new land use proceeds or a dispute arises;
- objectively assess the effect of a proposed land use on neighbouring land uses;
- increase the understanding of potential land use conflict to inform and complement development control and buffer requirements; and
- highlight or recommend strategies to help minimise the potential for land use conflicts to occur and contribute to the negotiation, proposal, implementation and evaluation of separation strategies.

3.3.2. Key steps in LUCRA

There are four key steps in undertaking a LUCRA, these are:

- gather information about proposed land use change and associated activities;
- evaluate the risk level of each activity;
- identify risk reduction management use conflict issues and risk of occurrence strategies before a new land use proceeds or a dispute; and
- record LUCRA results.

3.3.3. Evaluation of risk

A Risk Ranking Matrix, (Table 10) is used to rank the identified potential land use conflicts. The risk ranking matrix assesses the environmental, public health and amenity impacts according to the:

- probability of occurrence (Table 11), and
- consequence of the impact (Table 12).

Table 10: Risk matrix table (NSW DPI, 2011)

PROBABILITY	A	B	C	D	E
Consequence					
1	25	24	22	19	15
2	23	21	18	14	10
3	20	17	13	9	6
4	16	12	8	5	3
5	11	7	4	2	1

The risk ranking matrix yields a risk ranking from 25 to 1. It covers each combination of five levels of ‘probability’ (a letter A to E as defined in Table 11) and 5 levels of ‘consequence’, (a number 1 to 5 as defined in Table 10) to identify the risk ranking of each impact. For example an activity with a ‘probability‘ of D and a ‘consequence’ of 3 yields a risk rank of 9.

A rank of 25 (Table 10) is the highest magnitude of risk; a highly likely, very serious event. A rank of 1 represents the lowest magnitude or risk representing an almost impossible and very low consequence event. Priority is given to those activities listed as high risk (highlighted in red). This will help rank multiple effects and provide a priority list when developing management strategies.

Table 11outlines the likelihood, or probability, of a consequence occurring.

Table 11: Probability table – to score the likelihood of the consequence occurring (NSW DPI, 2011)

Level	Descriptor	Description
A	Almost certain	Common or repeating occurrence
B	Likely	Known to occur, or 'it has happened'
C	Possible	Could occur, or 'I've heard of it happening'
D	Unlikely	Could occur in some circumstances, but not likely to occur
E	Rare	Practically impossible

Table 12 on the other hand details the five levels of consequences and provides descriptions applicable to each level. Furthermore, consequential examples and their implications are also provided.

Table 12: Measures of consequences (NSW DPI, 2011)

Level: 1	Descriptor: Severe
Description	• Severe and/or permanent damage to the environment • Irreversible • Severe impact on the community • Neighbours are in prolonged dispute and legal action involved
Example/ Implication	• Harm or death to animals, fish, birds or plants • Long term damage to soil or water • Odours so offensive some people are evacuated or leave voluntarily • Many public complaints and serious damage to Council's reputation • Contravenes Protection of the Environment & Operations Act and the conditions of Council's licences and permits. Almost certain prosecution under the POEO Act
Level: 2	**Descriptor: Major**
Description	• Serious and/or long-term impact to the environment • Long-term management implications • Serious impact on the community • Neighbours are in serious dispute
Example/ Implication	• Water, soil or air impacted, possibly in the long term • Harm to animals, fish or birds or plants • Public complaints. Neighbour disputes occur. Impacts pass quickly • Contravenes the conditions of Council's licences, permits and the POEO Act • Likely prosecution
Level:3	**Descriptor: Moderate**
Description	• Moderate and/or medium-term impact to the environment and community • Some ongoing management implications • Neighbour disputes occur
Example/ Implication	• Water, soil or air known to be affected, probably in the short term • No serious harm to animals, fish, birds or plants • Public largely unaware and few complaints to Council • May contravene the conditions of Council's Licences and the POEO Act • Unlikely to result in prosecution
Level: 4	**Descriptor: Minor**
Description	• Minor and/or short-term impact to the environment and community • Can be effectively managed as part of normal operations • Infrequent disputes between neighbours
Example/ Implication	• Theoretically could affect the environment or people but no impacts noticed • No complaints to Council • Does not affect the legal compliance status of Council
Level: 5	**Descriptor: Negligible**
Description	• Very minor impact to the environment and community • Can be effectively managed as part of normal operations • Neighbour disputes unlikely
Example/ Implication	• No measurable or identifiable impact on the environment • No measurable impact on the community or impact is generally acceptable

3.3.4. Risk Reduction Management strategies

The process of risk reduction aims to identify management strategies that affect the probability of an event occurring, such as the implementation of certain procedures; new technology or scientific controls that might lower the risk probability values.

It is also appropriate to look at management strategies which affect consequences e.g. buffer distances to residential areas. Such matters can sometimes lower negative consequences.

3.4 Results of Conflict Risk Assessment

3.4.1. Review of land uses and potential edge impacts with agricultural land-uses

The land-use within and around the Study Area is illustrated on Figure 9.

Figure 9: Land-use map

The following land-uses were identified within and around the Study Area:

- Grazing is the dominant land-use within the Study Area;
- Residential and public recreation land-uses occupy the land to the south and east of the Study Area; and
- Extensive grazing land-uses occupy the land to the south-west, west and north of the Study Area.

3.4.2. Agricultural Land Use Conflict Risk Assessment table – Potential impacts

The agricultural land use risk assessment for the Study Area is outlined in Table 13.

It is noted that this table assesses the proposed land-use conflicts between the proposed urban zoning and a rural land-use. It does not attempt to identify all existing conflicts that may exist within the existing agricultural environment.

Table 13: LUCRA associated risk assessment rating (in brackets)

Activity	Identified Potential Conflict	Potential Aspects	Potential impacts identified in risk assessment rating (probability/ consequence)	Risk ranking	Comments
Grazing	Potential conflicts with residential land-use/s	Noise	Potential loss of amenity in residential area/s from noises associated with stock. (D / 4)	5	Generally unlikely as only a small section to the west of the Study Area shares a direct boundary with grazing land. This grazing land is of marginal quality and therefore is likely to have low stocking rates resulting negligible potential for conflict. All other boundaries to grazing land are physically separated by roads and/or creeks.
		Dust	Potential loss of amenity in residential area/s (D / 4)	5	Comment as per noise.
		Odour	Potential loss of amenity in residential area/s (D / 4)	5	Comment as per noise.
		Domestic pets	Potential impact on stock from domestic pets (D / 4)	5	Comment as per noise.
Proposed residential zoning	Potential conflicts with rural land-use/s	Trespass	Potential loss damage to stock and/or infrastructure (D / 4)	5	-
Possible future feedlot and/or dairy in RU2 zoning lands within the eastern portion of the investigation area	Potential conflicts with residential land-use/s	Noise, dust, odour	Potential loss of amenity in residential area/s (B / 2)	21	Under Wollondilly Shire Council LEP 2011, this activity would require consent and demonstrate manageable impacts on adjacent land uses.

3.5 Recommendations – Level of development to minimize agricultural land use conflict

Recommendations for the management of potential agricultural land-use conflicts are outlined in Table 14.

Table 14: Land use conflict management recommendations

Aspect	Recommendation/s	Basis for recommendation
Land zoning	The entire Study Area should be re-zoned for rural/residential land-use.	The basis for this recommendation is as follows: • The Study Area is bound to the north and east by Abbotsford Road and the west and south by constrained grazing land and residential development; and • Re-zoning the entire investigation area will reduce the potential for interactions between agricultural and urban land uses as the extent of potential interaction between these land-uses will be limited.
Potential future land use conflicts	Intensive animal enterprises, feedlots and dairies should be prohibited within the Study Area. Animal boarding and training facilities should be prohibited under the Land Use table for the R5 zone (or equivalent zoning within the Study Area).	The basis for this recommendation is as follows: • To prevent future land-use conflicts with these activities and the proposed new land zoning.

3.6 Conclusions

The land-use conflict assessment identified that potential land-use conflicts may occur between grazing and residential land-uses, but the risk rating for this conflict was low '5' and is considered to be an acceptable risk rating for this potential conflict.

The risk rating for potential conflicts between intensive animal enterprises and residential land-uses was found to be very high at a value of 25 and it was therefore recommended that these activities are prohibited within the proposed land-use zoning for the Study Area.

Providing that the recommendations outlined in this Study are implemented, it is concluded that the proposed land re-zoning will reduce the overall potential for land-use conflicts as it will result in the creation of a green belt interface between an existing residential area (i.e. Picton and associated large lot residential developments) and rural areas. This green belt will provide separation between the residential village of Picton without the ability of new agricultural enterprises which could not only impact on the Study Area but also the existing residential interface.

Furthermore, the rezoning of the Study Area will remove a direct fence line boundary between RU2 grazing land and an existing residential development to the south and replace this boundary with a road and associated road reserve (i.e. Abbotsford Road) boundary between residential large-lot land and RU rural grazing land. This will have a net effect of reducing potential edge effects between these land uses.

4.0 LIMITATIONS OF THIS STUDY

This Study has been prepared subject to a number of limitations. These include:

- The application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document. In particular, the occurrence of earthquakes of any magnitude, extreme rainfall events or the effects of climate change have not been considered but should they occur, may have a significant impact on the site. The client agrees that such events are possible but nevertheless accepts the risk that they pose;
- The findings contained in this Study are the result of discrete/specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site in question. Under no circumstances, however, can it be considered that these findings represent the actual state of the site/sites at all points;
- In preparing this Study, Harvest Scientific Services Pty Ltd has relied upon certain verbal information and documentation provided by the client and/or third parties. Harvest Scientific Services Pty Ltd did not attempt to independently verify the accuracy or completeness of that information. To the extent that the conclusions and recommendations in this Study are based in whole or in part on such information, they are contingent on its validity. Harvest Scientific Services Pty Ltd assume no responsibility for any consequences arising from any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to Harvest Scientific Services Pty Ltd;
- This Study is not to be relied upon for any purpose other than that defined in this Study; and
- The application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document. In particular, implications of climate change and/or global warming of any magnitude and extreme rainfall events have not been considered but should they occur, may have a significant impact on the site. The client agrees that such events are possible but nevertheless accepts the risk that they pose.

5.0 SPECIALIST STUDY REQUIREMENTS AND LOCATION WHERE REQUIREMENT IS ADDRESSED

Tables 15A, 16B and 16C provides a summary of the Study and identifies how each of the Specialist Study Requirements have been met.

Table 15A: Satisfaction of Specialist Study Requirements - Output

Output	How and Where Guidelines addressed
An agricultural land capability assessment that broadly examines: • *if there will be any loss of current agricultural potential;* • *if there is any loss of future agricultural land potential;*	This document.
Rezoning of land which provides an acceptable level of social, agricultural and economic sustainability and harmony.	This document

Table 15B: Satisfaction of Specialist Study Requirements - Objectives

Objectives	How and Where Guidelines addressed
To identify if there will be any loss of current agricultural development within the study area.	Section 2.6.1
To identify if there is any potential for future agricultural development within the study area.	Section 2.6.2
To identify if there are any constraints impeding agricultural development within the study area.	Section 2.6.3
To determine if there is any edge impact between the study area and adjoining agricultural land.	Section 3
To determine the appropriate level of development to minimise agricultural land use conflict.	Section 3

Table 15C: Satisfaction of Specialist Study Requirements - Objectives

Tasks/Methodology	How and Where Guidelines addressed
Examine the capability of the study area to support agricultural production.	Section 2.
Examine potential for future agricultural land uses by reference to Wollondilly Local Environmental Plan 2011.	Section 2.
Prepare constraints and opportunities mapping for any current and future agricultural development based on social, agricultural and economic sustainability.'	Section 2.

6.0 STUDY CONCLUSIONS

With regard to the Specialist Study Requirement's stated objectives, the following conclusions are noted:

- In the context of current agricultural development with the Study Area, the re-zoning proposal will:
  a. not result in the loss of any high class agricultural land (i.e. Class 1 or 2 lands); and
  b. result in the loss of some low quality and constrained agricultural land, but this loss will reduce pressure to develop more productive less fragmented surrounding agricultural lands for residential land-uses;
- The potential for future agricultural development within the Study Area is considered to be limited and the re-zoning proposal will therefore have little impact on the future agricultural capacity of this land. This is because the agricultural land within the Study Area is generally of low agricultural value, is of insufficient size to provide for viable intensive agricultural enterprises and adjacent residential land-uses may result in land-use conflicts if the Study Area is developed for an intensive agricultural land-use;
- Constraints have been identified which will impede agricultural development;
- The land-use conflict assessment identified several potential edge impacts between the Study Area and adjacent residential land-uses, but these were considered to be capable of management according to the recommendations outlined in this report; and
- This report has considered the appropriate level of development to minimize agricultural land use conflicts. Recommendations to address potential land-use conflicts are outlined in Table 9 of the report.

With regard to the three heads of consideration indicated in the brief, the following is noted:

- the capacity of the Study Area to support agricultural production was found to be low;
- under the current zoning, future agricultural potential would be limited to small scale grazing and potentially high value, high input intensive horticultural products. The latter use, however, would be constrained by water supply and potential land-conflict constraints; and
- an assessment of the constraints and opportunities of the Study Area failed to identify any high quality agricultural land (Class 1 and 2 lands) and found that the major part of the Study Area was 'Class 4' grazing land. Some 'Class 3' grazing land was identified but this land was constrained by soil, groundwater, water supply and land-use conflict constraints.

With regard to land-use conflicts, it is concluded that the proposed land re-zoning will reduce the overall potential for land-use conflicts as it will:

- provide for the creation of a buffer green belt residential buffer between the residential area of Picton and rural areas to the west of the township of Picton. This green belt will provide separation between Picton and rural land without the ability of new intensive agricultural enterprises which could not only impact on the Study Area but also the existing residential interface; and
- result in an existing interface between agricultural land and residential land to the south of the Study being re-located to the north of the Study Area. The new interface between residential land and agricultural land will in turn be separated by Abbotsford Road, which

will act as a physical barrier between the two land-uses. The provision of a physical barrier will reduce the potential for land-use conflicts between grazing and residential land-uses.

The overall loss of agricultural land as a result of the proposal is low.

No impediments to the re-zoning of the Study Area were identified in this Study.

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7.0 REFERENCES

Charman, P.E.V. & Murphy, B.W. (2000) Soils: their Properties and Management (Second Edition). Oxford University Press, Melbourne.

DIPNR (2004) Riparian Corridor Management Study : Covering all of the Wollongong Local Government Area and Calderwood Valley in the Shellharbour Local Government Area. Prepared for Wollongong City Council by Department of Infrastructure Planning and Natural Resources, March 2004.

Hazelton, P.A. & Tille, P.J. (1990) Soil Landscapes of the Wollongong to Port Hacking 1:100,000 Sheet. Soil Conservation Service of NSW, Sydney.

Ku-Ring-Gai Council. 2004. Riparian Policy dated December 2004.

Isbell, R.F. (2003) The Australian Soil Classification. CSIRO Australia, Collingwood, Australia.

Mackay City Council, 2006. Stormwater Quality Management Plan for Mackay. Mackay City Council.

Melbourne Water, 2005. Water Sensitive Urban Design (WSUD) Engineering procedures – Stormwater. CSIRO Publishing.

NSW Agriculture 1991. Agricultural Land Classification Atlas. Sydney Basin, including the Lower Nepean/Hawkesbury. NSW Agriculture.

NSW Agriculture, 2002. Agricultural Land Classification, AgFact AC.25. NSW Agriculture.

NSW Office of Water, 2010. Controlled Activities – Guidelines for riparian corridors. Dated August 2010.

NSW Office of Water, 2010. Policy and guidelines for fish friendly waterway crossing. Dated August 2010.

NSW Office of Water, 2011. Farm dam online calculator for Maximum Harvestable Right Dam Capacity (MHRDC)

http://www.water.nsw.gov.au/Water-licensing/Basic-water-rights/Harvestable-right-dams/Harvesting-runoff/default.aspx

NSW Government 1994. Fisheries Management Act. www.legislation.nsw.gov.au

NSW Government 1997. State Regional Environmental Plan No. 20 (SREP No. 20). Hawkesbury Nepean River (No. 2).

NSW Government, 2011. Wollondilly Local Environment Plan (LEP) 2011. www.legislation.nsw.gov.au

NSW State Pollution Control Commission 1980. An Atlas of Classified Waters in New South Wales. Dated January 1980.

Sherwin, L. & Holmes, G.G. (1982) Geology of the Wollongong and Port Hacking 1:100,000 sheets 9029,9129. New South Wales Geological Survey, Sydney.

State Pollution Control Commission, 1980. Atlas of Classified Waters in NSW.

Strahler, A. N. 1952. Hypsometric (Area Altitude) Analysis of Erosional Topology. *Geological Society of America Bulletin*.

