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PLANNING PROPOSAL

Land Subject of Planning Proposal:

- Lot 11, DP844443, 7 Standen Drive, Lower Belford;
- Part of Lot 12, DP1100005, 5 Standen Drive, Lower Belford;
- Part of Lot 13, DP1100005, 133 Standen Drive, Lower Belford;
- Part of Lot 6, DP237936, Standen Drive, Lower Belford;
- Lot 91, DP:1138554, 147B Standen Drive, Lower Belford;
- Lot 92, DP:1138554, 147A Standen Drive, Lower Belford.

Date: 18 October 2010

Version: 2

Executive Summary

This Planning Proposal seeks to amend Singleton Council's Local Environmental Plan to facilitate rural residential development with a minimum lot size of 8,000 square metres (sqm), and average minimum lot size of 1 hectare (ha). Lot size provisions are intended to be implemented by way of minimum lot size mapping.

This is a revised planning proposal which builds upon a previous planning proposal that was considered by the NSW Department of Planning in February 2010. The earlier Planning Proposal was considered by Council and supported (refer resolution 23rd November 2009, Item Ref. LA65/2008).

The gateway determination (February 2010), however, did not support the planning proposal proceeding at that time. Upon review, it was identified that the reasons provided for the gateway decision did not reflect the actual situation. As such, this revised planning proposal has been prepared which provides additional information to address the matters of concern raised by the Department of Planning.

This proposal seeks to rezone a large section of the Lower Belford Candidate Area to an environmental living zone as well as a strip of land adjoining the northern boundary of the candidate area. This would extend the area to the boundary of cleared vegetation. Minimum lot size provisions to allow subdivision of the land to create lots with a minimum lot size of 8,000sqm and a minimum average lot size of 1Ha are also proposed to be implemented. To provide for coordinated development of the site and efficient and effective infrastructure provision, it is intended to require Development Control Plan provisions to be prepared for the site.

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1 Introduction

1.1 Background

Over the last decade, Singleton Council has pursued a co-ordinated strategy to manage rural residential and residential development within the LGA. In 2004, Council adopted the Rural Residential Development Strategy (prepared by ERM) which first identified the Standen Drive area (including the subject site), as suitable for rural residential development. The potential of this land was further reviewed through the subsequent Singleton Land Use Strategy (SLUS) adopted by Council on 21st April 2008. The SLUS confirmed the subject site as part of the Lower Belford Candidate Area (CA) suitable for rural residential development and permits intensification to be considered where servicing is available. The table below provides a timeline of the development of the Strategy which provides the context for the consideration of this proposal.

On 23rd November 2009, Singleton Council considered and supported a Planning Proposal for the subject site held by Belford Land Corporation (BLC) in the Lower Belford Candidate Area (LA 65/2008). The proposal set out the amendments to Council's Local Environmental Plan (LEP) to permit rural residential allotments to a minimum lot size of 8,000sqm. Council then forwarded the Planning Proposal to the Department of Planning for Gateway determination in order to proceed to a more detailed planning phase. On 8th February 2010, the Gateway determination was issued, which identified further issues the Department of Planning considered necessary to be addressed.

Summary of Singleton Council's Rural Residential Planning Process

Mid 1990's	Hirst Consulting Rural Residential Strategy adopted in 1996 but not acted upon by Council due to consultation with DPI.
1999 – 2004	Singleton Council commenced the Rural Residential Development Strategy process.
December 2004	Singleton Rural Residential Development Strategy (ERM Report). *Site first identified*
2004 - 2006	2004 Report considered by Council however this process ran into a new process introduced by DoP. DoP advised that a new strategy process must be commenced and funding allocated to Council (from Plan First) to undertake Strategy development and comprehensive LEP.
2006	Exhibition of Situation Analysis, which formed the background for the consequent Singleton Land Use Strategy. *Submission by BLC includes identification of development at Standen Drive*
April 2007	Exhibition of Draft Singleton Land Use Strategy. *Submission by BLC includes identification of development at Standen Drive and comprehensive land supply analysis*
April 2008	Singleton Council adopted the Land Use Strategy in April 2008.
July 2008	Rezoning Submission made to Council for Standen Drive. Response: Council request Land Use Strategy Amendment with Rezoning submission as per advice from NSW Department of Planning *Note: In 2007, the Hunter Water Corporation expanded their area of operations. The land subject of this planning proposal is within this revised servicing area.*

	The Hunter Water Corporation has given preliminary advice on the planning proposal, which indicates that water supply can be made available to the site. The timing of provision of such supply will be influenced by user demand (i.e. lodgement/approval of development applications for subdivision etc), programming of infrastructure works and relevant economic considerations.
December 2008	*Land Use Strategy Amendment Proposal submitted by BLC to Council*
February – July 2009	Various revisions to Land Use Strategy Amendment submitted to Council to address matters raised by Council, DECCW, Hunter Water, Department of Primary Industries and the RTA including: ▪ Detailed ecology advice. ▪ Detailed geotechnical report on effluent disposal and salinity assessment. ▪ Traffic impact assessment.
November 2009	Report to Council. Council support Planning Proposal and refer to DoP Gateway.
January 2010	DoP provides example template to Council to inform preparation of land release monitor.
February 2010	Council provides DoP with Draft Land Use Monitor for comment.
February 2010	8 February 2010 - Gateway Determination issued. Gateway Determination indicates that the planning proposal should not proceed prior to Council's Standard Instrument LEP because: ▪ There is already an adequate supply of zoned rural residential lots across the Singleton LGA. ▪ The appropriate zoning to use for the site would be best confirmed as part of Council's principle plan to be prepared April/May 2010. The explanation provided for the gateway decision was not representative of the actual situation.
June 2010	DoP provides letter to Council clarifying Standen Drive Gateway matters.
July 2010	Comments on Council's Draft Land Use Monitor provided to Council by DoP.
August 2010	Council finalising Land Use Monitor in consultation with DoP.

1.2 Purpose

This revised planning proposal has been prepared as a result of advice from the Department of Planning subsequent to the gateway determination.

The Department of Planning advised that their view that sufficient rural residential zoned lots already existed across the LGA, was derived from the number of rezoning proposals which have been given initial support by the planning panel and the reference in Table 14 of the SLUS (within Section 7.2), that there is the potential for an additional 310 rural residential lots to be subdivided in Hanwood Estate, subject to overcoming significant development constraints.

The Hanwood Estate land, referenced in Table 14, became part of the Huntlee New Town site subsequent to the preparation of the SLUS. A number of the rural residential planning proposals that have been given initial support by the planning panel require resolution of matters raised by public authorities and have not progressed to being made. Upon realization of these facts, the Department of Planning provided advice in their letter dated 24 June 2010 **(Appendix A)**, indicating that a revised Planning Proposal could be considered. Such a proposal would need to include:

- A strengthened analysis of supply and demand.
- Strengthened justification for the proposed amendment in terms of the supply and demand analysis.
- The identification of zones to be used and proposed zone boundaries reflecting the land's capabilities.
- The resolution of any environmental issues that have been identified. In this regard the Planning Proposal should be consistent with advice previously received from the Department of Climate Change and Water (DECCW).
- Regard to Council's land use monitor (which is to be completed in consultation with the Department of Planning) that addresses matters such as availability of zoned land and services, its location, uptake rates and demand as well as future supply including LEPs and Planning Proposals currently under assessment.

As such, this Planning Proposal draws largely from the following:

- Council Report and Resolution Item LA 65/2008 (23rd November 2009).
- Belford Land Corporation's (BLC) Submission for Proposed Amendment to Singleton Land Use Strategy (Urbis, July 2009) including:
  - Advice from Hunter Water Corporation.
  - Land Supply Analysis (Urbis).
  - Preliminary Ecological Assessment (Cumberland Ecology).
  - Report on Effluent Disposal, Erosion and Salinity Assessment (Douglas Partners).
  - Traffic Impact Assessment (Hyder Consulting).
  - Consultation with various agencies by Council and/or the proponent including Department of Primary Industries, Department of Environment and Climate Change, Roads and Traffic Authority.
- BLC Rezoning Application (Urbis, July 2008).
- BLC submission to Council's Draft Land Use Strategy (Rohan Dickson and Associates, December 2007).

1.3 Council Report and Resolution November 2009

On 23rd November 2009 Singleton Council considered the Item LA65/2008 in relation to the Strategy Amendment and Planning Proposal for Standen Drive, Lower Belford (Meeting of Singleton Council, Executive Manager Strategy and Governance Report No. 30/09). Council's Report and Planning Proposal (November 2009 Report) was prepared by Council officers and incorporated the advice from Hunter Water, consultation with agencies involved with the development of the SLUS and the submission by BLC addressing issues raised by Council and agencies including ecology, land supply, traffic and geology.

After preliminary consideration of the impacts that a lower minimum lot size and thus increased lot yield may have in relation to demand and supply, ecology and the local road network; and after reviewing geotechnical advice provided by the proponent about the ability of the sites geology to cope with increased development (erosion etc) and onsite effluent disposal (septic); Council decided to provide initial support for the proposal.

The key relevant aspects of the Council Report and resolution are summarised as follows:

Servicing by Hunter Water Corporation

In regard to the Hunter Water Corporation, the report advises that consideration should be given to a lower minimum lot size with the extension of the Hunter Water Corporation service area and subsequent potential for reticulated water servicing.

Clarification of Development Potential

In regard to clarification of the development potential of the Lower Belford Candidate Area and to rezone the land accordingly, the requests are:

> *"…generally foreshadowed in the existing SLUS and are recommended to be supported in general terms. The details of the requests, however, such as minimum lot size provisions and location of the western boundary of the candidate area, will need to be determined through the "gateway" process and the assessment of the planning proposal which has been prepared in relation to this.*
>
> *The preliminary environmental assessment which has been lodged in support of the requests indicates that impacts can be satisfactorily addressed*."

Boundary Extension to Lower Belford Candidate Area

In regard to the request for a minor extension to the Lower Belford Candidate Area, Council considered that this:

> *"…should be investigated and resolved during the government authority consultation phase of the planning proposal assessment."*

The report noted that the existing candidate area boundary was largely set to align with cadastral boundaries to the north of the subject site. Council officers noted that BLC owns land on both sides of the Candidate Area boundary subject of this proposal.

Appropriate Lot Size

In preparation of their Rural Residential Strategy 2005, Council were advised by government authorities that are now incorporated into the Department of Environment, Climate Change and Water (DECCW), that if rural residential subdivision were to proceed, reticulated water should be provided. Further to this, Council's negotiations with agencies confirmed a minimum average of at least 1 ha lots, with an absolute minimum of 8,000sqm, is required to avoid potential cumulative impacts. These lot size outcomes were incorporated into the Rural Residential Strategy and carried over into the SLUS 2008:

> *Of particular note, the Planning proposal subject of the November 2009 meeting proposed to rezone the subject land to a minimum lot size of 8000sqm. This Revised Planning Proposal incorporates the agency advice and proposes to pursue a minimum average of at least 1 ha, with an absolute minimum of 0.8ha allotments.*

Report Resolution

The resolution of Council in the November 2009 Report was to:

1. *Adopt the planning proposal for the subject land and forward it to the Department of Planning for gateway determination; and*
2. *Amend its Singleton Land Use Strategy 2008 to clarify the development potential of the Lower Belford Candidate Area, the details of this amendment to be determined through the assessment of the planning proposal and to be exhibited concurrently with the planning proposal.*

1.4 Gateway Matters

On 8th February 2010, a Gateway determination was issued for the previous Planning Proposal. The Gateway determination indicated that the proposal should not proceed on the basis that:

- There is clear indication that there is an adequate supply of zoned rural residential lots across the Singleton LGA and there is no demonstrated need to proceed prior to Council's principle plan which is proposed to be submitted to the Department in April/May 2010.
- Consideration of the proposal in the context of the principle plan will provide Council with the opportunity to determine the most appropriate zone for the subject land.

Singleton Council Land Use Monitor

At the time of the February 2010 Gateway determination by the Department of Planning, the Singleton Council Land Use Monitor (the Monitor) was a work in progress. The Monitor is being prepared by Council in consultation with the Department of Planning and is nearing completion. While the land release monitor was not completed at the time of development of this planning proposal, it is expected that the monitor will only confirm that the amount of land that has been rezoned for rural residential purposes, since the adoption of the SLUS, is less than what has been recommended by the SLUS. This has resulted in a significant under supply of such land within the Singleton LGA.

In relation to the subject proposal and supply and demand for rural-residential land, the following points are noted:

- *The SLUS identified land for rural residential development, which it estimated would meet demand for approximately the next 8.93 years based on an estimated demand of 75 residential lots per year (including fully serviced and un-serviced lots).*
- The SLUS identified the potential yield of approximately 22 lots from this site, based on a minimum lot size of 4ha and minimum average lot size of 5ha.
- The SLUS identified the potential for intensification of the Lower Belford Candidate Area subject to servicing.
- 8,000 sqm lots with a minimum average 1 ha will provide for a maximum yield of 125 lots from the subject site, which is an additional 103 lots (based on 10% subdivision efficiency for roads, biodiversity, drainage etc) compared to the projected 22 lots.
- *The SLUS objectives for rural residential development indicate that up to 10 years supply of rural residential zoned land is appropriate. The supply of such land, as projected by the SLUS for its candidate areas; provides approximately 8.93 years total supply. The increase in lot yield indicated by this Planning Proposal of 103 lots, would increase the total projected rural residential lot yield to just over 10 years supply, which is consistent with the objectives of the SLUS for rural residential development.*

Further details regarding land supply and demand analysis are contained in Section 7 of this revised Planning Proposal.

Future LEP Provisions

Since lodgement of the previous Planning Proposal to the Department of Planning, Council has refined its advice as to an appropriate land use zone, and minimum lot size requirements applicable to subdivision of the site.

The decision to use an environmental living zone (7b zone under the Singleton LEP 1996 or E4 zone under the standard instrument LEP) and apply a minimum lot size of 8,000sqm, with a minimum average lot size of 1ha for subdivision, has now been confirmed by Council.

The proposed zoning and subdivision requirements recommended by this planning proposal are considered to be appropriate for the site given the zoning recommendations of the SLUS and the existence of an endangered ecological community (EEC) on the site (note: the Central Hunter Ironbark - Spotted Gum - Grey Box Forest has been listed as being an EEC under Part 3 of Schedule 1 of the *Threatened Species Conservation Act 199*5. This listing occurred after lodgement of the previous planning proposal).

It is intended to require site specific development control plan provisions to be prepared for the site as part of the LEP amendment, to help manage the design and staging of development of the site.

Boundary Alignment

The matter of the appropriate boundary alignment of the Lower Belford Candidate Area is addressed in Council's November 2009 Report, noting that:

- At the request of the now DECCW, the original Candidate Area boundaries were realigned to minimise the inclusion of native vegetation. As such, the western boundary of the Lower Belford Candidate Area was moved significantly to the east. This location was selected as it largely aligned with cadastral boundaries.
- A section of this boundary is shown to be located approximately 100m further to the west, over a north-south distance of approximately 800m. This increases the total area of the Candidate Area by approximately 8ha. Aerial photography demonstrates that there is minimal native vegetation within this strip.
- Consequently, Council stated that *"…since BLC own the land on both sides of the cadastral boundary, it will not be necessary to use it to define the edge of the Candidate Area."*

Lot Sizes

In relation to the provisions for lot sizes, Council's November 2009 Report noted that a minimum lot size map would be instrumental in controlling the size of lots created by subdivision. Council also noted that the site is able to be serviced by water but not by sewer. As a result, Council recommended that lot sizes be no less than 8,000 sqm.

The November 2009 Report noted that larger lot sizes would be required in locations where significant vegetation or other constraints were found to exist.

Environmental Issues

In relation to environmental issues, advice has been sought from DECCW on several occasions by Council and the proponent as part of preparing a Planning Proposal for the site. Council's November 2009 Report (Planning Proposal) detailed the following comments:

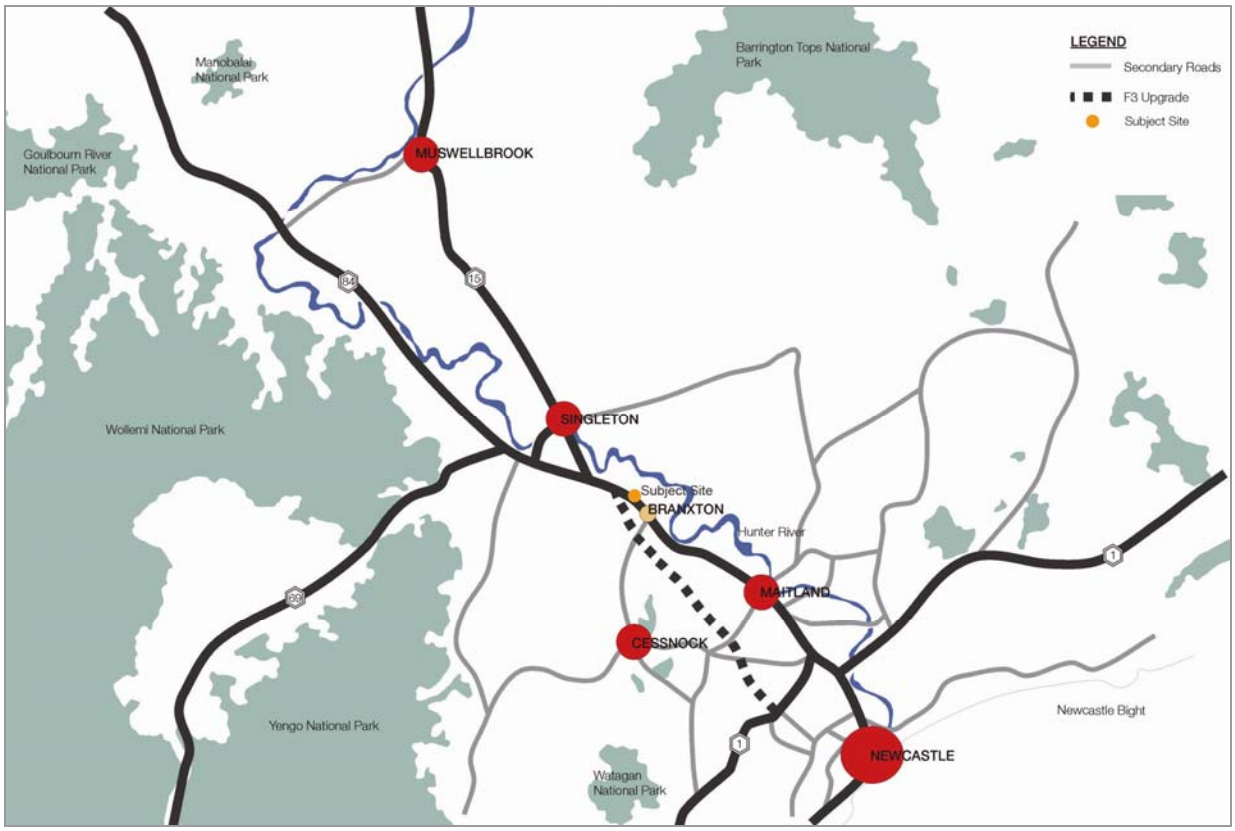
- The proposal is not expected to generate significant adverse environmental impacts. In relation to biodiversity, the onus is on the proponent to demonstrate that the proposal will maintain or improve the current situation.
- Intermittent natural water courses dissect the site. The site is not identified to be within a designated floodplain, although during major storm events some localised flooding of the natural watercourses may occur. Localised flooding can be addressed through appropriate subdivision design and layout.
- Bushfire and flora and fauna impacts can be addressed through appropriate subdivision, and as part of the development control plan and development application process. Detailed studies are required by the proponent to consider bushfire amelioration requirements and mechanisms, as well as vegetation protection.

The most recent advice sought by the proponent followed the February 2010 Gateway advice. This advice confirmed with both specialist ecological consultants Cumberland Ecology (who prepared the Preliminary Ecological Assessment) and DECCW, that no further consultation with DECCW is required prior to Gateway. Further details in relation to environmental issues are provided in later parts of this revised Planning Proposal.

2 Local and Site Context

The site is situated within 3km of the town of Branxton, within the Singleton Local Government Area. Branxton is located central to Singleton, Maitland and Cessnock in the central Hunter region, as illustrated in Figure 1.

Figure 1 – Central Hunter Region



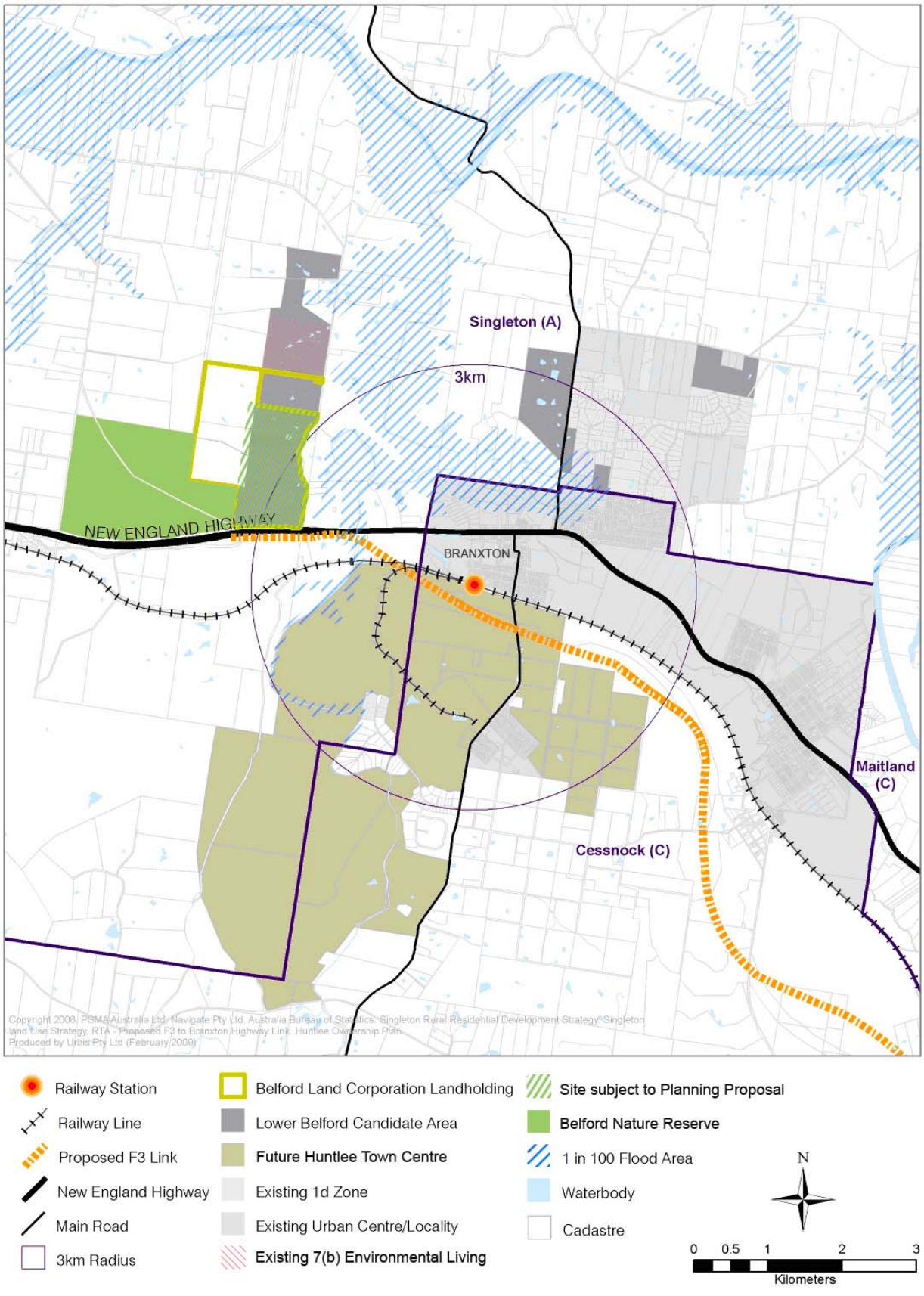
2.1 Local Context

The site is situated within an area characterised by the following local contextual features:

- The proposed F3 link will intersect with the New England Highway to the west of the southern part of the site.
- The site is located less than 3km to Branxton along the New England Highway, from the south-eastern site corner at the intersection of Standen Drive and the New England Highway.
- The site directly adjoins the Belford Nature Reserve to the west.
- Black Creek currently traverses land approximately 0.7-2.1km east of the site.
- The Lower Belford Candidate Area, to which the large majority of the subject site is located within, provides for rural residential development with a minimum of 5ha lots and the potential for intensification of lots to a minimum of 8,000sqm (average 1 ha) where reticulated water is provided.
- Land less than 300 metres to the north of the subject site has recently been rezoned for rural residential development purposes.

Figure 2 illustrates the local contextual features of the site.

Figure 2 – Local Context



2.2 Key Site Characteristics

This Planning Proposal relates to the site as identified in Figure 3. The site is constituted by five adjoining parcels of land being the south-eastern corner of Lot 6 DP237936, the eastern portion of Lot 13 DP1100005, the eastern portion of Lot 12 DP1100005, Lot 11 DP844443, Lot 91 DP1138554 and Lot 92 DP1138554.

Figure 3 – Site Aerial

The site comprises the following key features and characteristics:

- A combination of 5 lots constituting a total area of 139ha.
- Four dwellings and other smaller structures exist on the site.
- The site has dual frontages to Standen Drive (east) and the New England Highway (south), with access only from Standen Drive.
- To the west of the site is the Belford Nature Reserve and vacant rural land that is outside the candidate area.
- The soil on the site is of a Muree Sandstone formation from the Maitland Group, typified by sandstone, conglomerate and minor clay. Minor rock outcrops exist in the western portion (ridge) of the site.
- The site contains a north-south ridge located towards the centre of the site, which attains a height of 102 metres. The site has an approximate 1:10 slope in areas, falling away from the site's central ridgeline to the west and east of the site.
- There are several existing farm dams across the site.
- The site has historically been used for hobby farm grazing.
- The majority of the site is cleared, with trees occurring predominantly along the New England Highway frontage and along drainage lines.
- The site is not within the area identified as being inundated by floodwaters during the 1:100yr ARI flood event.
- The site is not constrained by areas of high agricultural or scenic value.
- Cumberland Ecology in their Preliminary Ecological Assessment has identified the presence of 3 Endangered Ecological Communities on the site, being:
    - **Lower Hunter Spotted Gum – Ironbark Forest** (occurs predominantly on the western slopes of the site)
    - **Central Hunter Ironbark – Sportted Gum – Grey Box Forest** (occurs largely on the western slopes of the site and in a few patches on the eastern slopes); and
    - **Hunter Lowlands Red Gum Forest** (occurs predominantly in gullies on the site).