PLATES

PLATE 1 Relatively flat grazing land

PLATE 2 Side-slope grazing land

PLATE 3 Steep side-slope grazing land

PLATE 4 Hill crest grazing land

PLATE 5 Infrastructure associated with a former dairy

PLATE 6 Infrastructure associated with a former dairy

PLATE 7 Infrastructure associated with a former dairy

PLATE 8 Infrastructure associated with a feed shed

PLATE 9 Infrastructure associated with a former feed shed

PLATE 10 Derelict residence

PLATE 11 Cattle yards

APPENDIX 1

SOIL PROFILE LOG 201368-01

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A	0 - 600	 Gradual	5YR 3/3	Dark Reddish Borwn	CL	Nil	Moderate	R	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised. No mixing.
B	600 - 1100	Gradual Gradual	5YR 5/6	Yellowish Red	MC	Nil	Moderate	R	N/A	N/A	+ Nodular Mn	Mottled Red / Grey
C	1100 - 3500	Gradual Gradual	Fractured shale layer.						N/A	N/A	+ Diffuse Mn	Moist but no free flowing groundwater.
C	3500 - 3800	Gradual	Pedo-logically disorganised mix of fractured shale and mottled yellow/grey light to medium clay.						N/A	N/A	+ Diffuse Mn	Suspected former slip horizon. Moist.

ASC: Australian Soil Classification

Notes:

1. Profile in area of former land-slip.
2. Profile terminated at a depth of 3.8 metres in a mix of light to medium clay and fractured shale.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-02

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A	0 - 800	Gradual Gradual	5YR 3/3	Dark Reddish Borwn	CL	Nil	Moderate	R	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised. No mixing.
B	800 - 1700	Gradual Gradual	5YR 5/6	Yellowish Red	MC	Nil	Moderate	R	N/A	N/A	+ Nodular Mn	Mottled Red / Grey. Pedo-logically organised. No mixing.
B/C	1700 - 2700	Gradual	7.5YR 5/4	Brown	MC	20-40% shale	Weak	R	N/A	N/A	+ Nodular Mn	Pedologically dis-organised. Possible slip zone.
C	>2700	Shale.									+ Nodular Mn	Moist.

ASC: Australian Soil Classification

Notes:

1. Profile in area of former land-slip.
2. Profile terminated at a depth of 2.7 metres in shale.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-03

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A	0 - 450	Gradual Gradual	5YR 5/3	Reddish Brown	CL	Nil	Moderate	R	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised. No mixing.
B	450 - 900	Gradual Gradual	2.5YR 5/3	Red	MC	Nil	Moderate	R	N/A	N/A	-	Pedo-logically organised. No mixing.
B/C	900 - 1700	Gradual Gradual	2.5YR 5/1	Reddish Grey	MC	5 - 20% shale	Weak	R	N/A	N/A	+ Diffuse Mn	
C	>1700	Gradual	Shale									

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 1.7 metres in shale.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-04

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A	0 - 500	Gradual Gradual	2.5YR 4/4	Reddish Brown	CL	Nil	Moderate	R	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised. No mixing.
B	500 - 2500	Gradual Gradual	2.5YR 4/6	Red	MC	Nil	Moderate	R	N/A	N/A	+ Nodular Mn	Pedo-logically organised. No mixing.
B/C	2500 - 4000	Gradual Gradual	5Y 8/1	White	MC	5 - 10% shale	Weak	R	N/A	N/A	-	Yellow mottles.
C	>4000	Gradual	Highly weathered shale									

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 4.0 metres in highly weathered shale.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-05

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A	0 - 350	Gradual Gradual	5YR 5/3	Reddish Brown	CL	Nil	Moderate	R	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised. No mixing.
B	350 - 650	Gradual Sharp	2.5YR 5/3	Red	MC	5% shale	Moderate	R	N/A	N/A	-	Pedo-logically organised. No mixing.
Possible slip horizon	650-750	Shale layer overlaying B horizon										Possible Slip zone
B	750 - 1900	Sharp Gradual	2.5YR 5/3	Red	MC	Nil	Moderate	R	N/A	N/A	-	Pedo-logically organised. No mixing. Grey mottles
B/C	>1900	Gradual	Weathered shale									

ASC: Australian Soil Classification

Notes:

1. 750mm deep land-slip overlying a residual soil profile.
2. Profile terminated at a depth of 1.9 metres in weathered shale.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-06

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A	0 - 500	Gradual Gradual	2.5YR 3/1	Very dark grey	CL	1-2 % shale	Moderate	R	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised. No mixing.
B	500 - 1100	Gradual Gradual	2.5YR 6/6	Olive yellow	LC	Nil	Massive	R	N/A	N/A	-	Pedo-logically organised. No mixing. Porous
B/C	1100 - 2900	Gradual Gradual	2.5YR 6/6	Olive yellow	LC	5 - 10% shale	Weak	R	N/A	N/A	-	Pedo-logically organised. No mixing. Porous
C	>2900	Gradual	Highly weathered shale									

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 2.9 metres in highly weathered shale.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-07

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A	0 - 900	Gradual Gradual	5YR 4/3	Reddish brown	CL	Nil.	Moderate	R	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised.
$B2_1$	900 - 3500	Gradual Gradual	5YR 5/3	Reddish Brown	LC	1-2% shale	Massive	R	N/A	N/A	+ Nodular Mn	Pedo-logically organised. Porous. Very hard
$B2_2$	3500 - 4000	Gradual Gradual	2.5YR 5/6	Red	MC	Nil	Weak	R	N/A	N/A	+ Diffuse Mn	Pedo-logically organised. Grey mottles. Moist.
$B2_2$	>4000	Gradual	Highly weathered shale									

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 4.0 metres in B2 medium clay horizon.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-08

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A	0 - 500	Gradual Gradual	5YR 4/3	Reddish brown	CL	Nil.	Moderate	R	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised.
$B2_1$	50 - 1200	Gradual Gradual	5YR 5/3	Reddish Brown	MC	1-2% shale	Massive	R	N/A	N/A	-	Pedo-logically organised. Porous. Very hard
$B2_2$	> 1200	Gradual	2.5YR 6/2	Pale red	MC	1-2% shale	Massive	R	N/A	N/A	-	Pedo-logically organised. Porous. Very hard Mottled grey/red.

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 1.2 metres in $B2_2$ medium clay horizon.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-09

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A1	0 - 500	Gradual Gradual	7.5YR 5/1	Grey	CL	Nil.	Massive	-	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised.
$B2_1$	500 - 1200	Gradual Gradual	2.5Y 6/4	Light yellowish brown	LC	Nil.	Weak	R	N/A	N/A	+ Nodular Mn	Pedo-logically organised. Porous. Periodically saturates.
$B2_2$	1200- 3800	Gradual	Gley 1 7/N	Light grey	MC	Nil.	Weak	R	N/A	N/A	-	Pedo-logically organised. Porous. Mottled grey/red.
$B2_3$	3800- 4200	Gradual	2.5YR 6/2	Pale red	MC	Nil.	Massive	R	N/A	N/A	+ Nodular Mn	Pedo-logically organised. Porous. Mottled grey/red.

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 4.2 metres in $B2_3$ medium clay horizon.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-10

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A1	0 - 250	Gradual Gradual	7.5YR 5/1	Grey	CL	Nil.	Massive	-	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised.
$B2_1$	250 - 1000	Gradual Gradual	10YR 6/6	Brownish yellow	MC	Nil.	Weak	R	N/A	N/A	-	Pedo-logically organised. Porous.
$B2_2$	1000 - 1200	Gradual	10YR 7/1	Light grey	MC	Nil.	Weak	R	N/A	N/A	-	Pedo-logically organised. Mottled grey/yellow.

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 1.2 metres in $B2_2$ medium clay horizon.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-11

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A1	0 - 400	Gradual Gradual	5 YR 5/1	Grey	CL	Nil.	Massive	-	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised.
$B2_1$	400 - 1700	Gradual Gradual	5YR 5/6	Yellowish red	MC	Nil.	Weak	R	N/A	N/A	+ Diffuse and nodular Mn	Pedo-logically organised. Porous. Mottled red/grey

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 1.7 metres in $B2_1$ medium clay horizon.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-12

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Alluvium overlying Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A1	0 - 600	Gradual Gradual	5YR 4/1	Dark grey	Clayey Sand	Nil.	Massive	-	N/A	N/A	-	Alluvium Hard-setting and porous.
A2	600 - 1200	Gradual Gradual	2.5Y 7/1	Light Grey	Clayey Sand	Nil	Massive	-				Bleached Alluvium Hard-setting Porous
$B2_1$	1200- 3200	Gradual	5YR 5/6	Yellowish red	FSLC	Nil.	Weak	R	N/A	N/A	+ Diffuse and nodular Mn	Pedo-logically organised. Mottled red/grey

ASC: Australian Soil Classification

Notes:

1. Alluvium overlying a residual soil profile.
2. Profile terminated at a depth of 3.2 metres in $B2_1$ FSLC clay horizon.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
FSLC = Fine Sandy Light Clay
N/A = Not assessed
R = Rough
S = Smooth
OM = Organic Matter
Mn = Ferromagniferous Manganese
WS = Weathered shale

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-13

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A1	0 - 400	Gradual Gradual	2.5YR 6/3	Light Yellowish Brown	CL	Nil.	Weak	-	N/A	N/A	+ Diffuse Mn or OM	Topsoil, pedo-logically organised.
$B2_1$	400 - 800	Gradual Gradual	7.5YR 5/6	Strong Brown	LC	Nil.	Weak	R	N/A	N/A	+ Nodular Mn	Pedo-logically organised. Porous. Periodically saturates.
$B2_2$	800- 4300	Gradual	Gley 1 7/N	Light grey	MC	Nil.	Weak	R	N/A	N/A	-	Pedo-logically organised. Porous. Mottled grey/red.

ASC: Australian Soil Classification

Notes:

1. Residual soil profile.
2. Profile terminated at a depth of 4.3 metres in $B2_3$ medium clay horizon.
3. Free flowing groundwater present at 4.2 metres

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
N/A = Not assessed
R = Rough
S = Smooth
WS = Weathered shale
OM = Organic Matter
Mn = Ferromagniferous Manganese
LC = Light Clay

Author	JC
Date Logged	09/01/2013

SOIL PROFILE LOG 201368-14

Project	Re-zoning	**Method of Investigation**	Mechanical excavation
Job Number	201368	**Aspect**	
Location	No. 1 Abbotsford Road, Abbotsford	**Slope**	
Land Use	Grazing	**Topography**	
Geology	Alluvium overlying Ashfield Shale	**Soil Landscape Unit**	
ASC Classification		**External Drainage**	

Horizon	Depth (mm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	$CaCO_3$	pH	H_2O_2 test	Comments
A1	0 - 300	Gradual Gradual	7.5YR 4/4	Strong Brown	FSCL	Nil.	Massive	-	N/A	N/A	-	Alluvium Hard-setting and porous.
A2	300 - 1200	Gradual Gradual	7.5YR 5/6	Strong Brown	Sandy Clay	Nil	Massive	-			+ Diffuse	Bleached Alluvium Hard-setting Porous
$B2_1$	1200- 2900	Gradual	5YR 5/6	Yellowish red	Sandy Clay	Nil.	Weak	R	N/A	N/A	+ Diffuse and nodular Mn	Pedo-logically organised. Mottled Yellow/grey

ASC: Australian Soil Classification

Notes:

1. Alluvium overlying a residual soil profile.
2. Profile terminated at a depth of 2.9 metres in $B2_1$ Sandy Clay horizon.

Abbreviations:

CL = Clay Loam
MC = Medium Clay
HC = Heavy Clay
FSLC = Fine Sandy Light Clay
N/A = Not assessed
R = Rough
S = Smooth
OM = Organic Matter
Mn = Ferromagniferous Manganese
WS = Weathered shale

Author	JC
Date Logged	09/01/2013

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CLIENT		Job No.	Borehole No.	Digga	✓	Logged
PROJECT			15	Gemco		S.W.
		Lot No.	R.L.	Fox		Date
		–	E/S	Hand Auger		22/01/13

LAYER		1	2	3	4	5	6
GEOL PROFILE	Fill	✓					
	Topsoil						
	Alluvium	✓	✓	✓			
	Indurated Sand						
	Colluvium						
	Residual Soil						
	EW Rock						
	Other						
Depth to base of layer		0.10 m	1.20 m	4.30 m	m	m	m

SOIL Components	1 Primary	1 Second	2 Primary	2 Second	3 Primary	3 Second	4 Primary	4 Second	5 Primary	5 Second	6 Primary	6 Second
Gravel												
Sand	✓		✓			✓						
Silt		✓		✓		✓						
Clay					✓							
Peat												

	1	2	3	4	5	6
USC SYMBOL	SM/	SM/	CL/CH			
PLASTICITY (L - M - H)			M ✓ / H ✓			
GRANULAR MATERIAL Grading (Poor Gap Well)						
Grain Size (F - M - C) Primary	F ✓, M ✓	F ✓, M ✓				
Grain Size (F - M - C) Second			F ✓, M ✓ 35 25%			

MINOR MATERIAL	1 Some	1 Trace	2 Some	2 Trace	3 Some	3 Trace	4 Some	4 Trace	5 Some	5 Trace	6 Some	6 Trace
Gravel												
Sand												
Silt												
Clay												

COLOUR	1	2	3	4	5	6
Brown			✓			
Red-Brown						
Yellow-Brown						
Grey	✓	light	✓			
White						
Black						
Other						

	1	2	3	4	5	6
MOISTURE CONTENT (W < pl > D)	D ✓	D ✓	pl ✓ > ✓			
RELATIVE DENSITY (VL L MD D VD)		MD ✓				
CONSISTENCY (VS S F St Vst)			St ✓ Vst ✓			
ORGANIC MATTER Roots	GRASS					
Plant						
Finely Disseminated						

Termination of Hole					
TC-Bit	V-Bit	Full Depth	Water X	Collapse X	Cobbles
Boulders	Hard Clays		NIL	NIL	

GROUNDWATER

General Notes

DCP/SPT RESULTS

Depth	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Reading																														

Depth	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
Reading																														

Grant Alexander & Associates Pty. Ltd

CLIENT		Job No.	Borehole No.	Digga	✓	Logged
			16	Gemco		S.W.
PROJECT		Lot No.	R.L.	Fox		Date
		—	E/S	Hand Auger		22/01/13

LAYER		1	2	3	4	5	6
GEOL PROFILE	Fill						
	Topsoil	✓					
	Alluvium		✓	✓	✓		
	Indurated Sand						
	Colluvium						
	Residual Soil						
	EW Rock						
	Other						
Depth to base of layer		0.15 m	1.30 m	1.90 m	4.30 m	m	m

SOIL Components	1 Primary	1 Second	2 Primary	2 Second	3 Primary	3 Second	4 Primary	4 Second	5 Primary	5 Second	6 Primary	6 Second
Gravel												
Sand	✓		✓			✓						
Silt		✓		✓		✓		✓				
Clay				✓	✓		✓					
Peat												

	1	2	3	4	5	6
USC SYMBOL	SM	SM/CL	CL/CH	CL/CH		
PLASTICITY (L - M - H)		M	M / H	M / H		
GRANULAR MATERIAL Grading (Poor Gap Well)						
Grain Size (F - M - C) Primary	F ✓ M ✓	F ✓ M ✓				
Grain Size (F - M - C) Second			F ✓ M ✓	F ✓ 30%		
MINOR MATERIAL (Some / Trace) Gravel						
Sand						
Silt						
Clay						
COLOUR Brown	light ✓	✓	✓ DARK			
Red-Brown						
Yellow-Brown				✓		
Grey	✓			✓		
White						
Black						
Other						
MOISTURE CONTENT (W < pl > D)	D/W ✓	> ✓	pl ✓	> ✓		
RELATIVE DENSITY (VL L MD D VD)						
CONSISTENCY (VS S F St Vst)		Vst ✓	Vst ✓	Vst ✓		
ORGANIC MATTER Roots	LARGES					
Plant						
Finely Disseminated						

Termination of Hole	TC-Bit	V-Bit	Full Depth	Water	Collapse	Cobbles
	Boulders	Hard Clays				

GROUNDWATER

General Notes

DCP/SPT RESULTS

Depth	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Reading																														
Depth	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
Reading																														

Grant Alexander & Associates Pty. Ltd

CLIENT		Job No.	Borehole No.	Digga	✓	Logged
			17	Gemco		S.F.W
PROJECT				Fox		Date
		Lot No. –	R.L. E/S	Hand Auger		22/07/13

LAYER		1	2	3	4	5	6
GEOL PROFILE	Fill						
	Topsoil	✓					
	Alluvium		✓ ??				
	Indurated Sand						
	Colluvium						
	Residual Soil		✓	✓			
	EW Rock						
	Other						
Depth to base of layer		0.10 m	1.30 m	4.30 m	m	m	m

SOIL Components	1 Primary	1 Second	2 Primary	2 Second	3 Primary	3 Second	4 Primary	4 Second	5 Primary	5 Second	6 Primary	6 Second
Gravel												
Sand	✓			✓		✓						
Silt		✓		✓		✓						
Clay			✓		✓							
Peat												

	1	2	3	4	5	6
USC SYMBOL	SM	CL/CH	CL/CH			
PLASTICITY (L - M - H)		M ✓, H ✓	M ✓, H ✓			
GRANULAR MATERIAL Grading (Poor Gap Well)						
Grain Size (F - M - C) Primary	F ✓, M ✓					
Second		✓ 20%	✓ 25%			
MINOR MATERIAL Gravel (Some / Trace)			Some: IRON STONE; Trace: ✓			
Sand						
Silt						
Clay						
COLOUR Brown	✓	✓				
Red-Brown			✓			
Yellow-Brown			✓			
Grey			light ✓			
White						
Black						
Other						
MOISTURE CONTENT (W < pl > D)	D ✓	< pl ✓	> pl ✓			
RELATIVE DENSITY (VL L MD D VD)						
CONSISTENCY (VS S F St Vst)		Vst ✓	St ✓, Vst ✓ ✗			
ORGANIC MATTER Roots	GRASS	HARD	MOTTLED			
Plant						
Finely Disseminated						

Termination of Hole						
TC-Bit	V-Bit	Full Depth	Water ✗	Collapse ✗	Cobbles	
Boulders	Hard Clays		NIL	NIL		

GROUNDWATER

General Notes

DCP/SPT RESULTS																														
Depth	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Reading																														
Depth	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
Reading																														

Grant Alexander & Associates Pty. Ltd

CLIENT	Job No.	Borehole No.	Digga	✓ Logged
PROJECT		18	Gemco	S.F.W.
	Lot No.	R.L.	Fox	Date
	—	E/S	Hand Auger	22/01/13

LAYER	1	2	3	4	5	6
GEOL PROFILE – Fill						
Topsoil	✓					
Alluvium		[illegible]				
Indurated Sand						
Colluvium						
Residual Soil		✓				
EW Rock						
Other						
Depth to base of layer	0.10 m	4.30 m	m	m	m	m

SOIL Components	1 Primary	1 Second	2 Primary	2 Second	3 Primary	3 Second	4 Primary	4 Second	5 Primary	5 Second	6 Primary	6 Second
Gravel												
Sand	✓			✓								
Silt		✓		✓								
Clay			✓									
Peat												

	1	2	3	4	5	6
USC SYMBOL	SM	CL				
PLASTICITY (L - M - H)		M ✓				
GRANULAR MATERIAL – Grading (Poor Gap Well)						
Grain Size (F - M - C) – Primary	F ✓, M ✓					
Grain Size – Second		F ✓, M ✓ 325%				
MINOR MATERIAL (Some / Trace) – Gravel, Sand, Silt, Clay						
COLOUR – Brown		✓ light				
Red-Brown						
Yellow-Brown						
Grey	✓ light	✓ light				
White						
Black						
Other						
MOISTURE CONTENT (W < pl > D)	D	< m				
RELATIVE DENSITY (VL L MD D VD)						
CONSISTENCY (VS S F St Vst)		St ✓ Vst ✓				
ORGANIC MATTER – Roots	GRASS	mottled				
Plant		>3.0m				
Finely Disseminated		≤PL				

Termination of Hole					
TC-Bit	V-Bit	Full Depth ✓	Water ✗	Collapse ✗	Cobbles
Boulders	Hard Clays		NIL	NIL	

GROUNDWATER

General Notes

DCP/SPT RESULTS

Depth	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Reading																														
Depth	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
Reading																														

CLIENT		Job No.	Borehole No. 19	Digga	✓	Logged S.F.W
PROJECT		Lot No. —	R.L. E/S	Gemco		
				Fox		Date 22/01/13
				Hand Auger		

LAYER		1	2	3	4	5	6
GEOL PROFILE	Fill						
	Topsoil	✓					
	Alluvium		✓	✓			
	Indurated Sand						
	Colluvium						
	Residual Soil						
	EW Rock						
	Other						
Depth to base of layer		0.15 m	0.70 m	4.30 m	m	m	m

SOIL Components	1 Primary	1 Second	2 Primary	2 Second	3 Primary	3 Second	4 Primary	4 Second	5 Primary	5 Second	6 Primary	6 Second
Gravel												
Sand	✓		✓			✓						
Silt		✓		✓		✓						
Clay					✓							
Peat												

	1	2	3	4	5	6
USC SYMBOL	SM	SM	CL			
PLASTICITY (L - M - H)			M			
GRANULAR MATERIAL Grading (Poor / Gap / Well)						
Grain Size Primary (F - M - C)	F, M	F, M				
Grain Size Second (F - M - C)			F, M 325%			
MINOR MATERIAL Gravel (Some / Trace)			Some: IRON STONE GRAVEL			
MINOR MATERIAL Sand						
MINOR MATERIAL Silt						
MINOR MATERIAL Clay						
COLOUR Brown	light					
COLOUR Red-Brown		✓	✓			
COLOUR Yellow-Brown						
COLOUR Grey			✓			
COLOUR White						
COLOUR Black						
COLOUR Other						
MOISTURE CONTENT (W < pl > D)	D	D	M			
RELATIVE DENSITY (VL L MD D VD)		VD				
CONSISTENCY (VS S F St Vst)			Vst			
ORGANIC MATTER Roots	GRASS		HARD			
ORGANIC MATTER Plant						
Finely Disseminated						

Termination of Hole						
TC-Bit	V-Bit	Full Depth ✓	Water X	Collapse X	Cobbles	
Boulders	Hard Clays		NIL	NIL		

GROUNDWATER | General Notes

DCP/SPT RESULTS																														
Depth	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
Reading																														
Depth	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
Reading																														

APPENDIX 2

Reference: 201368
Horizon: A
Soil Type: Alluvial

Location	ph (1:5)	Chloride (ppm)	Sulphate (1:5) (ppm)	Resistivity (ohm.m)	Resistivity (ohm.cm)	EC (1:5)	Texture class	ECe (dS/m)	ESP (%)	PRI (mg/kg)	eCEC
12 (0-300)	6.5	30	20	113.9	11390	0.02	14	0.28	0.8	535.4	4.9
14 (0-300)	6.7	50	10	106.2	10620	0.02	14	0.28	0.8	639.7	5.7
Min	**6.5**	**30**	**10**	**106.2**	**10620**	**0.02**	**14**	**0.3**	**0.8**	**535.4**	**4.9**
Max	**6.7**	**50**	**20**	**113.9**	**11390**	**0.02**	**14**	**0.3**	**0.8**	**639.7**	**5.7**

Reference: 201368
Horizon: B
Soil Type: Alluvial

Location	ph (1:5)	Chloride (ppm)	Sulphate (1:5) (ppm)	Resistivity (ohm.m)	Resistivity (ohm.cm)	EC (1:5)	Texture class	ECe (dS/m)	ESP (%)	PRI (mg/kg)	eCEC
12 (600-800)	6.6	10	5	365.9	36590	0.02	10	0.2	1.6	125.7	1.6
14 (800-1000)	6.7	40	20	177.7	17770	0.02	9	0.18	1.4	795.2	4.8
Min	**6.6**	**10**	**5**	**177.7**	**17770**	**0.02**	**9**	**0.18**	**1.4**	**125.7**	**1.6**
Max	**6.7**	**40**	**20**	**365.9**	**36590**	**0.02**	**10**	**0.2**	**1.6**	**795.2**	**4.8**

Reference: 201368
Horizon: B/C
Soil Type: Alluvial

Location	ph (1:5)	Chloride (ppm)	Sulphate (1:5) (ppm)	Resistivity (ohm.m)	Resistivity (ohm.cm)	EC (1:5)	Texture class	ECe (dS/m)	ESP (%)	CEC
12 (1200-1800)	7.3	80	40	68.9	6890	0.02	8.5	0.17	2	**10.4**
Min	**7.3**	**80**	**40**	**68.9**	**6890**	**0.02**	**8.5**	**0.2**	**2**	**10.4**
Max	**7.3**	**80**	**40**	**68.9**	**6890**	**0.02**	**8.5**	**0.2**	**2**	**10.4**

Reference: 201368
Horizon: A
Soil Type: Residual Soils

Location	ph (1:5)	Chloride (ppm)	Sulphate (1:5) (ppm)	Resistivity (ohm.m)	Resistivity (ohm.cm)	EC (1:5)	Texture class	ECe (dS/m)	ESP (%)	PRI (mg/kg)	eCEC
02 (0-300)	6.1	30	70	42.8	4280	0.06	9	0.54	0.8	1120.4	9.5
08 (0-300)	6.7	40	40	53	5300	0.03	9	0.27	0.5	530.4	9.2
09 (0-500)	7.4	40	20	56.2	5620	0.03	9	0.27	1.9	381.7	8.5
10 (0-250)	6.3	30	30	27.9	2790	0.11	9	0.99	1.3	809.4	7.6
11 (0-400)	6.8	50	20	65.2	6520	0.02	8.5	0.17	0.8	741.5	0.2
13 (0-300)	6.9	230	20	26.4	2640	0.04	7	0.28	5.1	783.1	10.2
Min	**6.1**	**30**	**20**	**26.4**	**2640**	**0.02**	**7**	**0.2**	**0.5**	**381.7**	**0.2**
Max	**7.4**	**230**	**70**	**65.2**	**6520**	**0.11**	**9**	**1.0**	**5.1**	**1120.4**	**10.2**

Reference: 201368
Horizon: B
Soil Type: Residual Soils

Location	ph (1:5)	Chloride (ppm)	Sulphate (1:5) (ppm)	Resistivity (ohm.m)	Resistivity (ohm.cm)	EC (1:5)	Texture class	ECe (dS/m)	ESP (%)	PRI (mg/kg)	CEC
02 (800-1000)	7.1	130	40	47.6	4760	0.03	7	0.21	3.8	869.4	12.8
08 (600-800)	7.2	120	50	48.5	4850	0.03	7	0.21	2.7	1662.2	15.3
09 (1000-1200)	8.8	790	170	7.3	730	0.28	7	1.96	35.2	940.2	12.8
10 (400-600)	6	410	170	6.7	670	0.32	7	2.24	5.5	991.8	18.3
11 (800-1000)	7.2	100	20	68	6800	0.02	7	0.14	1.5	1241.2	12.2
13 (600-800)	6.9	1110	120	3.4	340	0.69	7	4.83	29.8	841.5	15.8
Min	**6**	**100**	**20**	**3.4**	**340**	**0.02**	**7**	**0.14**	**1.5**	**841.5**	**12.2**
Max	**8.8**	**1110**	**170**	**68**	**6800**	**0.69**	**7**	**4.83**	**35.2**	**1662.2**	**18.3**

Reference: 201368
Horizon: B/C
Soil Type: Residual Soils

Location	ph (1:5)	Chloride (ppm)	Sulphate (1:5) (ppm)	Resistivity (ohm.m)	Resistivity (ohm.cm)	EC (1:5)	Texture class	ECe (dS/m)	ESP (%)	CEC
02 (2400-2800)	7.4	170	10	38.7	3870	0.04	8.5	0.34	6.7	12.5
08 (1000-1200)	5.4	20	130	50.7	5070	0.06	7	0.42	7.9	8.2
09 (2500-2800)	8.4	1330	550	3	300	0.93	7	6.51	27.5	21.5
10 (1000-1200)	8.5	1300	40	3.8	380	0.82	8.5	6.97	11	24.5
11 (1500-1700)	7.3	110	40	41.1	4110	0.04	8.5	0.34	8	9.3
13 (4000-4300)	8.3	440	40	15.5	1550	0.12	8.5	1.02	13.2	11.4
Min	**5.4**	**20**	**10**	**3**	**300**	**0.04**	**7**	**0.3**	**6.7**	**8.2**
Max	**8.5**	**1330**	**550**	**50.7**	**5070**	**0.93**	**8.5**	**7.0**	**27.5**	**24.5**

Effluent Subdivison Profile

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Certified System Quality ISO 9001

Batch N°: 25211 | **Sample N°: 1** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-02 (0-300)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.1	Slight Acidity
pH in $CaCl_2$ 1:5	5.3	Strong Acidity
EC mS/cm 1:5	0.06	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.075	0.8	
Potassium			0.79	8.3	
Calcium			6.8	71.8	
Magnesium			1.8	19	
Aluminium			-	-	
		ECEC	9.5		Low
		Ca/Mg	6.2		Normal

Phosphate Retention Index (%): 19.50 Low | **PRI (mgP/kg):** 1120.4 | **PRI (kg/ha):** 2185 to 150mm

PHYSICAL CHARACTERISTICS — Comment

Texture:	Clay Loam	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	25 - 35%		
Potential infiltration rate:	Moderate		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 2** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-02 (800-1000)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	7.1	Neutral pH
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	0.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.49	3.8	
Potassium			0.12	0.9	
Calcium			8.4	65.6	
Magnesium			3.8	29.7	
Aluminium			-	-	
		ECEC	12.8		Moderate
		Ca/Mg	3.6		Normal

Phosphate Retention Index (%): 15.10 Low | **PRI (mgP/kg):** 869.4 | **PRI (kg/ha):** 1695 to 150mm

PHYSICAL CHARACTERISTICS — Comment

Texture:	Medium Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	40 - 55%		
Potential infiltration rate:	Very Slow		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211 | **Sample N°: 3** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-08 (0-300)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.7	Very Slight Acidity
pH in $CaCl_2$ 1:5	5.9	Medium Acidity
EC mS/cm 1:5	0.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.049	0.5	
Potassium			0.74	8.1	
Calcium			6.5	70.7	
Magnesium			1.9	20.7	
Aluminium			-	-	
		ECEC	9.2		Low
		Ca/Mg	5.6		Normal

Phosphate Retention Index (%): 9.20 Very Low **PRI (mgP/kg):** 530.4 **PRI (kg/ha):** 1034 to 150mm

PHYSICAL CHARACTERISTICS **Comment**

Texture:	Clay Loam	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	25 - 35%	> 2mm	Gravel
Potential infiltration rate:	Moderate	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Not gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 **Sample N°: 4** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-08 (600-800)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	7.2	Neutral pH
pH in $CaCl_2$ 1:5	6.1	Slight Acidity
EC mS/cm 1:5	0.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.42	2.7	
Potassium			1.3	8.5	
Calcium			7.5	49	
Magnesium			6.1	39.8	
Aluminium			-	-	
		ECEC	15.3		Moderate
		Ca/Mg	2		Low - Magnesic

Phosphate Retention Index (%): 28.90 Low **PRI (mgP/kg):** 1662.2 **PRI (kg/ha):** 3241 to 150mm

PHYSICAL CHARACTERISTICS **Comment**

Texture:	Medium Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	40 - 55%	> 2mm	Gravel
Potential infiltration rate:	Very Slow	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Not gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 5** | **Date Received: 29/1/13** | **Report Status:** ○ **Draft** ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-09 (0-500)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	7.4	Slight Alkalinity
pH in $CaCl_2$ 1:5	6.4	Slight Acidity
EC mS/cm 1:5	0.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.16	1.9	
Potassium			0.54	6.4	
Calcium			4.4	51.8	
Magnesium			3.4	40	
Aluminium			-	-	
		ECEC	8.5		Low
		Ca/Mg	2.1		Low - Magnesic

Phosphate Retention Index (%): 6.60 Very Low **PRI (mgP/kg):** 381.7 **PRI (kg/ha):** 744 to 150mm

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Clay Loam
Texture comment:	
Size:	
Aggregate strength:	Did not test
Structural unit:	Did not test
Approx. Clay Content (%):	25 - 35%
Potential infiltration rate:	Moderate
Gravel Content:	Soil is Not gravelly
Additional comments:	

Field Density (g/mL):	
Emerson Stability Class:	H20
High SAR/Low Iconic Strength:	
Med SAR/High Iconic Strength:	

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Certified System Quality ISO 9001

Batch N°: 25211 | **Sample N°: 6** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-09 (1000-1200)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	8.8	Strong Alkalinity
pH in $CaCl_2$ 1:5	7.3	Slight Alkalinity
EC mS/cm 1:5	0.28	Elevated Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			4.5	35.2	
Potassium			0.29	2.3	
Calcium			3.1	24.2	
Magnesium			4.9	38.3	
Aluminium			-	-	
		ECEC	12.8		Moderate
		Ca/Mg	1		Low - Magnesic

Phosphate Retention Index (%): 15.90 Low **PRI (mgP/kg):** 914.2 **PRI (kg/ha):** 1783 to 150mm