  Protection and enhancement of environmental values is specifically required under the proposed environmental living zoning.

3 Part 1 – Objectives or Intended Outcomes

The intention of this Planning Proposal is to rezone land consistent with the SLUS to deliver rural residential development on a site that is recognised by the Strategy as suitable for rural residential development.

The specific objectives of the proposed LEP are:

(a) To change the land use zoning of Lot 11, DP844443; Part of Lot 12, DP1100005; Part of Lot 13, DP1100005; Part of Lot 6, DP237936; Lot 91, DP:1138554; and Lot 92, DP: 1138554; Standen Drive, Lower Belford; to land use zone(s) which appropriately correspond to the minimum lot sizes and constraints of the site.

(b) To apply minimum rural residential lot size provisions of 8,000sqm for subdivision of the land with a minimum average lot size of 1ha.

(c) To prevail over *State Environmental Planning Policy (Rural Lands) 2008* to the extent to which the policy prohibits a dwelling to be erected on Lot 92, DP 1138554.

4 Part 2 – Explanation of Provisions

Council is currently operating under the Singleton Local Environmental Plan 1996. Like most Councils in NSW, Singleton Council is in the process of drafting a new Local Environmental Plan (LEP) in accordance with the LEP standard instrument (SI) template to replace the Singleton LEP 1996.

Preparation of Singleton Councils new SI LEP is not prioritized by NSW Planning as reflected in its list of SI LEPs proposed to be fast-tracked which was publicised in 2009. The timing of preparation, exhibition and adoption of Singleton Councils SI LEP is therefore uncertain.

Council is currently processing rezoning proposals separately from the new SI LEP to simplify and streamline the process of developing the SI LEP. This provides for matters associated with individual rezoning proposals to be resolved without affecting the SI LEP process.

The method of achieving the objectives of this Planning Proposal will differ according to whether or not the amendment occurs to the Singleton LEP 1996 or the SI LEP.

4.1 Under the Singleton Local Environmental Plan 1996 (SLEP 1996)

Description

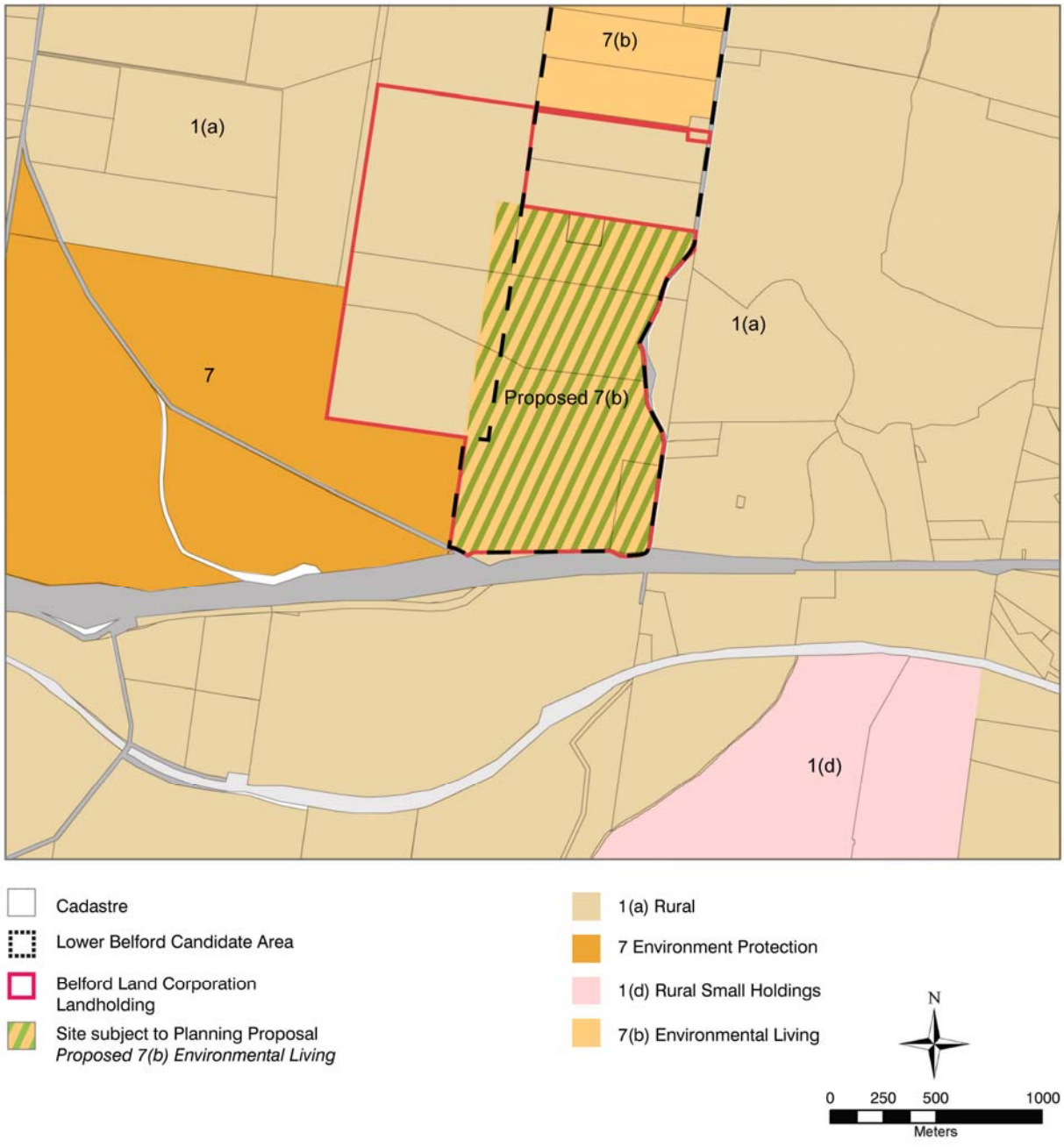
Implementation of this Planning Proposal as an amendment to the Singleton LEP 1996 would involve:

- Utilisation of the 7(b) (Environmental Living Zone) for the site. Note: This zone was incorporated into the Singleton LEP 1996 on the 18th June 2010 as part of Amendment No. 55 to the Singleton LEP 1996.
- Creation of a zoning plan and lot size map for the site.
- Modification of clause 14D of the Singleton LEP 1996 so that it applies to the land subject of this Planning Proposal (requires a development control plan to be prepared for the site).
- Modification of the definition of "Lot Size Map" of clause 9(1) of the Singleton LEP 1996 to include the subject amendment.
- Modification of the definition of "the map" of clause 9(1) of the Singleton LEP 1996 to include the subject amendment.

Zoning

In consideration of the proposed lot sizes, the 7(b) (Environmental Living Zone) is considered appropriate for the site. The site comprises an EEC of ecological value. The 7(b) zone provides for low-impact development in areas comprising ecological value such that the value is not adversely impacted (refer Figure 4 – Map Showing Area Proposed to be Rezoned).

Figure 4 – Map Showing Area Proposed to be Rezoned



Objectives

The following objectives of the 7(b) (Environmental Living) zone as contained in the SLEP 1996 would apply to the Proposal:

(a) to provide for low-impact residential development in areas with special ecological, scientific or aesthetic values,

(b) to ensure that residential development does not have an adverse effect on those values,

(c) to ensure development maintains and contributes to the character of the locality and minimises disturbance to the land,

(d) to protect, enhance and manage riparian corridors to facilitate species movement and dispersal and maintain the integrity of banks of watercourses,

(e) to encourage rehabilitation and conservation of environmentally important land.

Definitions

The definitions to be modified would include:

- Modification of the definition of "Lot Size Map" of clause 9(1) of the Singleton LEP 1996 to include the subject amendment.
- Modification of the definition of "the map" of clause 9(1) of the Singleton LEP 1996 to include the subject amendment.

Minimum Lot Size

The LEP amendment would apply the 8,000 sqm minimum lot size and 1ha minimum average lot size requirements for subdivision using a lot size map (as referred to in Clause 11 of the Singleton LEP 1996).

The averaging provision promotes location of smaller lots in cleared areas of the site and location of larger lot sizes in areas comprising significant vegetation. This helps minimise the impacts of rural residential development on the EEC.

Preparation of Development Control Plan

A requirement to prepare development control plan provisions for the site is proposed to implement the recommendations of the SLUS, provide for sustainable development of the site and minimise the potential for impacts on biodiversity and Indigenous cultural heritage.

The requirement to prepare development control plan provisions for the site (which would occur as an amendment to the Singleton Development Control Plan incorporating locality specific provisions for the site) would be implemented by amending Clause 14D of the Singleton LEP 1996 so that the clause applies to the site.

4.2 Under the Comprehensive LEP

Description

Implementation of this planning proposal as an amendment to the SI LEP would involve:

- Utilisation of the E4 (Environmental Living Zone) for the site.
- Creation of a zoning plan and lot size map for the site.
- A requirement for development control plan provisions to be prepared for the site.

Zoning

In consideration of the proposed lot sizes, the E4 (Environmental Living Zone) is considered appropriate for the site. The site comprises an EEC of ecological value. The SI template E4 zone provides for low-impact development in areas comprising ecological value such that the value is not adversely impacted.

Objectives

The objectives of the E4 Environmental Living Zone under the Standard Instrument will be adopted:

- *To provide for low-impact residential development in areas with special ecological, scientific or aesthetic values.*
- *To ensure that residential development does not have an adverse effect on those values.*

Council may expand on the SI objectives, to which suggested additional objectives include:

- *To ensure development maintains and contributes to the character of the locality and minimises disturbance to the land.*
- *To protect, enhance and manage riparian corridors to facilitate species movement and dispersal and maintain the integrity of banks of watercourses.*
- *To encourage rehabilitation and conservation of environmentally important land.*

Definitions

As per the SI definitions (Dictionary).

Minimum Lot Size

Lot size provisions are to be implemented using a Lot Size Map in the SI LEP.

4.3 Local Provisions

The preparation of a DCP (amendment to the Singleton DCP) is intended for the site. The draft DCP proposal would be processed concurrently with the Planning Proposal. Such a draft DCP could be exhibited with the Planning Proposal and would need to take effect at the time of making of the LEP amendment so that it can be considered as part of the assessment any development applications to develop the site.

The DCP for the site would need to:

- Contain a subdivision layout and staging plan, which provides for the progression of subdivision of the site in a logical and coordinated manner, providing for necessary infrastructure sequencing. The plan is to provide for connectivity of infrastructure throughout the site.
- Provide an overall movement hierarchy for the site, showing the major circulation routes and connections to achieve a simple and safe movement system for private vehicles and public transport.
- Contain stormwater and water quality management controls.
- Provide for the amelioration of natural and environmental hazards, including bushfire, flooding, landslip and erosion, and potential site contamination.
- Contain measures to conserve any heritage items or places of significance.
- Contain an overall landscaping strategy for the protection and enhancement of riparian areas and remnant vegetation, including visually prominent locations, which includes concept plans for street tree planting.
- Comprise any buffers necessary to ameliorate visual and amenity impacts.
- Contain detailed urban design controls for significant development sites.
- Provide for suitably located public facilities, services and recreational areas.

The concept subdivision layout of the draft could be used as a basis for preparation of the SI LEP minimum lot size map. The concept subdivision layout and minimum lot size map should be designed such as to minimise vegetation removal.

5 Part 3 – Justification

5.1 Section A: Need for the Planning Proposal

(1) Is the Planning Proposal a result of any strategic study or report?

The majority of the site subject of this planning proposal is located within the *Singleton Land Use Strategy* (SLUS) 2008 "Lower Belford Candidate Area", which is identified by the SLUS as being suitable for rezoning to an environmental living zone.

Approximately 12ha of land outside of the Lower Belford Candidate Area is also intended to be rezoned as part of this planning proposal. This strip of land adjoins the candidate area and represents an extension to the candidate area.

The extension is contained within lots 12 and 13, DP: 1100005 and Lot 6 DP 237936. Parts of lots 12 and 13 already fall within the candidate area. Lot 6 is not within the candidate area boundary.

The SLUS proposes a minimum lot size of 4ha and a minimum average lot size of 5ha for lots created by subdivision in the Lower Belford Candidate Area. It also provides for intensification of the Lower Belford Candidate Area to be considered where servicing is available.

Council previously considered a planning proposal for the site, which sought to intensify the number of lots yielded from the site by reducing the minimum lot size for subdivision to 8,000sqm. The basis for support was largely due to confirmation from the Hunter Water Corporation (attached in **Appendix B**) that the site could be serviced with reticulated water and after preliminary consideration was given to.

- land supply and demand,
- utility servicing,
- geotechnical considerations (i.e. effluent disposal and potential for erosion impacts;
- traffic impacts; and
- flora and fauna impacts.

While Council provided initial support for that proposal, the Gateway response detailed that the proposal could not be considered at that time. The proponent has since liaised with the regional office of the Department of Planning and has been advised that a revised planning proposal is now able to be considered, provided that it addresses a number of key issues. This planning proposal has been prepared in response to the advice from the NSW Department of Planning.

Variation to the Singleton Land Use Strategy

As mentioned above, this proposal seeks to include 12ha of land held in three lots adjacent to the Lower Belford Candidate Area. Lots 12 and Lot 13 in DP 1100005, comprising approximately 9ha, have land within the candidate area; the boundary in the SLUS cuts through the centre of the lots, which reflects an extension of cadastral boundaries further to the north of the subject site. A further 3 ha in Lot 6 DP237936, not within the Candidate Area, is an extension of the proposed boundary through Lots 12 and 13 as illustrated in Figure 4.

As noted in the previous report to Council (November 2009), the proponent owns land on both sides of the Candidate Area boundary and that:

> *"the realigned boundary aligns with areas of vegetation clearing, whereas the SLUS candidate area boundary aligned with eastern boundary of Lot 6. The final boundary of the candidate area as identified by the SLUS (2008) was identified in consultation with the (then) Department of Environment and Conservation with the intent of minimising inclusion of areas of vegetation. The*

inclusion of the strip of land within Lot 6, DP 237936 is not viewed to be in conflict with this objective".

The matter of the appropriate boundary line is further addressed in Council's November 2009 Council Report as follows:

"… in the preparation of the RRDS 2005, the original Candidate Area boundaries were realigned at the request of the now DECCW to minimise the inclusion of native vegetation. The western boundary of the subject Lower Belford candidate Area was moved significantly to the east for this reason. The current location was chosen because it largely aligned with cadastral boundaries.

The BLC supporting documentation shows a section of this boundary located approximately 100 metres further to the west. This is over a distance of approximately 800metres, which increases the area of the Candidate Area by about 8 ha. This is supported by aerial photography demonstrating there is minimal native vegetation within this strip. The heavy vegetation clearly commences further to the west of this line. Since BLC own the land on both sides of the cadastral boundary, it will not be necessary to use it to define the edge of the candidate Area.

Again, this is a matter which should be investigated and resolved during the government authority consultation phase of the planning proposal amendment. "

Consideration of the variation to the Lower Belford Candidate Area boundary is considered to be justified. The suitability of the variation would be subject to review as part of the public authority consultation.

(2) Is the Planning Proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

Placing land use and minimum lot size provisions for subdivision in Council's LEP, in conjunction with appropriate design controls in Council's DCP; is considered to be the most appropriate method for managing subdivision and land use in the locality. This method is supported by the adopted SLUS (2008) and is consistent with the method of managing land use for similar proposals in the Singleton LGA (For example: Amendment No. 55 to the Singleton LEP 1996, made on the 18 June 2010).

(3) Is there a net community benefit?

The subject planning proposal will make land available for the creation of approximately 125 rural residential style lots in the Lower Belford/Branxton area. It is to the benefit of the community to plan for population growth such that it occurs in an environmentally, economically and socially sustainable manner.

The proposed environmental living zone objectives support low impact development in areas with special ecological value. While some of the site comprises established vegetation, other areas of the site are cleared of vegetation, comprising predominantly native grasses. The proposed 8,000sqm minimum lot size and 1ha minimum average lot size requirements for subdivision, provides for the creation of smaller lots in cleared areas of the site and larger lots in vegetated areas, so that impacts upon vegetation and segregation of vegetation is minimized.

The requirement to prepare a DCP (amendment to the Singleton DCP) allows for the broad subdivision layout for the site to be planned (via a concept subdivision layout plan) and for application of controls on development of the site, such as to maintain or potentially improve the existing biodiversity situation. It is viewed that development of the site is able to occur in an environmentally sustainable manner.

Rezoning and development of the site is considered to be economically sustainable. The Lower Belford and Branxton localities have been identified as being suitable for catering for future population growth in the Hunter Region. This is evidenced by the inclusion of the Huntlee site into the Lower Hunter Regional Strategy (2006) and through the identification of rural residential candidate areas in the Lower Belford and Branxton localities by the SLUS (2008).

Provision of significant employment lands in the Huntlee New Town proposal, development of the Whittingham Industrial Estate, growth in the coal industry, intensification of the Singleton Army Base

and extension of the Hunter Expressway are all expected to generate substantial employment opportunities in the area.

Such development opportunities are expected to increase the demand for housing in the Lower Belford/Branxton area and thus increase the demand for rural residential land past that which is projected by the SLUS, because those projections were based on maintaining historical growth rates. The site is ideally located for housing development to help provide for the expected growth in population associated with the nearby employment opportunities.

The proposal is considered to be socially sustainable. It provides for development of rural residential lots which have an environmental living focus, which in turn, helps fulfil particular lifestyle demands of the community. Given the lot size and DCP requirements, development of the site is able to occur in a manner which is sympathetic to; and compatible with, surrounding land uses.

Overall, the proposal is environmentally, economically and socially sustainable and as such, will result in a net community benefit.

5.2 Section B: Relationship to Strategic Planning Framework

(4) Is the Planning Proposal consistent with the objectives and actions contained within the applicable regional or sub-regional strategy (including the Sydney Metropolitan Strategy and exhibited draft strategies)?

Singleton Council is located adjacent to the Lower Hunter Region and is not part of the Sydney Metropolitan Strategy area. As such, the relevant Strategy is Council's SLUS. However, given the proximity of the site to Branxton which is partly within the Lower Hunter Regional Strategy, it maintains some relevance.

Lower Hunter Regional Strategy

The main objective of the Lower Hunter Regional Strategy (LHRS) is to ensure adequate land is available that is appropriately located and serviced. This is to ensure that projected housing, employment and environmental needs of the Lower Hunter Region population are accommodated over the coming 25 years. A key consideration is the housing target of 115,000 new homes required to accommodate future growth in the area. More specifically, the LHRS has identified a new community to be developed at 'Huntlee' to the south of Branxton; this is intended to accommodate a major release site for over 7,000 dwellings. While Huntlee had been on track to provide dwellings in the short term the potential for this area to land supply in the area, particularly in the short term is currently being reviewed by the Department of Planning under the Major Projects approvals process.

The Huntlee development also included some large residential lots within the Singleton LGA. While this may ultimately comprise 200-300 lots, it is part of the overall scheme for over 7,000 dwellings which was required in the Lower Hunter Strategy to meet demand in the Lower Hunter. Huntlee was not progressed to address land supply issues in Singleton. As such the potential development associated with Huntlee is permitted by and to be pursued under the LHRS not the SLUS. The relevance of Huntlee development is discussed in more detail in the later section '2010 Gateway Matters' on land supply and is not considered a determining factor in relation to this proposal being progressed.

In addition to major land release sites, Singleton Council's preferred approach to managing rural residential development is to support smaller, well located development, as is the subject of this of this application. This provides a more modest and consistent approach to providing land supply that reflects the urban structure of Singleton LGA. Furthermore, this rezoning proposal is consistent with the Department of Planning's approach in the LHRS that encourages and focuses growth at or around existing centres.

As Singleton LGA has not formed part of any regional or sub-regional planning, the SLUS (2008) is the governing strategic plan for the Singleton LGA. Endorsed by the Department of Planning, it provides the appropriate framework for managing growth such as rural residential development. In particular, it provides and maintains its relevance through the objectives and actions for managing land use and supply.

(5) Is the Planning Proposal consistent with the local council's Community Strategic Plan, or other local strategic plan?

Singleton Land Use Strategy (2008)

The Strategy

The Singleton Land Use Strategy (SLUS) 2008 is a local strategic plan that provides direction relating to future land use and supply within the Singleton LGA. The SLUS provides key strategic land use policies and principles for land within the Singleton LGA. The aim of the SLUS is to provide strategic recommendations that align with the land use objectives of the Singleton community and Council, as well as to provide recommended changes to the SLEP 1996, intended to feed into the process of preparing a Comprehensive LEP for Singleton. The SLUS also provides updated population and strategy projections previously outlined in the (now repealed) Hunter Regional Environmental Plan 1989. Within the SLUS, urban and rural issues facing the LGA are also identified, with accompanying objectives and strategic actions.

Within rural residential development considerations, the SLUS recognises the need to provide additional land to cater for rural residential purposes and associated infrastructure requirements. As an outcome of the detailed process undertaken to arrive at the SLUS, areas identified within the LGA that are appropriate for rural residential development have been categorised into the following Candidate Areas:

- Lower Belford.
- Jerrys Plains.
- Wattle Ponds North East.
- Wattle Ponds North West.
- Sedgefield.
- Gowrie.
- Branxton North West.
- Branxton North East.
- Branxton South West.

The site is situated within the Lower Belford Candidate Area, as detailed in the SLUS (Figure 6). Approximately 3ha of Lot 6, DP237936 is included as part of this Planning Proposal, which, despite not being within the Lower Belford Candidate Area, will not affect the intended outcome of the site, or hinder the proposal's consistency with the aims and objectives of the SLUS. An additional 9ha is located outside the Candidate Area but within the lots 12 and 13 DP 1100005 that are subject of the Candidate Area.

Compliance with the SLUS

The SLUS indicates that an environmental living zone is appropriate for the site. The absence of confirmation that the site could be serviced with reticulated water at the time of preparation of the SLUS, resulted in the SLUS recommending a 4ha minimum and 5ha minimum average lot size for subdivision of the land. The SLUS acknowledges that consideration can be given to applying a lower minimum lot size to subdivision of the land if reticulated water is available (p 62).

The proposal is considered to be consistent with the rural residential development objectives of the SLUS (p 63) for the following reasons:

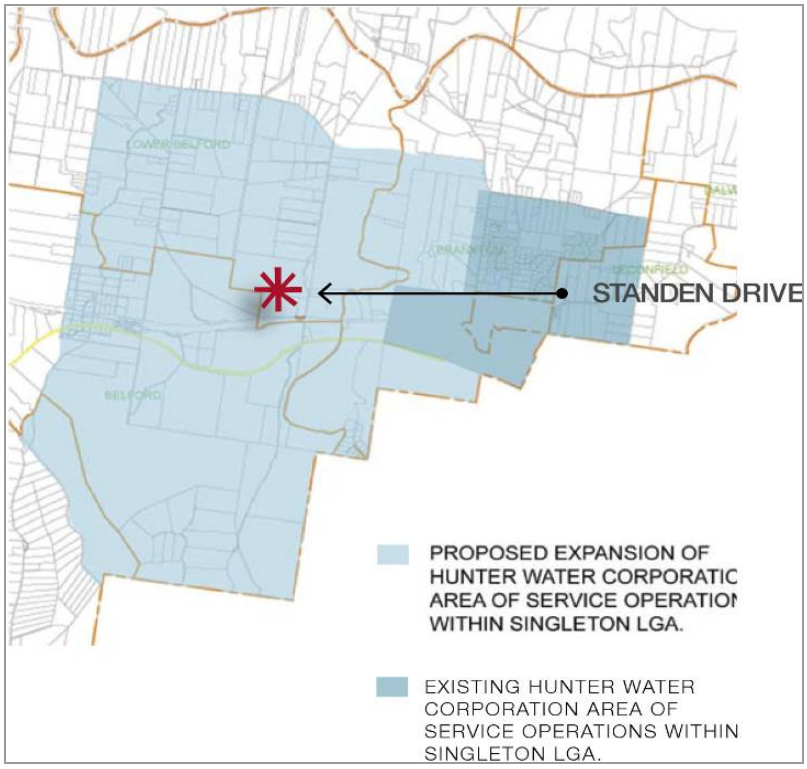
- *Provide opportunities for additional rural residential subdivision and development in suitable locations, and enable a range of different types of rural residential development*

- As recommended by the Department of Planning, the expansion of villages should be proximate to village centres to prevent urban sprawl. The site is in a suitable location, being within close proximity to the centre of Branxton.
- A range of lot sizes will be provided for by the proposal due to the 8,000sqm minimum lot size and 1ha minimum average lot size requirements. Lots of such sizes are not catered for elsewhere in the Lower Belford/Branxton area by the SLUS. These lot size provisions allow subdivision of the site to appropriately respond to its topographic and environmental characteristics.

Figure 5 – Existing and Proposed Rural Residential Areas and Minimum Lot Sizes

- *Ensure that adequate services are available for rural residential lots*
  - Hunter Water Corporation have confirmed that they are able to service the site (refer Figure 6 – Proposed Extension of Hunter Water Corporation Services).
  - The SLUS does not require reticulated sewer to be provided where lots are greater than 8,000sqm (pg 64). For reticulated water not to be required, lots need to be 5ha or greater (SLUS, p 62). As such the subject proposal would require provision of reticulated water but not sewer.
  - The site is able to be provided with suitable electricity provision and telephone connection, as electricity supply services are readily available to be upgraded and connected to development on the site.

Figure 6 – Proposed Expansion of Hunter Water Corporation Services



- *Ensure that the supply of zoned rural residential land does not unreasonably exceed demand*
  - The Planning Proposal is expected to increase the total yield projected for the rural residential candidate areas by approximately 103 lots.
  - The SLUS estimates a yield of approximately 670 lots from the rural residential candidate areas if developed in accordance with Table 12 of the strategy (p 62-63). However, the SLUS identifies that there is a need for approximately 75 lots per year, which equates to 750 lots for a 10 year projection.
  - The supply of 670 lots is 80 lots short of what is projected by the SLUS as required for the LGA for a 10 year period. An addition of 103 lots would place the total yield from the candidate areas to 767 lots, which is approximately 10.23 years supply.
  - 10.23 years supply of rural residential land is not considered to be an unreasonable amount of zoned land to be available for development. Considering that some land within the candidate areas are not (at the time of preparation of this Planning Proposal) subject of rezoning proposals, this Planning Proposal is considered to be acceptable and not expected to result in supply unreasonably exceeding demand.
- *Apply criteria to identify the best location for rural residential estates and balance socio-economic goals associated with new rural residential development with the needs to preserve areas of high agricultural, scenic or environmental value.*
  - Table 13 of the SLUS (p 68) comprises criteria for use when identifying potential rural residential land. The subject land is considered to be consistent with these criteria. The site is less than 5km from the Branxton Township and approximately 18km from the Singleton Township. It is therefore considered to be within reasonable travel distance/time from these centres.
  - The site is able to be provided with relevant service utilities and is ideally located for rural residential purposes. The site has the ability to provide for onsite water storage, subject to

water resource limits and harvestable water rights. No adverse impacts on existing infrastructure have been identified. Staged road upgrades may be required to cater for the additional traffic generated by the development.

- Development of the site is able to be managed in a manner which will minimise impacts on flora, fauna and biodiversity. Bushfire impacts are able to be managed through appropriate subdivision design. Given the extent of cleared areas of the site, there are suitable options for developing the land, while still complying with requirements to plan for bushfire protection.
- The site is distanced away from operational coal mines. While coal seam methane exploration activities associated with Petroleum Exploration Lease 267 (Sydney Gas) may impact upon the expectations of future residents, there is no coal title over the land. The scope for significant minerals development within close proximity to the site is minimal.
- The proposal is compatible with surrounding land uses and should not have an adverse impact on water supply catchment land. While the site does comprise endangered ecological communities, the recommendation of this planning proposal provides for development of the land without generating significant adverse impacts on the EECs.
- Development of the site is able to occur without generating significant adverse impacts in regard to soil erosion. The site does not comprise forestry land and is not identified as being contaminated. Any minor contamination which may have occurred on the site as a result of historical farming activities would be minor and would not preclude development of the site in the manner proposed.
- The site is capable of providing for the onsite effluent disposal associated with the development density proposed. The site is not within a floodplain and is not identified as comprising sites or items of indigenous cultural heritage. Given the proposed minimum lot size requirements, there would be ample housing sites available that would not disturb indigenous heritage, should such heritage be discovered as part of preparation of detailed environmental studies for the proposal.
- The proposal should not have an adverse impact upon existing groundwater tables or slopes greater than 18 degrees.

(6) Is the Planning Proposal consistent with applicable state environmental planning policies?

State Environmental Planning Policy No 44—Koala Habitat Protection

The main aim of this SEPP is to ensure proper protection of existing koala habitats, through the conservation and management of natural vegetation areas that provide these habitats. As outlined in Schedule 1 of SEPP 44, this policy is applicable to the Singleton Local Government Area.

The suitability of the site for rural residential subdivision is identified in SLUS (2008), following a situation analysis undertaken in consultation with DECCW. Koala habitats are not believed to exist on the site, given it is mostly cleared grazing land and has been identified as a candidate area generally suitable for intensification. Further detailed studies of flora and fauna will be undertaken as a part of detailed environmental studies.

State Environmental Planning Policy No 55— Remediation of Land

This SEPP requires the relevant authorities to be satisfied that environmental risks associated with past activities on the land have been considered. This is only applicable when a change of use may be more sensitive to the risks generated by historical land uses.

The main objective of this SEPP has been addressed on a strategic level, as the site is identified as a candidate area in the SLUS. The site is not considered to have contamination impacts given the impacts from the previous use for grazing purposes. Initial testing of the topsoil and underlying clays generally indicated that there was minimal salinity potential (Douglas Partners, Report on Effluent

Disposal, Erosion and Salinity, July 2009). Approval for the site to be rezoned for rural residential purposes is not believed to generate adverse environmental risks. Further detailed studies will be undertaken as part of the environmental studies.

SEPP (Rural Lands) 2008

Lot 92, DP 1138554, which forms part of the site subject of this planning proposal, was created pursuant to Clause 9(2) of *State Environmental Planning Policy (Rural Lands) 2008*. Pursuant to Clause 9(4) of the policy, a dwelling cannot be erected on the lot. As reflected in Clause 5 of the SEPP, the policy prevails over Council's Local Environmental Plan to the extent of any inconsistency, irrespective of whether an amendment to the plan was made before or after the commencement of the policy restriction.

To make prospective purchasers of the lots aware of the restriction created by *State Environmental Planning Policy (Rural Lands) 2008*, the consent for the development application, which approved the creation of the lot (DA537/2008 - SA71/2008), required creation of a restriction under *the Conveyancing Act 1919*. This was to ensure that the restriction on the erection of a dwelling on the land was identified on the 88B instrument relating to the lot, so that prospective purchasers would be made aware of the restriction.

The removal of the restriction created under section 88B of the Conveyancing Act 1919 does not void the restriction created *by State Environmental Planning Policy (Rural Lands) 2008*.

Where there is an inconsistency between *State Environmental Planning Policy (Rural Lands) 2008* and *the Singleton Local Environmental Plan 1996*, *State Environmental Planning Policy (Rural Lands) 2008* takes precedence to the extent the inconsistency. As such, the restriction could continue to prevail over Council's Local Environmental Plan irrespective of whether a change in the zoning of the land takes place under the plan after the commencement of the restriction created by the policy.

The restriction under *State Environmental Planning Policy (Rural Lands) 2008* needs to be removed to provide for the proposal. This is because the rezoning is for the purposes of providing land to help meet demand for rural-residential (Environmental Living) style lots for the purposes of building houses on them. If dwellings were unable to be constructed on the land, then it would defeat the purpose of rezoning it.

The Rural Lands SEPP does not appear to clearly provide for the removal of the restriction. As part of the process associated with this planning proposal, it must be made legally clear that there is no underlying restriction to development of the land.

Notwithstanding the restriction, this planning proposal is considered to be consistent with the aims of the policy, which are:

- To facilitate the orderly and economic use and development of rural lands for rural and related purposes.
- To identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State.
- To implement measures designed to reduce land use conflicts.
- To identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations.
- To amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.

The lot size provisions and requirement to prepare a DCP for the site provide for the development of the site to occur in a logical and orderly manner. The site is not considered to be of high agricultural value and as such, subdivision of the site into numerous rural residential lots would be a better economic use for the land. The proposal is consistent with the rural planning principles contained in section 7 of the SEPP and rural subdivision principles contained within section 8 of the SEPP.

As discussed earlier in this report, the minimum lot size provisions and requirement to prepare a DCP for the site provide for development of the land to occur such that land use conflicts are minimized. The site is not identified as State significant agricultural land. This planning proposal does affect concessional lot provisions.

Hunter Regional Environmental Plan 1989

The Hunter Regional Environmental Plan 1989 (HREP) was repealed in June 2009 and as such, the provisions of this REP are no longer relevant.

Draft State Environmental Planning Policy No 66— Integration of Land Use and Transport

This policy no longer needs to be considered as it has been in draft form since 2001.

(7) Is the Planning Proposal consistent with applicable Ministerial Directions (s.117 directions)?

The Ministerial Directions issued 1 July 2009 under Section 117(2) of the Environmental Planning and Assessment Act 1979 (the Act), set out local planning directions to Councils. The following Directions require consideration as they are relevant to this Planning Proposal.

Rural Zones (1.2)

This section sets out various requirements for the rezoning of rural land, with particular focus on protecting the agricultural production value of rural land.

The Planning Proposal will not result in the loss of agricultural production value of the land, as confirmed in the land capability analysis undertaken by Council to inform the preparation of the SLUS, which is endorsed by the NSW Department of Planning Director-General. The SLUS did not identify land subject to this Planning Proposal as having a high agricultural value. The site has previously been utilised for grazing, and is currently vacant.

Mining, Petroleum Production and Extractive Industries (1.3)

The objectives of this Direction is to ensure that the future extraction of State or regionally significant reserves of coal, other minerals, petroleum and extractive materials are not compromised by inappropriate development.

The Department of Primary Industries (DPI) has been consulted in regard to the proposal (letter dated 3 November 2003 (Appendix E) and has advised that they support it in principal. The DPI raises no specific objections to the proposal but indicates that their advice is subject to further detailed assessment after the gateway process.

The proposal is not considered to compromise the extraction of State or regionally significant coal, mineral or petroleum resources or extractive materials.

Rural Lands (1.5)

The objectives of this direction are to protect agricultural production value of rural land, and facilitate the orderly and economic development of rural lands for rural and related purposes.

The SLUS, endorsed by the Director-General of the NSW Department of Planning, has identified the site as a candidate area suitable for rezoning to an environmental living zone. The key land use issues for the SLUS include promoting agricultural development, protection of employment opportunities and protection of the natural resource base. The location and boundary of the subject candidate area was selected to avoid impacting areas of high agricultural value.

Integrating Land Use and Transport (3.4)

This Direction is aimed at ensuring future development encourages a wider variety of transport; reducing car dependency and the distance and number of trips generated as a result of urban development.

The proposal is ideally located due to its proximity to the Branxton Town, and access to the regional road and public transport network. This is consistent with the objectives of SLUS in the identification of the Lower Belford Candidate Area for development.

Flood Prone Land (4.3)

This section outlines directives to ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and principles of the Floodplain Development Manual 2005. Flood hazards and potential flood impacts on and off the subject site should also be considered when assessing a rezoning application.

As SLUS identifies the site as suitable for rural residential subdivision. The site is not subject to any flood hazards or potential flood impacts as a result of the 1 in 100 year flood. Further detailed studies to manage drainage and achieve Water Sensitive Urban Design (WSUD) outcomes will be undertaken in consultation with relevant agencies following the gateway process.

Planning for Bushfire Protection (4.4)

The focus of this Direction is to encourage sound management of bushfire prone areas and discourage incompatible land uses in such areas.

The site has been identified as being bushfire prone on Council bushfire prone land mapping. This proposal provides for low density development which can be designed comply with the requirements of the NSW Rural Fire Services - Planning for Bushfire Protection (PBP) guidelines.

The concept layout and provisions of the DCP (amendment to Singleton DCP), which is intended to be required for the site, will encourage development which complies with the PBP guidelines.

Site Specific Provisions (6.3)

The aim of this direction is to discourage unnecessarily restrictive site specific planning controls. Lot 92, DP1138554 has a restriction created over it by *SEPP (Rural Lands) 2008*, which prohibits the construction of a dwelling (or dwellings) on the land.

It is intended by this planning proposal allow dwelling house development on Lot 92, DP1138554. This dwelling-house restriction is considered to be unnecessary, given that the SLUS identifies the site as being appropriate for rural residential use.

Given that *SEPP (Rural Lands) 2008* does not incorporate a provision for removing the restriction and the fact that the SEPP takes precedence over Council's LEP to the extent of any inconsistency; the legal status of this restriction, once the land is rezoned, is uncertain.

In summary, this planning proposal seeks to make it clear that the restriction no longer applies. The method of achieving this outcome is proposed to be resolved by the Department of Planning / Parliamentary Counsel as part of the drafting of the amending instrument. This is in accordance with verbal advice provided to the proponent by the Department of Planning in September 2010.

5.3 Section C: Environmental, Social and Economic Impact

(8) Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

A preliminary ecological assessment has been undertaken for the site by Cumberland Ecology. Grassland occurs across approximately 60% of the site and varies significantly in composition from largely exotic with few species to native with a wide diversity in species.

The assessment report (**Appendix C**) confirms the existence of 3 types if native vegetation, being:

- Lower Hunter Spotted Gum - Ironbark Forest;
- Central Hunter Ironbark Spotted Gum - Grey Box Forest; and
- Hunter Lowlands Red Gum Forest.

Each of these forest types are classified as being endangered ecological communities (EEC's) under the *Threatened Species Conservation Act 1995*.

The preliminary ecological assessment report indicates that habitat for threatened fauna is likely to exist on the site, including habitat for:

- Squirrel Glider;
- Various Microchiropteran Bats;
- Grey Crowned Babbler;
- Speckled Warbler; and
- Diamo nd Firetail.

The site comprises Forest Red Gum (*Eucalyptus tereticornis*) which is a primary feed tree for koalas. There is also potential foraging habitat for threatened owl species.

The site adjoins the Belford National Park. The forest on the site is contiguous with the forest in the National Park and as such, species are likely to move between the National Park and the subject site.

Development on the site can be achieved without adversely impacting upon EECs, by placing housing sites in cleared areas comprising grassland. There are opportunities to conserve vegetation on the site and even improve the existing biodiversity situation.

The detailed ecological information to be prepared for the Planning Proposal, if it is supported by the gateway decision, is intended to identify conservation values for the site. Such values will need to be managed through the development control plan and development application processes.

(9) Are there any other likely environmental effects as a result of the Planning Proposal and how are they proposed to be managed?

Bushfire

The site has been identified on Council's bushfire prone mapping as being bushfire prone land. The consideration of bushfire can be addressed as part of the concept subdivision layout of the DCP (amendment to the Singleton DCP) for the site; and through the detailed subdivision design subject of the development application process. Development will be planned to satisfy the relevant requirements of the NSW Rural Fire Service and applicable controls including Planning for Bushfire Protection 2006. This will include the provision of adequate Asset Protection Zones (APZ) to future dwellings. Further detailed studies will be undertaken in consultation with relevant agencies following the gateway process.

Flooding

The site is not identified as being flood prone land but is dissected by intermittent natural watercourses which may generate localised flood impacts during significant storm events. Any development applications will require compliance with the current Singleton Development Control Plan provisions relating to localised flood impacts from natural watercourses.

Mine Subsidence

The site is not within a proclaimed mine subsidence district pursuant to Section 15 of the *Mine Subsidence Compensation Act 1961* and is not identified as being subject to landslip or comprising acid sulphate soils.

(10) How has the Planning Proposal adequately addressed any social and economic effects?

Social Effects

Proximity to Branxton town

The Lower Belford Candidate Area is a strategically suitable location for housing intensification due to its proximity to Branxton township, and the subject site's easy accessibility to the town. The site is situated within the southern portion of the Lower Belford Candidate Area; with the southern site boundary adjoining the New England Highway. The site is approximately 3km from Branxton Railway Station which is located at the south-west corner of the Branxton town centre.

An increase in development yield on the site will have a positive social impact as it will provide future residents with accessibility to jobs, social and other support services and infrastructure located within Branxton town, including but not limited to:

- A number of speciality shops.
- Newsagency.
- Pharmacy.
- Butcher.
- Post office.
- IGA supermarket.
- Cafes, restaurants, takeaway food outlets.
- Toilets.
- Sporting facilities, district recreational areas, open space.
- Medical centre.
- Primary schools and pre-school.

An increased density on the site will also provide the opportunity to enhance existing bus services that currently run along the New England Highway to these services within Branxton town, to the benefit of the broader community.

Rural Residential Lot Supply

The site subject of this planning proposal is supported by the SLUS, which has been endorsed by the NSW Department of Planning.

The proposal would enable subdivision of the land into lots with a minimum lot size of 8,000sqm and a minimum average lot size of 1ha. Lots within this size range are not provided for in the Lower Belford and Branxton area by the SLUS, or any of the Planning Proposals lodged with Council at the time of preparing the subject Planning Proposal.

It would contribute to the overall supply of rural residential housing opportunities in the region, which would positively affect housing affordability, because high housing prices are largely a result of increased demand due to undersupply.

Economic Effects

The proposal is a logical expansion of the existing Branxton town, and is consistent with the land use planning framework set out in the LHRS that encourages and focuses growth at existing centres.

The location of rural residential housing on the site will also help to ensure Singleton LGA is accommodating an equitable share of the growth in the Hunter region, which will reinforce Singleton's economic sustainability. Singleton's economic sustainability will also be strengthened as a result of the Planning Proposal, as:

- 'Tree-changers' are an increasing phenomenon of people relocating from cities to areas offering high amenity and a leisure focus:
  - Due to the limited availability and affordability of coastal areas for 'sea-changers', a move to high amenity hinterland and regional areas has occurred.
  - The Branxton-Belford-Pokolbin locality is a prime area for tree-changers, given its proximity to the Wine Country, scenic amenity, and proposed F3 extension.
  - Cellar doors, restaurants and recreational facilities within the area would be well supported by tree-changers, with money to spend from relocating in search of lifestyle living.
- Rural residential housing plays an important role servicing the premium end of the housing market, which is extremely important in underpinning a community's economic development. Opportunities for successful locals to stay in the area are an important economic and social consideration to maintaining their ongoing investment in local business and often leadership roles within the local community.
- The supply of additional and alternative housing choice will also increase the economic support of employment and industries around Singleton such as coal, and tourism associated with the Wine Country.

5.4 Section D: State and Commonwealth Interests

(11) Is there adequate public infrastructure for the Planning Proposal?

Provision of Services

All necessary infrastructure services are available to service minimum 8,000 sqm / 1ha average lots. If the proposal is supported to allow these lot sizes, the proposed net increase of 103 lots will not result in any unmanageable demand on existing public infrastructure such as roads and services, including reticulated water, electricity and telecommunications supply. Investigations by the proponent as part of the SLUS amendment to confirm intensification on this site are outlined as follows.

Road Infrastructure

A Traffic Impact Assessment (TIA) has been prepared by Hyder Consulting (June 2009) to provide a detailed analysis of traffic generation and capacity resulting from the proposal. The TIA indicates that that Standen Drive has the capacity to accommodate traffic generated by the proposal and that rural residential development on the site would be acceptable in terms of traffic impacts.

Development of the site in accordance with the proposed absolute minimum and minimum average lot size provisions would be expected to generate up to 1,350 vehicle trips per day and 128 trips per hour. The intersection of Standen Drive and the New England Highway would continue to operate satisfactorily beyond 2014, factoring in the annual growth rate of 3.4% on external roads.

Development of the site should not warrant upgrading of the intersection of Standen Drive and the New England Highway. This would, however, be determined through consultation with the responsible road authorities.

The intersection provides sight distances of at least 500m for drivers leaving Standen Drive, which adequately meet standard minimum site distance requirements for speeds up to 120km/hr.

Water and Sewage Services

The Hunter Water Corporation (HWC) has indicated that they will be able to service the site, although not immediately in the short term. Infrastructure works required to be able to service the site are expected in 2013/2014. Given the time associated with the rezoning, development control plan and development application processes; it is feasible that construction of the subdivision will coincide with provision of sewer and water services from the HWC. The SLUS did not have the benefit of the HWC's plans when finalised in 2008, but had flagged the potential for these services.

The increased demand for water supply services as a result of the additional lots within the site is acceptable as HWC's water servicing plan for this area provides for an 'additional capacity' of 3,000-3,500 Equivalent Tenements (ETs) as contained in correspondence between the HWC and Singleton Council (letter dated 3 November 2008, as previously provided to Council). The HWC defines an ET as *'the average annual demand of a single detached dwelling'*. As the proposal will restrict development to a single detached dwelling per lot through zoning and planning controls, the proposal requires a maximum allocation of 140 ETs. This represents a small portion of the overall additional capacity being provided, as it represents less than 5% of the lower ET capacity of 3,000 provided by the HWC.

In accordance with Council's provisions, minimum lot sizes of 8,000sqm do not require reticulated sewage services. As such, sewage service requirements are not an impediment to approval of the Planning Proposal.

Electricity and Telecommunications

The site is able to be provided with suitable electricity provision and telephone connection, as electricity supply services are readily available to be upgraded and connected to development on the site.

Stormwater

Appropriate stormwater management systems are able to be provided to accommodate the proposed increased density as a result of the 8,000sqm minimum lot sizes. Design for this will be part of detailed development outcomes following consultation with relevant agencies to ensure appropriate riparian conservation, water quality and stormwater management issues are addressed in a coordinated way.

(12) What are the views of State and Commonwealth public authorities consulted in accordance with the gateway determination?

Consultation with relevant public authorities is proposed to occur as part of the gateway process. Such views will be reflected in the revised Planning Proposal prior to submission to the NSW Department of Planning with the request that the plan be made.

Government agencies that have been consulted in preparation of the planning proposal include:

- NSW Department of Planning: advice was received in a letter to Council dated 24 June 2010, confirming that a revised planning proposal could be submitted and detailing matters which needed to be addressed by such a proposal. This letter is attached in **Appendix A.**
- NSW Department of Environment, Climate Change and Water (DECCW): advice was received from DECCW in relation to the recently listed Central Hunter Ironbark Spotted Gum – Grey Box Forest vegetation community as EEC, which has been addressed through this Planning Proposal accordingly. This is attached in **Appendix F**.
- Roads and Traffic Authority (RTA): as noted in the Traffic Impact Assessment (Hyder, June 2009), as part of the feasibility study the proposed development was referred to RTA for comment. The RTA replied in a letter dated 28 October 2008 that it had no objections to the proposed rezoning and an amendment to the LEP.
- NSW Department of Primary Industries (DPI): in a letter to Singleton Council (3 November 2008), the DPI stated that they have no specific objections to the proposed rezoning of the site for rural residential purposes in accordance with Council's Strategy. This is attached in **Appendix E**.

During the preparation of, and as noted in the Situation Analysis (2006) which has informed the preparation of the SLUS, Council sought advice from the following government agencies (please note some agency names have changed since 2006):

- Department of Transport and Regional Services (Commonwealth).
- Department of Environment and Heritage (Commonwealth).
- Department of Communications, Information Technology and the Arts (Commonwealth).
- NSW Department of Planning.
- NSW Department of Primary Industries (Agriculture, Fisheries).
- NSW Department of Environment and Conservation.
- NSW Department of Natural Resources.
- NSW Department of Housing.
- Department of Energy, Utilities and Sustainability.
- Department of Education.
- Department of State and Regional Development.
- Department of Commerce.
- Department of Lands.
- NSW Heritage Office.
- Energy Australia.
- Tran sGrid.
- State Forests of NSW.
- NSW Department of Education and Training.
- Hunter Central Rivers Catchment Management Authority.
- Hawkesbury Nepean Catchment Management Authority.
- Hunter New England Health Service.
- NSW Roads and Traffic Authority.
- Ce ssnock City Council.
- Ha wkesbury Shire Council.
- Muswellbrook Shire Council.
- Upper Hunter Shire Council.
- Dungog Shire Council.
- Mid Western Regional Council.
- Lithgow City Council.

The preparation of the SLUS was undertaken in close consultation with the NSW Department of Planning to ensure an efficient path through the DoP endorsement process.

6 Part 4 – Community Consultation

In accordance with the NSW Department of Planning document '*A guide to preparing local environmental plans'*, the Planning Proposal does not fit within the category of *'Low impact Planning Proposals'*. Subsequently under these guidelines, the Planning Proposal is required to be exhibited for a minimum period of 28 days. Community consultation will commence through the formal notification of the public exhibition of this Planning Proposal through way of:

- Advertisement in the local newspaper that circulates the local area.
- Advertisement on the Singleton Council web page.

Previous community consultation processes have been carried out in relation to the site's suitability for rural residential development, including community consultation for the preparation of:

- Singleton Land Use Strategy (Singleton Council, 2008).
- Situation Analysis (Planning Workshop Australia, 2006).
- Singleton Rural Residential Development Strategy (ERM, 1999).

In addition to this, the initial rezoning application was subject of a Planning Proposal reported to Council at its meeting of 23rd November 2009. This was a publically advertised meeting and members of the public were able to attend and express their views during the 'public access session'.

Given this, it is viewed that there has been a high degree pre-consultation leading to the development of this Planning Proposal. If supported, the Gateway proposal will be publicly exhibited in accordance with the requirements of the Environmental Planning and Assessment Regulation 2000. Preparation of a DCP for the site (amendment to the Singleton DCP) would also be subject to public exhibition requirements.

7 2010 Gateway Considerations

A previous Planning Proposal for the site was considered and supported by Council but not supported by the Department of Planning's Gateway response.

The Gateway review identified issues needing further attention for the proposal to be considered. The scope of issues was further clarified in the letter to Council dated 24 June 2010 from the regional office of the Department of Planning. The letter detailed that the following issues needed to be addressed as part of this revised Planning Proposal:

1. *A strengthened analysis of land supply;*
2. *Strengthened justification for the proposed amendment in terms of the supply and demand analysis;*
3. *The identification of zones to be used and proposed zone boundaries reflecting the land's capabilities; and*
4. *The resolution of any environmental issues that have been identified. In this regard the Planning Proposal should be consistent with the advice previously received from the Department of Climate Change and Water (DECCW).*

Separate from the above-mentioned matters, the letter from the regional office of the NSW Department of Planning also encouraged Council to complete its Land Release Monitor to help inform the revised Planning Proposal. The purpose of this was so that the subject proposal could be considered in the context of information about the availability and location of zoned land, availability of services, uptake rates and demand and future supply.

At the time of preparing this Proposal, Council and NSW Planning were still in the process of negotiating the form and content of the draft monitor. As such, the information expected to be derived from the monitor has been discussed in this proposal.

The specific zone(s) proposed for the site and the boundaries of the area to be rezoned, are clarified in detail in Section 4 of this Planning Proposal. As such, this section focuses on the remaining issues outlined in the NSW Department of Planning's letter. In particular, this section:

- Reviews rural residential demand and supply data for the Singleton LGA.
- Demonstrates that demand exists for the type of lots proposed in the location proposed.
- Demonstrates that this planning proposal will not generate an oversupply of rural residential zoned land in the Singleton LGA.
- Demonstrates that the matters raised by the NSW Department of Environment and Climate Change, in their letter provided to Council in September 2008 (Appendix F), are able to be appropriately resolved.
- Discusses matters expected to be addressed by the proposed land release monitor.

7.1 Housing Demand and Supply Data

7.1.1 Demand

Singleton Housing Demand

The Singleton Rural Residential Development Strategy (RRDS) reviewed historical demand for rural-residential dwellings in the Singleton LGA for the period 1997 to mid 2004. Based on this data, it predicted annual demand for a 10 year horizon. The RRDS projected that there would be a need for approximately 75 rural-residential dwellings per year in the Singleton LGA.