PHYSICAL CHARACTERISTICS **Comment**

Texture:	Medium Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	40 - 55%		
Potential infiltration rate:	Very Slow		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 7** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-10 (0-250)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.3	Slight Acidity
pH in $CaCl_2$ 1:5	5.5	Strong Acidity
EC mS/cm 1:5	0.11	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.098	1.3	
Potassium			1.4	18.4	
Calcium			4.1	54	
Magnesium			2	26.3	
Aluminium			-	-	
		ECEC	7.6		Low
		Ca/Mg	3.4		Normal

Phosphate Retention Index (%): 14.10 Low **PRI (mgP/kg):** 809.4 **PRI (kg/ha):** 1578 to 150mm

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Clay Loam
Texture comment:	
Size:	
Aggregate strength:	Did not test
Structural unit:	Did not test
Approx. Clay Content (%):	25 - 35%
Potential infiltration rate:	Moderate
Gravel Content:	Soil is Gravelly
Additional comments:	

Field Density (g/mL):	
Emerson Stability Class:	H20
High SAR/Low Iconic Strength:	
Med SAR/High Iconic Strength:	

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211	Sample N°: 8	Date Received: 29/1/13	Report Status: ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-10 (400-600)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.0	Medium Acidity
pH in $CaCl_2$ 1:5	5.5	Strong Acidity
EC mS/cm 1:5	0.32	Elevated Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1	5.5	
Potassium			1.1	6	
Calcium			6.5	35.5	
Magnesium			9.7	53	
Aluminium			-	-	
		ECEC	18.3		Moderate
		Ca/Mg	1.1		Low - Magnesic

Phosphate Retention Index (%): 17.20 Low **PRI (mgP/kg):** 991.8 **PRI (kg/ha):** 1934 to 150mm

PHYSICAL CHARACTERISTICS — Comment

Texture:	Medium Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	40 - 55%	> 2mm	Gravel
Potential infiltration rate:	Very Slow	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Not gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211 **Sample N°: 9** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-11 (0-400)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.8	Very Slight Acidity
pH in $CaCl_2$ 1:5	5.9	Medium Acidity
EC mS/cm 1:5	<0.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.061	0.8	
Potassium			0.35	4.9	
Calcium			4.8	66.6	
Magnesium			2	27.7	
Aluminium			-	-	
		ECEC	7.2		Low
		Ca/Mg	4		Normal

Phosphate Retention Index (%): 12.90 Low **PRI (mgP/kg):** 741.5 **PRI (kg/ha):** 1446 to 150mm

PHYSICAL CHARACTERISTICS **Comment**

Texture:	Light Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	35 - 40%		
Potential infiltration rate:	Slow		
Gravel Content:	Soil is Gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211 | **Sample N°: 10** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-11 (800-1000)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	7.2	Neutral pH
pH in $CaCl_2$ 1:5	6.1	Slight Acidity
EC mS/cm 1:5	<0.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.18	1.5	
Potassium			0.16	1.3	
Calcium			6.4	52.3	
Magnesium			5.5	44.9	
Aluminium			-	-	
		ECEC	12.2		Moderate
		Ca/Mg	1.9		Low - Magnesic

Phosphate Retention Index (%): 21.60 Low **PRI (mgP/kg):** 1241.2 **PRI (kg/ha):** 2420 to 150mm

PHYSICAL CHARACTERISTICS **Comment**

Texture:	Medium Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	40 - 55%		
Potential infiltration rate:	Very Slow		
Gravel Content:	Soil is Gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 11** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-12 (0-300)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.5	Slight Acidity
pH in $CaCl_2$ 1:5	5.3	Strong Acidity
EC mS/cm 1:5	<0.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.038	0.8	
Potassium			0.16	3.3	
Calcium			3.5	71.5	
Magnesium			1.2	24.5	
Aluminium			-	-	
		ECEC	4.9		Very Low
		Ca/Mg	4.8		Normal

Phosphate Retention Index (%): 9.30 Very Low **PRI (mgP/kg):** 535.4 **PRI (kg/ha):** 1044 to 150mm

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Fine Sandy Clay Loam	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	20 - 30%		
Potential infiltration rate:	Moderate		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211	**Sample N°:** 12	**Date Received:** 29/1/13	**Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-12 (600-800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.6	Very Slight Acidity
pH in $CaCl_2$ 1:5	5.7	Medium Acidity
EC mS/cm 1:5	<0.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE meq%	SOLUBLE Comment	EXCHANGEABLE meq%	EXCHANGEABLE % of ECEC	EXCHANGEABLE Comment
Sodium			0.025	1.6	
Potassium			0.073	4.7	
Calcium			1.1	70.2	
Magnesium			0.37	23.6	
Aluminium			-	-	
		ECEC	1.6		Very Low
		Ca/Mg	4.9		Normal

Phosphate Retention Index (%): 2.20 Very Low **PRI (mgP/kg):** 125.7 **PRI (kg/ha):** 245 to 150mm

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Sandy Loam	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	10 - 20%	> 2mm	Gravel
Potential infiltration rate:	Rapid	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Not gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 13** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name: **Harvest Scientific Services**
Client Contact: **Jim Cupitt**
Client Job N°:
Client Order N°:
Address: **PO Box 427 NARELLAN NSW 2567**

Project Name: **REF: 201368**
Location:
SESL Quote N°:
Sample Name: **201368-13 (0-300)**
Description: **Soil**
Test Type: **CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.9	Neutral pH
pH in $CaCl_2$ 1:5	5.8	Medium Acidity
EC mS/cm 1:5	0.04	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.52	5.1	
Potassium			0.65	6.4	
Calcium			5	49.2	
Magnesium			4	39.3	
Aluminium			-	-	
		ECEC	10.2		Low
		Ca/Mg	2.1		Low - Magnesic

Phosphate Retention Index (%): 13.60 Low **PRI (mgP/kg):** 783.1 **PRI (kg/ha):** 1527 to 150mm

PHYSICAL CHARACTERISTICS — **Comment**

Texture: Medium Clay
Texture comment:
Size:
Aggregate strength: Did not test
Structural unit: Did not test
Approx. Clay Content (%): 40 - 55%
Potential infiltration rate: Very Slow
Gravel Content: Soil is Not gravelly
Additional comments:

Field Density (g/mL):
Emerson Stability Class: H20
High SAR/Low Iconic Strength:
Med SAR/High Iconic Strength:

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Certified System Quality ISO 9001

Batch N°: 25211 | **Sample N°: 14** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-13 (600-800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.9	Neutral pH
pH in $CaCl_2$ 1:5	6.4	Slight Acidity
EC mS/cm 1:5	0.69	Very High Salinity (saline)

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			4.7	29.8	
Potassium			0.056	0.4	
Calcium			5.5	34.9	
Magnesium			5.5	34.9	
Aluminium			-	-	
		ECEC	15.8		Moderate
		Ca/Mg	1.6		Low - Magnesic

Phosphate Retention Index (%): 14.60 Low **PRI (mgP/kg):** 841.5 **PRI (kg/ha):** 1641 to 150mm

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Medium Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	40 - 55%	> 2mm	Gravel
Potential infiltration rate:	Very Slow	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211 **Sample N°: 15** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-14 (0-300)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.7	Very Slight Acidity
pH in $CaCl_2$ 1:5	5.5	Strong Acidity
EC mS/cm 1:5	<0.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.045	0.8	
Potassium			0.26	4.6	
Calcium			4.4	77.1	
Magnesium			1	17.5	
Aluminium			-	-	
		ECEC	5.7		Low
		Ca/Mg	7.2		Normal

Phosphate Retention Index (%): 11.10 Low **PRI (mgP/kg):** 639.7 **PRI (kg/ha):** 1247 to 150mm

PHYSICAL CHARACTERISTICS **Comment**

Texture:	Sandy Loam	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	10 - 20%	> 2mm	Gravel
Potential infiltration rate:	Rapid	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Not gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211 **Sample N°: 16** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-14 (800-1000)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water 1:5	6.7	Very Slight Acidity
pH in $CaCl_2$ 1:5	5.8	Medium Acidity
EC mS/cm 1:5	<0.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.068	1.4	
Potassium			0.083	1.7	
Calcium			3.4	71.6	
Magnesium			1.2	25.3	
Aluminium			-	-	
		ECEC	4.8		Very Low
		Ca/Mg	4.7		Normal

Phosphate Retention Index (%): 13.80 Low **PRI (mgP/kg):** 795.2 **PRI (kg/ha):** 1550 to 150mm

PHYSICAL CHARACTERISTICS **Comment**

Texture:	Sandy Clay Loam	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	20 - 30%		
Potential infiltration rate:	Moderate		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211 | **Sample N°: 17** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-02 (2400-2800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water 1:5	7.4	Slight Alkalinity
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	0.04	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.84	6.7	
Potassium			0.14	1.1	
Calcium			7.4	59.3	
Magnesium			4.1	32.9	
Aluminium			-	-	
		ECEC	12.5		Moderate
		Ca/Mg	3		Normal

Phosphate Retention Index (%): | **PRI (mgP/kg):** | **PRI (kg/ha):**

PHYSICAL CHARACTERISTICS | **Comment**

Texture:	Light Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	35 - 40%	> 2mm	Gravel
Potential infiltration rate:	Slow	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Not gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211 | **Sample N°: 18** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-08 (1000-1200)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water 1:5	5.4	Strong Acidity
pH in $CaCl_2$ 1:5	4.2	Very Strong Acidity
EC mS/cm 1:5	0.06	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.65	7.9	
Potassium			0.37	4.5	
Calcium			2.5	30.4	
Magnesium			4.7	57.2	
Aluminium			-	-	
		ECEC	8.2		Low
		Ca/Mg	.9		Low - Magnesic

Phosphate Retention Index (%): **PRI (mgP/kg):** **PRI (kg/ha):**

PHYSICAL CHARACTERISTICS — **Comment**

Texture: Medium Clay
Texture comment:
Size:
Aggregate strength: Did not test
Structural unit: Did not test
Approx. Clay Content (%): 40 - 55%
Potential infiltration rate: Very Slow
Gravel Content: Soil is Not gravelly
Additional comments:

Field Density (g/mL):
Emerson Stability Class: H20
High SAR/Low Iconic Strength:
Med SAR/High Iconic Strength:

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Batch N°: 25211 | **Sample N°: 19** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-09 (2500-2800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water 1:5	8.4	Moderate Alkalinity
pH in $CaCl_2$ 1:5	7.8	Slight Alkalinity
EC mS/cm 1:5	0.93	Very High Salinity (saline)

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			5.9	27.5	
Potassium			0.16	0.7	
Calcium			4.6	21.4	
Magnesium			10.8	50.3	
Aluminium			-	-	
		ECEC	21.5		Moderate
		Ca/Mg	.7		Low - Magnesic

Phosphate Retention Index (%): | **PRI (mgP/kg):** | **PRI (kg/ha):**

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Medium Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	40 - 55%		
Potential infiltration rate:	Very Slow		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 20** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-10 (1000-1200)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water 1:5	8.5	Moderate Alkalinity
pH in $CaCl_2$ 1:5	8.1	Moderate Alkalinity
EC mS/cm 1:5	0.82	Very High Salinity (saline)

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			2.7	11	
Potassium			0.17	0.7	
Calcium			8.4	34.3	
Magnesium			13.2	53.9	
Aluminium			-	-	
		ECEC	24.5		Moderate
		Ca/Mg	1		Low - Magnesic

Phosphate Retention Index (%): **PRI (mgP/kg):** **PRI (kg/ha):**

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Silty Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	40 - 50%		
Potential infiltration rate:	Very Slow		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 21** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-11 (1500-1700)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water 1:5	7.3	Slight Alkalinity
pH in $CaCl_2$ 1:5	5.3	Strong Acidity
EC mS/cm 1:5	0.04	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.74	8	
Potassium			0.12	1.3	
Calcium			3.9	42.1	
Magnesium			4.5	48.6	
Aluminium			-	-	
		ECEC	9.3		Low
		Ca/Mg	1.4		Low - Magnesic

Phosphate Retention Index (%): **PRI (mgP/kg):** **PRI (kg/ha):**

PHYSICAL CHARACTERISTICS **Comment**

Texture:	Light Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	35 - 40%	> 2mm	Gravel
Potential infiltration rate:	Slow	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Certified System Quality ISO 9001

Batch N°: 25211 | **Sample N°: 22** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-12 (1200-1800)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water 1:5	7.3	Slight Alkalinity
pH in $CaCl_2$ 1:5	6.2	Slight Acidity
EC mS/cm 1:5	0.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.21	2	
Potassium			0.83	8	
Calcium			5.3	50.8	
Magnesium			4.1	39.3	
Aluminium			-	-	
		ECEC	10.4		Low
		Ca/Mg	2.1		Low - Magnesic

Phosphate Retention Index (%): | **PRI (mgP/kg):** | **PRI (kg/ha):**

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Light Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	35 - 40%		
Potential infiltration rate:	Slow		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

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Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 23** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-13 (4000-4300)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water 1:5	8.3	Moderate Alkalinity
pH in $CaCl_2$ 1:5	7.1	Neutral
EC mS/cm 1:5	0.12	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.5	13.2	
Potassium			0.17	1.5	
Calcium			5.7	50.1	
Magnesium			4	35.2	
Aluminium			-	-	
		ECEC	11.4		Low
		Ca/Mg	2.3		Low - Magnesic

Phosphate Retention Index (%): | **PRI (mgP/kg):** | **PRI (kg/ha):**

PHYSICAL CHARACTERISTICS | **Comment**

Texture:	Light Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test	**Particle Size Analysis (PSA)**	
Approx. Clay Content (%):	35 - 40%	> 2mm	Gravel
Potential infiltration rate:	Slow	2 - 0.2 mm	Coarse Sand
Gravel Content:	Soil is Not gravelly	0.2 - 0.02 mm	Fine Sand
Additional comments:		0.02 - 0.002 mm	Silt
		< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Effluent Subdivison Profile

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Batch N°: 25211 | **Sample N°: 24** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-14 (2600-2900)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water 1:5	7.1	Neutral pH
pH in $CaCl_2$ 1:5	5.8	Medium Acidity
EC mS/cm 1:5	0.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			0.11	2	
Potassium			0.074	1.3	
Calcium			2.7	49.2	
Magnesium			2.6	47.4	
Aluminium			-	-	
		ECEC	5.5		Low
		Ca/Mg	1.7		Low - Magnesic

Phosphate Retention Index (%): **PRI (mgP/kg):** **PRI (kg/ha):**

PHYSICAL CHARACTERISTICS — **Comment**

Texture:	Sandy Clay	**Field Density (g/mL):**	
Texture comment:		**Emerson Stability Class:**	H20
Size:		**High SAR/Low Iconic Strength:**	
Aggregate strength:	Did not test	**Med SAR/High Iconic Strength:**	
Structural unit:	Did not test		
Approx. Clay Content (%):	35 - 45%		
Potential infiltration rate:	Slow		
Gravel Content:	Soil is Not gravelly		
Additional comments:			

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

Analysed by SESL Australia NATA #15633

No commentary requested from SESL.

Please refer to Corrosion and Scaling Assessment profile for other laboratory data.

Method References:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). Exchangeable Cations, ECEC: Method 15A1 Rayment & Higginson (1992) Chloride: Vogel (1961). Aluminium: Method 3500 APHA (1992). Phosphate: Method 9E1 Rayment & Higginson (1992). Wax Block Density: Method 30-4 Black (1983), Texture: "Northcote" (1992), Emerson's Aggregate Test: Charman & Murphy (1991), Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6.

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 8 Feb 2013

Corrosion & Scaling Assessment:
Soil Reporting Profile

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Batch N°: 25211 **Sample N°: 1** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-02 (0-300)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.1	Slight Acidity
EC mS/cm (1:5)	0.06	Low Salinity
Texture Class	Clay Loam	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	70	Low (non-aggressive)
Chloride (1:5) mgCl / kg	30	Low (non-aggressive)
* Resistivity Ω.□	42.8	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight acidity, low salinity, low sulphate and low chloride levels and moderate resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
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Batch N°: 25211 **Sample N°: 2** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-02 (800-1000)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.1	Neutral pH
EC mS/cm (1:5)	0.03	Very Low Salinity
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	40	Low (non-aggressive)
Chloride (1:5) mgCl / kg	130	Low (non-aggressive)
* Resistivity Ω.□	47.6	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows a neutral pH, very low salinity, low sulphate and low chloride levels and moderate resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
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Batch N°: 25211 | **Sample N°: 3** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-08 (0-300)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.7	Very Slight Acidity
EC mS/cm (1:5)	0.03	Very Low Salinity
Texture Class	Clay Loam	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	40	Low (non-aggressive)
Chloride (1:5) mgCl / kg	40	Low (non-aggressive)
* Resistivity Ω.□	53.0	High Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows very slight acidity, very low salinity, low sulphate and low chloride levels and high resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

<u>Factors affecting concrete scaling are:</u> (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

<u>Factors affecting steel corrosivity are:</u> (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

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Corrosion & Scaling Assessment:

Soil Reporting Profile

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Batch N°: 25211 **Sample N°: 4** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-08 (600-800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.2	Neutral pH
EC mS/cm (1:5)	0.03	Very Low Salinity
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	50	Low (non-aggressive)
Chloride (1:5) mgCl / kg	120	Low (non-aggressive)
* Resistivity Ω.□	48.5	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows a neutral pH, very low salinity, low sulphate and low chloride levels and moderate resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant:
Chris Fraser

Authorised Signatory:
Ryan Jacka

Date of Report:
08/02/2013

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Corrosion & Scaling Assessment:

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Batch N°: 25211 **Sample N°: 5** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-09 (0-500)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.4	Slight Alkalinity
EC mS/cm (1:5)	0.03	Very Low Salinity
Texture Class	Clay Loam	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	20	Low (non-aggressive)
Chloride (1:5) mgCl / kg	40	Low (non-aggressive)
* Resistivity Ω.m	56.2	High Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alalkinity, very low salinity, low sulphate and low chloride levels and high resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
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Batch N°: 25211 **Sample N°: 6** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-09 (1000-1200)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	8.8	Strong Alkalinity
EC mS/cm (1:5)	0.28	Elevated Salinity
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	170	Low (non-aggressive)
Chloride (1:5) mgCl / kg	790	Low (non-aggressive)
* Resistivity Ω.m	7.3	Very Low Resistivity

* Resistivity tested on a saturated sample/paste (Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows strong alkalinity, elevated salinity, low sulphate and low chloride levels and very low resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be moderately-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is moderate.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

 Total No Pages:

Corrosion & Scaling Assessment:
Soil Reporting Profile

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Batch N°: 25211 **Sample N°: 7** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-10 (0-250)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.3	Slight Acidity
EC mS/cm (1:5)	0.11	Low Salinity
Texture Class	Clay Loam	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	30	Low (non-aggressive)
Chloride (1:5) mgCl / kg	80	Low (non-aggressive)
* Resistivity Ω.□	27.9	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight acidity, low salinity, low sulphate and low chloride levels and moderate resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
Soil Reporting Profile

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Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
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Batch N°: 25211	**Sample N°: 8**	**Date Received: 29/1/13**	**Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-10 (400-600)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.0	Medium Acidity
EC mS/cm (1:5)	0.32	Elevated Salinity
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	170	Low (non-aggressive)
Chloride (1:5) mgCl / kg	410	Low (non-aggressive)
* Resistivity Ω.m	6.7	Very Low Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows medium acidity, elevated salinity, low sulphate and low chloride levels and very low resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be moderately-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is moderate.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

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Corrosion & Scaling Assessment:

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Batch N°: 25211 **Sample N°: 9** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-11 (0-400)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.8	Very Slight Acidity
EC mS/cm (1:5)	<0.02	Very Low Salinity
Texture Class	Light Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	20	Low (non-aggressive)
Chloride (1:5) mgCl / kg	50	Low (non-aggressive)
* Resistivity Ω.m	65.2	High Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows very slight acidity, very low salinity, low sulphate and low chloride levels and high resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

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Batch N°: 25211 | **Sample N°: 10** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-11 (800-1000)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.2	Neutral pH
EC mS/cm (1:5)	<0.02	Very Low Salinity
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	20	Low (non-aggressive)
Chloride (1:5) mgCl / kg	100	Low (non-aggressive)
* Resistivity Ω.□	68.0	High Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows neutral pH, low salinity, low sulphate and low chloride levels and high resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
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Batch N°: 25211 **Sample N°: 11** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-12 (0-300)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.5	Slight Acidity
EC mS/cm (1:5)	<0.02	Very Low Salinity
Texture Class	Fine Sandy Clay Loam	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	20	Low (non-aggressive)
Chloride (1:5) mgCl / kg	30	Low (non-aggressive)
* Resistivity Ω.m	113.9	Very High Resistivity

* Resistivity tested on a saturated sample/paste (Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight acidity, very low salinity, low sulphate and low chloride levels and very high resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser
Authorised Signatory: Ryan Jacka
Date of Report: 08/02/2013

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Corrosion & Scaling Assessment:
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Batch N°: 25211	**Sample N°: 12**	**Date Received: 29/1/13**	**Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-12 (600-800)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.6	Very Slight Acidity
EC mS/cm (1:5)	<0.02	Very Low Salinity
Texture Class	Sandy Loam	
Soil Permeability Class		High Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg	<5.0	Low (non-aggressive)
Chloride (1:5) mgCl / kg	10	Low (non-aggressive)
* Resistivity Ω.▯	365.9	Very High Resitivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows very slight acidity, very low salinity, low sulphate and low chloride levels and very high resistivity.

According to AS2159-2009, the pH is considered mildly-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered mildly-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be mildly-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is mild.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant:
Chris Fraser

Authorised Signatory:
Ryan Jacka

Date of Report:
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Total No Pages:

Corrosion & Scaling Assessment:
Soil Reporting Profile

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Batch N°: 25211	**Sample N°: 13**	**Date Received: 29/1/13**	**Report Status:** ○ Draft ◉ Final

Client Name: **Harvest Scientific Services**
Client Contact: **Jim Cupitt**
Client Job N°:
Client Order N°:
Address: **PO Box 427, NARELLAN NSW 2567**

Project Name: **REF: 201368**
Location:
SESL Quote N°:
Sample Name: **201368-13 (0-300)**
Description: **Soil**
Test Type: **CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.9	Neutral pH
EC mS/cm (1:5)	0.04	Very Low Salinity
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	20	Low (non-aggressive)
Chloride (1:5) mgCl / kg	230	Low (non-aggressive)
* Resistivity Ω.▯	26.4	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows a neutral pH, very low salinity, low sulphate and low chloride levels and moderate resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
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Batch N°: 25211	**Sample N°: 14**	**Date Received: 29/1/13**	**Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-13 (600-800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.9	Neutral pH
EC mS/cm (1:5)	0.69	Very High Salinity (saline)
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	120	Low (non-aggressive)
Chloride (1:5) mgCl / kg	1110	Low (non-aggressive)
* Resistivity Ω.m	3.4	Very Low Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows a neutral pH, very high salinity, low sulphate and low chloride levels and very low resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be moderately-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is moderate.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

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Batch N°: 25211 **Sample N°: 15** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-14 (0-300)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.7	Very Slight Acidity
EC mS/cm (1:5)	<0.02	Very Low Salinity
Texture Class	Sandy Loam	
Soil Permeability Class		High Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	10	Low (non-aggressive)
Chloride (1:5) mgCl / kg	50	Low (non-aggressive)
* Resistivity Ω.□	106.2	Very High Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows very slight acidity, very low salinity, low sulphate and low chloride levels and very high resistivity.

According to AS2159-2009, the pH is considered mildly-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered mildly-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be mildly-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is mild.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant:
Chris Fraser

Authorised Signatory:
Ryan Jacka

Date of Report:
08/02/2013

Corrosion & Scaling Assessment:
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Batch N°: 25211 **Sample N°: 16** **Date Received: 29/1/13** **Report Status:** ○ **Draft** ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-14 (800-1000)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC, PRI**

TEST	RESULT	COMMENTS
pH in water (1:5)	6.7	Very Slight Acidity
EC mS/cm (1:5)	<0.02	Very Low Salinity
Texture Class	Sandy Clay Loam	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg	20	Low (non-aggressive)
Chloride (1:5) mgCl / kg	40	Low (non-aggressive)
* Resistivity Ω.□	177.7	Very High Resistivity

* Resistivity tested on a saturated sample/paste (Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows very slight acidity, very low salinity, low sulphate and low chloride levels and very high resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
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Batch N°: 25211 **Sample N°: 17** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-02 (2400-2800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.4	Slight Alkalinity
EC mS/cm (1:5)	0.04	Very Low Salinity
Texture Class	Light Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	10	Low (non-aggressive)
Chloride (1:5) mgCl / kg	170	Low (non-aggressive)
* Resistivity Ω.	38.7	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alkalinity, very low salinity, low sulphate and low chloride levels and moderate resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **/Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:

Soil Reporting Profile

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Batch N°: 25211	**Sample N°: 18**	**Date Received: 29/1/13**	**Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-08 (1000-1200)**
Address:	**PO Box 427** **NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water (1:5)	5.4	Strong Acidity
EC mS/cm (1:5)	0.06	Low Salinity
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	130	Low (non-aggressive)
Chloride (1:5) mgCl / kg	20	Low (non-aggressive)
* Resistivity Ω.□	50.7	High Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows strong acidity, low salinity, low sulphate and low chloride levels and high resistivity.

According to AS2159-2009, the pH is considered mildly-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is mild.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant:
Chris Fraser

Authorised Signatory:
Ryan Jacka

Date of Report:
08/02/2013

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Corrosion & Scaling Assessment:

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Batch N°: 25211 | **Sample N°: 19** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-09 (2500-2800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water (1:5)	8.4	Moderate Alkalinity
EC mS/cm (1:5)	0.93	Very High Salinity (saline)
Texture Class	Medium Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	550	Low (non-aggressive)
Chloride (1:5) mgCl / kg	1330	Low (non-aggressive)
* Resistivity Ω.▯	3.0	Very Low Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows moderate alkalinity, very high salinity, low sulphate and low chloride levels and very low resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be moderately-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is moderate.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

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Corrosion & Scaling Assessment:

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Batch N°: 25211 | **Sample N°: 20** | **Date Received: 29/1/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-10 (1000-1200)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water (1:5)	8.5	Moderate Alkalinity
EC mS/cm (1:5)	0.82	Very High Salinity (saline)
Texture Class	Silty Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	40	Low (non-aggressive)
Chloride (1:5) mgCl / kg	1300	Low (non-aggressive)
* Resistivity Ω.□	3.8	Very Low Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows moderate alkalinity, very high salinity, low sulphate and low chloride levels and very low resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be moderately-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is moderate.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser [signature]
Authorised Signatory: Ryan Jacka [signature]
Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
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Batch N°: 25211 **Sample N°: 21** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-11 (1500-1700)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.3	Slight Alkalinity
EC mS/cm (1:5)	0.04	Very Low Salinity
Texture Class	Light Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg	40	Low (non-aggressive)
Chloride (1:5) mgCl / kg	110	Low (non-aggressive)
* Resistivity Ω.□	41.1	Moderate Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alkalinity, very low salinity, low sulphate and low chloride levels and moderate resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

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Corrosion & Scaling Assessment:

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Batch N°: 25211 **Sample N°: 22** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-12 (1200-1800)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.3	Slight Alkalinity
EC mS/cm (1:5)	0.02	Very Low Salinity
Texture Class	Light Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$ / kg	40	Low (non-aggressive)
Chloride (1:5) mgCl / kg	80	Low (non-aggressive)
* Resistivity Ω.□	68.9	High Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alkalinity, very low salinity, low sulphate and low chloride levels and high resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

Corrosion & Scaling Assessment:
Soil Reporting Profile

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Batch N°: 25211 **Sample N°: 23** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-13 (4000-4300)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water (1:5)	8.3	Moderate Alkalinity
EC mS/cm (1:5)	0.12	Low Salinity
Texture Class	Light Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	40	Low (non-aggressive)
Chloride (1:5) mgCl / kg	440	Low (non-aggressive)
* Resistivity Ω.m	15.5	Moderate Resistivity

* Resistivity tested on a saturated sample/paste (Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows moderate alkalinity, low salinity, low sulphate and low chloride levels and moderate resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be mildly-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is mild.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

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Corrosion & Scaling Assessment:
Soil Reporting Profile

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Batch N°: 25211 **Sample N°: 24** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-14 (2600-2900)**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Soil**
		Test Type:	**CSCSS, CECAC**

TEST	RESULT	COMMENTS
pH in water (1:5)	7.1	Neutral pH
EC mS/cm (1:5)	0.02	Very Low Salinity
Texture Class	Sandy Clay	
Soil Permeability Class		Low Permeability
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) $mgSO_4$/ kg	40	Low (non-aggressive)
Chloride (1:5) mgCl / kg	60	Low (non-aggressive)
* Resistivity Ω.m	115.9	Very High Resistivity

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows neutral pH, very low salinity, low sulphate and low chloride levels and very high resistivity.

According to AS2159-2009, the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The low chloride levels are considered non-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be non-aggressive towards concrete. The resistivity is considered to be non-aggressive towards steel.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is low.

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

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Batch N°: 25211 **Sample N°: 25** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-13 GW 09012013**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Water**
		Test Type:	**CMSCSW**

TEST	RESULT	COMMENTS
pH in water (1:5)	8.0	Slight Alkalinity
EC mS/cm (1:5)	2.73	Very High Salinity (Saline)
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4 / kg	340	Low (non-aggressive)
Chloride (1:5) mgCl / kg	4020	Low (non-aggressive)
* Resistivity Ω.□		

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alkalinity, very high salinity, low sulphate and low chloride levels.

According to AS2159-2009, the pH is considered mildly-aggressive towards concrete and non-corrosive towards steel due to unknown permeability and resistivity. The low chloride levels are considered mildly-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be midly-aggressive towards concrete due to unknown permeability and resistivity.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is mild to moderate..

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

 Total No Pages:

APPENDIX 3

AUSTRALIA'S MOST TRUSTED EARTH SCIENCE SERVICES

Corrosion & Scaling Assessment:

Soil Reporting Profile

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Batch N°: 25211 **Sample N°: 25** **Date Received: 29/1/13** **Report Status:** ○ Draft ◉ **Final**

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-13 GW 09012013**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Water**
		Test Type:	**CMSCSW**

TEST	RESULT	COMMENTS
pH in water (1:5)	8.0	Slight Alkalinity
EC mS/cm (1:5)	2.73	Very High Salinity (Saline)
Texture Class		
Soil Permeability Class		
SOLUBLE ANION ANALYSIS		
Sulphate (1:5) mgSO_4/ kg	340	Low (non-aggressive)
Chloride (1:5) mgCl / kg	4020	Low (non-aggressive)
* Resistivity Ω.□		

* Resistivity tested on a saturated sample/paste

(Note:- 10,000 mg/kg = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of soils towards concrete structures with steel reinforcement, concrete and steel piles, this soil shows slight alkalinity, very high salinity, low sulphate and low chloride levels.

According to AS2159-2009, the pH is considered mildly-aggressive towards concrete and non-corrosive towards steel due to unknown permeability and resistivity. The low chloride levels are considered mildly-aggressive towards concrete and non-corrosive towards steel while the low sulphate levels are considered to be midly-aggressive towards concrete due to unknown permeability and resistivity.

Factors affecting concrete scaling are: (a) elevated sulphate, becoming mildly aggressive at >5000mg/kg SO4; and (b) low pH, becoming mildly aggressive at pH of <5.5.

Factors affecting steel corrosivity are: (a) elevated chloride, becoming mildly aggressive at >5,000mg/kg Cl; and (b) low pH, becoming mildly aggressive at pH of <5 and (c) low resistivity, becoming mildly aggressive with resistivity values less than 50Ω.m.

Overall, according AS2159:2009 the likelihood of aggressive corrosion is mild to moderate..

If you would like to discuss further please contact the office on 9980 6554.

Explanation of the Methods:
pH, EC, Soluble SO_4: Bradley et al., (1983); **Cl,** (4500-Cl- E; APHA, 1998); **Texture Class,** AS2159:2009; **Resistivity,** AS1289.4.4.1:1997,

Consultant: Chris Fraser

Authorised Signatory: Ryan Jacka

Date of Report: 08/02/2013

 Total No Pages:

Corrosion & Scaling Assessment: Water Reporting Profile

SESL AUSTRALIA
AUSTRALIA'S MOST TRUSTED EARTH SCIENCE SERVICES

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
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Tel: 02 9980 6554
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Em: info@sesl.com.au
Web: www.sesl.com.au

Certified System Quality ISO 9001

Batch N°: 25596 | **Sample N°: 1** | **Date Received: 5/3/13** | **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:	**201368**	Sample Name:	**201368-15 GW 28/02/2013**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Water**
		Test Type:	**CMSCSW**

TEST		RESULT	COMMENTS
pH		6.5	Slight Acidity
EC mS/cm		0.48	Moderate
SOLUBLE CATION ANALYSIS			
Sodium	mg/L	36.1	Low
Calcium	mg/L	31.9	Low
Magnesium	mg/L	21	Low
Ammonium-N	mg/L	0.5	Low
SOLUBLE ANION ANALYSIS			
Sulphate	$mgSO_4$/L	18.4	Low
Chloride	mg/L	88.6	Low
Carbonate	mg/L	0.0	Very Low
Bicarbonate	mg/L	90.0	Low
Derived Values			
* Total Dissolved Salts mg/L		307.2	Class 2 Salinity for Irrigation
* Resistivity Ω.m		20.8	Moderate Resistivity
$CaCO_3$ Saturation Index ($pH-pH_C$)		-1.3	Moderate Potential for Concrete Corrosion
Total Hardness (mg/L as $CaCO_3$)		166.1	Slightly Hard

* derived value from EC

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of water towards concrete structures with steel reinforcement, concrete and steel piles, this water shows a Class 2 salinity for irrigation water, which is considered moderately appropriate for irrigation and is a moderate salinity level.