In 2008, the Singleton Land Use Strategy (SLUS) replaced the RRDS as the primary local strategy relating to rural residential development in the Singleton LGA. The concept that approximately 75 rural-residential dwellings would be required per year in the Singleton LGA was, however, maintained by the SLUS.

Of the 75 projected rural-residential lots per annum, the SLUS predicted that there would be demand for a range of lots falling within the following broad lot size categories:

- Lots with a minimum lot size of 2,000sqm and a minimum average lot size of 4,000sqm, which are provided with reticulated water and sewer. The SLUS suggests that consideration should be given to using the "E4 – Environmental Living zone" where such lots are proposed;
- Lots with a minimum lot size of 8,000sqm and a minimum average lot size of 1Ha, which are provided with reticulated water. The SLUS suggests that consideration should be given to using the "R5 Large Lot Residential zone" where such lots are proposed; and
- Lots with a minimum lot size of 4Ha and a minimum average lot size of 5Ha where no services are provided. The SLUS suggests that consideration should be given to using the "E4 – Environmental Living zone" where such lots are proposed.

The SLUS identifies candidate areas potentially suitable for rural residential development within the Singleton LGA and indicates which lot size categories may be appropriate for the respective candidate areas. It also makes lot yield projections for each of the candidate areas based on the suggested lot size categories.

7.1.2 Development Intensification Data

The land subject of this planning proposal is substantially within the "Lower Belford Candidate Area" (note: this proposal includes a proposal to rezone a strip of land adjoining the candidate area).

The SLUS indicates that the land would be suitable for lots with a minimum lot size of 4Ha and a minimum average lot size of 5Ha if no services are available. The SLUS details that consideration can be given to applying a lower minimum lot size to subdivision of the candidate area if it is serviced with reticulated water.

At the time of preparation of the SLUS, the ability to service the site with reticulated water was uncertain. As such, the SLUS projections for the Lower Belford Candidate Area suggest a minimum lot size of 4Ha and a minimum average lot size of 5Ha. A yield of approximately 30 lots is projected from the Lower Belford Candidate Area if such minimum lot size provisions are applied. Approximately 22 of these 30 lots would be within the site subject of this planning proposal.

Since preparation of the SLUS, the Hunter Water Corporation has expanded its area of operations to incorporate the Lower Belford Candidate Area and has confirmed that the site is able to be serviced with reticulated water. Smaller minimum lot size provisions are therefore proposed to be applied to the site.

This planning proposal intends to apply a minimum lot size of 8,000sqm and a minimum average lot size of 1Ha to subdivision of the subject land. This would generate a yield of approximately 125 lots from the site, which is an increase of 103 lots to the SLUS projections.

The revised projection assumes a 90% efficiency factor (i.e. 10% of the site being utilised for roads, vegetation protection, watercourse protection and drainage, other open space areas, etc).The estimated yield of 125 lots within the subject site represents the maximum potential development yield from the land. This yield has been adopted to ensure that analysis of the suitability and impacts of the proposal are based on an 'upper level' potential outcome as against a 'conservative' basis. It is anticipated that detailed site master planning having regard to site constraints and features including vegetation, drainage lines, APZ setbacks for bushfire protection, ridgelines, etc, may result in a site subdivision yield less than 125 lots.

The site subject to this Planning Proposal is located within the Lower Belford Candidate Area. It comprises five of the 17 lots included in the Candidate Area. Having an area of 140ha, the site

represents the largest landholding under single ownership within the Lower Belford Candidate Area. Its development would significantly contribute to the supply of land within the LGA and in particular within the Branxton area.

Development of the land in accordance with the recommendations of this planning proposal would increase the total yield projected for the SLUS candidate areas from 670 lots to 767 lots, assuming that there is no intensification of other land within the candidate areas.

At the time of lodging this planning proposal, no other proposals for intensification had been lodged with Council. The SLUS does not incorporate land supply relating to the Huntlee proposal which is identified by the Lower Hunter Regional Strategy. The potential land supply at Huntlee (projected to provide for approximately 7,000 dwellings) responds to growth drivers of the Lower Hunter region rather than for the projected local growth associated with the Singleton LGA.

7.1.3 Implication of Intensification on Land Supply

The rural-residential candidate areas are projected by the SLUS to yield approximately 670 dwellings over a 10 year period (based on 1 dwelling per new rural-residential lot). This provides for an average of 67 dwellings per year, which is 8 dwellings below the number of new rural-residential dwellings required to meet the demand projected by the SLUS.

The gap between the projected yield for the candidate areas; and the yield required to meet projected demand, presents an opportunity to intensify development of the land subject of this planning proposal. This potential to increase number of lots (and therefore dwellings) yielded from the Lower Belford Candidate Area is highlighted in Table 12 of the SLUS.

This planning proposal would increase the projected yield from the rural-residential candidate areas to 76.7 dwellings per year for a 10 year period. This is only 1.7 dwellings per year more than what has been projected as required by the SLUS based on historical demand. This proposed increase in land supply would not result in an oversupply of land for rural-residential development in the Singleton LGA or in the Branxton area.

Table 1 which follows places the subject planning proposal into the context of the yields currently projected for the SLUS candidate areas. As evident from Table 1, no other proposals to intensify lot yield have been submitted and supported by Council at this point in time.

Table 1 – Candidate Areas: Rural Residential

Candidate Area	Total Area	SLUS 2008 Approximate Subdivision Yield	Estimate 2010 Land Use Projection
Lower Belford	277 ha	30 Environmental Living zoning (rural-residential zone) lots @ minimum average 5ha	Approx. 125 lots Large Lot Residential zoning (rural-residential zone) lots @ minimum average 1ha 8 lots Environmental Living zoning (rural-residential zone) lots @ minimum average 5ha including LEP amendment LA 55/2007 completed in 2010; rezoning has potential for up to 7 lots Environmental Living zoning (rural-residential zone) lots @ minimum average 5ha ***(increase of 103 lots in Candidate Area)***
Jerry's Plains	20 ha	70 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 1ha	70 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 1ha

Wattle Ponds North East	88 ha	70 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 1ha	68 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 1ha
Wattle Ponds North West	167 ha	134 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 1ha	134 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 1ha
Sedgefield	922 ha	100 Environmental Living zoning (rural-residential zone) lots @ minimum average 5ha	94 lots Environmental Living zoning (rural-residential zone) lots @ minimum average 5ha ***(decrease of 6 lots in Candidate Area)***
Gowrie	18 ha	35 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 4,000sqm	35 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 4,000sqm
Branxton North West	88 ha	180 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 4,000sqm	180 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 4,000sqm
Branxton North East	41 ha	87 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 4,000sqm	87 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 4,000sqm
Branxton South East	8 ha	17 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 4,000sqm	15 Large Lot Residential zoning (rural-residential zone) lots @ minimum average 4,000sqm
TOTAL		**670 lots**	**763 lots**

Table 2 provides an aggregate of the anticipated lot sizes to be provided from the rural-residential Candidate Areas in Branxton and Singleton and compares them to updated estimate figures.

Table 2 – Anticipated Breakdown of Lot Sizes

Candidate Area	Large Lot Residential (Rural-Residential Zone)	Large Lot Residential (Rural-Residential Zone)	Environmental Living (Rural-Residential Zone)	Total
	Average 4,000sqm lots	*Average 1ha lots*	*Average 5ha lots*	
SLUS 2008				
Branxton	284	0	30	314
Singleton	35	221	100	356
Total SLUS 2008	**319**	**221**	**130**	**670**
Estimate 2010				
Branxton	284	125	8	415
Singleton	35	219	94	348
Total 2010	**317**	**344**	**102**	**763**

Given that the Branxton Area has been identified as being suitable for catering for future regional population growth (Lower Hunter Regional Strategy) and given the additional housing demand expected to be generated as a result of development of the nearby Whittingham Industrial Estate, provision of significant employment lands within the Huntlee New Town site, continued expected growth in the coal industry, intensification of the Singleton Army Base and planned extension of the Hunter Expressway; the additional 1.7 dwellings per year is considered to be a reasonable increase on the SLUS target.

7.1.4 Implications of Undersupply of Rural-Residential Land

Demand for an average of 75 rural-residential dwellings per year in Singleton LGA has been established by the RRDS and SLUS.

High demand and low supply of rural-residential land over the last 5 years has generated housing affordability issues in the Singleton LGA. The comparatively higher house prices in Singleton LGA are evidenced in the recent property sales statistics published by NSW Housing (**Appendix H**).

High house prices have resulted in an increased dependency on rental accommodation and an increase in the number of people who work in the Singleton LGA, but reside outside of the LGA.

Recent rental accommodation statistics published by NSW Housing (**Appendix I**) indicate that LGA's similar to Singleton LGA tend to experience lower average rental prices compared to the average rental prices for the Singleton LGA. As a result of the high demand for rental accommodation, Singleton LGA has relatively high rental prices compared to similar LGA's.

It is not only necessary to provide affordable housing opportunities, it is also important to provide housing choice to meet demand. High historical take-up rates for vacant rural-residential allotments of the type sought by this planning proposal and extremely low current supply indicates that there is unfulfilled demand for rural-residential allotments in the Singleton LGA ranging in the 8000sqm/1Ha size. This view has been reinforced by responses to consultation with local real estate agents.

The high demand for rural-residential land in the region is evidenced by similar developments outside of the Singleton LGA, such as the Sutton Grove and Highfield Way Estates in the Belford-Branxton area, which were all pre-sold 'off the plan' before subdivision certificate release (Sutton Grove comprises a total of 22 lots including 19 in DP1022400 registered January 2001, Highfield Way comprises 12 lots in DP1060301 registered October 2003).

Continued undersupply of vacant rural-residential land within the Singleton LGA is expected to exacerbate housing and rental affordability issues in the LGA. Housing and commercial opportunities would be lost and the Singleton LGA would suffer.

While the subject planning proposal will not resolve the housing supply and affordability issues currently experienced within the Singleton LGA, it is believed that the proposal will positively contribute to addressing these issues.

7.2 Ecological Assessment and Consultation with DECCW

The site subject of this planning proposal has been identified by the SLUS as being potentially suitable for rural-residential development. The Department of Environment, Climate Change and Water (DECCW) played a significant role in the final selection of the SLUS candidate areas; particularly in relation to flora, fauna, biodiversity and environmental sustainability issues.

The site comprises Endangered Ecological Communities (EECs) and adjoins the Belford State Forest. It is important that this planning proposal consider any potential impacts on the State forest and EECs and addresses any such issues accordingly. As such, pre-consultation with the DECCW during the preparation of this planning proposal has been necessary.

In late September 2008, DECCW provided written advice to Council (**Appendix F**) outlining what the DECCW expected to be addressed by a planning proposal. In summary, the letter detailed that:

- The site comprises EEC's and any losses in biodiversity on the site would require offsets such that a maintained or improved biodiversity outcome would be achieved.
- An appropriate level of Aboriginal Cultural Heritage assessment is required to be undertaken, which includes consideration of views expressed by Local Aboriginal Community groups. Impacts on items or places of Aboriginal Cultural Heritage are to be avoided
- Potential direct and indirect impacts on DECCW estate, wilderness areas, wild rivers and recognised areas of high conservation value are to be adequately considered and avoided, ameliorated or compensated as appropriate.
- Any areas of contamination on the site are to be identified and managed in accordance with the *Contaminated Land Management Act 199*7.
- Stormwater emanating from the area must be managed in a sustainable manner to prevent any impacts on adjacent rivers, wetlands or estuaries.
- If the proposal affects any species requiring consideration under the *Environment Protection and Biodiversity Conservation Act 1999*, consultation with the Department of Environment, Water, Heritage and the Arts (now the Department of Sustainability, Environment, Water, Population and Communities) may be required.

7.2.1 Endangered Ecological Communities

A preliminary ecological assessment has been undertaken for the site by Cumberland Ecology. The assessment report (**Appendix C**) confirms the existence of 3 Endangered Ecological Communities (EEC's), being:

- Lower Hunter Spotted Gum - Ironbark Forest;
- Central Hunter Ironbark Spotted Gum - Grey Box Forest; and
- Hunter Lowlands Red Gum Forest.

The preliminary ecological assessment confirms the potential for the site to accommodate allotments with a minimum lot size of 8000 sqm and an average lot size of 1 hectare.

Further more detailed assessment is required to ensure biodiversity values on the site are maintained or improved. Such detailed assessment is to be undertaken as part of the detailed planning justification following the gateway assessment.

The detailed planning justification will include a comprehensive Ecological Assessment Report prepared by a suitably qualified environmental consultant. This report will include (but not be limited to) the following key features:

- Detailed Flora and Fauna Survey;
- Biodiversity Impact Assessment;
- Conservation Management Strategy (which includes consideration of riparian corridors and any necessary off-set requirements);
- Vegetation Management Plan (which demonstrates how the land will be managed to ensure that development on the site achieves and improved or maintained biodiversity outcome); and
- Consideration of relevant State and Commonwealth legislation.

The information from the comprehensive ecological assessment will inform the preparation of Development Control Plan (DCP) provisions for the site. Such provisions will aim to ensure that development of the site does not generate significant adverse impacts on the EEC's.

7.2.2 Aboriginal Cultural Heritage Assessment

Following initial gateway support for this planning proposal, a detailed Aboriginal Cultural Heritage Assessment would be undertaken. Such an assessment would be undertaken by a suitably qualified archaeologist and would be prepared in accordance with the requirements of the Department of Environment, Climate Change and Water (DECCW).

The proposed Aboriginal Cultural Heritage Assessment Study would include:

- A literary review of available data, including previous studies, investigations;
- Details of consultation with relevant Public Authorities and key local stakeholders (i.e. local Aboriginal Land Council); and
- Details of the findings of a field survey of the site, which will confirm either the presence or absence of any relics, sites or places of significance within the area.

If any Aboriginal Cultural Heritage is present, the study would also:

- Explore the constraints and opportunities that may affect the rezoning of the land for the purposes of rural residential development;
- Identify an appropriate conservation and management strategy in consultation with key stakeholders; and
- Provide details of consultation in accordance with the consultation requirements of DECCW.

7.2.3 DECCW Estate, Wilderness Areas, Wild Rivers and Recognised Areas of High Conservation Value

The site adjoins the Belford National Park, which is managed by the Department of Environment, Climate Change and Water. The preliminary ecological assessment which has been undertaken for the site by Cumberland Ecology (**Appendix C**) indicates that there is the potential for future development to occur on the site in a manner which would complement the ecological values of the National Park.

The western section of the site could be developed in a low intensity way with minimal clearing, such that the vegetation conserved provides a buffer to the National Park. Concentration of development within the clearings of the eastern and central western areas of the site would also minimise impacts on the National Park.

Consideration of the Belford National Park will form part of the Conservation Management Strategy to form part of the comprehensive ecological assessment which will be prepared for the site once gateway support is provided. Consideration will be given to the "*Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water*" in development of the strategy.

The comprehensive ecological assessment will be used to inform preparation of DCP provisions. Such provisions will aim to ensure that there are no significant adverse impacts on the National park as a result of rezoning the site.

7.2.4 Site Contamination

The likelihood of contamination of the site is low, given its history of use for agriculture (predominantly grazing). A site contamination assessment is intended to be prepared for the site once gateway support has been provided for this planning proposal. This assessment will include (but not necessarily be limited to):

- Details of fieldwork, testing and results;
- Details of the history of use of the site;
- Details of any possible contaminants that may be encountered across the site (including any possible contaminant associated with previous livestock grazing); and

- Management strategies to address contamination if it is identified on the site.

7.2.5 Stormwater Management

A Stormwater Management Strategy is intended to be prepared for the site once Gateway support has been provided for this planning proposal. The strategy will identify stormwater flows emanating from the site and provide details of how stormwater will be managed in an environmentally sustainable manner.

Douglas Partners has prepared a "Report on Effluent Disposal, Erosion and Salinity Assessment" (**Appendix J**). This assessment report considers erosion risk, salinity risk and suitability of the site for on-site effluent disposal. The report will be used to help inform the provisions of the stormwater management strategy.

Overall the Stormwater Management Strategy will address the hydrology of the site in consideration of proposed future development and will include an evaluation of the role and structure of the existing dams. Protection of riparian values will also be addressed in the strategy. The strategy will identify and provide a description of the sub-catchment and provide details of how any localised flooding from natural watercourses will be managed.

7.2.6 Consideration under the *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is a piece of Commonwealth Legislation which provides a legal framework for protecting and managing matters of national environmental significance, including nationally and internationally important flora, fauna, ecological communities and heritage places.

The preliminary ecological assessment which has been undertaken for the site by Cumberland Ecology (**Appendix C**) does not indicate that the site contains nationally threatened species, ecological communities or migratory species listed pursuant to the EPBC Act.

The comprehensive ecological assessment to be prepared for the site following gateway approval of this planning proposal, will review compliance with the EPBC Act. The Conservation Management Strategy to form part of the comprehensive ecological assessment for the site will address any issues which may arise as a result of the review compliance with the EPBC Act.

7.3 Land Release Monitor

In the letter to Council from the Department of Planning, dated 24 June 2010, it was recommended that Council complete its land release monitor to enable consideration of this planning proposal in context of development that has occurred since endorsement of the SLUS.

At the time of preparation of this planning proposal, Council and the Department of Planning were still in the process of finalising the draft monitor. As such, this section discusses the information expected to be derived from the monitor once it is completed and how such information relates to this proposal.

7.3.1 The SLUS and the Monitor

The SLUS classifies key planning issues according to whether they are urban or rural issues. Urban issues focus on provisions for residential, commercial and industrial growth. Rural issues focus on rural and rural-residential growth.

The strategy develops policies to provide for the growth of the Singleton LGA and comprises recommendations predominantly relating to the provision of land and services to facilitate such growth.

The SLUS policy matters mainly focus on how the strategy will be implemented. The key indicator for the success of the strategy implementation will be land release. As such, it is expected that the monitor will focus predominantly on urban and rural land release and monitor consistency with SLUS projections and targets.

7.3.2 Urban Issues

Residential Land

At the time of the adoption of the SLUS, the majority of zoned residential release land was comprised within the Bridgman Ridge, Gowrie Links and Huntergreen urban release areas. Section 6 of the SLUS indicates that these areas would be able to provide adequate residential zoned land to satisfy demand for such land up until 2023/24 (15 years from the time of adoption of the strategy).

The strategy projects a yield of between 1550 to 1750 lots from these areas, which equates to approximately 104 to 117 lots per year based on the 15 year timeframe. The review process associated with the implementation of the SLUS would consider options to cater for growth past this 15 year time period.

Since adoption of the strategy, an area of land within south Hunterview has been rezoned for residential purposes (Amendment No. 51 to the Singleton LEP 1996). This area of land is projected to yield approximately 35 lots.

Development Control Plan (DCP) provisions are required to be prepared for each of the residential release areas prior to consent being able to be issued for subdivision of the land. Of the residential release areas, only the Bridgman Ridge and Gowrie Links areas have had DCP proposals lodged with Council and made.

The Huntergreen and Burbank Crescent areas are yet to have DCP proposals submitted for them. No development application(s) for subdivision of the Gowrie Links urban release area to create residential release block has been lodged as yet.

Of the residential release areas, only 27 allotments have been created for release and these lots are all within the Bridgman Ridge Urban Release Area. Only 2 of these remaining allotments are still to be sold. 20 dwellings have been approved within the 27 Bridgman Ridge residential release allotments.

Development approval has been issued to further subdivide the Bridgman Ridge urban release area to create 24 residential allotments for release; however construction of these allotments is still in progress.

Subdivision of zoned land remaining within north Hunterview (Pinnacle subdivision) has progressed more slowly than expected. At the time of preparation of the SLUS, it was believed that the pinnacle land would be developed to satisfy demand while the release areas progressed.

30 residential allotments for release have been created within the Pinnacle subdivision since endorsement of the SLUS. Approvals have been issued for approximately 22 dwellings on these allotments. 5 of these allotments are still to be sold.

As evident, there has been limited supply of residential lots to the Singleton market, but relatively high uptake rates. The global financial crisis is believed to have impacted on the rate of development of lots.

In relation to the subject planning proposal, it is believed that the lack of supply of residential lots will only encourage people to look at alternatives such as rural-residential land.

Commercial Land

The SLUS indicates that commercial development in Singleton as a whole is well catered for under existing zonings. As such the strategy has not identified further commercial land for development. Relocation of large commercial developments away from the Singleton Central Business District (CBD) is expected to free-up commercial land for development. As yet such relocation has not occurred.

In relation to the subject planning proposal, it is believed that once the commercial land is freed-up, substantial new commercial development will occur. Such development is likely to generate employment opportunities, which have a positive influence on population growth. Additional housing opportunities will need to be available to provide for such population growth.

Industrial Land

The SLUS relies on approximately 250Ha of industrial zoned land at Whittingham (Whittingham Industrial Estate) satisfying the next 25 years of demand for such land. The amendment to the Singleton Development Control Plan for create DCP provisions for this land is presently being exhibited and expected to be finalised relatively soon. This will enable consideration of any applications to develop the land.

Commercial and employment opportunities associated with development of the Whittingham Industrial Estate are expected to generate significant demand for housing in the Singleton LGA. The subject planning proposal would provide rural-residential land for housing development to help satisfy this demand.

7.3.3 Rural Issues

Rural-Residential Land

The SLUS identifies 9 candidate areas for rural-residential growth. 4 allotments within the northern part of the Lower Belford Candidate Area have been rezoned since endorsement of the SLUS. This rezoned land (Standen Drive Environmental Living Estate) has the potential to yield approximately 8 additional allotments for release. Council is yet to receive a DCP proposal for this land or a development application to subdivide this land.

Since endorsement of the SLUS an enabling clause has been made to enable creation of 1 additional allotment within the Sedgefield Candidate Area.

The table (Table 3) which follows shows rural-residential rezoning proposals which have been lodged with Council but still to be finalised. It also provides an indication of the lot yield projected for the land subject of these rezoning proposals.

Table 3 – LEP Amendment Proposals Being Processed for Rural Residential Release Areas

Council File Reference	SLUS Candidate Area	Projected Potential Yield	Status of Proposal
LA37/2003	Sedgefield	33	Pending resolution of issues raised by Public Authorities
LA42/2005	Wattle Ponds North East	20	Pending resolution of issues raised by Public Authorities – DCP proposal required
LA43/2005	Sedgefield	31	Pending resolution of issues raised by Public Authorities – DCP proposal required
LA46/2005	Wattle Ponds North East	12	Pending resolution of issues raised by Public Authorities – DCP proposal required
LA50/2005	Wattle Ponds North West	30	Pending resolution of issues raised by Public Authorities
LA59/2007	Wattle Ponds North East	24	Pending resolution

			of issues raised by Public Authorities – DCP proposal required
LA61/2007	Wattle Ponds North East	12	Pending resolution of issues raised by Public Authorities – DCP proposal required
LA64/2008	Branxton North West	166	With Department of Planning (DoP) seeking Parliamentary Counsel opinion and request to be made
LA65/2008	Lower Belford	103 (Subject Planning Proposal)	Current proposal
LA67/2009	Branxton South West	15	Pending lodgement of details environmental studies as required by s54(4) advice
LA68/2009	Adjoining Branxton North West Candidate Area	4	Pending resolution of issues raised by Public Authorities
LA73/2009	Branxton North East	Unknown - appropriate minimum lot size provisions in process of being determined	Initial stage - Awaiting information from proponent regarding the ability to service the site (will influence minimum lot size provisions and yield).
LA1/2010	Sedgefield 1		Planning Proposal being reported to Council meeting seeking initial support
LA2/2010	Sedgefield 4		Planning Proposal being reported to Council meeting seeking initial support
LA3/2010	Sedgefield 22		Planning Proposal being reported to

			Council meeting seeking initial support

Rural Land

The SLUS details that Singleton LGA comprises substantial rural zoned land and focuses on minimum lot size provisions to reduce the likelihood of segregation of prime agricultural land. New rural lots (approximately 5 of the 200 LGA dwellings per year) would have a negligible impact in relation to satisfying housing demand.

The subject planning proposal would create large rural-residential lots, which are expected to reduce the demand for subdividing rural zoned land to create large living blocks.

7.4 Summary

Based on the above analysis, the following summary of the compliance of the proposal against the objectives specified in the SLUS and additional information requested under the Gateway process is provided:

SLUS Objectives	Assessment of the BLC Proposal
Provide opportunities for additional rural residential subdivision and development in suitable locations and enable a range of different types of rural residential development.	The subject site is identified as an area suitable for environmental living (rural-residential zone). The proposal will contribute to the provision of an appropriate range of different sized lots.
Ensure that adequate services are available for rural residential lots.	The proposed minimum 8,000sqm lots (average 1ha lots) can be supplied with all necessary utility services, including reticulated water supply. The site has good access and proximity to a wide range of social and other support services available to the local area.
Ensure that the supply of zoned rural residential land does not unreasonably exceed demand	The proposal will not result in an oversupply of land for the reasons stipulated in Section 7.3.1 of this Planning Proposal.
Have regard to the monitoring of land use and land supply.	Monitoring reveals: ▪ A significant shortage of rural residential land available to the market. ▪ No indication that land supply targets will be met in the immediate or short term form the current proposals. ▪ The proposal represents a major contribution to land supply to meet land supply targets.
Apply criteria to identify the best location for rural residential estate and balance socio-economic goals associated with new rural residential development with the need to preserve areas of high agricultural, scenic or environmental value.	Minimum 8,000sqm lots (average 1ha lots) can be developed on the subject site while maintaining the important ecological and physical attributes of the site and without detrimental impact on adjoining land.
Ensure zone boundaries address land capabilities and appropriate zone provisions are identified	The consideration of the proposed extension to the Lower Belford Candidate Area will be subject of more detailed ecological investigations; DECCW have confirmed they will review the more detailed ecological assessment following the Gateway process to determine the appropriate boundary for development. Zone provisions have been established by recent provisions

SLUS Objectives	Assessment of the BLC Proposal
	for rural residential development on land to the north of the site in the Lower Belford candidate Area as 7(b) (Environmental Living Zone) with an associated Lot Size Map.
Resolution of Environmental issues, having particular regard to consultation with DECCW	The site is located within a Candidate Area In the SLUS identified in consultation with DECCW as suitable for rural residential development and as suitable to consider for intensification should reticulated water become available. Further environmental considerations specially relating to the site have been addressed through various studies including geological and ecological considerations that indicate the proposal is able to proceed to more detailed resolution following Gateway determination; DECCW have confirmed no further involvement is required from them until after the Gateway process.
Identify appropriate development controls for rural residential areas through DCP provisions.	Appropriate development, land use and built form controls will be established for the site during detailed site planning.

8 Conclusion

This planning proposal has been prepared in accordance with the NSW Department of Planning's: *Guide to Preparing Planning Proposals* (2009). It responds to matters raised in the 8 February 2010 gateway response to a previous planning proposal lodged for the site and addresses issues identified by the Department of Planning's advisory letter dated 24 June 2010.

The rezoning and proposed minimum lot size provisions for subdivision are considered to be consistent with the provisions of the SLUS. The minimum lot size provisions sought by this planning proposal would allow for subdivision of the land to create approximately 125 rural residential lots for release. This is an increase of 103 lots to the yield projected by the SLUS for the Lower Belford Candidate Area. The revised yield for this site would increase the total yield from the SLUS candidate areas to approximately 10.23 years supply.

The fact that the SLUS recommends rezoning 10 years supply of rural residential release land and the fact that future infrastructure (i.e. F3 Freeway extension) and employment opportunities (i.e. Whittingham Industrial Estate etc) in the local area are likely to increase demand for rural residential blocks, this planning proposal is considered appropriate and reasonable.

The land subject of this planning proposal is physically and environmentally capable of providing for the proposed lot yield. Use of the environmental living zone for the rezoning has been confirmed and the boundary of the area to be rezoned has been clearly defined. Matters of concern raised by the NSW Department of Environment, Climate Change and Water have been addressed and are able to be resolved as part of the LEP amendment and required DCP provisions for the site.

The proposal:

- reflects an efficient and effective use of this land, which is consistent with the provisions of the *Environmental Planning and Assessment Act, 1979*.
- is consistent with the objectives and policies for rural residential development set out in the SLUS.
- will not result in an oversupply of rural residential land.
- will assist Singleton Council to meet overall housing supply targets, and meet the target of providing rural residential land supply of 75 lots per annum in the short to medium term.
- will contribute to the provision of a diversity of rural residential lot sizes catering for the needs of future residents in the Branxton area and more broadly in the Singleton LGA.
- Provides for appropriate development of the site, generating a range of economic, social and environmental benefits.

9 Recommendation

Based on this Planning Proposal and Council's previous support of an earlier similar proposal, it is recommended that this Planning Proposal be supported.

Appendix A Department of Planning Correspondence (24th June 2010)

NSW GOVERNMENT | Planning

Contact: Gary Freeland
Phone: 4904 2700
Fax: 4904 2701
Email: gary.freeland@planning.nsw.gov.au

Our ref: 09/04150
Your ref: LA 65/2008

Mr Scott Greensill
General Manager
Singleton Council
PO Box 314
SINGLETON NSW 2330

Attention: Gary Pearson

Dear Mr Greensill

PLANNING PROPOSAL – STANDEN DRIVE, LOWER BELFORD

I refer to the Gateway Determination in respect of this Planning Proposal dated 8 February 2010. Please be advised that senior officers of the Department met with the proponent's representatives in relation to this determination on 28 May 2010.

The proponent has indicated that it intends to submit a fresh proposal to Council for its consideration. The Department has advised the proponent that prior to any rezoning submission being submitted to Council the following issues are to be addressed:

1. A strengthened analysis of supply and demand;
2. Strengthened justification for the proposed amendment in terms of the supply and demand analysis;
3. The identification of zones to be used and proposed zone boundaries reflecting the land's capabilities; and
4. The resolution of any environmental issues that have been identified. In this regard the planning proposal should be consistent with advice previously received from the Department of Climate Change and Water (DECCW).

With regards to points 1 and 2, Council is strongly encouraged to complete its Land Use Monitor and forward such to the Department prior to the submission of the subject planning proposal. The monitor is the appropriate mechanism to address matters such as availability of zoned land and services, its location, uptake rates and demand as well as future supply including LEPs and Planning Proposals currently under assessment.

Should Council support any application, it it envisaged that it would expedite the preparation of a Planning Proposal for a Gateway determination.

Should you require any additonal information please feelfree to contact me on 4904 2710.

Yours sincerely

Gary Freeland 24/6/10

Gary Freeland
Team Leader
HUNTER & CENTRAL COAST REGION

Appendix B Hunter Water Corporation Correspondence (3rd November 2008)

HUNTER WATER CORPORATION PO BOX 1249 NEWCASTLE NSW 2300 DX 4313 NEWCASTLE
36 HONEYSUCKLE DRIVE NEWCASTLE NSW 2300 PH 02 4979 9500 FAX 02 4979 9501

Ref: 2008-1187

3 November 2008

General Manager
Singleton Council
PO Box 314
SINGLETON NSW 2330

Attention : Gary Pearson

Dear Gary

RE SECTION 62 CONSULTATION – DRAFT AMENDMENT TO SINGLETON LOCAL ENVIRONMENT PLAN FOR LOT 11 DP 844443, LOT 12 DP 1100005, LOT 13 DP 1100005, LOT 6 DP 237936, LOT 2 DP 739822, - 7, 5, 133 & 147 STANDEN DRIVE, LOWER BELFORD.

Thank you for your letter of 2nd October 2008 regarding the proposed draft amendment to the Singleton LEP for the land described above.

Hunter Water values the opportunity to comment on the draft amendment and accordingly offers the following preliminary assessment with respect to providing water and sewer services to the subject land.

Water Supply

Hunter Water anticipates that the site would connect to the Maitland – North Rothbury Water Supply System. Currently this system does not have spare capacity to service the areas west of Branxton including the subject site. However, Hunter Water is currently finalising a revised servicing strategy for this system to cater for the additional growth identified in the Lower Hunter Regional Strategy (LHRS). The proposed capital works program (to be completed by 2023) will be able to cater for approximately 7,000 additional Equivalent Tenements (ET) downstream of the Harpers Hill Reservoir. Major developments identified downstream of the Harpers Hill includes Greta Army Camp, proposed Huntlee New Town, Buildev Industrial Development and other potential developments west of Branxton resulting from recent boundary adjustment of Hunter Water's area of operation.

It is estimated that there will be additional capacity of approximately 3,000 to 3,500 ET downstream of the Harpers Hill Reservoir after completion of Stage 4 augmentation works proposed to be completed by 2013. Capacity for the proposed development is unlikely to be available before this time. Exact capacity of the water system can only be assessed once the developer submits detailed demand and timing information.

The closest connection points for the site would be the existing water mains along Maitland Street, Branxton located approximately 2.5 km east of the site. Hunter Water has been working with potential developers in this area to facilitate the construction of a new water main to service the area west of Branxton.

A developer-funded servicing strategy for the site will need to be prepared to determine local upgrades to the water system which may be required to serve the development.

Wastewater Transportation

Hunter Water expects that the site would fall within the Branxton Waste Water Treatment Works (WWTW) catchment for wastewater services. From a review of the site it appears that not all of the wastewater from the site (especially the northern part of the site) will be able to gravitate to the existing wastewater transportation system. Therefore the developer will need to submit a Servicing Strategy detailing accurate loading and timing information to Hunter Water, and proposals to service the site.

Flows from the site may be discharged into the wastewater system located on Maitland Street, approximately 2.5 km east of the site. Flows in this system gravitate to the Branxton 1 Waste Water Pump Station (WWPS) which currently has limited pumping capacity. However, an upgrade of this station has been included in the Forward Capital Works program and is anticipated to be completed by 2013/2014.

Following this, it is likely that some capacity will be available in the upgraded station to cater for at least the preliminary stages of the development.

It should be noted that this information is only indicative at this stage and available capacity will be more accurately assessed when the developer submits accurate loading, timing and lot layout information. In order to cater for the early stages of the development, some local upgrades may be required.

Wastewater Treatment

The Branxton 1 WWPS pumps directly to the Branxton WWTW. It is likely that there will be available capacity for preliminary stages of the development; however this will be assessed in more detail once Hunter Water receives sufficient loading information.

General

Hunter Water has no objections to the proposed rezoning application; however it may be 5 -7 years before water and wastewater services can be provided to this area depending upon other development interest. The developer should continue to liaise with Hunter Water regarding the other possible alternatives to service the development once the capacity is available in the system.

Should you require further clarification or assistance please contact the enquiries officer listed below.

Yours faithfully

Brett Lewis
Manager Development Services

Enquiries: Steve Alexander
Tel: 1300-657-657
Fax: (02) 4979-9711

Appendix C Cumberland Ecology Preliminary Assessment Report (April 2009)

6 April 2009

Daniel Golenia
Development Manager
Belford Land Corporation
PO Box 89
Singleton NSW 2330

Cumberland Ecology
PO Box 2474
Carlingford Court 2118
NSW Australia
Telephone (02) 9868 1933
Mobile 0425 333 466
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Web: www.cumberlandecology.com.au

Dear Daniel

RE: PRELIMINARY ECOLOGICAL ASSESSMENT OF STANDEN DRIVE, LOWER BELFORD

The purpose of this letter is to provide a preliminary ecological assessment of land at 5, 7, 113 and 147 Standen Drive, Lower Belford. The land Lot 11, DP: 844444, Lots 12 and 13, DP: 1100005, Lot 6, DP: 237936 and Lot 2, DP: 739822. Figure 1, Appendix A provides an aerial photograph of the subject land.

We understand that the subject land is proposed for rezoning and the Department of Environment and Climate Change (DECC) has been consulted by Singleton Council to elicit the Departments' views about relevant planning considerations. The DECC prepared a letter to Singleton Council summarising what the Department considers to be relevant matters under its jurisdiction. The following is an extract of a letter from the DECC letter dated 27th October to Singleton Council regarding the subject site:

> *Prior to approving the amendment, it is recommended that Council be satisfied that:*
>
> 1. *The proposed rezoning are not likely to result in impacts on areas of native vegetation, with special reference to threatened or regionally significant flora and fauna species, populations and ecological communities. Where impacts are considered unavoidable and proposed for areas of biodiversity value, the proponent has clearly demonstrated how they propose to offset any loss in biodiversity value to meet the "improve or maintain" biodiversity principle. Further information on assessing the improvement or maintenance of biodiversity values can be found on the DECC website at: http://www.environment.nsw.gove.au/biocertification/offsets.htm*

2. *Any potential land use conflicts associated with air, noise and odour impacts are adequately addressed, particularly in relation to premises scheduled under the Protection of the Environment Operations Act 1997.*

3. *Adequately considers the relevant threatened species provisions of the Environmental Planning and Assessment Act 1979, State Environment Planning Policy (SEPP) 44 – Koala Habitat Protection, SEPP 71 – Coastal Protection and the Native Vegetation Act 2003.*

4. *Potential direct and indirect impacts on DECC estate, wilderness areas, wild rivers and recognised areas of high conservation value have been adequately considered and avoided, ameliorated or compensated as appropriate.*

5. *Stormwater emanating from the area must be managed in a sustainable manner to prevent any impacts on the adjacent rivers. DECC notes that the site contains creek systems and water bodies. There should be adequate protection and rehabilitation of riparian corridors within these lots.*

This letter responds to points 1, 3 and 4 of the aforementioned DECC requirements.

1. THREATENED AND REGIONALLY SIGNIFICANT FLORA

1.1 General Description of Habitats

Cumberland Ecology has traversed the entire property and has collected flora data from within nine sample 400 metres square quadrats. A series of photographs has been provided of each quadrat location in Appendix A. A full set of quadrat data including plant species and the percentage cover values within each quadrat are provided in Appendix B.

The subject site consists of gently undulating land that has been used for farming and forestry operations for many years. There is a low ridge in the centre of the land and approximately half of the land slopes to the east to Standen Drive. Much of the remainder has a westerly aspect and slopes down towards Belford National Park. A small dry gully parallels the western boundary and water would flow northwards along this gully during heavy rain. The narrow strip of land between the gully and the western boundary is relatively flat but slopes in an easterly direction towards the gully.

A high proportion of the eastern slopes have been cleared for pastoral usage and approximately only 20% of this portion of the site retains tree cover. The majority of trees are relatively young and most lack tree hollows for hollow dependent fauna. The tree cover on the eastern side of the site is also highly fragmented and lacks any connectivity with other forest vegetation. Land immediately to the east of the subject site has been cleared and affords little habitat (see Figure 1, Appendix A).

The majority of forested land on the subject site occurs on the western slopes and in the land beside the gully near the Belford National Park. The forest occurs in larger blocks and there is

consequently greater connectivity amongst the patches on the subject site and to other vegetation within the National Park. Notwithstanding that, there are large cleared areas on the western side of the subject land. Also, the majority of trees are relatively young and lack hollows for hollow dependent wildlife.

As can be seen from the quadrat data in Appendix B, a considerable diversity of native plants occurs on the subject site. The list to date is not a complete representation of the floristic diversity and more species will be detected once the flora and fauna surveys are completed in 2009.

No threatened plant species were found within the quadrat survey in December, though there is potential for several species to occur and it is conceivable that one or more of these species could be detected in subsequent survey work.

African Olive infestations occur across the forested land on the subject site and this species is a significant threat to the biodiversity of the subject site in the long term. Current management has entailed slashing to control this woody weed and the slashing has apparently controlled the level of infestation across a high proportion of the site. However, as the African Olive can invade relatively undisturbed forest and seeds are long lived. It is also well established in the National Park. For this reason, there will need to be ongoing active management of African Olive in any future conservation areas of the subject land.

1.2 Forest Types

The vegetation on site has been mapped by Peake (2006) **The Vegetation of the Central Hunter Valley, New South Wales. A report on the findings of the Hunter Remnant Vegetation Project.** Hunter-Central Rivers CMA. Our preliminary vegetation survey has ground truthed the mapping by Peake (2006) and we can confirm that three types of native forest vegetation occur on the subject site as described below:

1.3 Lower Hunter Spotted Gum – Ironbark Forest

This is a mid tall open forest, which has been classified as an endangered ecological community under the NSW Threatened Species Conservation Act 1999 (TSC Act).

On the subject site it appears to occur largely on the western slopes and it was sampled in the recent vegetation survey within quadrats 1 and 8 (see photographs 1 and 8 in Appendix A and quadrat data in Appendix B).

It is dominated by Spotted Gum (*Corymbia maculata*) and Broad-leaved Ironbark (*Eucalyptus fibrosa*). On site there is a shrubby understorey including Gorse Bitter Pea (*Daviesia ulicifolia* subsp. *ulicifolia*), Native Blackthorn (*Bursaria spinosa* subsp. *spinosa*) and Coffee Bush (*Breynia oblongifolia*). The ground stratum consists of grasses and herbs including Kangaroo Grass (*Themeda australis*), Wiry Panic (*Entolasia stricta*), Barbed Wire Grass (*Cymbopogon refractus*), Whiteroot (*Pratia purpurascens*), Blue Flax Lily (*Dianella revoluta*), and Pomax (*Pomax umbellata*).

African Olive and to a lesser extent Lantana occur within this community and threatens is integrity.

1.4 Central Hunter Ironbark – Spotted Gum – Grey Box Forest

This is a mid tall open forest; it is not an endangered ecological community but has been described as over cleared and regionally significant by Peake (2006).

On the subject site it appears to occur largely on the western slopes but it also occurs in patches on the eastern slopes of the subject land and it was sampled in the recent vegetation survey within quadrats 2, 5, 6, and 9 (see photographs 2, 5, 6, and 9 in Appendix A and quadrat data in Appendix B).

It is dominated by Spotted Gum (*Corymbia maculata*) and Broad-leaved Ironbark (*Eucalyptus fibrosa*). On site there is a shrubby understorey including Gorse Bitter Pea (*Daviesia ulicifolia* subsp. *ulicifolia*), Native Blackthorn (*Bursaria spinosa* subsp. *spinosa*) and Coffee Bush (*Breynia oblongifolia*). The ground stratum consists of grasses and herbs including Kangaroo Grass (*Themeda australis*), Wiry Panic (*Entolasia stricta*), Barbed Wire Grass (*Cymbopogon refractus*), Whiteroot (*Pratia purpurascens*), Blue Flax Lily (*Dianella revoluta*), and Pomax (*Pomax umbellata*).

African Olive and Lantana are long term threats to the integrity of this community.

1.5 Hunter Lowlands Red Gum Forest

This is a mid tall open forest, which has been classified as an endangered ecological community under the NSW Threatened Species Conservation Act 1999 (TSC Act).

It is dominated by Forest Red Gum (*Eucalyptus tereticornis*), and Narrow-leaved Ironbark (*Eucalyptus crebra*). On site there is a shrubby understorey including Gorse Bitter Pea (*Daviesia ulicifolia* subsp. *ulicifolia*), Native Blackthorn (*Bursaria spinosa* subsp. *spinosa*) and Forest Nightshade (*Solanum prinophyllum*). The ground stratum consists of grasses and herbs including Weeping Grass (*Microlaena stipoids*), Wiry Panic (*Entolasia stricta*), Barbed Wire Grass (*Cymbopogon refractus*), Whiteroot (*Pratia purpurascens*) and Kidney Weed (*Dichondra repens*).

On the subject site it appears to occur in gullies, such as the far western gully and several eastern gullies. It was sampled in the recent vegetation survey within quadrats 3 and 7 (see photographs 3, 4 and 7 in Appendix A and quadrat data in Appendix B).

1.6 Grassland

Grassland occurs across at least 60% of the subject site and is most prevalent in the eastern slopes. Grassland varies considerably in composition from largely exotic and with few species, to predominantly native with a wide diversity of species. In the west, particularly along the western boundary with the National Park grasslands are essentially the same floristic composition as that described above for the native forest communities.

Grassland in the western side of the subject land can be regenerated to forest by removal of livestock and cessation of slashing if required.

2. THREATENED AND REGIONALLY SIGNIFICANT FAUNA

No fauna surveys have yet been conducted on the subject land but a number of predictions can reliably be made based upon the preliminary flora and habitat analysis.

The subject site does have sizeable forest patches on the western slopes. These are dominated by trees that are generally too young to support many hollows. As a consequence the forests of the subject site are not likely to support a high density of hollow dependent fauna. Notwithstanding that, some tree hollows do occur and it is possible for the forest vegetation to support threatened fauna such Squirrel Glider and various microchiropteran bats. There is also good potential habitat for some of the smaller forest and woodland birds such as Grey Crowned Babbler, Speckled Warbler and Diamond Firetail – particularly as the forests on the western slopes border the more extensive habitats of the National Park.

No data is yet available about Koalas, but there are Forest Red Gum (*Eucalyptus tereticornis*) which are a primary feed tree for the species. These trees are prevalent along the gully in the western portion of the subject site. Therefore, it must be considered that there is at least potential Koala habitat, particularly in the west of the site.

Threatened Owl species – particularly the Masked Owl – have foraging habitat on the subject land and would be expected to forage across the site. Large hollows suitable for nesting appear to be rare or absent, but this will need to be confirmed in subsequent surveys.

3. IMPACTS UPON DECC ESTATE: BELFORD NATIONAL PARK

The forest on site is contiguous with the forest in the Belford National Park. For this reason many of the species that occur in the National Park are likely to move between the National Park and subject land. Significant reduction in the habitats on the subject land could therefore reduce the integrity and viability of habitats in the National Park.

Development of the subject land has obvious implications for Belford National Park. If development takes place immediately adjacent to the National Park and/or involves extensive clearing of the forest on the subject land then this would result in undesirable and significant ecological impacts.

There is potential for future development to occur on site in a way that could complement the ecological values of the National Park. If portions of the western side of the subject site are developed as a conservation area they could serve as a significant buffer to the National Park. Similarly if forest habitats in the central west of the site are developed in a low intensity way that involves minimal clearing and long term active management of ecological values, then the total area of forest can be maintained and improved.

Concentration of development in the eastern areas would minimise impacts to the DECC lands. Also, if limited development occurs in the central western portion of the site, within clearings

within grassland, then little if any clearing would be required. This is discussed below in the recommendations.

4. PRELIMINARY RECOMMENDATIONS

Three broad areas of the site could be recognised based upon the condition and context of remaining native vegetation. Figure 1 in Appendix A illustrates the property. Treatment of the land for development as recommended would meet the requirements of DECC for this property and may facilitate improved ecological condition in the long term whilst ensuring appropriate retention and management of native vegetation

The eastern slopes of the subject land are predominantly cleared and lack major ecological constraints. The eastern slopes area could be zoned for relatively intense urban development, such as 0.8 ha lots because such development could be achieved with little clearing or fragmentation of native forest vegetation.

The central western slopes of the subject site include extensive areas of forest but there are also sizeable clearings. This area is outside the scope of this report as regards development.

The far western side of the subject land, which adjoins Belford Nature Reserve and other forested areas to the west, contains a drainage line and could be allocated for future conservation however it is also outside the scope of this report as regards development.

The majority of native forest vegetation can be retained and it may be possible to create a net gain of native forest cover in the long term. Native vegetation will be under threat from continuing invasion by African Olive, which is widespread throughout the nearby nature reserve and throughout the forest of the subject site. A vegetation management plan for the entire property should be prepared and implemented in the long term to ensure sustainable management of forest. The plan should relate to all three areas of the property.

If the majority of forest was retained as a result of such treatment (or something similar) threatened fauna known or likely to occur in the area would not be significantly impacted and the wildlife corridor function of the forest on site would be maintained. As the majority of trees on site are relatively young, it is likely that habitat values will increase in the long term as trees age an develop more hollows for hollow-dependent fauna including some bird species, microchiropteran bats, gliders and other species.

Yours sincerely

David Robertson

David Robertson
Director
david.robertson@cumberlandecology.com.au

Appendix A

Photographs

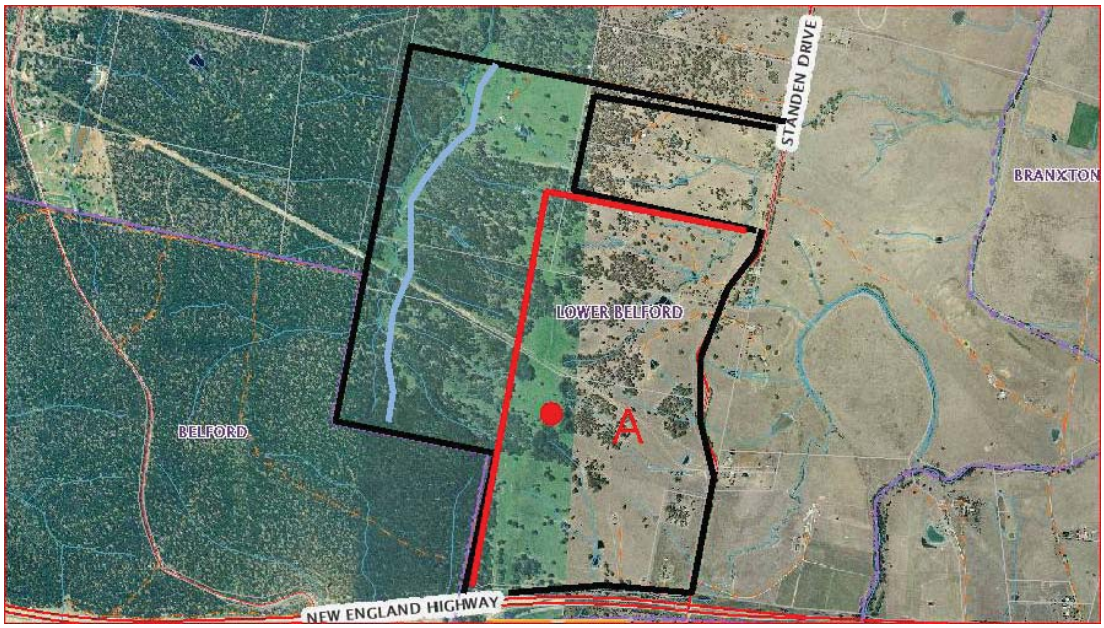


Figure 1: Aerial photograph showing the context of the subject site (black border). Note that the forested land to the south west of the property is Belford Nature Reserve. Area A is the recommended higher density residential area.

Photograph 1: Lower Hunter Spotted Gum Ironbark Forest, on western margin of the subject land (Quadrat 1)

Photograph 2: Young Central Hunter Spotted Gum – Ironbark Forest on the western side of the subject site (Quadrat 2).

Photograph 3: Hunter Lowlands Red Gum Forest with grassy forest, on western margin of the subject land (Quadrat 3).

Photograph 4: Hunter Lowland Red Gum Forest with Melaleuca decora subcanopy, on western margin of the subject land (Quadrat 4).

Photograph 5: Highly disturbed Central Hunter Spotted Gum – Ironbark Forest on the eastern side of the subject site (Quadrat 5)

Photograph 6: Central Hunter Spotted Gum – Ironbark Forest on the eastern side of the subject site Quadrat 6

Photograph 7: Heavily disturbed Forest Red Gum within a gully on the eastern slopes of the subject site (Quadrat 7).

Photograph 8: Lower Hunter Spotted Gum - Ironbark Forest, in the central western portion of the subject land (Quadrat 8).

Photograph 9: Grassland amid Central Hunter Spotted Gum Ironbark Open Forest (Quadrat 9).