According to AS2159:2009, DIN 4030:1991 and Basson (1989), the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The chloride level is considered to pose a low degree of aggressiveness towards concrete and steel.

The resistivity is considered to be moderately-aggressive towards unprotected steel.

The saturation index shows an increasing risk of concrete corrosion.

This assessment has been based on the assessment of the water sample provided to SESL.

Explanation of the Methods:
pH, EC, Soluble Na, Ca, Cl, Mg, NH_4, SO_4: Bradley et al (1983);
HCO_3, CO_3, $CaCO_3$ Saturation Index, Hardness: Rayment & Higginson, (1983);

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Total No Pages: 1/1

Consultant Chris Fraser

Authorised Signatory Ryan Jacka

Date of Report 15/03/2013

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Corrosion & Scaling Assessment: Water Reporting Profile

Sample Drop Off: 16 Chilvers Road, Thornleigh NSW 2120
Mailing Address: PO Box 357, Pennant Hills NSW 1715
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Web: www.sesl.com.au

Certified System Quality ISO 9001

Batch N°: 25596 **Sample N°: 2** **Date Received: 5/3/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:	**201368**	Sample Name:	**201368-16 GW 28/02/2013**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Water**
		Test Type:	**CMSCSW**

TEST		RESULT	COMMENTS
pH		6.6	Very Slight Acidity
EC mS/cm		0.56	Moderate Salinity
SOLUBLE CATION ANALYSIS			
Sodium	mg/L	37.3	Low
Calcium	mg/L	35.2	Low
Magnesium	mg/L	23.2	Low
Ammonium-N	mg/L	0.5	Low
SOLUBLE ANION ANALYSIS			
Sulphate	$mgSO_4/L$	12.9	Low
Chloride	mg/L	111.8	Low
Carbonate	mg/L	0.0	Very Low
Bicarbonate	mg/L	100.0	Low
Derived Values			
* Total Dissolved Salts mg/L		358.4	Class 2 Salinity for Irrigation
* Resistivity Ω.m		17.9	Moderate Resistivity
$CaCO_3$ Saturation Index ($pH-pH_C$)		-1.1	Moderate Potential for Concrete Corrosion
Total Hardness (mg/L as $CaCO_3$)		183.4	Slightly Hard

* derived value from EC

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of water towards concrete structures with steel reinforcement, concrete and steel piles, this water shows a Class 2 salinity for irrigation water, which is considered moderately appropriate for irrigation and is a moderate salinity level.

According to AS2159:2009, DIN 4030:1991 and Basson (1989), the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The chloride level is considered to pose a low degree of aggressiveness towards concrete and steel.

The resistivity is considered to be moderately-aggressive towards unprotected steel.

The saturation index shows an increasing risk of concrete corrosion.

This assessment has been based on the assessment of the water sample provided to SESL.

Explanation of the Methods:
pH, EC, Soluble Na, Ca, Cl, Mg, NH_4, SO_4: Bradley et al (1983);
HCO_3, CO_3, $CaCO_3$ Saturation Index, Hardness: Rayment & Higginson, (1983);

SESL Australia ABN 70 106 810 708

Total No Pages: 1/1

Consultant Chris Fraser

Authorised Signatory Ryan Jacka

Date of Report 15/03/2013

AUSTRALIA'S MOST TRUSTED EARTH SCIENCE SERVICES

Corrosion & Scaling Assessment: Water Reporting Profile

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Web: www.sesl.com.au

Certified System Quality ISO 9001

Batch N°: 25967 **Sample N°: 1** **Date Received: 9/4/13** **Report Status:** ○ Draft ◉ Final

Client Name:	**Harvest Scientific Services**	Project Name:	**REF: 201368**
Client Contact:	**Jim Cupitt**	Location:	
Client Job N°:		SESL Quote N°:	
Client Order N°:		Sample Name:	**201368-17 GW 20/03/2013**
Address:	**PO Box 427 NARELLAN NSW 2567**	Description:	**Water**
		Test Type:	**CMSCSW**

TEST		RESULT	COMMENTS
pH		6.0	Medium Acidity
EC mS/cm		0.27	Elevated
SOLUBLE CATION ANALYSIS			
Sodium	mg/L	43.1	Low
Calcium	mg/L	8.3	Low
Magnesium	mg/L	5.5	Low
Ammonium-N	mg/L	0.4	Low
SOLUBLE ANION ANALYSIS			
Sulphate	$mgSO_4$/L	7.8	Low
Chloride	mg/L	58.3	Low
Carbonate	mg/L	0.0	Low
Bicarbonate	mg/L	50.0	Low
Derived Values			
* Total Dissolved Salts mg/L		172.8	Low
* Resistivity Ω.m		37.0	Moderate
$CaCO_3$ Saturation Index ($pH-pH_C$)		-2.6	Significant Potential for Concrete Corrosion
Total Hardness (mg/L as $CaCO_3$)		43.4	Very Soft

* derived value from EC

(Note:- 10,000 mg/L = 1%)

Recommendations

For the purpose of corrosion and scaling assessment of water towards concrete structures with steel reinforcement, concrete and steel piles, this water shows a Class 2 salinity for irrigation water, which is considered suitable for moderately sensitive plants and most plant species.

According to AS2159:2009, DIN 4030:1991 and Basson (1989), the pH is considered non-aggressive towards concrete and non-corrosive towards steel. The chloride level is considered to pose a low degree of aggressiveness towards concrete and steel.

The resistivity is considered to be mildly-aggressive towards unprotected steel.

The saturation index shows an increasing risk of concrete corrosion.

This assessment has been based on the assessment of the water sample provided to SESL.

Explanation of the Methods:
pH, EC, Soluble Na, Ca, Cl, Mg, NH_4, SO_4: Bradley et al (1983);
HCO_3, CO_3, $CaCO_3$ Saturation Index, Hardness: Rayment & Higginson, (1983);

SESL Australia ABN 70 106 810 708

Total No Pages: 1/1

Consultant Chris Fraser

Authorised Signatory Ryan Jacka

Date of Report 15/04/2013

APPENDIX 4

Wollondilly Local Environmental Plan 2011

Land Use Matrix [DoP version 3.0]

Legend

- **o** permitted without consent [mandated under the SI].
- **o** permitted without consent.
- **c** permitted with consent [mandated under the SI].
- **c** permitted with consent.
- **x** prohibited [mandated under the SI].
- **x** prohibited.
- **A** permitted under SEPP (Affordable Rental Housing) 2009.
- **I** permitted under SEPP (Infrastructure) 2007.

*fill colours in **green** or **red** mandated under the SI.*
*fill colour in **purple** public infrastructure permitted under a SEPP.*

	Rural						Residential					Business							Industrial				SP3	Recr'n		Env Prot'n			Waterways		
	RU1 Primary Production	RU2 Rural Landscape	RU3 Forestry	RU4 Primary Production Small Lots	RU5 Village	RU6 Transition	R1 General Residential	R2 Low Density Residential	R3 Medium Density Residential	R4 High Density Residential	R5 Large Lot Residential	B1 Neighbourhood centre	B2 Local centre	B3 Commercial Core	B4 Mixed Use	B5 Business Development	B6 Enterprise corridor	B7 Business Park	IN1 General Industrial	IN2 Light Industrial	IN3 Heavy Industrial	IN4 Working Waterfront	SP3 Tourist	RE1 Public Recreation	RE2 Private Recreation	E2 Environmental conservation	E3 Environmental Management	E4 Environmental Living	W1 Natural Waterways	W2 Recreational Waterways	W3 Working Waterways
Is the zone used? [please select Y/N for each zone]	Y	Y	N	Y	N	N	N	Y	Y	N	Y	Y	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N
(LAND USE terms WITHIN agriculture group term)																															
agriculture								x	x		x	x	x		x					x	x			x	x	x	x	x			
aquaculture	c	c		c				x	x		x	x	x		x					x	x			x	x	x	x	x			
extensive agriculture [eg. grazing of livestocks, etc.]	o	o		o				x	x		x	x	x		x					x	x			x	x	x	o	o			
bee keeping	o	o		o				x	x		x	x	x		x					x	x			x	x	x	o	o			
dairy (pasture-based)	o	o		o				x	x		x	x	x		x					x	x			x	x	x	o	o			
intensive livestock agriculture [eg. poultry farms, etc.]	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
feedlots	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
dairies (restricted)	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
intensive plant agriculture [eg. cultivation of irrigated crops]	c	c		c				x	x		x	x	x		x					c	c			x	x	x	x	x			
horticulture	c	c		c				x	x		x	x	x		x					c	c			x	x	x	x	x			
turf farming	c	x		c				x	x		x	x	x		x					c	c			x	x	x	x	c			
viticulture	c	c		c				x	x		x	x	x		x					c	c			x	x	x	x	c			
(LAND USE terms OUTSIDE agriculture group term)																															
animal boarding or training establishments	c	c		c				x	x		x	x	x		x					x	x			x	x	x	x	x			
farm buildings	c	c		c				x	x		x	c	c		c					c	c			x	x	x	x	c			
forestry	x	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
(LAND USE terms WITHIN residential accommodation group term)																															
residential accommodation								c	c		c		x		c					x	x			x	x	x	x	x			
attached dwellings	x	x		x			c	x	c		x	x	x		c					x	x			x	x	x	x	x			
boarding houses	x	x		x			c	c	c	c	x	c	c		c					x	x			x	x	x	x	x			
dual occupancies	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	x			
dual occupancies (attached)	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	c			
dual occupancies (detached)	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	x			
dwelling houses	c	c		c	c	c	c	c	c		c	c	x		c					x	x			x	x	x	c	c			
group homes	c	c		c			c	c	c	A	c	c	x		A					x	x			x	x	x	x	x			
group homes (permanent)	c	c		c			c	c	c	A	c	c	x		A					x	x			x	x	x	x	x			
group homes (transitional)	c	c		c			c	c	c	A	c	c	x		A					x	x			x	x	x	x	x			
hostels	x	x		x			c	c	c		c	c	c		c					x	x			x	x	x	x	x			
multi dwelling housing	x	x		x			c	x	c		x	x	x		c					x	x			x	x	x	x	x	x	x	
residential flat buildings	x	x		x			c	x	c	c	x	x	x		c					x	x			x	x	x	x	x	x	x	
rural worker's dwellings	c	c		c				x	x		x	c	x		c					x	x			x	x	x	x	x			
secondary dwellings	c	c		c			A	A	A	A	A	x	x		c					x	x			x	x	x	x	c			
semi-detached dwellings	x	x		x			c	c	c		x	x	x		c					x	x			x	x	x	x	x			
seniors housing	x	x		x			c	c	c		c	c	x		c					x	x			x	x	x	x	x	x	x	
residential care facilities	x	x		x			c	c	c		c	c	x		c					x	x			x	x	x	x	x	x	x	
shop top housing	x	x		x			c	x	x	c	x	c	c		c					x	x			x	x	x	x	x			
(LAND USE terms OUTSIDE residential accommodation group term)																															
home-based child care	c	c		c				c	c		c	c	c		c					c	c			x	x	x	c	c			
home business	c	c		c				c	c		c	c	c		c					c	c			x	x	x	c	c			
home occupations	o	o		o	o		o	o	c		o	c	c		c					c	c			x	x	x	o	o			
home occupation (sex services)	c	c		c				c	c		c	c	c		c					c	c			x	x	x	c	c			
(LAND USE terms WITHIN tourist and visitor accommodation group term)																															
tourist and visitor accommodation													c		c					x	x		c	x	x	x	x	c			
backpackers' accommodation	x	x		x				x	x		x	c	c		c					x	x		c	x	x	x	x	c			
bed & breakfast accommodation	c	c		c				c	c		c	x	c		c					x	x		c	x	x	x	x	c			
farm stay accommodation	c	c		c				x	x		x	c	c		c					x	x		c	x	x	x	x	c			
hotel or motel accommodation	x	x		x				x	x		x	c	c	c	c		c			x	x		c	x	x	x	x	x	x		
serviced apartments	x	x		x				x	c		x	c	c		c					x	x		c	x	x	x	x	x			
(LAND USE terms OUTSIDE tourist and visitor accommodation group term)																															
camping grounds	x	x		x				x	x		x	x	c		c					x	x			c	c	x	x	x			
caravan parks	x	x		x				x	x		x	x	c		c					x	x			c	c	x	x	x			
eco-tourist facilities	x	x		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
(LAND USE terms WITHIN commercial premises group term)																															
commercial premises													c	c	c																
business premises [eg. banks, post offices, hairdressers, etc.]	x	x		x				x	x		x	c	c	c	c		c			x	x			x	x	x	x	x	x		
funeral homes	c	c		x				x	x		x	c	c	c	c		c			x	x			x	x	x	x	x	x		
office premises	x	x		x				x	x		x	c	c	c	c			c		x	x			x	x	x	x	x			
retail premises								x	x		x	c	c	c	c					x	x			x	x	x	x	x	x		
bulky goods premises	x	x		x				x	x		x	c	c	c	c	c				c	c			x	x	x	x	x	x		
cellar door premises	c	c		c				x	x		x	c	c	c	c					x	x			x	x	x	x	c	x		
food & drink premises	x	x		x				x	x		x	c	c	c	c					x	x		c	x	c	x	x	x	x		
pubs	x	x		x				x	x		x	c	c	c	c					x	x		c	x	c	x	x	x	x		
restaurants or cafes	x	x		x				x	x		x	c	c	c	c					x	x		c	x	c	x	x	x	x		
take-away food & drink premises	x	x		x				x	x		x	c	c	c	c					c	x		c	c	c	x	x	x	x		
garden centres	x	x		x				x	x		x	c	c	c	c	c	c			c	x			x	x	x	x	x	x		
hardware & building supplies	x	x		x				x	x		x	c	c	c	c	c	c			c	x			x	x	x	x	x	x		
kiosks	x	x		x				x	x		x	c	c	c	c					c	c			c	c	x	x	x	x	c	
landscaping material supplies	c	c		c				x	x		x	c	c	c	c	c	c			c	c			x	x	x	x	x	x		
markets	x	x		x				x	x		x	c	c	c	c					x	x			x	x	x	x	x	x		
plant nurseries	c	c		c				x	x		x	c	c	c	c		c			c	c			x	x	x	x	x	x		
roadside stalls	c	c		c				x	x		x	x	c	c	c					x	x			x	x	x	x	c	x		
rural supplies	c	c		c				x	x		x	c	c	c	c					c	x			x	x	x	x	c	x		
shops	x	x		x				x	x		x	c	c	c	c					x	x			x	x	x	x	x	x		
neighbourhood shops	x	x		x	c		c	c	c	c	x	c	c	c	c			c	c	c	x			x	x	x	x	x	x		
timber yards	x	x		x				x	x		x	c	c	c	c					c	x			x	x	x	x	x	x		
vehicle sales or hire premises	x	x		x				x	x		x	x	c	c	c					x	c			x	x	x	x	x	x		
(LAND USE terms OUTSIDE commercial premises group term)																															
amusement centres	x	x		x				x	x		x	x	c		c					c	x			x	x	x	x	x			
entertainment facilities	x	x		x				x	x		x	c	c	c	c					c	x			x	x	x	x	x			
function centres	x	x		x				x	x		x	x	c	c	c					c	x			x	c	x	x	x			

Wollondilly Local Environmental Plan 2011

Land Use Matrix [DoP version 3.0]

Legend

- **o** permitted without consent [mandated under the SI].
- **o** permitted without consent.
- **c** permitted with consent [mandated under the SI].
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- **x** prohibited.
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- **I** permitted under SEPP (Infrastructure) 2007.

fill colours in ***green*** *or* ***red*** *mandated under the SI.*
fill colour in ***purple*** *public infrastructure permitted under a SEPP.*