Appendix B

Plant species list and quadrat data

The table below provides a summary of plant species that were found within nine 400 metres square quadrat areas that were located within forest on the subject site in December 2008. Three forest types occur on site and have been sampled as follows:

- Lower Hunter Spotted Gum – Ironbark Forest (Quadrats 1 and 8)
- Hunter Lowlands Red Gum Forest (Quadrat 3 and 7);
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest (Quadrats 2, 4, 5, 6, and 9)

Table 1 PLANT SPECIES DETECTED IN NINE 400 METRE SQUARE QUADRATS LOCATED IN FOREST PATCHES ON THE SUBJECT LAND (DECEMBER16 2008). S = STATUS (NATIVE – N, INTRODUCED – I)

Families	Plant Species	S	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
Trees											
Casuarinaceae	*Allocasuarina leuhmannii*	n						+			
Meliaceace	*Melia azederach*	n	+								
Myrtaceae	*Angophora floribunda*	n				+					
Myrtaceae	*Corymbia maculata*	n	+	1		2	3	3	+	3	+
Myrtaceae	*Eucalyptus crebra*	n		+				2	1		+
Myrtaceae	*Eucalyptus fibrosa*	n			3					3	
Myrtaceae	*Eucalyptus moluccana*	n	+			2					
Myrtaceae	*Eucalyptus tereticornis*	n	+	+	3				3		
Shrubs											
Asclepidaceae	*Gomphocarpus fruticosus**										
Asteraceae	*Cassinia quinquefaria*	n		+							
Asteraceae	*Olearea sp*	n								+	
Asteraceae	*Ozothamnus diosmifolia*	n				+	+			+	
Epacridaceae	*Leucopogon sp (2)*	i	+			+	+	+	+		+
Euphorbiaceae	*Breynia oblongifolia*	n				+			+	+	
Fabaceae	*Acacia falcata*	n	+	+						+	+
Fabaceae	*Daviesia geniculata (1)*	n	+	+		+	+	+	+	2	1
Fabaceae	*Pultenea sp*	n	+					+	+		+
Fabaceae	*Templetonia stenophylla*	i	+	+				+			+
Goodeniaceae	*Goodenia hederaceae*	n				+				+	
Goodeniaceae	*Goodenia obtusifolia*	n					+				
Goodeniaceae	*Goodenia sp (23)*	n									+
Haloragaceae	*Gonocarpus (dissected)*	n				+				+	+
Myrtaceae	*Melaleuca decora*	n				3					
Oleaceae	*Notolaea microcarpa*	n				+					

Table 1 PLANT SPECIES DETECTED IN NINE 400 METRE SQUARE QUADRATS LOCATED IN FOREST PATCHES ON THE SUBJECT LAND (DECEMBER16 2008). S = STATUS (NATIVE – N, INTRODUCED – I)

Families	Plant Species	S	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
Oleaceae	*Olea europea* ssp. *cuspidata**	i	+	+	+	+	+	+	2	+	+
Pittosporaceae	*Bursaria spinosa*	n	0				+	+	1		
Protecceae	*Hakea teretifolia*	n								+	
Santalaceae	*Exocarpus cupressiformis*	n	+								
Solanaceae	*Solanum nigrum**	i					+				
Solanaceae	*Solanum prinophyllum*	n			+	+		+	+		
Verbenaceae	*Lantana camara**	i				+					
Grasses											
Poaceae	*Aristida jericoensis*									+	
Poaceae	*Aristida ramosa*	n			+			2	1	+	+
Poaceae	*Aristida vagans*	n	+	+			+		+	+	+
Poaceae	*Austrodanthonia fulva*		+	1			+	+		+	+
Poaceae	*Austrodanthonia racemosa*	n	+	+	+			+			
Poaceae	*Austrostipa verticillata*	n						+			
Poaceae	*Avena barbata**										
Poaceae	*Axonopus affinis**	i			1						
Poaceae	*Bothriochloa macra*	n	+	+				+			
Poaceae	*Chloris gayana*	i	+								
Poaceae	*Chloris ventricosa*	n		+	+			+	+	+	
Poaceae	*Cymbopogon refractus*	n	+	+	+	1	+	+	+	1	
Poaceae	*Cynodon dactylon*	n		+			3		3		+
Poaceae	*Dichelachne micrantha*	i			+		+		+	+	+
Poaceae	*Digitaria brownii*	n							+		
Poaceae	*Echinopogon caespitosus*	n			+	+	+	+	+	+	
Poaceae	*Entolasia stricta*	n		+		+			+	+	
Poaceae	*Eragrostis curviflora*	i							+		
Poaceae	*Eragrostis leptostachya*	n	+			+		+	+	+	+
Poaceae	*Lachnagrostis filiformis* (syn. *Agrostis avenacea*)	n	+				+				
Poaceae	*Microlaena stipoides*	n				2		+	+	+	
Poaceae	*Paspalidium distans*	n	+	+	+	+	+	+	+	+	+
Poaceae	*Paspalum dilalatum**	n			+		+		+		
Poaceae	*Pennisetum clandestinum**								+		
Poaceae	*Sorghum leiocladum*	n						+	+		

Table 1 PLANT SPECIES DETECTED IN NINE 400 METRE SQUARE QUADRATS LOCATED IN FOREST PATCHES ON THE SUBJECT LAND (DECEMBER16 2008). S = STATUS (NATIVE – N, INTRODUCED – I)

Families	Plant Species	S	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
Poaceae	*Sporobolus creber*	n					+		+		
Poaceae	*Themeda australis*	i		+	+			+	+	+	1
Herbs											
Acanthaceae	*Brunoniella australis*	n	+	+	+	+	+	+	+	+	+
Adiantaceae	*Cheilanthes distans*	i						+			
Adiantaceae	*Cheilanthes sieberi*	n	+	+	1	+	+	+	+	+	+
Anthericaceae	*Laxmannia gracilis*	n	+			+					
Anthericaceae	*Tricoryne elatior*	n							+		+
Asteraceae	*Arctotheca calendula**										
Asteraceae	*Bidens pilosa**	i						+	+		
Asteraceae	*Calotis cuneifolia*	i	+	1		+	+	+	+	+	+
Asteraceae	*Calotis lappulacea*	i							+	+	
Asteraceae	*Calotis* sp.	i				+					
Asteraceae	*Chrysocephalum apiculatum*	i	+			+	+	+		+	+
Asteraceae	*Cirsium vulgare**	i	1		+	+	+		+		
Asteraceae	*Conyza bonariensis **	i	+	+	+	+	+	+	+	+	
Asteraceae	*Euchiton sphaericum*	n	+	+	2	1	+	+	+	+	
Asteraceae	*Glossogyne tannensis*	n	+	+			+				
Asteraceae	*Gnaphalium sp.*	n	+	+	+	+	+		+	+	+
Asteraceae	*Hypochaeris radicata**	i	+	+	+		+	+	+	+	+
Asteraceae	*Lactuca seriola**										
Asteraceae	*Senecio madagascariensis **	i	+								+
Asteraceae	*Solenogyne belliodes*	n								+	+
Asteraceae	*Sonchus oleraceus**	i			+	+	+		+		
Asteraceae	*Vittadinia cuneata*	n					+				
Apiaceae	*Centella asiatica*	n									+
Asteraceae	*Vernonia sp (5)**	i	+	+	+	+	+		+		
Brassicaceae	*Lepidium pseudohyssopifolium*	i					+				
Juncaceae	*Juncus subsecundus*	n			+	+	+			+	
Cyperaceae	*Lepidosperma laterale*	n							+		
Cactaceae	*Opuntia sp**										
Campanulaceae	*Wahlenbergia communis*	n	+		+						

Table 1 PLANT SPECIES DETECTED IN NINE 400 METRE SQUARE QUADRATS LOCATED IN FOREST PATCHES ON THE SUBJECT LAND (DECEMBER16 2008). S = STATUS (NATIVE – N, INTRODUCED – I)

Families	Plant Species	S	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
Campanulaceae	*Wahlenbergia gracilis*	n	+	+			+		+		+
Campanulaceae	*Wahlenbergia stricta*	n									+
Caryophllaceae	*Cerastium glomeratum**										
Caryophllaceae	*Petrorhagia dubia**	n			+		+				
Caryophllaceae	*Paronychia brasiliana**	i				+					
Caryophllaceae	*Polycarpon tetraphyllus**	i					+				
Chenopodiaceae	*Einadia hastata*	n	+	+	+						
Chenopodiaceae	*Einadia polygonoides*	n					+				
Chenopodiaceae	*Enchylaena tomentosa*										
Clusiaceae	*Hypericum gramineum*	i				+			+	+	
Convolvulaceae	*Convolvulus erubescens*	n					+				
Convolvulaceae	*Dichondra repens*	i	+	+	1	1	2	1	2	1	
Cyperaceae	*Carex inversa*	n			+						
Cyperaceae	*Cyperus gracilus*	n	+						+	+	
Cyperaceae	*Bolboschoenus caldwellii*	n									+
Euphorbiaceae	*Chamasyce drummondii*	n									
Euphorbiaceae	*Phyllanthus virgatus*	i	+	+			+	+	+		+
Euphorbiaceae	*Poranthera microphylla*	i						+		+	
Rubiaceae	*Pomax umbellata*	n	+	+		+		+		+	
Fabaceae	*Desmodium brachypodum*	i									
Fabaceae	*Desmodium varians*	i	+		+		+		+	+	+
Fabaceae	*Glycine clandestina*	i		+				+		+	+
Fabaceae	*Glycine microphylla*			+		+	+	+			
Fabaceae	*Glycine tabacina*	i	+	+	+		+	+	+	+	
Fabaceae	*Hardenbergia violacea*		+	+							
Gentianaceae	*Centaurium spicatum**	i	+		+			+	+	+	+
Geraniaceae	*Erodium crinitum*	n									
Geraniaceae	*Geranium solanderi*	n					+				
Iridaceae	*Romulea rosea**									+	
Juncaceae	*Luzula* sp.	n									
Lamiaceae	*Ajuga australis*	i	+				+				
Lamiaceae	*Mentha satureioides*	n			+				+		
Linaceae	*Linum trigynum**	i					+		+		
Lobeliaceae	*Pratia purpurescens*	n	1	+	+	+	+	+		+	+
Lomandraceae	*Lomandra filiformis*	n					+	+	+		

Table 1 PLANT SPECIES DETECTED IN NINE 400 METRE SQUARE QUADRATS LOCATED IN FOREST PATCHES ON THE SUBJECT LAND (DECEMBER16 2008). S = STATUS (NATIVE – N, INTRODUCED – I)

Families	Plant Species	S	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9
Lomandraceae	*Lomandra confertifolia*	n			+	+	+				
Lomandraceae	*Lomandra longifolia*	n				+	+	+			
Lomandraceae	*Lomandra multiflora*	n	+	+	+	+		+		+	+
Commelinaceae	*Commelina cyanea*	n			+	+	+	+			
Malvaceae	*Modiola caroliniana**	i	+								
Malvaceae	*Sida corrugata*	n			+			+			
Malvaceae	*Sida rhombifolia **						+		+		
Myoporaceae	*Eremophila debilis*	n	+				+	+			
Myrsinaceae	*Anagallis arvensis**	i	+				+	+	+		+
Orchidaceae	*Caladenia sp*	n	+								
Orchidaceae	*Microtis unifolia*	n								+	
Orchidaceae	*Thelemitra sp*	n								+	
Oxalidaceae	*Oxalis exilis*	n									
Phormiaceae	*Dianella longifolia*	n	+		+	+				+	
Phormiaceae	*Dianella revoluta*	n	+	+	+		+	+	+	+	+
Plantaginaceae	*Plantago debilis*	n	+	+			+			+	
Plantaginaceae	*Plantago gaudichaudii*	n			+						
Plantaginaceae	*Plantago lanceolata**	i			+		+			+	
Rubiaceae	*Opercularia aspera*										
Rubiaceae	*Richardia stellaris**	i	+		+					+	+
Scrophulariaceae	*Verbascum thapsis**										
Scrophulariaceae	*Veronica plebia*	n				+		+	+	+	
Solanaceae	*Solanum nigrum**				+						
Stackhousiaceae	*Stackhousia viminea*	n	+					+	+	+	+
Verbenaceae	*Verbena stricta**	i					+				
Verbenaceae	*Verbena bonariensis**	i									

Key:
*Introducted Species
inc = occurs adjacent and outside of sampling quadrat
n = listed as a characteristic Box Gum Woodland species

Appendix D Cumberland Ecology Correspondence (2nd July 2010)

02 July 2010

Stephanie Barker
Urbis
Level 21, 321 Kent Street
Sydney NSW 2000

Cumberland Ecology
PO Box 2474
Carlingford Court 2118
NSW Australia
Telephone (02) 9868 1933
Mobile 0425 333 466
Facsimile (02) 9868 1977
Web: www.cumberlandecology.com.au

RE: UPLISTING OF CENTRAL HUNTER IRONBARK-SPOTTED GUM-GREY BOX FOREST AT STANDEN DRIVE, LOWER BELFORD

Dear Stephanie,

This letter confirms that the vegetation community, Central Hunter Ironbark – Spotted Gum – Grey Box Forest has been listed as an Endangered Ecological Community (EEC) under the *Threatened Species Conservation Act 1995*. This EEC was gazetted on the 12 February 2010.

Our preliminary ecological assessment of Lot 11, DP: 844444, Lots 12 and 13, DP: 1100005, Lot 6, DP 237936 and Lot 2, DP 739822 at Standen Drive, Lower Belford (Cumberland Ecology, 22 December 2010) reported the occurrence of Central Hunter Ironbark – Spotted Gum – Grey Box Forest on the western slopes of the subject site, and also in patches on the eastern slopes.

Our preliminary assessment concluded that the proposed development could be achieved with little clearing or fragmentation to the existing native forest and that a net gain in native forest cover and condition was possible in the long term through the implementation of a vegetation management plan. The integrity of the existing native vegetation is currently under long term threat from Lantana and African Olive and will continue to do so without active management; the proposal has opportunity to facilitate improved ecological condition in the long term whilst ensuring appropriate retention and management of native vegetation.

These conclusions and recommendations apply to all the native vegetation on the subject site, including Central Hunter Ironbark – Spotted Gum – Grey Box Forest. Although our preliminary assessment predates the listing of the community, we believe that it adequately addresses the potential impacts to the EEC.

I invite you to contact either Dr. David Robertson or myself if you would like to discuss this letter in further detail.

Yours sincerely,

Cecilia Phu

Ecologist/Project Manager

cecilia.phu@cumberlandecology.com.au

Appendix E Department of Primary Industries Correspondence (3rd November 2008)

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

TRIM OUT08/13065
2006/01554

3 November 2008

General Manager
Singleton Council
PO Box 314
Singleton NSW 2430

ATTENTION: G Pearson

Development Application No LA65 / 2008
Proposed Rezoning of 5 Lots Standen Drive, Lower Belford.

I refer to your letter of 2 October 2008 seeking the advice of NSW Department of Primary Industries (DPI) on the proposed rezoning of this 139 ha holding to permit its subdivision for residential development. This is a coordinated response from the Department of Primary Industries. There are no issues relevant to Forests NSW or the direct protection of fisheries habitat.

Primary Industry Resources
The subject area is underlain by the Maitland Group and Greta Coal Measures. Limited borehole data in the area indicates that coal occurs at depths of between 450 – 500m. The coal seams in the Greta Coal Measures are commonly split and separated by persistent stone intervals. Many of the seams are affected by igneous intrusions, and seam continuity is often disrupted by small scale faulting. There is no coal title over the subject area. There are, however, known coal resources on the opposite side of the New England Highway which may be developed in future.

The property is additionally located within Petroleum Exploration Lease 267 (Sydney Gas) and hence may be subject to exploration activities for coal seam methane resources. Such exploration activities would not conflict with the current land use and zoning, but may conflict with the expectations of future rural residential landowners.

The area identified for rezoning in this first development stage corresponds with;

- Extensively cleared grazing lands mapped as Class 4 Agricultural Suitability.
- The Lower Belford Candidate area in Council's Rural Residential Development Strategy which was identified as a candidate area for rezoning as Zone 7(b).

Consequently the scope for significant agricultural or minerals development is minimal.

Planning Issues
The application proposes to rezone the site from Rural 1(a) to E4 Environmental Living and the preliminary subdivision plans indicate the potential for 143 lots. Singleton's Rural Residential strategy identifies that the annual demand for 75 rural residential lots across Singleton LGA.

TOCAL AGRICULTURAL CENTRE
Advisory Office
Tocal Paterson NSW 2421

ABN 51 734 124 190
www.dpi.nsw.gov.au
Tel: 02 4939 8940
Fax: 02 4939 8950

The application states that this would not constitute an over supply, but fails to support this. The report also lacks details to support statements that;

- the smaller rural residential lots would provide promote housing affordability
- the proposed development represents a logical expansion of the Branxton Township and is appropriate for this location.
- is consistent with the aims of the Rural SEPP

The application additionally fails to assess the risk of conflict with adjoining land uses or to propose measures to reduce such conflict. The application also fails to address the planning principles set out in the Rural SEPP.

NSW DPI has no specific objections to the proposed rezoning of this site from Rural 1(a) to rural residential in accord with Council's current approved planning strategy.

DPI supports the principle of reducing the area of rural land alienated to provide a set number of rural lifestyle lots and has no specific objections to the proposed rezoning. but encourages Council to assess the;

- merit of the proposed scale and type of residential development on this site
- need for further assessment to support for the proposed rezoning.

Should Council require further information about the Petroleum Exploration Licence please contact Cressida Gilmore of the Minerals Division by email cressida.gilmore@dpi.nsw.gov.au or on 4931 6537. Alternatively, for agricultural issues please contact Glenda Briggs via email glenda.briggs@dpi.nsw.gov.au or on 4939 8942.

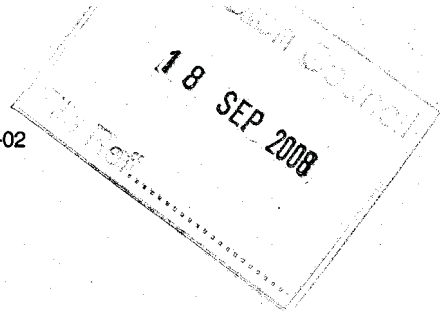
Please note, however, that DPI does not require further consultation on this rezoning proposal.

Yours sincerely

Glenda Briggs
Resource Management Officer, Hunter.

Appendix F Department of Environment, Climate Change and Water Correspondence (16th September 2008)

Your reference : 05/0192-3
Our reference : DOC08/37661; FIL06/927-02
Contact : Karen Thumm 4908 6829



16 SEP 2008

Mr S McGrath
General Manager
Singleton Council
PO Box 314
SINGLETON NSW 2330

Attention: Ken Horner

Dear Mr McGrath

RE: SINGLETON LAND USE STRATEGY 2008 - PROPOSED EXPANSION TO RURAL RESIDENTIAL LAND AT BRANXTON

I refer to your letter dated 12 August 2008 requesting comments from the Department of Environment and Climate Change (DECC) on the above matter.

DECC notes this proposal is for an expansion to rural/residential land outside of the Branxton main town. Rural residential subdivisions are in effect very low-density urban developments. There is a need to take account the long term and cumulative impacts of this style of development when determining the future use of the proposed area. Further, when considering the demand for rural residential development it is suggested that Council consider the issues of accessibility and sustainable settlement structure. These related issues have long-term implications for travel demand, energy consumption, greenhouse gas emissions, regional air quality and climate change.

When assessing the proposed rural residential land expansion, it is recommended that Council be satisfied that:

- The proposal is not likely to result in impacts on areas of native vegetation, with special reference to threatened or regionally significant flora and fauna species, populations and ecological communities. Where impacts are proposed on areas of biodiversity value, the proponent has clearly demonstrated how they propose to offset any loss in biodiversity value to meet the 'improve or maintain' threshold.

  The subject site has been identified in Peake's vegetation mapping as having a vegetation community listed as an Endangered Ecological Community (EEC) under the *Threatened Species Conservation Act 1995* (TSC Act). DECC supports the use of Travis Peake's vegetation mapping (Peake, 2005) as an accurate and reliable source of information for the abundance and distribution of vegetation communities of the Central Hunter Valley. Travis Peake's vegetation mapping shows the proposed site as Lower Hunter Spotted Gum Ironbark forest, an EEC listed under the TSC Act. The Lower Hunter Spotted Gum-

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Ironbark Forest EEC in the Branxton region has been identified as having an Intuitive Regional Threat Level of 'high'. Whilst it has been confirmed that the land owner regularly mows under the trees within the site with a tractor and slasher, this does not remove the classification of the vegetation community present as an EEC.

Any losses of biodiversity within the proposed site would require offsets in accordance with DECC's 'improve or maintain' biodiversity guidelines. Impacts on biodiversity should be avoided up front, as offsetting impacts is much more difficult and costly than the retention of existing biodiversity values. DECC believes there is likely to be potential for rehabilitation and regeneration of potential vegetation removed from the site due to clearing activities.

The 'improve or maintain' requirement assesses the losses in biodiversity from clearing/development and the gains from actions taken to improve biodiversity values elsewhere. Council should keep the principles of 'improve or maintain biodiversity' in the forefront of all planning decisions in order to reduce conflict at the development stage. The Biobanking tool will be available in the near future to calculate development impacts which require offsetting.

- In preparing any rezoning application, an appropriate level of Aboriginal cultural heritage assessment has been undertaken, and that the proposal is not likely to impact on areas of cultural significance to the Aboriginal community. Also, it is important that the views of Aboriginal community groups be sought and fully considered in regard to the proposal.

- Potential direct and indirect impacts on DECC estate, wilderness areas, wild rivers and recognised areas of high conservation value have been adequately considered and avoided, ameliorated or compensated as appropriate.

- Any areas of contamination on the site are identified and managed in accordance with the Contaminated Land Management Act 1997.

- Stormwater emanating from the area must be managed in a sustainable manner to prevent any impacts on the adjacent rivers, wetlands or estuaries.

Your attention is also drawn to the Commonwealth legislation, the *Environment Protection and Biodiversity Conservation Act 1999*. If the proposed rezoning affects any species requiring consideration under this legislation then consultation may be required from the the Australian Government, Department of the Environment, Water, Heritage and the Arts (formerly the Department of the Environment and Water Resources).

If you require any further information regarding this matter please contact Dr Karen Thumm, Conservation Planning Officer, on 4908 6829.

Yours sincerely

DL Crosdale

DIANE CROSDALE
Head Planning Unit - Hunter
Environment Protection and Regulation

Appendix G Land Supply Analysis (Urbis)

Table 1. Rural Resiential land supply from Candidate Areas - Adopted SLUS

Candiate Area	Location	Size of Candidate Area HA	Lot Size HA	Lot Yield	
Jerrys Plains	Singleton	20	***0***	17	
Wattle Ponds North East	Singleton	88	***1***	70	
Wattle Ponds North West	Singleton	167	***1***	134	
Sedgefield	Singleton	922	***5***	100	
Gowrie	Singleton	18	***0.4***	35	
Lower Belford	Branxton	277	***5***	30	
Branxton North Weat	Branxton	88	***0.4***	180	
Branxton North East	Branxton	41	***0.4***	87	
Branxton South West	Branxton	8	***0.4***	17	
Totals		**1629**		**670**	
		Area (ha)		Lots	
Branxton		414		314	*47%*
Singleton		1215		356	*53%*
Mix	Lot Size (ha)	***5***	***1***	***0.4***	**Totals**
Branxton		30	0	284	**314**
Singleton		100	221	35	**356**
Years Supply @75 p a					
Branxton	4.2				
Singleton	4.7				
Total	**8.9**				

Table 2. Rural Resiential land supply from Candidate Areas - Planning Proposal

Candiate Area	Location	Size of Candidate Area HA	Lot Size HA	Lot Yield	
Jerrys Plains	Singleton	20	***0***	17	
Wattle Ponds North East	Singleton	88	***1***	70	
Wattle Ponds North West	Singleton	167	***1***	134	
Sedgefield	Singleton	922	***5***	94	
Gowrie	Singleton	18	***0.4***	35	
Lower Belford	Branxton	277	***5***	133	
Branxton North Weat	Branxton	88	***0.4***	180	
Branxton North East	Branxton	41	***0.4***	87	
Branxton South West	Branxton	8	***0.4***	17	
Totals		**1629**		**767**	
		Area (ha)		Lots	
Branxton		414		417	*54%*
Singleton		1215		350	*46%*
Mix	Lot Size (ha)	***5***	***1***	***0.4***	**Totals**
Branxton		8	125	284	**417**
Singleton		94	221	35	**350**
					767
Years Supply @75 p a					
Branxton	5.6				
Singleton	4.7				
Total	**10.2**				

Table 3. Summary of Impacts			
Increase in yield for Candidate Areas	103	lots	(Lower Belford)
Decrease in yield for candiadte Areas	6	lots	(Sedgefield)
Increase in yield from Branxton	103	lots	
Revised increase from Candidate Areas	97	lots	
Revised Increase in annual supply from Candidate Areas	**1.3**	years	

Appendix H NSW Housing Sales Data (NSW Housing)

A9. Median Sale Prices - Rural Local Government Areas - All Dwellings - Mar 2010

notes: (s) 30 or less sales lodged; (-) 10 or less sales lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area	Median $'000s		Change in Median Qtly %	Ann %
Hunter SD Bal	**340**		**6.3**	**9.7**
Dungog 335		s	n	n
Gloucester 260		s	n	n
Great Lakes	350		5.7	9.0
Muswellbrook 301			5.1	11.3
Singleton 379			2.7	17.3
Upper Hunter Shire	315		20.0	34.0
Nowra-Bomaderry	**282**		**4.3**	**4.3**
Shoalhaven 325			-1.5	12.8
Illawarra SD Bal	**376**		**-1.1**	**15.7**
Shoalhaven 325			-1.5	12.8
Wingecarribee 450			4.7	26.8
Tweed Heads and Tweed Coast	**427**		**-4.0**	**9.5**
Tweed 423			-5.8	8.4
Lismore	**318**		**1.9**	**13.2**
Lismore 330			3.8	15.0
Richmond-Tweed SD Bal	**420**		**-4.5**	**12.0**
Ballina 433			-7.0	10.9
Byron 569			5.9	21.1
Kyogle 273			13.8	15.2
Lismore 330			3.8	15.0
Richmond Valley	290		0.3	16.5
Tweed 423			-5.8	8.4
Coffs Harbour	**340**		**1.2**	**7.9**
Coffs Harbour	350		-0.3	6.4
Clarence	**330**		**1.5**	**9.6**
Bellingen 362			5.2	22.7
Coffs Harbour	350		-0.3	6.4
Clarence Valley	305		-1.9	7.0
Nambucca 320			8.9	12.1
Port Macquarie	**370**		**1.9**	**12.8**
Hastings 366			-2.4	12.6
Hastings	**305**		**-1.9**	**9.1**
Greater Taree	260		-6.1	4.0
Hastings 366			-2.4	12.6
Kempsey 299			13.7	26.2
Tamworth	**240**		**-7.7**	**2.1**
Tamworth Regional	250		-3.8	5.5
Northern Slopes	**235**		**5.6**	**12.5**
Gunnedah 253			8.6	5.2
Gwydir	-		n	n
Inverell 176			-12.9	-7.6
Liverpool Plains	125	s	n	n
Tamworth Regional	250		-3.8	5.5