	Rural						Residential					Business							Industrial				SP3	Recr'n		Env Prot'n			Waterways		
	RU1 Primary Production	RU2 Rural Landscape	RU3 Forestry	RU4 Primary Production Small Lots	RU5 Village	RU6 Transition	R1 General Residential	R2 Low Density Residential	R3 Medium Density Residential	R4 High Density Residential	R5 Large Lot Residential	B1 Neighbourhood centre	B2 Local centre	B3 Commercial Core	B4 Mixed Use	B5 Business Development	B6 Enterprise corridor	B7 Business Park	IN1 General Industrial	IN2 Light Industrial	IN3 Heavy Industrial	IN4 Working Waterfront	SP3 Tourist	RE1 Public Recreation	RE2 Private Recreation	E2 Environmental conservation	E3 Environmental Management	E4 Environmental Living	W1 Natural Waterways	W2 Recreational Waterways	W3 Working Waterways
Is the zone used? [please select Y/N for each zone]	Y	Y	N	Y	N	N	N	Y	Y	N	Y	Y	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N
highway service centres	x	x		x				x	x		x	x	c		x					x	x			x	x	x	x	x			
industrial retail outlets	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
registered clubs	x	x		x				x	x		x	c	c	c	c					x	x			x	c	x	x	x			
restricted premises	x	x		x				x	x		x	x	c	c	c					c	x			x	x	x	x	x	x		
service stations	x	x		x				x	x		x	c	c		c					c	x			x	x	x	x	x	x		
sex services premises	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
veterinary hospitals	c	c		c				c	x		c	c	c		c					c	x			x	x	x	x	x			
wholesale supplies	x	x		x				x	x		x	c	c		c					c	x			x	x	x	x	x			
(LAND USE terms WITHIN rural industry group term)																															
rural industries [eg. use of composting facilities and works]	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
agricultural produce industries	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
livestock processing industries	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
sawmill or log processing industries	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
stock & sale yards	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
(LAND USE terms WITHIN industry group term)																															
industries																										x	x	x	x	x	
heavy industries	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x	x	x	
hazardous industry	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x	x	x	
offensive industry	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x	x	x	
light industries	x	x		x				x	x		x	x	x		x		c	c	c	c	c	c		x	x	x	x	x	x	x	
high technology industries	x	x		x				x	x		x	x	x		x		c	c	c	c	c	c		x	x	x	x	x	x	x	
home industry	c	c		c				c	c		c	c	x		c		c	c	c	c	x	c		x	x	x	c	c	x	x	
general industries	x	x		x				x	x		x	x	x		x				c	c	c			x	x	x	x	x	x	x	
(LAND USE terms OUTSIDE industry group term)																															
boat building and repair facilities	x	c		x				x	x		x	x	x		x					c	c	c		x	x	x	x	x			c
vehicle body repair workshops	x	x		x				x	x		x	x	x		x					c	c			x	x	x	x	x			
vehicle repair stations	x	x		x				x	x		x	x	c		x					c	x			x	x	x	x	x			
(LAND USE terms WITHIN heavy industrial storage establishment group term)																															
heavy industrial storage establishments	x	x		x				x	x		x	x	x		x									x	x	x	x	x			
hazardous storage establishments	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x			
liquid fuel depots	x	x		x				x	x		x	x	x		x					c	c			x	x	x	x	x			
offensive storage establishments	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x			
(LAND USE terms WITHIN storage premises group term)																															
storage premises	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
self storage units	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
(LAND USE terms OUTSIDE storage premises group term)																															
depots	c	c		x				x	x		x	x	x		x				c	c	c			c	x	x	x	x			
warehouse or distribution centres	x	x		x				x	x		x	c	c		c	c	c	c	c	c	c			x	x	x	x	x	x	x	
(LAND USE terms WITHIN sewerage system group term)																															
sewerage systems				x				c	c		c		c		c					c	c			c	c	x	x	c			
biosolids treatment facilities	I	I		I				c	x		x	x	x		c				I	c	I			c	c	x	x	x			
sewage reticulation systems	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
sewage treatment plants	I	I		I				c	c		x	c	c		c				I	c	I			c	c	x	x	x			
water recycling facilities	I	I		I				c	c		x	x	c		c				I	c	I			c	c	x	x	c			
(LAND USE terms WITHIN waste or resource management facility group term)																															
waste or resource management facilities	I	I		x				x	x		x								I	c	I			x	x	x	x	x			
resource recovery facilities	I	I		x				x	x		x	x	x		x				I	x	I			x	x	x	x	x			
waste disposal facilities	I	I		x				x	x		x	x	x		x				I	x	I			x	x	x	x	x			
waste or resource transfer stations	I	I		x				x	x		x	c	c		c	I	I		I	I	I	I		x	x	x	x	x			
(LAND USE terms WITHIN water supply system group term)																															
water supply systems	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c			
water reticulation systems	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c			
water storage facilities	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c			
water treatment facilities	c	c		c				x	c		x	x	x		c					c	c			c	c	c	c	c			
(LAND USE terms WITHIN air transport facility group term)																															
air transport facilities	c			x				x	x		x	x	c		c					x	c			x	x	x	x	x			
airport	c	c		x				x	x		x	x	c		c					x	c			x	x	x	x	x			
heliport	c	x		x				x	x		x	x	c		c					c	c			x	x	x	x	x			
(LAND USE terms OUTSIDE air transport facility group term)																															
airstrip	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
helipad	x	x		x				x	x		x	c	c		c					c	c			c	x	x	x	c			
(Other LAND USE terms relating to infrastructure)																															
car parks	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
electricity generating works	I	I	I	I				x	x		x	c	c		c				I	c	I			c	c	x	x	x			
freight transport facilities	x	c		x				x	x		x	x	x		x				c	x	c			x	x	x	x	x			
passenger transport facilities	x	x		x				x	x		x	x	c	c	c	c	c	c		x	x			x	x	x	x	x			
port facilities	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			c
roads	c	c	*	c	*	*	*	c	c	*	c	c	c	*	c	*	*	*	*	c	c	*	*	c	c	c	c	c			
transport depots	c	c		x				x	x		x	x	c		c					c	c			x	x	x	x	x			
truck depots	c	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
wharf or boating facilities	x	x		x				x	x		x	x	x		x					x	x			x	x	x	x	x			c
(LAND USE terms WITHIN educational establishment group term)																															
educational establishments [eg. TAFE establishment, etc.]	x	I		I	I	I	I	I	I	I	I	I	c	c	c	I	I	I		c	x			x	x	x	x	I			
schools	x	I		I	c	I	I	I	I	I	I	I	c	c	c	I	I	I		c	x			x	x	x	x	I			
(LAND USE terms WITHIN health services facility group term)																															
health services facilities	x			I	I	I	I	x	I	I	I	c	I	I	I	I	I	I		c	c			x	x	x	x	x			
hospitals	x	c		I	I	I	I	x	I	I	I	c	I	I	I	I	I	I		c	c			x	x	x	x	x			
medical centres	x	x		I	I	I	I	x	I	I	I	c	c	c	c	I	I	I		c	x			x	x	x	x	x			
health consulting rooms	x	x		I	I	I	I	c	I	I	I	c	I	I	I	I	I	I		c	c			x	x	x	x	x			
(Other LAND USE terms relating to community infrastructure)																															

Wollondilly Local Environmental Plan 2011

Land Use Matrix [DoP version 3.0]

Legend

- **o** permitted without consent [mandated under the SI].
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- *fill colour in* ***purple*** public infrastructure permitted under a SEPP.

	Rural						Residential					Business							Industrial				SP3	Recr'n		Env Prot'n			Waterways		
	RU1 Primary Production	RU2 Rural Landscape	RU3 Forestry	RU4 Primary Production Small Lots	RU5 Village	RU6 Transition	R1 General Residential	R2 Low Density Residential	R3 Medium Density Residential	R4 High Density Residential	R5 Large Lot Residential	B1 Neighbourhood centre	B2 Local centre	B3 Commercial Core	B4 Mixed Use	B5 Business Development	B6 Enterprise corridor	B7 Business Park	IN1 General Industrial	IN2 Light Industrial	IN3 Heavy Industrial	IN4 Working Waterfront	SP3 Tourist	RE1 Public Recreation	RE2 Private Recreation	E2 Environmental conservation	E3 Environmental Management	E4 Environmental Living	W1 Natural Waterways	W2 Recreational Waterways	W3 Working Waterways
Is the zone used? [please select Y/N for each zone]	Y	Y	N	Y	N	N	N	Y	Y	N	Y	Y	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N
child care centres	x	x		c	c		c	c	c	c	c	c	c	c	c	c		c		x	x			c	x	x	x	x			
community facilities	c	c		c	c		c	c	c	c	c	c	c	c	c		c			c	x			c	c	x	x	x			
correctional centres	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
emergency services facilities	I	I	I	I	I			c	c			I	I	I	I	I	I	I	I	I	I	I		c	x	x	x	c			
industrial training facilities	x	x		x				x	x			x	x		x				c	c	c			x	x	x	x	x			
information and education facilities	c	c		c				x	x			c	c	c	c					c	c			c	c	x	c	c			
places of public worship	c	c		c	c		c	c	c	c	c	c	c		c					c	x			x	x	x	x	x			
public administration building	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
research stations	c	c		c				x	x		x	x	x		x					x	x			x	x	x	x	x			
respite day care centres	x	x		c	c		c	c	c	c	c	c	c	c	c	c		c		x	x			c	x	x	x	x			
(LAND USE terms WITHIN signage group term)																															
signage	c	c		c				c	c		c	c	c		c					c	c			x	c	x	x	c			
advertising structure	c	c		c				c	c		c	c	c		c					c	c			x	c	x	x	c			
building identification sign	c	c		c				c	c		c	c	c		c					c	c			x	c	x	x	c			
business identification sign	c	c		c				c	c		c	c	c		c					c	c			x	c	x	x	c			
(LAND USE terms relating to recreation)																															
boat launching ramps	x	x		x				x	x		x	c	c		c					c	c	c		x	x	x	x	x			
boat sheds	x	c		x				x	x		x	x	x		x					c	c			c	c	x	x	x			
charter & tourism boating facilities	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
environmental facilities	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c			
jetties	x	x		x				x	x		x	c	c		c					c	c	c		x	x	x	x	x			
marinas	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x		c	
mooring	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
mooring pens	x	x		x				x	x		x	c	c		c					x	x			x	x	x	x	x			
recreation areas	c	c		c	c			c	c		c	c	c		c					c	c			c	c	x	x	c			
recreation facilities (indoor)	x	c		x	c			x	x		x	c	c	c	c					c	x			c	c	x	x	x			
recreation facilities (major)	x	x		x				x	x		x	x	x		x					x	c			c	c	x	x	x	x		
recreation facilities (outdoor)	x	c		x	c			x	x		x	x	x		c					x	c			c	c	x	x	c			
water recreation structures	c	c		x				x	x		x	x	x		x					x	x			c	x	x	c	c			
(Other miscellaneous LAND USE terms)																															
cemetery	c	c		c				c	x		c	x	x		x					x	x			x	x	x	x	x			
crematorium	c	c		x				x	x		x	x	x		x					x	c			x	x	x	x	x			
environmental protection works	c	c		c				c	c		x	c	c		c					c	c			c	c	c	c	c			
exhibition homes	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	x			
exhibition villages	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	x			
extractive industries	c	c		x				x	x		x	x	x		x					x	c			x	x	x	x	x			
flood mitigation works	c	c		c				c	c		c	c	c		c					c	c			c	c	x	c	c			
mortuaries	x	c		x				x	x		x	x	x		x					c	c			x	x	x	x	x			
open cut mining	x	x		c				x	x		x	x	x		x					x	x			x	x	x	x	x			
(OTHER LAND USES)																															
development which cannot be characterised into any land uses defined in the SI																															

Note 1. Zone B8 Metropolitan Centre is not included in the matrix given this zone may only be used in two nominated LGAs. Zone E1 National Parks and Nature Reserves is not included given there is no need to add any additional uses to the zone. Zones SP1 Special Activities and SP2 Infrastructure are not included given the primary uses in these zones should be annotated on the Land Zoning Map.

Note 2. A type of development referred to in the matrix is a reference to that type of development only to the extent it is not regulated by an applicable State Environmental Planning Policy (SEPP). The following SEPPs in particular may be relevant to development on land covered by this Plan:

SEPP (Housing for Seniors or People with a Disability) 2004
SEPP (Infrastructure) 2007
SEPP (Mining, Petroleum Production and Extractive Industries) 2007
SEPP (Rural Lands) 2008
SEPP (Affordable Rental Housing) 2009
SEPP No 33—Hazardous and Offensive Development
SEPP No 50—Canal Estate Development
SEPP No 62—Sustainable Aquaculture
SEPP No 64—Advertising and Signage

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Is the zone used? [please select Y/N for each zone]	Y	Y	N	Y	N	N	N	Y	Y	N	Y	Y	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N
(LAND USE terms WITHIN agriculture group term)																															
agriculture								x	x		x	x	x		x					x	x			x	x	x	x	x			
aquaculture	c	c		c				x	x		x	x	x		x					x	x			x	x	x	x	x			
extensive agriculture [eg. grazing of livestocks, etc.]	o	o		o				x	x		x	x	x		x					x	x			x	x	x	o	o			
bee keeping	o	o		o				x	x		x	x	x		x					x	x			x	x	x	o	o			
dairy (pasture-based)	o	o		o				x	x		x	x	x		x					x	x			x	x	x	o	o			
intensive livestock agriculture [eg. poultry farms, etc.]	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
feedlots	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
dairies (restricted)	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
intensive plant agriculture [eg. cultivation of irrigated crops]	c	c		c				x	x		x	x	x		x					c	c			x	x	x	x	x			
horticulture	c	c		c				x	x		x	x	x		x					c	c			x	x	x	x	x			
turf farming	c	x		c				x	x		x	x	x		x					c	c			x	x	x	x	c			
viticulture	c	c		c				x	x		x	x	x		x					c	c			x	x	x	x	c			
(LAND USE terms OUTSIDE agriculture group term)																															
animal boarding or training establishments	c	c		c				x	x		x	x	x		x					x	x			x	x	x	x	x			
farm buildings	c	c		c				x	x		x	c	c		c					c	c			x	x	x	x	c			
forestry	x	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
(LAND USE terms WITHIN residential accommodation group term)																															
residential accommodation								c	c		c		x		c					x	x			x	x	x	x	x			
attached dwellings	x	x		x			c	x	c		x	x	x		c					x	x			x	x	x	x	x			
boarding houses	x	x		x			c	c	c	c	x	c	c		c					x	x			x	x	x	x	x			
dual occupancies	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	x			
dual occupancies (attached)	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	c			
dual occupancies (detached)	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	x			
dwelling houses	c	c		c	c	c	c	c	c		c	c	x		c					x	x			x	x	x	c	c			
group homes	c	c		c			c	c	c	A	c	c	x		A					x	x			x	x	x	x	x			
group homes (permanent)	c	c		c			c	c	c	A	c	c	x		A					x	x			x	x	x	x	x			
group homes (transitional)	c	c		c			c	c	c	A	c	c	x		A					x	x			x	x	x	x	x			
hostels	x	x		x			c	c	c		c	c	c		c					x	x			x	x	x	x	x			
multi dwelling housing	x	x		x			c	x	c		x	x	x		c					x	x			x	x	x	x	x	x	x	
residential flat buildings	x	x		x			c	x	c	c	x	x	x		c					x	x			x	x	x	x	x	x	x	
rural worker's dwellings	c	c		c				x	x		x	c	x		c					x	x			x	x	x	x	x			
secondary dwellings	c	c		c			A	A	A	A	A	x	x		c					x	x			x	x	x	x	c			
semi-detached dwellings	x	x		x			c	c	c		x	x	x		c					x	x			x	x	x	x	x			
seniors housing	x	x		x			c	c	c		c	c	x		c					x	x			x	x	x	x	x	x	x	
residential care facilities	x	x		x			c	c	c		c	c	x		c					x	x			x	x	x	x	x	x	x	
shop top housing	x	x		x			c	x	x	c	x	c	c		c					x	x			x	x	x	x	x			
(LAND USE terms OUTSIDE residential accommodation group term)																															
home-based child care	c	c		c				c	c		c	c	c		c					c	c			x	x	x	c	c			
home business	c	c		c				c	c		c	c	c		c					c	c			x	x	x	c	c			
home occupations	o	o		o	o		o	o	c		o	c	c		c					c	c			x	x	x	o	o			
home occupation (sex services)	c	c		c				c	c		c	c	c		c					c	c			x	x	x	c	c			
(LAND USE terms WITHIN tourist and visitor accommodation group term)																															
tourist and visitor accommodation													c		c					x	x		c	x	x	x	x	c			
backpackers' accommodation	x	x		x				x	x		x	c	c		c					x	x		c	x	x	x	x	c			
bed & breakfast accommodation	c	c		c				c	c		c	x	c		c					x	x		c	x	x	x	x	c			
farm stay accommodation	c	c		c				x	x		x	c	c		c					x	x		c	x	x	x	x	c			
hotel or motel accommodation	x	x		x				x	x		x	c	c	c	c		c			x	x		c	x	x	x	x	x	x		
serviced apartments	x	x		x				x	c		x	c	c		c					x	x		c	x	x	x	x	x			
(LAND USE terms OUTSIDE tourist and visitor accommodation group term)																															
camping grounds	x	x		x				x	x		x	x	c		c					x	x			c	c	x	x	x			
caravan parks	x	x		x				x	x		x	x	c		c					x	x			c	c	x	x	x			
eco-tourist facilities	x	x		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
(LAND USE terms WITHIN commercial premises group term)																															
commercial premises													c	c	c																
business premises [eg. banks, post offices, hairdressers, etc.]	x	x		x				x	x		x	c	c	c	c		c			x	x			x	x	x	x	x	x		
funeral homes	c	c		x				x	x		x	c	c	c	c		c			x	x			x	x	x	x	x	x		
office premises	x	x		x				x	x		x	c	c	c	c			c		x	x			x	x	x	x	x			
retail premises								x	x		x	c	c	c	c					x	x			x	x	x	x	x	x		
bulky goods premises	x	x		x				x	x		x	c	c	c	c	c				c	c			x	x	x	x	x	x		
cellar door premises	c	c		c				x	x		x	c	c	c	c					x	x			x	x	x	x	c	x		
food & drink premises	x	x		x				x	x		x	c	c	c	c					x	x		c	x	c	x	x	x	x		
pubs	x	x		x				x	x		x	c	c	c	c					x	x		c	x	c	x	x	x	x		
restaurants or cafes	x	x		x				x	x		x	c	c	c	c					x	x		c	x	c	x	x	x	x		
take-away food & drink premises	x	x		x				x	x		x	c	c	c	c					c	x		c	c	c	x	x	x	x		
garden centres	x	x		x				x	x		x	c	c	c	c	c	c			c	x			x	x	x	x	x	x		
hardware & building supplies	x	x		x				x	x		x	c	c	c	c	c	c			c	x			x	x	x	x	x	x		
kiosks	x	x		x				x	x		x	c	c	c	c					c	c			c	c	x	x	x	x	c	
landscaping material supplies	c	c		c				x	x		x	c	c	c	c	c	c			c	c			x	x	x	x	x	x		
markets	x	x		x				x	x		x	c	c	c	c					x	x			x	x	x	x	x	x		
plant nurseries	c	c		c				x	x		x	c	c	c	c		c			c	c			x	x	x	x	x	x		
roadside stalls	c	c		c				x	x		x	x	c	c	c					x	x			x	x	x	x	c	x		
rural supplies	c	c		c				x	x		x	c	c	c	c					c	x			x	x	x	x	c	x		
shops	x	x		x				x	x		x	c	c	c	c					x	x			x	x	x	x	x	x		
neighbourhood shops	x	x		x	c		c	c	c	c	x	c	c	c	c			c	c	c	x			x	x	x	x	x	x		
timber yards	x	x		x				x	x		x	c	c	c	c					c	x			x	x	x	x	x	x		
vehicle sales or hire premises	x	x		x				x	x		x	x	c	c	c					x	c			x	x	x	x	x	x		
(LAND USE terms OUTSIDE commercial premises group term)																															
amusement centres	x	x		x				x	x		x	x	c		c					c	x			x	x	x	x	x			
entertainment facilities	x	x		x				x	x		x	c	c	c	c					c	x			x	x	x	x	x			
function centres	x	x		x				x	x		x	x	c	c	c					c	x			x	c	x	x	x			