A9. Median Sale Prices - Rural Local Government Areas - All Dwellings - Mar 2010

notes: (s) 30 or less sales lodged; (-) 10 or less sales lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area	Median $'000s		Change in Median Qtly %	Ann %
Northern Tablelands	**230**		**-4.4**	**9.5**
Armidale-Dumaresq	283		-3.4	13.2
Glen Innes Severn	155		n	-11.4
Guyra 143		s	n	n
Inverell 176			-12.9	-7.6
Tenterfield 224		s	n	n
Uralla 299		s	n	n
Walcha -			n	n
North Central Plain	**215**		**2.4**	**16.2**
Moree Plains	195		-5.8	18.2
Narrabri 240		s	n	n
Dubbo	**248**		**-2.2**	**7.0**
Dubbo 250			-2.0	8.0
Central Macquarie	**245**		**-1.6**	**36.1**
Dubbo 250			-2.0	8.0
Gilgandra 135		s	n	n
Mid-Western Regional	269		-8.7	8.2
Narromine 164		s	n	n
Warrumbungle Shire	165	s	n	n
Wellington 142		s	n	n
Macquarie-Barwon	**98**	**s**	**n**	**n**
Bogan -			n	n
Coonamble -			n	n
Walgett -			n	n
Warren -			n	n
Upper Darling	**190**	**s**	**n**	**n**
Bourke -			n	n
Brewarrina -			n	n
Cobar 218		s	n	n
Bathurst	**285**		**-1.2**	**12.6**
Bathurst Regional	292		0.9	14.5
Orange	**288**		**-1.5**	**2.9**
Orange 288			-1.5	2.9
Central Tablelands (excl. Bathurst-Orange)	**210**		**-7.7**	**0.0**
Bathurst Regional	292		0.9	14.5
Blayney	220	s	n	n
Cabonne	213		-32.5	11.8
Lithgow City	190		-11.2	-2.6
Mid-Western Regional	269		-8.7	8.2
Oberon -			n	n
Lachlan	**180**		**2.9**	**20.0**
Bland 203		s	n	n
Cowra 195			5.4	16.6
Forbes 179		s	n	n
Lachlan -			n	n
Parkes 218			13.0	-0.7
Weddin 115		s	n	n
Queanbeyan	**430**		**1.8**	**16.9**
Palerang	508		-4.2	3.6
Queanbeyan 413			3.5	14.8
Southern Tablelands (excl. Queanbeyan)	**265**		**-3.6**	**13.5**
Boorowa -			n	n
Goulburn Mulwaree	255		-1.9	13.3
Harden -			n	n
Palerang	508		-4.2	3.6
Upper Lachlan	278	s	n	n
Yass Valley	340		-21.4	-0.7
Young 226			13.7	2.7
Lower South Coast	**335**		**3.1**	**8.2**
Bega Valley	338		12.5	16.4
Eurobodalla 335			-1.5	6.3
Snowy	**235**		**-12.1**	**8.5**
Bombala -			n	n
Cooma-Monaro 230		s	n	n
Snowy River	349		21.4	51.4

A9. Median Sale Prices - Rural Local Government Areas - All Dwellings - Mar 2010

notes: (s) 30 or less sales lodged; (-) 10 or less sales lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area	Median $'000s		Change in Median Qtly %	Ann %
Wagga Wagga	**273**		**-2.3**	**9.2**
Wagga Wagga	279		-1.7	10.3
Central Murrumbidgee	**189**		**-5.5**	**1.2**
Coolamon 140		s	n	n
Cootamundra 206			n	21.5
Gundagai -			n	n
Junee 159		s	n	n
Lockhart -			n	n
Narrandera 243		s	n	n
Temora 142		s	n	n
Tumut 242		s	n	n
Wagga Wagga	279		-1.7	10.3
Lower Murrumbidgee	**225**		**-6.3**	**4.7**
Carrathool -			n	n
Griffith 280			3.7	13.8
Hay 92		s	n	n
Leeton 212		s	n	n
Murrumbidgee -			n	n
Albury	**248**		**-6.4**	**7.6**
Albury 250			-5.3	6.4
Greater Hume Shire	205	s	n	n
Upper Murray (excl. Albury)	**220**		**7.3**	**25.7**
Corowa 230			-4.3	6.9
Greater Hume Shire	205	s	n	n
Tumbarumba -			n	n
Urana -			n	n
Central Murray	**210**		**2.3**	**24.3**
Berrigan 150		s	n	n
Conargo -			n	n
Deniliquin 195			-1.3	21.9
Jerilderie -			n	n
Murray 265			n	n
Wakool 242		s	n	n
Murray-Darling	**165**	**s**	**n**	**n**
Balranald -			n	n
Wentworth 185		s	n	n
Far West	**99**		**-21.2**	**-17.9**
Broken Hill	101		-22.1	-25.0
Central Darling	-		n	n
Rest of NSW	**309**		**-0.3**	**13.2**
New South Wales	**418**		**-1.6**	**16.1**

Appendix I NSW Rental Accommodation Data (NSW Housing)

A5. Median Weekly Rents - Rural Local Government Areas - All Dwellings - Jun 2010

notes: (s) 30 or less bonds lodged; (-) 10 or less bonds lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area*	All Dwellings											
	One Bedroom			Two Bedrooms			Three Bedrooms			Four + Bedrooms		
	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %
Hunter SD Balance	153	-4.7	8.9	220	4.8	12.8	280	3.7	7.7	370	5.7	12.1
Dungog	-	n	n	230 s	n	n	235 s	n	n	-	n	n
Gloucester	-	n	n	165 s	n	n	-	n	n	-	n	n
Great Lakes	160 s	n	n	220	4.8	14.3	275	1.9	5.8	320	-7.2	0.0
Muswellbrook	129 s	n	n	200 s	n	n	280	7.7	16.7	390	11.4	n
Singleton	-	n	n	245	n	2.1	330	3.1	6.5	400	n	5.3
Upper Hunter Shire	-	n	n	170 s	n	n	240	-4.0	9.1	360 s	n	n
Nowra-Bomaderry	150 s	n	n	190	-5.0	0.0	270	0.0	8.0	340	6.3	6.3
Shoalhaven	155	10.7	10.7	210	3.7	7.7	269	3.4	7.5	350	6.1	12.9
Illawarra SD Balance	170	11.5	13.3	220	4.8	4.8	275	1.9	7.8	360	2.9	9.1
Shoalhaven	155	10.7	10.7	210	3.7	7.7	269	3.4	7.5	350	6.1	12.9
Wingecarribee	185 s	n	n	230	4.5	-2.1	320	6.7	10.3	410	0.0	5.1
Tweed Heads and Tweed Coast	220	2.3	-2.2	290	0.0	1.8	350	-2.8	0.0	450	0.0	5.9
Tweed	215	4.9	7.5	285	-1.7	1.8	350	0.0	1.4	440	2.3	4.8
Lismore	130 s	n	n	220	2.3	10.0	300	1.7	7.1	350	25.0	9.4
Lismore	130	-13.3	n	220	1.1	10.0	300	1.7	7.1	350	16.7	9.4
Richmond-Tweed SD Balance	180	0.0	4.3	270	0.0	5.9	350	0.0	2.9	400	-3.6	-4.8
Ballina	185 s	n	n	275	-1.8	1.9	365	1.4	4.3	420	-1.2	-0.6
Byron	200 s	n	n	350	1.4	13.8	430	2.4	7.5	520	4.0	0.0
Kyogle	-	n	n	178 s	n	n	250 s	n	n	270 s	n	n
Lismore	130	-13.3	n	220	1.1	10.0	300	1.7	7.1	350	16.7	9.4
Richmond Valley	-	n	n	190	0.0	2.7	270	0.0	3.8	305 s	n	n
Tweed	215	4.9	7.5	285	-1.7	1.8	350	0.0	1.4	440	2.3	4.8
Coffs Harbour	190	5.6	2.7	250	4.2	8.7	330	3.1	10.0	420	5.0	10.5
Coffs Harbour	190	5.6	2.7	250	4.2	8.7	320	0.0	6.7	400	1.3	6.7
Clarence	150	-6.3	-6.3	220	4.8	10.0	280	0.0	7.7	330	-2.9	10.0
Bellingen	-	n	n	220 s	n	n	280	n	n	-	n	n
Coffs Harbour	190	5.6	2.7	250	4.2	8.7	320	0.0	6.7	400	1.3	6.7
Clarence Valley	150 s	n	n	220	0.0	10.0	280	0.0	7.7	300	-6.3	3.4
Nambucca	145 s	n	n	200	8.1	11.1	265	1.9	10.4	293 s	n	n
Port Macquarie	165	n	n	240	4.3	9.1	340	0.0	13.3	405	-3.0	2.5
Hastings	160	0.0	0.0	240	2.1	11.6	330	3.1	13.8	398	-0.6	7.4
Hastings	143	5.6	14.0	195	0.0	5.4	250	0.0	4.2	320	0.0	6.7
Greater Taree	150	15.4	25.0	190	0.0	5.6	250	0.0	4.2	300	-3.2	7.1
Hastings	160	0.0	0.0	240	2.1	11.6	330	3.1	13.8	398	-0.6	7.4
Kempsey	125 s	n	n	180	2.9	1.4	230	0.0	4.5	280 s	n	n
Tamworth	145 s	n	n	200	0.0	8.1	270	0.0	8.0	330	6.5	0.0
Tamworth Regional	145 s	n	n	200	2.6	8.1	265	1.9	6.0	325	4.8	-1.5
Northern Slopes	123 s	n	n	160	0.0	0.0	210	5.0	10.5	255	-5.6	15.9
Gunnedah	125 s	n	n	190 s	n	n	250	13.6	13.6	270 s	n	n
Gwydir	-	n	n	-	n	n	-	n	n	-	n	n
Inverell	125 s	n	n	160 s	n	n	250	8.7	19.0	278 s	n	n
Liverpool Plains	-	n	n	-	n	n	200 s	n	n	255 s	n	n
Tamworth Regional	145 s	n	n	200	2.6	8.1	265	1.9	6.0	325	4.8	-1.5
Northern Tablelands	125	4.2	13.6	175	2.9	6.1	250	4.2	13.6	300	-3.2	13.2
Armidale Dumaresq	145 s	n	n	190	2.7	5.6	273	-1.8	4.8	350	-2.8	2.2
Glen Innes Severn	-	n	n	150 s	n	n	195 s	n	n	-	n	n
Guyra	-	n	n	-	n	n	-	n	n	-	n	n
Inverell	125 s	n	n	160 s	n	n	250	8.7	19.0	278 s	n	n
Tenterfield	-	n	n	174 s	n	n	200 s	n	n	-	n	n
Uralla	-	n	n	-	n	n	230 s	n	n	-	n	n
Walcha	-	n	n	-	n	n	-	n	n	-	n	n
North Central Plain	110 s	n	n	140	0.0	3.7	225	7.1	7.1	280 s	n	n
Moree Plains	118 s	n	n	140	-6.7	-6.7	220	0.0	0.0	290 s	n	n
Narrabri	110 s	n	n	140	0.0	7.7	240 s	n	n	-	n	n
Dubbo	150 s	n	n	170	-2.9	0.0	250	0.0	4.2	320	-5.9	3.2
Dubbo	150 s	n	n	170	-2.9	0.0	250	0.0	4.2	320	-5.9	3.2
Central Macquarie	113 s	n	n	175	4.5	16.7	210	-12.5	5.0	240	-12.7	-4.0
Dubbo	150 s	n	n	170	-2.9	0.0	250	0.0	4.2	320	-5.9	3.2
Gilgandra	-	n	n	-	n	n	-	n	n	-	n	n
Mid-Western Regional	-	n	n	185	-7.5	5.7	270	0.0	22.7	345	6.2	7.8
Narromine	-	n	n	-	n	n	180 s	n	n	-	n	n
Warrumbungle Shire	-	n	n	130 s	n	n	165 s	n	n	-	n	n

A5. Median Weekly Rents - Rural Local Government Areas - All Dwellings - Jun 2010

notes: (s) 30 or less bonds lodged; (-) 10 or less bonds lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area*	All Dwellings											
	One Bedroom			Two Bedrooms			Three Bedrooms			Four + Bedrooms		
	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %
Wellington	-	n	n	155 s	n	n	170	n	6.3	210 s	n	n
Macquarie-Barwon	-	n	n	160	10.3	6.7	170 s	n	n	200 s	n	n
Bogan	-	n	n	-	n	n	170 s	n	n	-	n	n
Coonamble	-	n	n	-	n	n	-	n	n	-	n	n
Walgett	-	n	n	160 s	n	n	-	n	n	-	n	n
Warren	-	n	n	-	n	n	-	n	n	-	n	n
Upper Darling	120 s	n	n	135	n	n	190	n	5.6	255 s	n	n
Bourke	-	n	n	-	n	n	-	n	n	-	n	n
Brewarrina	-	n	n	-	n	n	-	n	n	-	n	n
Cobar	-	n	n	140 s	n	n	195 s	n	n	260 s	n	n
Bathurst	140	0.0	n	203	1.3	6.6	260	4.0	4.0	350	2.9	6.1
Bathurst Regional	140	0.0	n	200	0.0	6.7	260	4.0	4.0	350	2.9	6.1
Orange	140	-9.7	-17.6	220	4.8	10.0	270	0.0	3.8	360	-5.3	0.0
Orange	140	-9.7	-17.6	220	4.8	10.0	270	0.0	3.8	360	-5.3	0.0
Central Tablelands	130 s	n	n	168	4.7	8.1	200	0.0	2.6	273	0.9	14.7
Bathurst Regional	140	0.0	n	200	0.0	6.7	260	4.0	4.0	350	2.9	6.1
Blayney	-	n	n	163 s	n	n	230 s	n	n	-	n	n
Cabonne	-	n	n	165 s	n	n	180 s	n	n	-	n	n
Lithgow City	-	n	n	170	-5.6	6.3	200	-9.1	0.0	300 s	n	n
Mid-Western Regional	-	n	n	185	-7.5	5.7	270	0.0	22.7	345	6.2	7.8
Oberon	-	n	n	175 s	n	n	220 s	n	n	-	n	n
Lachlan	113 s	n	n	140	-3.4	7.7	190	2.7	5.6	245	4.3	2.1
Bland	-	n	n	-	n	n	200 s	n	n	-	n	n
Cowra	-	n	n	145 s	n	n	185	0.0	2.8	-	n	n
Forbes	-	n	n	150 s	n	n	180 s	n	n	-	n	n
Lachlan	-	n	n	-	n	n	-	n	n	-	n	n
Parkes	-	n	n	130	-8.8	-3.7	215	7.5	10.3	280 s	n	n
Weddin	-	n	n	-	n	n	-	n	n	-	n	n
Queanbeyan	210	-4.5	5.0	300	3.4	7.1	400	0.0	3.9	523	4.5	0.5
Palerang	-	n	n	-	n	n	380 s	n	n	480 s	n	n
Queanbeyan	210	-2.3	7.7	300	3.4	7.1	410	2.5	6.5	528	-2.3	1.4
Southern Tablelands	125 s	n	n	170	-2.9	3.0	230	-2.1	4.5	308	2.5	9.8
Boorowa	-	n	n	-	n	n	-	n	n	-	n	n
Goulburn Mulwaree	135 s	n	n	170	0.0	7.9	250	0.0	12.4	300	n	11.1
Harden	-	n	n	-	n	n	-	n	n	-	n	n
Palerang	-	n	n	-	n	n	380 s	n	n	480 s	n	n
Upper Lachlan	-	n	n	-	n	n	185 s	n	n	-	n	n
Yass Valley	-	n	n	250 s	n	n	298 s	n	n	420 s	n	n
Young	-	n	n	170	0.0	0.0	210	-4.5	n	295 s	n	n
Lower South Coast	155	n	n	200	5.3	5.3	270	3.8	8.0	320	10.3	10.3
Bega Valley	-	n	n	190	5.6	5.6	270	3.8	12.5	290 s	n	n
Eurobodalla	150	n	n	215	7.5	13.2	280	7.7	12.0	333	7.3	10.8
Snowy	350 s	n	n	270	50.0	8.0	253	16.1	1.0	370	n	32.1
Bombala	-	n	n	-	n	n	-	n	n	-	n	n
Cooma-Monaro	-	n	n	140 s	n	n	220	2.3	7.3	-	n	n
Snowy River	370 s	n	n	475	115.9	-1.0	700	180.0	100.0	460	n	n
Wagga Wagga	150 s	n	n	208	-7.8	-1.2	280	-5.1	1.8	368	0.7	-0.7
Wagga Wagga	150 s	n	n	210	-6.7	0.0	280	-5.1	1.8	368	0.7	-0.7
Central Murrumbidgee	100 s	n	n	165	10.0	10.0	180	-10.0	-5.3	230	-8.0	0.0
Coolamon	-	n	n	-	n	n	-	n	n	-	n	n
Cootamundra	-	n	n	142 s	n	n	180 s	n	n	-	n	n
Gundagai	-	n	n	160 s	n	n	-	n	n	-	n	n
Junee	-	n	n	150 s	n	n	195 s	n	n	-	n	n
Lockhart	-	n	n	-	n	n	-	n	n	-	n	n
Narrandera	-	n	n	-	n	n	-	n	n	-	n	n
Temora	-	n	n	-	n	n	140 s	n	n	-	n	n
Tumut	-	n	n	180 s	n	n	245 s	n	n	-	n	n
Wagga Wagga	150 s	n	n	210	-6.7	0.0	280	-5.1	1.8	368	0.7	-0.7
Lower Murrumbidgee	120	-4.0	n	165	0.0	6.5	225	-2.2	3.4	290	16.0	18.4
Carrathool	-	n	n	-	n	n	-	n	n	-	n	n
Griffith	145 s	n	n	170	-10.5	3.0	250	0.0	8.7	295 s	n	n
Hay	-	n	n	130 s	n	n	-	n	n	-	n	n
Leeton	-	n	n	150	0.0	0.0	200 s	n	n	230 s	n	n
Murrumbidgee	-	n	n	-	n	n	-	n	n	-	n	n

A5. Median Weekly Rents - Rural Local Government Areas - All Dwellings - Jun 2010

notes: (s) 30 or less bonds lodged; (-) 10 or less bonds lodged; (n) not available due to small number

Statistical Sub-Division and Local Government Area*	All Dwellings											
	One Bedroom			Two Bedrooms			Three Bedrooms			Four + Bedrooms		
	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %	Median $	Change Qtly %	Change Ann %
Albury	125	0.0	n	165	-8.3	-2.9	250	-3.8	4.2	330	-5.7	3.1
Albury	125	0.0	n	163	-9.7	-4.4	250	-3.8	2.0	340	-2.9	6.3
Greater Hume Shire	-	n	n	140 s	n	n	180 s	n	n	-	n	n
Upper Murray	-	n	n	150	0.0	0.0	203	1.3	3.8	245 s	n	n
Corowa Shire	-	n	n	160 s	n	n	230	2.2	9.5	-	n	n
Greater Hume Shire	-	n	n	140 s	n	n	180 s	n	n	-	n	n
Tumbarumba	-	n	n	-	n	n	173 s	n	n	-	n	n
Urana	-	n	n	-	n	n	-	n	n	-	n	n
Central Murray	115 s	n	n	145	3.6	0.0	185	-7.5	-2.6	220	n	n
Berrigan	-	n	n	130 s	n	n	180	n	n	-	n	n
Conargo	-	n	n	-	n	n	-	n	n	-	n	n
Deniliquin	-	n	n	115	n	-8.0	178 s	n	n	220 s	n	n
Jerilderie	-	n	n	-	n	n	-	n	n	-	n	n
Murray	-	n	n	180 s	n	n	255 s	n	n	-	n	n
Wakool	-	n	n	-	n	n	-	n	n	-	n	n
Murray-Darling	-	n	n	145 s	n	n	180 s	n	n	-	n	n
Balranald	-	n	n	-	n	n	-	n	n	-	n	n
Wentworth	-	n	n	145 s	n	n	180 s	n	n	-	n	n
Far West	85 s	n	n	140	-6.7	0.0	180	0.0	0.0	220 s	n	n
Broken Hill	-	n	n	140	-6.7	0.0	180	-4.0	0.0	235 s	n	n
Central Darling	-	n	n	-	n	n	-	n	n	-	n	n
Rest of NSW	150	3.4	7.1	200	0.0	5.3	270	1.9	8.0	350	2.9	9.4
NEW SOUTH WALES	340	4.6	6.3	350	0.0	7.7	350	1.4	9.4	440	3.5	10.0

Appendix J Report on Effluent Disposal, Erosion and Salinity Assessment (Douglass Partners July 2009)

Douglas Partners
Geotechnics • Environment • Groundwater

Integrated Practical Solutions

REPORT
on
EFFLUENT DISPOSAL, EROSION AND SALINITY ASSESSMENT

PROPOSED REZONING
STANDEN DRIVE, LOWER BELFORD, NSW

Prepared for
BELFORD LAND CORPORATION

Project 49385
JULY 2009

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ATTACHMENTS

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31 July 2009

REPORT ON
EFFLUENT DISPOSAL, EROSION AND SALINITY ASSESSMENT
LOWER BELFORD PROPOSED REZONING
STANDEN DRIVE, LOWER BELFORD, NSW

1. INTRODUCTION

This revised report presents the findings of a preliminary effluent disposal, erosion and salinity assessment for the proposed rezoning of several lots off Standen Drive, Lower Belford. The investigation was undertaken for Belford Land Corporation.

The purpose of the preliminary effluent disposal assessment was to provide the following:

- Subsurface conditions;
- On site effluent disposal assessment in accordance with AS 1547-2000;
- Recommendations on disposal options;
- Comments on the suitability of the site for on-site effluent disposal;
- Estimates on minimum areas required for disposal.

The effluent disposal assessment was undertaken with reference to the current Environmental and Health Protection Guidelines: “On-site Sewage Management for Single Household”, (Ref 1) and AS 1547:2000 “On-site domestic-wastewater management” (Ref 2).

Based on discussions with the client, the following is understood:

- Residential development with reticulated water supply is proposed for the site;
- Singleton Council has requested information regarding the suitability of 8000 m^2 residential lots with regards to on-site effluent disposal;
- Council has also requested assessment of the land for salinity and erosion risk with regards to the proposed subdivision and on-site effluent disposal.

2. SITE INFORMATION

Site-specific information relevant to the assessment is outlined in Table 1 below:

Table 1 - Site Information

Address:	Standen Drive, Lower Belford
Lot/DP:	Lot 2, DP 739822; Part Lot 6, DP 237936; Part Lot 13, DP 1100005; Part Lot 12, DP 1100005; Lot 11, DP 844443
Client:	Belford Land Corporation
Site Area:	139 ha approx.
Intended water supply (i.e. reticulated or non-reticulated):	Reticulated

3. GEOLOGY / HYDROGEOLOGY

Reference to the 1:100,000 Newcastle Coalfield Regional Geology map indicates the site is underlain by the Muree Sandstone formation of the Maitland Group. The Maitland Group is of middle to late Permian age, and typically includes sandstone, conglomerate and minor clay.

The regional groundwater flow regime for the site is believed to be towards Black Creek, which is located approximately between 700 m and 2.1 km east of the site.

The nearest registered groundwater well (GW080958) is approximately 740 m to the north from the north western corner of the site. The groundwater well was registered as a fire fighting monitoring bore. The well information indicated a water bearing zone between 18 m and 27 m depth below the ground surface and subsurface conditions generally comprising clay to approximately 2 m, underlain by 'shale' to termination at 30 m.

Searches on the Department of Lands web site (www.nratlas.nsw.gov.au) indicate that the following areas may have dryland salinity characteristics (i.e. observations of saline indicator species and possible salt outbreaks):

- A drainage channel in the north east corner of the site where Black Creek's minor tributaries exit the site;
- A drainage channel in the eastern portion of the site.

The approximate mapped areas by the Department of Lands have been reproduced on Drawing 1, attached.

4. SITE FEATURES

A site walkover was undertaken on 15 May 2009 by an experienced environmental engineer from Douglas Partners to assess the site with regards to effluent disposal constraints and potential salinity and erosion issues.

Relevant site features observed include the following:

- Drainage gullies across the site (Photos 1 to 6) and associated steep slopes;
- Rock outcrops generally observed in the south western and western portion of the site (Photos 7 to 9);
- Dams at several locations across the site (Photos 10 to 12);
- Localised erosion scouring (Photos 13 and 14);
- Localised filling (generally in the north western portion of the site and in existing effluent disposal areas within the site).

Drainage gullies and associated site slopes generally fell to the east on the eastern side of the ridge line in the western portion of the site. Site slops on the western side of the ridge line fell to the west. Site slops were generally about 8%, however localised slops of 20% to 40% were observed in the vicinity of gullies. Gullies are shown in Photos 1 to 6 below.

Photo 1 – Drainage gully and vegetation in the north eastern portion of the site

Photo 2 – Drainage gully in the northern portion of the site

Photo 3 – Drainage gully and dam in the central eastern portion of the site

Photo 4 – Drainage gully in the central portion of the site

Photo 5 – Drainage gully in the central-southern portion of the site

Photo 6 – Drainage gullies in the southern portion of the site

Rock outcrops were observed along the ridge line in the western and south western portion of the site as shown in Photos 7 to 9 below.

Photo 7 – Rock outcrops in the south western portion of the site

Photo 8 – Rock outcrops in the south western portion of the site

Photo 9 – Rock outcrop in the western portion of the site

Dams were observed in the majority of gullies across the site, as shown in Photo 3 above, and Photos 10 to 12 below.

Photo 10 – Dam in the north western portion of the site

Photo 11 – Dams in the southern portion of the site

Photo 12 – Dam in the south – eastern portion of the site

Localised erosion scouring was observed in the north eastern portion of the site, in the vicinity of a dam overflow, as shown in Photo 13.

Photo 13 – Localised erosion scour in the north eastern portion of the site (note dam overflow culvert)

Photo 14 – Localised minor erosion in the central portion of the site

Localised minor filling was observed in the north–western portion of the site (i.e. in the vicinity of a small shed and dumped rubbish - Photo 15) and in possible existing effluent disposal areas adjacent to existing residences in the north-western, central, southern and south-eastern portions the site (Photo 16).