Wollondilly Local Environmental Plan 2011

Land Use Matrix [DoP version 3.0]

Legend
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- **I** permitted under SEPP (Infrastructure) 2007.

fill colours in ***green*** *or* ***red*** *mandated under the SI.*
fill colour in ***purple*** *public infrastructure permitted under a SEPP.*

Zone groups: Rural (RU1–RU6); Residential (R1–R5); Business (B1–B7); Industrial (IN1–IN4); SP3; Recr'n (RE1–RE2); Env Prot'n (E2–E4); Waterways (W1–W3).

RU1 Primary Production; RU2 Rural Landscape; RU3 Forestry; RU4 Primary Production Small Lots; RU5 Village; RU6 Transition; R1 General Residential; R2 Low Density Residential; R3 Medium Density Residential; R4 High Density Residential; R5 Large Lot Residential; B1 Neighbourhood centre; B2 Local centre; B3 Commercial Core; B4 Mixed Use; B5 Business Development; B6 Enterprise corridor; B7 Business Park; IN1 General Industrial; IN2 Light Industrial; IN3 Heavy Industrial; IN4 Working Waterfront; SP3 Tourist; RE1 Public Recreation; RE2 Private Recreation; E2 Environmental conservation; E3 Environmental Management; E4 Environmental Living; W1 Natural Waterways; W2 Recreational Waterways; W3 Working Waterways

Land use	RU1	RU2	RU3	RU4	RU5	RU6	R1	R2	R3	R4	R5	B1	B2	B3	B4	B5	B6	B7	IN1	IN2	IN3	IN4	SP3	RE1	RE2	E2	E3	E4	W1	W2	W3
Is the zone used? [please select Y/N for each zone]	Y	Y	N	Y	N	N	N	Y	Y	N	Y	Y	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N
highway service centres	x	x		x				x	x		x	x	c		x					x	x			x	x	x	x	x			
industrial retail outlets	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
registered clubs	x	x		x				x	x		x	c	c	c	c					x	x			x	c	x	x	x			
restricted premises	x	x		x				x	x		x	x	c	c	c					c	x			x	x	x	x	x	x		
service stations	x	x		x				x	x		x	c	c		c					c	x			x	x	x	x	x	x		
sex services premises	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
veterinary hospitals	c	c		c				c	x		c	c	c		c					c	x			x	x	x	x	x			
wholesale supplies	x	x		x				x	x		x	c	c		c					c	x			x	x	x	x	x			
(LAND USE terms WITHIN rural industry group term)																															
rural industries [eg. use of composting facilities and works]	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
agricultural produce industries	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
livestock processing industries	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
sawmill or log processing industries	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
stock & sale yards	c	c		x				x	x		x	x	x		x					x	x			x	x	x	x	x			
(LAND USE terms WITHIN industry group term)																															
industries																										x	x	x	x	x	
heavy industries	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x	x	x	
hazardous industry	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x	x	x	
offensive industry	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x	x	x	
light industries	x	x		x				x	x		x	x	x		x		c	c	c	c	c	c		x	x	x	x	x	x	x	
high technology industries	x	x		x				x	x		x	x	x		x		c	c	c	c	c	c		x	x	x	x	x	x	x	
home industry	c	c		c				c	c		c	c	x		c		c	c	c	c	x	c		x	x	x	c	c	x	x	
general industries	x	x		x				x	x		x	x	x		x				c	c	c			x	x	x	x	x	x	x	
(LAND USE terms OUTSIDE industry group term)																															
boat building and repair facilities	x	c		x				x	x		x	x	x		x					c	c	c		x	x	x	x	x			c
vehicle body repair workshops	x	x		x				x	x		x	x	x		x					c	c			x	x	x	x	x			
vehicle repair stations	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
(LAND USE terms WITHIN heavy industrial storage establishment group term)																															
heavy industrial storage establishments	x	x		x				x	x		x	x	x		x									x	x	x	x	x			
hazardous storage establishments	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x			
liquid fuel depots	x	x		x				x	x		x	x	x		x					c	c			x	x	x	x	x			
offensive storage establishments	x	x		x				x	x		x	x	x		x					x	c			x	x	x	x	x			
(LAND USE terms WITHIN storage premises group term)																															
storage premises	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
self storage units	x	x		x				x	x		x	x	x		x					c	x			x	x	x	x	x			
(LAND USE terms OUTSIDE storage premises group term)																															
depots	c	c		x				x	x		x	x	x		x				c	c	c			c	x	x	x	x			
warehouse or distribution centres	x	x		x				x	x		x	c	c		c	c	c	c	c	c	c			x	x	x	x	x	x	x	
(LAND USE terms WITHIN sewerage system group term)																															
sewerage systems				x				c	c		c		c		c					c	c			c	c	x	x	c			
biosolids treatment facilities	I	I		I				c	x		x	x	x		c				I	c	I			c	c	x	x	x			
sewage reticulation systems	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
sewage treatment plants	I	I		I				c	c		x	c	c		c				I	c	I			c	c	x	x	x			
water recycling facilities	I	I		I				c	c		x	x	c		c				I	c	I			c	c	x	x	c			
(LAND USE terms WITHIN waste or resource management facility group term)																															
waste or resource management facilities	I	I		x				x	x		x								I	c	I			x	x	x	x	x			
resource recovery facilities	I	I		x				x	x		x	x	x		x				I	x	I			x	x	x	x	x			
waste disposal facilities	I	I		x				x	x		x	x	x		x				I	x	I			x	x	x	x	x			
waste or resource transfer stations	I	I		x				x	x		x	c	c		c	I	I		I	I	I	I		x	x	x	x	x			
(LAND USE terms WITHIN water supply system group term)																															
water supply systems	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c			
water reticulation systems	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c			
water storage facilities	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c			
water treatment facilities	c	c		c				x	c		x	x	x		c					c	c			c	c	c	c	c			
(LAND USE terms WITHIN air transport facility group term)																															
air transport facilities	c			x				x	x		x	x	c		c					x	c			x	x	x	x	x			
airport	c	c		x				x	x		x	x	c		c					x	c			x	x	x	x	x			
heliport	c	x		x				x	x		x	x	c		c					c	c			x	x	x	x	x			
(LAND USE terms OUTSIDE air transport facility group term)																															
airstrip	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
helipad	x	x		x				x	x		x	c	c		c					c	c			c	x	x	x	c			
(Other LAND USE terms relating to infrastructure)																															
car parks	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
electricity generating works	I	I	I	I				x	x		x	c	c		c				I	c	I			c	c	x	x	x			
freight transport facilities	x	c		x				x	x		x	x	x		x				c	x	c			x	x	x	x	x			
passenger transport facilities	x	x		x				x	x		x	x	c	c	c	c	c	c		x	x			x	x	x	x	x			
port facilities	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			c
roads	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c			
transport depots	c	c		x				x	x		x	x	c		c					c	c			x	x	x	x	x			
truck depots	c	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
wharf or boating facilities	x	x		x				x	x		x	x	x		x					x	x			x	x	x	x	x			c
(LAND USE terms WITHIN educational establishment group term)																															
educational establishments [eg. TAFE establishment, etc.]	x	I		I	I	I	I	I	I	I	I	I	c	c	c	I	I	I		c	x			x	x	x	x	I			
schools	x	I		I	c	I	I	I	I	I	I	I	c	c	c	I	I	I		c	x			x	x	x	x	I			
(LAND USE terms WITHIN health services facility group term)																															
health services facilities	x			I	I	I	I	I	I	I	I	c	I	I	I	I	I	I		c	c			x	x	x	x	x			
hospitals	x	c		I	I	I	I	x	I	I	I	c	I	I	I	I	I	I		c	c			x	x	x	x	x			
medical centres	x	x		I	I	I	I	x	I	I	I	c	c	c	c	I	I	I		c	x			x	x	x	x	x			
health consulting rooms	x	x		I	I	I	I	c	I	I	I	c	I	I	I	I	I	I		c	c			x	x	x	x	x			
(Other LAND USE terms relating to community infrastructure)																															

Wollondilly Local Environmental Plan 2011

Land Use Matrix [DoP version 3.0]

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	Rural						Residential					Business							Industrial				SP3	Recr'n		Env Prot'n			Waterways		
	RU1 Primary Production	**RU2** Rural Landscape	**RU3** Forestry	**RU4** Primary Production Small Lots	**RU5** Village	**RU6** Transition	**R1** General Residential	**R2** Low Density Residential	**R3** Medium Density Residential	**R4** High Density Residential	**R5** Large Lot Residential	**B1** Neighbourhood centre	**B2** Local centre	**B3** Commercial Core	**B4** Mixed Use	**B5** Business Development	**B6** Enterprise corridor	**B7** Business Park	**IN1** General Industrial	**IN2** Light Industrial	**IN3** Heavy Industrial	**IN4** Working Waterfront	**SP3** Tourist	**RE1** Public Recreation	**RE2** Private Recreation	**E2** Environmental conservation	**E3** Environmental Management	**E4** Environmental Living	**W1** Natural Waterways	**W2** Recreational Waterways	**W3** Working Waterways
Is the zone used? [please select Y/N for each zone]	Y	Y	N	Y	N	N	N	Y	Y	N	Y	Y	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N
child care centres	x	x		c	c		c	c	c	c	c	c	c	c	c	c		c		x	x			c	x	x	x	x			
community facilities	c	c		c	c		c	c	c	c	c	c	c	c	c		c			c	x			c	c	x	x	x			
correctional centres	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
emergency services facilities	I	I	I	I	I			c	c			I	I	I	I	I	I	I	I	I	I	I		c	x	x	x	c			
industrial training facilities	x	x		x				x	x			x	x		x				c	c	c			x	x	x	x	x			
information and education facilities	c	c		c				x	x			c	c	c	c					c	c			c	c	x	c	c			
places of public worship	c	c		c	c		c	c	c	c	c	c	c		c					c	x			x	x	x	x	x			
public administration building	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
research stations	c	c		c				x	x		x	x	x		x					x	x			x	x	x	x	x			
respite day care centres	x	x		c	c		c	c	c	c	c	c	c	c	c	c		c		x	x			c	x	x	x	x			
(LAND USE terms WITHIN signage group term)																															
signage	c	c		c				c	c		c	c	c		c					c	c			x	c	x	x	c			
advertising structure	c	c		c				c	c		c	c	c		c					c	c			x	c	x	x	c			
building identification sign	c	c		c				c	c		c	c	c		c					c	c			x	c	x	x	c			
business identification sign	c	c		c				c	c		c	c	c		c					c	c			x	c	x	x	c			
(LAND USE terms relating to recreation)																															
boat launching ramps	x	x		x				x	x		x	c	c		c					c	c	c		x	x	x	x	x			
boat sheds	x	c		x				x	x		x	x	x		x					c	c			c	c	x	x	x		*	*
charter & tourism boating facilities	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
environmental facilities	c	c		c				c	c		c	c	c		c					c	c			c	c	c	c	c	*	*	*
jetties	x	x		x				x	x		x	c	c		c					c	c	c		x	x	x	x	x			
marinas	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x		c	
mooring	x	x		x				x	x		x	c	c		c					c	c			x	x	x	x	x			
mooring pens	x	x		x				x	x		x	c	c		c					x	x			x	x	x	x	x			
recreation areas	c	c		c	c			c	c		c	c	c		c					c	c			c	c	x	x	c			
recreation facilities (indoor)	x	c		x	c			x	x		x	c	c	c	c					c	x			c	c	x	x	x			
recreation facilities (major)	x	x		x				x	x		x	x	x		x					x	c			c	c	x	x	x	x		
recreation facilities (outdoor)	x	c		x	c			x	x		x	x	x		c					x	c			c	c	x	x	c			
water recreation structures	c	c		x				x	x		x	x	x		x					x	x			c	x	x	c	c		*	*
(Other miscellaneous LAND USE terms)																															
cemetery	c	c		c				c	x		c	x	x		x					x	x			x	x	x	x	x			
crematorium	c	c		x				x	x		x	x	x		x					x	c			x	x	x	x	x			
environmental protection works	c	c		c				c	c		x	c	c		c					c	c			c	c	c	c	c	*	*	*
exhibition homes	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	x			
exhibition villages	x	x		x				c	c		x	x	x		c					x	x			x	x	x	x	x			
extractive industries	c	c		x				x	x		x	x	x		x					x	c			x	x	x	x	x			
flood mitigation works	c	c		c				c	c		c	c	c		c					c	c			c	c	x	c	c			
mortuaries	x	c		x				x	x		x	x	x		x					c	c			x	x	x	x	x			
open cut mining	x	x		c				x	x		x	x	x		x					x	x			x	x	x	x	x			
(OTHER LAND USES)																															
development which cannot be characterised into any land uses defined in the SI																															

Note 1. Zone B8 Metropolitan Centre is not included in the matrix given this zone may only be used in two nominated LGAs. Zone E1 National Parks and Nature Reserves is not included given there is no need to add any additional uses to the zone. Zones SP1 Special Activities and SP2 Infrastructure are not included given the primary uses in these zones should be annotated on the Land Zoning Map.

Note 2. A type of development referred to in the matrix is a reference to that type of development only to the extent it is not regulated by an applicable State Environmental Planning Policy (SEPP). The following SEPPs in particular may be relevant to development on land covered by this Plan:
SEPP (Housing for Seniors or People with a Disability) 2004
SEPP (Infrastructure) 2007
SEPP (Mining, Petroleum Production and Extractive Industries) 2007
SEPP (Rural Lands) 2008
SEPP (Affordable Rental Housing) 2009
SEPP No 33—Hazardous and Offensive Development
SEPP No 50—Canal Estate Development
SEPP No 62—Sustainable Aquaculture
SEPP No 64—Advertising and Signage