Photo 15 – Dumped rubbish and possible filling in the north-western portion of the site

Photo 16 – Possible effluent disposal area in the central portion of the site

Surface water monitoring for pH and Electrical Conductivity (EC) was undertaken during the site walkover. The results of surface water monitoring are presented in Table 2 below. Approximate locations are shown on Drawing 1, attached.

Table 2 - Surface Water Monitoring

Location	pH	EC (mS/cm)
A	8.1	0.18
B	7.6	0.24
C	7.2	0.3
D	7.9	0.1
E	7.3	0.09
F	7.4	0.093
G	7.5	0.09
H	8.2	0.07
I	8.0	0.07
J	8.5	0.06
K	8.2	0.07
L	9.2	0.08
M	9.0	0.07
N	8.7	0.09

Various relevant site features are listed in Table 3 below and have been compared to the requirements of Reference 1 in terms of possible limitations to effluent disposal.

Table 3 - Site Features

Site Feature	Rating	Limitation
Flood potential	To be confirmed by Surveyor	
Exposure	Well exposed to sun and wind	Minor
Slope	Generally 5 % to 8% Near gullies 10% to 40%	Minor Moderate/Major
Land form	Convex side slopes across majority of site, some areas of gullies	Minor to Major
Run-on and upslope seepage	Some potential for run-on	Minor/moderate
Erosion Potential	Generally localised erosion only, gullies are generally well vegetated	Minor
Site Drainage	No obvious signs of surface dampness	Minor
Fill	Fill present in north western corner of the site	Minor/Moderate
Depth to Bedrock	Generally >0.5 m	Minor/moderate
Rock outcrops	Some rock outcrops observed in western portion (ridge)	Minor/Moderate
Buffer distances	See Table 9 for further information.	Minor/moderate
Land availability	Land generally available	Minor
Geology/Regolith	Muree sandstone formation – sandstone, conglomerate, minor clay	Minor

Notes to Table 3:

Limitation as defined by the NSW Government Environmental and Health Protection Guidelines (Ref 1).

5. SUBSURFACE CONDITIONS

Fieldwork and subsequent laboratory testing has been undertaken to assess the site's suitability for effluent disposal. A summary of the fieldwork test methods and results is shown below in Table 4.

Table 4 - Field Work

Date Sampled	18/05/09 – 20/05/09
Test Method	Test Pits undertaken by an environmental engineer from DP
Number of Pits [2]	30
Depth of Investigation	0.7 m to 2.0 m
Summary of Subsurface Conditions [1]	Generally topsoil over clay/sandy clay, underlain by clayey sand and gravel, and sandstone
Groundwater Observations	No free groundwater was observed during fieldwork

Notes to Table 4:

1 - Detailed test pit report sheets are attached and should be read in conjunction with the general notes preceding them.

2 - Refer to Drawing 1 attached for approximate test pit locations.

Laboratory testing for the effluent disposal assessment was performed by SESL and comprised measurement of various soil parameters, as suggested for subdivision developments by the NSW Government Guidelines (Ref 1) on the predominant/controlling soil types within the site.

The results are shown in Table 5 below and have been marked where the results indicate possible limitations to suitability for effluent application (Ref 1).

Table 5 - Laboratory Test Results

Test Location	1/0.1	5/0.2	9/0.1	12/0.4	14/0.1	18/0.2	20/0.5	23/0.3	26/0.5	30/0.5
Description	Clayey sand topsoil	Clay	Clayey sand topsoil	Clay	Clayey sand topsoil	Sandy clay & gravel	Clay	Clayey sand & gravel	Sandy Clay	Clay
Bulk Density (t/m^3)	1.46	1.84	1.61	1.93	1.42	1.59	1.81	1.77	1.75	1.85
pH in water	5.8	5.9	5.8	4.9	5.8	5.6	5.8	6.1	5.8	5.6
pH in CaCl	**4.7**	**4.7**	**4.8**	4.3	**4.9**	**4.5**	4.4	**4.5**	4.3	4.4
ESP (%)	**7.1**	**5.9**	1.5	19	2.7	4.3	3.2	**8**	14.5	**7.9**
CEC (Cmol/kg)	3.4	16.3	2.7	23	4.4	3	**13.5**	**8.1**	**12.1**	**13.6**
ECe (dS/m)	0.45	0.56	0.18	**5**	0.27	0.17	0.21	0.27	0.63	0.63
Phosphorus Sorption [1] (kg/ha)	**5220**	13950	1560	17850	**5700**	**2460**	17700	**5490**	18220	16620
Modified Emerson Class [2]	5	5	3	6	5	5	6	6	6	6

Notes to Table 5:
ECe – Electrical Conductivity (Laboratory results EC (1soil:5 water) converted to ECe using soil correction factor (Ref 3))
CEC – Cation Exchange Capacity
ESP - Exchangeable Sodium Percentage
1 - Based on 1 m soil profile or observed depth to bedrock
2 - Modified Emerson Class carried out using SAR 5 solution, which replicates domestic effluent
Bold results indicate a moderate limitation as defined by Reference 1
Shaded results indicate a major limitation as defined by Reference 1

Additional laboratory testing was undertaken by SGS Australia and comprised analysis of soil samples for pH and Electrical Conductivity (EC). The results of this analysis are presented in Table 6 below.

Table 6 - Laboratory Test Results

Test Location	Description	pH	EC_e (dS/m)	Salinity Class
2/0.1	Clayey sand topsoil	6.3	0.09	Non-saline
2/0.5	Clay	6.3	0.26	Non-saline
3/0.1	Gravelly sand clay topsoil	5.6	0.28	Non-saline
4/0.25	Clay	5.8	0.27	Non-saline
6/0.05	Sand topsoil	6.3	0.23	Non-saline
7/0.15	Sandy clay topsoil	5.4	0.07	Non-saline
13/0.5	Clay	5.1	2.29	Slightly saline
14/0.5	Clay	5.9	7.47	Moderately Saline
15/0.05	Clayey sand topsoil	5.9	1.17	Non-saline
16/0.25	Clayey sand	6.0	0.10	Non-saline
17/0.2	Silty clay topsoil	5.9	0.24	Non-saline
18/0.5	Clay	5.8	1.44	Non-saline
19/0.15	Silty clay topsoil	6.3	0.35	Non-saline
21/0.2	Silty clay topsoil	6.0	1.54	Non-saline
22/0.1	Clayey sand topsoil	6.5	0.25	Non-saline
22/0.5	Clay	5.9	0.38	Non-saline
24/0.2	Gravelly sand	6.3	0.17	Non-saline
25/0.2	Sandy gravelly clay	6.4	0.06	Non-saline
28/0.15	Clayey sand topsoil	5.9	0.43	Non-saline
29/0.25	Clay	5.9	0.16	Non-saline

6. EFFLUENT DISPOSAL AREA REQUIREMENTS

Estimated land areas required for both irrigation (spray, trickle or subsurface) and evapotranspiration absorption (ETA) systems are provided based on typical effluent quality as published in Reference 1 for the following effluent treatment systems:

- Standard Septic Treatment System;
- Standard Aerated Wastewater Treatment System (AWTS);
- Enhanced Aerated Wastewater Treatment System (i.e. Treatment system such as an 'Envirocycle', which reduced the nitrogen output to 10 mg/L).

Minimum disposal areas have been calculated by taking account of both the hydraulic capability of the land to accept effluent as well as the ability of the land to accept nutrients. The main parameters used in these calculations are outlined in Table 7 below:

Table 7 - Model Parameters

Effluent Treatment System	Standard AWTS	Enhanced AWTS	Septic System
Nitrogen loading (mg/L) [2]	37	10	55
Phosphorus loading (mg/L) [2]	10		
Rainfall data [1]	Singleton[4]		
Evaporation data	Cessnock[4]		
DIR (mm/week)	15		
DLR (mm/day)	5		
Design Period (yrs) [3]	50		

Notes to Table 7:
DIR – Design Irrigation Rate in accordance with AS 1547-2000 (Ref 2)
DLR – Design Loading Rate (ETA systems) in accordance with AS 1547-2000 (Ref 2)
1 – Median (50th percentile or 5 Decile) monthly rainfall supplied by the Bureau of Meteorology
2 – Typical nutrient loading rates as published in Reference 1
3 – In accordance with Reference 1
4 – Nearest available weather station with appropriate data

At present, there is no town water supply to the site, however, it is understood that town water supply is required for the proposed development. Minimum disposal areas have therefore been calculated based on reticulated water supply.

The minimum plan areas noted in Table 8 below are the limiting areas based on consideration of the hydraulic and nutrient (nitrogen and phosphorus) balance estimates.

Table 8 - Minimum Plan Area (m^2) Required for Both ETA and Irrigation Disposal Systems

No of Bedrooms	Evapotranspiration/Absorption				Irrigation		
	Daily Effluent Load (L/day)	Effluent Treatment System			Effluent Treatment System		
		Septic [1, 2]	Standard AWTS [1]	Enhanced AWTS [3]	Septic [1, 2]	Standard AWTS [1]	Enhanced AWTS [3]
2	600	1220	820	270	NA	820	330
3	900	1830	1230	410	NA	1230	490
4	1200	2440	1640	550	NA	1640	660
5	1500	3060	2060	680	NA	2060	820

Notes to Table 8:

1 - Minimum plan areas for both septic and standard AWTS treatment system were found to be governed by the nitrogen balance.

2 - It should be noted that septic treatment systems should only be used in conjunction with ETA disposal systems and not used in conjunction with irrigation disposal systems. Subsoil application is required for septic systems due to the highly infectious nature of the effluent (Ref 1).

3 - The minimum plan area for an enhanced AWTS system, however, was found to be governed by a combination of the phosphorus balance and the hydraulic balance. The calculation for the phosphorus balance has assumed that the underlying clay soils are the predominant soil type.

During periods of rainfall, the nutrient levels in the effluent would be diluted, increasing the importance of the hydraulic capability of the soil. Wet weather storage should be provided for prolonged heavy rainfall events. A minimum storage capacity of three days is recommended based on NSW EPA guidelines (Ref 1), subject to council requirements.

7. RECOMMENDATIONS

7.1 Salinity

No obvious signs of soil salinity were observed during the current investigation. The results of surface water monitoring across the site generally indicated minimal salinity potential in runoff from gullies/drainage channels (i.e. fresh waters).

The results of laboratory testing undertaken on topsoil and underlying clays generally indicate minimal salinity potential. The measured electrical conductivity of the soils is unlikely to have a measurable impact on vegetation growth, and is unlikely to be a limiting factor in residential development and on-site effluent disposal at the site.

Regardless of the absence of saline indicators, it is recommended that future design and construction should be undertaken with respect to good practices as detailed in Reference 3 to minimise the potential for saline impact to occur. Typical construction practices include:

- Correctly installing a damp-proof course within each building;
- Providing adequate floor ventilation beneath buildings constructed on bearers and joists;
- Minimise the disruption to natural water courses (surface and subsurface) to reduce the potential for waters to come in contact with structures, i.e. minimising cut and fill;
- Maintaining good drainage and minimising excessive infiltration;
- Ensuring that paths which are provided around buildings slope away from the building;
- Careful design of landscaping and landscape watering methods;
- Adequate drainage provided behind retaining walls;
- Regular monitoring of pipes, etc for leaks.

Most of the above features are consistent with the guidelines AS 2870 (Ref 4) for standard non-saline sites.

For the construction of roads the following is recommended:

- Minimise ponding of water and the concentration of surface run-off on shoulders and adjacent drains;
- Increasing the seal width to minimise water infiltrating beneath the pavement. This could be achieved by bitumen sealing of the road shoulders and ensuring adequate cross fall to drains;
- Careful selection of construction materials to minimise salt content and to maximise compaction.

7.2 Soil Erosion

Observations made during the site walkover generally indicated the absence of gross erosion within gullies and slopes at the site. With the exception of eroded soils in the north-eastern portion of the site (i.e. in the vicinity of potentially high velocity dam overflows), drainage gullies were generally vegetated, with only minor exposed soils observed across the site.

The results of modified Emerson dispersion testing at the site generally indicate non-dispersive soils, particularly when testing is undertaken using a high salt solution (i.e. used to model the effect of treated effluent on soil dispersion), with the exception of clayey sand topsoils in the sample from Pit 9.

Provided adequate vegetation cover is maintained within the effluent disposal area and disposal area slopes are minimised, the site soils are considered generally suitable for residential development and to accept treated effluent with respect to potential soil erosion.

7.3 Lot Sizing

When calculating minimum lot sizes, the following should be considered:

- Maintaining the minimum effluent disposal area (as presented in Table 8 above), including reserve disposal area, soil bunds etc;
- Maintaining buffer distances to water bodies, drainage channels, residences etc (as discussed in Section 7.5 below);
- The location of flood contours (1 in 20 year contour for land application systems, 1 in 100 year contour for treatment systems).

The overall site has been assessed with reference to NSW guidelines (Ref 1). The results of the assessment indicate that the site is suitable for residential subdivision with on-site effluent disposal, and that limitations to effluent disposal assessment are minimal. Based on the calculation of minimum disposal areas as presented in Table 8 above and the assessment of the site with reference to the NSW guidelines (Ref 1), lot sizes of 8000 m^2 will allow adequate area for the proposed effluent disposal system.

Provided that the above points and the recommended site improvements (as presented in Section 7.4 below) and recommended buffer distances are adhered to in the design of lot sizes (as shown in Table 9 below), a lot size of 8000 m^2 would be unlikely to generate gross adverse cumulative impact on the site and surrounding sites.

7.4 Site Improvements

The site is considered to be generally suitable for on-site disposal of domestic effluent provided that the limitations previously mentioned are addressed, as discussed below:

Soil pH

Laboratory testing has indicated some acid soil conditions within the site. While the current site vegetation appears to have relatively good growth, agricultural lime could be added to the disposal area to maintain plant growth. Recommended lime application rates are presented in the attached SESL laboratory report sheets.

Sodic Soils/Erosivity

The soil within each disposal area could be treated with an appropriate application of gypsum. Adding gypsum to the soil increases the salinity of the soil moisture without increasing the sodium level, thereby reducing the Sodium Adsorption Ratio (SAR). This will improve the soil structure and reduce the potential for dispersion and erosion. Recommended gypsum application rates are presented in the attached SESL laboratory sheets.

Shallow Bedrock

The minor to moderate limitation caused by the presence of shallow rock within some areas of the site could be improved by mounding suitable clay loam filling within the disposal area to achieve a minimum depth of 1 m to bedrock. The material should be moderately permeable and have a high nutrient uptake. This would reduce the potential for effluent resurfacing and increase the soil's ability to uptake phosphorus.

The requirements for this would be subject to the treatment and disposal system proposed, and the depth to rock within the lot-specific disposal area.

If imported clays are to be used for additional filling, it is recommended that further laboratory testing be undertaken to assess the phosphorus absorption capacity and general suitability.

Run-on/Run-off

Catch drains / bunds upslope and downslope of the disposal areas are recommended to prevent rainfall run-on and run-off of the effluent respectively. This is particularly important on steeper areas of the site where irrigation disposal systems are proposed.

Flood Potential

In accordance with Reference 1, all components of the effluent disposal system including electrical components, vents and inspection openings of wastewater treatment devices should be located above the 1 in 100 year probability flood contour. However the 1 in 20 year probability flood contour may be used as a limit for land application areas.

General

Disposal areas should be planted with high nutrient uptake vegetation, and lawn clippings should be removed.

Maintenance of the effluent disposal area is important and should be conducted regularly. The attached pamphlet titled “Your Land Application Area” produced by the Department of Local Government provides recommendations on maintenance procedures. Additionally, all disposal areas should be constructed in accordance with AS 1547-2000 (Ref 2).

7.5 Location of Disposal Systems

Buffer zones should be kept between on-site systems and sensitive environments on and off-site. It is suggested that the buffer distances given in Reference 1 for land application systems be adopted for locating disposal areas on this site. The buffer distances from Reference 1 are reproduced below.

Table 9 – Recommended Buffer Distances for On-site Systems

System	Recommended Buffer Distances
All land application systems	• 100 m to permanent surface waters (e.g. river, streams, lakes, etc) • 250 m to domestic groundwater well • 40 m to other waters (e.g. farm dams, intermittent waterways and drainage channels, etc)
Surface spray irrigation	• 6 m if area up-gradient and 3 m if area down-gradient of driveways and property boundaries • 15 m to dwellings • 3 m to paths and walkways • 6 m to swimming pools
Surface drip and trickle irrigation and subsurface irrigation	• 6 m if area up-gradient and 3 m if area down-gradient of swimming pools, property boundaries, driveways and buildings

7.6 General

It is noted that the above assessment is preliminary only, and has been undertaken to assess general site conditions. Additional lot specific investigation may therefore be required once the proposed lot layout has been finalised to confirm the depth to rock and disposal area requirements.

8. LIMITATIONS OF THIS REPORT

DP has performed investigation and consulting services for this project in general accordance with current professional and industry standards for land contamination investigation.

Whilst every effort has been made to ensure a representative programme of field and laboratory sampling and testing, conditions different to those identified during these tasks may exist. Therefore DP cannot provide unqualified warranties nor does DP assume any liability for site conditions not observed, or accessible during the time of the investigations.

Despite all reasonable care and diligence, the ground conditions encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. In addition, site characteristics may change over time in response to variations in natural conditions, chemical reactions and other events, eg. groundwater movement and/or spillages of contaminating substances. These changes may occur subsequent to DP's investigations and assessment.

This report and associated documentation and the information herein have been prepared solely for the use of Belford Land Corporation Pty Ltd. Any reliance assumed by other parties on this report shall be at such party's own risk. Any ensuing liability resulting from use of the report by other parties cannot be transferred to DP.

DOUGLAS PARTNERS PTY LTD

Reviewed by:

Bahareh Mansouri
Environmental Engineer

John Harvey
Principal

Patrick Heads
Associate

REFERENCES

1. Environment & Health Protection Guidelines On-Site Wastewater Management Systems for Single Households, NSW EPA, NSW Department of Health", NSW Department Land & Water Conservation, NSW Department of Local Government, January 1998.

2. Australian Standard AS 1547-2000, "On-site domestic - wastewater management", Standards Australia.

3. Department of Infrastructure Planning and Natural Resources, "Site Investigations for Urban Salinity", 2002.

4. Australian Standard AS 2870-1996 ''Residential Slabs and Footings - Construction", June 1996, Standards Australia

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- ✘ Don't erect any structures, construct paths, graze animals or drive over the land application area.
- ✘ Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- ✘ Don't plant trees or shrubs near or on house drains.
- ✘ Don't alter stormwater lines to discharge into or near the land application area.
- ✘ Don't flood the land application area through the use of hoses or sprinklers.
- ✘ Don't let children or pets play on land application areas.
- ✘ Don't water fruit and vegetables with the effluent.
- ✘ Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- surface ponding and run-off of treated wastewater
- soil quality deterioration
- poor vegetation growth
- unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- Λ Overloading the treatment system with wastewater.
- Λ The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- Λ The application area has been poorly designed.
- Λ Stormwater is running onto the area.

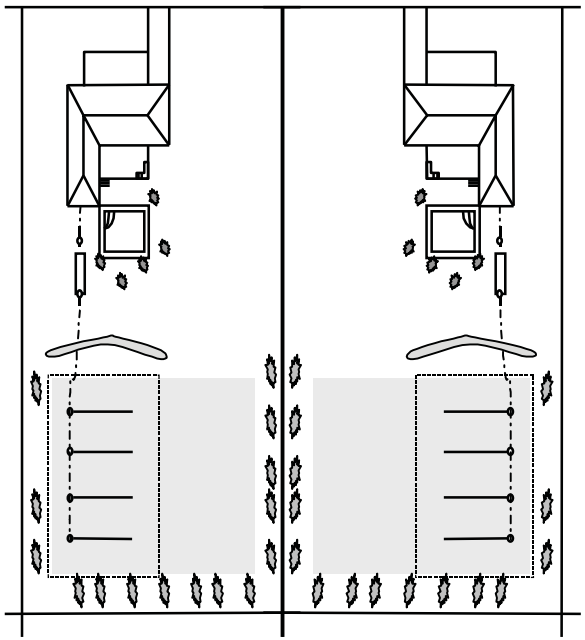
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area



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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS IN THE SYDNEY AREA

This classification system provides a standardized terminology for the engineering description of the sandstone and shales in the Sydney area, but the terms and definitions may be used elsewhere when applicable.

Under this system rocks are classified by Rock Type, Degree of Weathering, Strength, Stratification Spacing, and Degree of Fracturing. These terms do not cover the full range of engineering properties. Descriptions of rock may also need to refer to other properties (e.g. durability, abrasiveness, etc.) where these are relevant.

ROCK TYPE DEFINITIONS

Rock Type	Definition
Conglomerate:	More than 50% of the rock consists of gravel sized (greater than 2mm) fragments
Sandstone:	More than 50% of the rock consists of sand sized (.06 to 2mm) fragments
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06mm) granular particles and the rock is not laminated
Claystone:	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated
Shale:	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g. clayey sandstone, sandy shale.

DEGREE OF WEATHERING

Term	Symbol	Definition
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	Fs	Rock substance unaffected by weathering, limonite staining along joints.
Fresh	Fr	Rock substance unaffected by weathering.

STRATIFICATION SPACING

Term	Separation of Stratification Planes
Thinly laminated	<6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	>2 m

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Society of Rock Mechanics (Reference).

Strength Term	Is(50) MPa	Field Guide	Approx. qu MPa*
Extremely Low:	0.03	Easily remoulded by hand to a material with soil properties	0.7
Very Low:	0.1	May be crumbled in the hand. Sandstone is “sugary” and friable.	2.4
Low:	0.3	A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	7
Medium:	1	A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.	24
High:	3	A piece of core 150 mm long x 50 mm dia. cannot be broken by unaided hands, can be slightly scratched or scored with knife.	70
Very High:	10	A piece of core 150 mm long x 50 mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.	240
Extremely High:		A piece of core 150 mm long x 50 mm dia. is difficult to break with hand held hammer. Rings when struck with a hammer.	

* The approximate unconfined compressive strength (qu) shownin the table is based on an assumed ratio to the point load index of 24:1. This ratio may vary widely.

DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude known artificial fractures such as drilling breaks

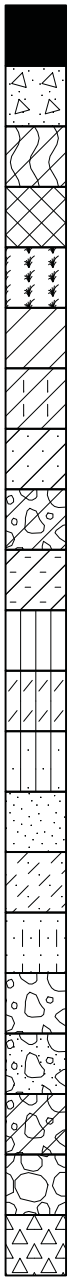
Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than the core diameter.
Highly Fractured:	Core lengths are generally less than 20 mm - 40 mm with occasional fragments.
Fractured:	Core lengths are mainly 30 mm - 100 mm with occasional shorter and longer sections.
Slightly Fractured:	Core lengths are generally 300 mm - 1000 mm with occasional longer sections and occasional sections of 100 mm - 300 mm.
Unbroken:	The core does not contain any fracture.

REFERENCE

International Society of Rock Mechanics, Commission on Standardisation of Laboratory and Field Tests, Suggested Methods for Determining the Uniaxial Compressive Strength of Rock Materials and the Point Load Strength Index, Committee on Laboratory Tests Document No. 1 Final Draft October 1972

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL



BITUMINOUS CONCRETE

CONCRETE

TOPSOIL

FILLING

PEAT

CLAY

SILTY CLAY

SANDY CLAY

GRAVELLY CLAY

SHALY CLAY

SILT

CLAYEY SILT

SANDY SILT

SAND

CLAYEY SAND

SILTY SAND

GRAVEL

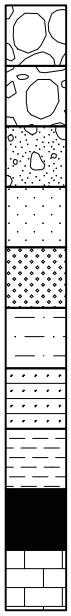
SANDY GRAVEL

CLAYEY GRAVEL

COBBLES/BOULDERS

TALUS

SEDIMENTARY ROCK



BOULDER CONGLOMERATE

CONGLOMERATE

CONGLOMERATIC SANDSTONE

SANDSTONE FINE GRAINED

SANDSTONE COARSE GRAINED

SILTSTONE

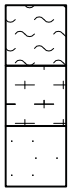
LAMINITE

MUDSTONE, CLAYSTONE, SHALE

COAL

LIMESTONE

METAMORPHIC ROCK

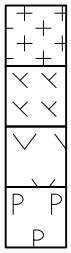


SLATE, PHYLITTE, SCHIST

GNEISS

QUARTZITE

IGNEOUS ROCK



GRANITE

DOLERITE, BASALT

TUFF

PORPHYRY

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342668
NORTHING: 6387205
DIP/AZIMUTH: 90°/--

PIT No: 1
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand, some gravel, humid		D	0.1				
	0.26	CLAY - Very stiff/hard, red/brown clay, M>Wp		D, pp	0.8		190 - 240 kPa		
1	1.03	SANDSTONE - Very low strength, extremely weathered dark grey/brown sandstone		D	1.1				1
	1.15	At 1.11m, strength increasing with depth							
		Pit discontinued at 1.15m, slow progress on sandstone							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342574
NORTHING: 6387143
DIP/AZIMUTH: 90°/--

PIT No: 2
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand, with some fine to coarse grained gravel, damp		D	0.1				
	0.28	CLAY - Very stiff, red/brown clay, M<Wp		D, pp	0.5		220 - 340 kPa		
	0.89	CLAYEY SAND - Grey/orange/brown clayey sand, damp		D	0.9				
1	1.03	SANDSTONE - Extremely low strength, extremely weathered, grey/orange sandstone		D	1.05				1
	1.13	At 1.08m, strength increases with depth							
		Pit discontinued at 1.13m, slow progress on sandstone							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342529
NORTHING: 6386993
DIP/AZIMUTH: 90°/--

PIT No: 3
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown gravelly sandy clay/clayey sand, fine to coarse grained gravel, damp		D	0.1				
	0.18	CLAY - Very stiff, grey/brown/yellow clay, trace sand, M≥Wp		D, pp	0.6		270 - 310 kPa		
	0.74	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange, sandstone		D	0.8				
	0.85	Pit discontinued at 0.85m, slow progress on sandstone							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341980
NORTHING: 6387312
DIP/AZIMUTH: 90°/--

PIT No: 4
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown sand, trace rootlets, damp		D	0.05				
	0.2	CLAY - Very stiff, brown mottled orange clay, with trace sand and rootlets, M<Wp		D, pp	0.25		300 - 380 kPa		
	0.7	SANDY CLAY AND GRAVEL - Light brown sandy clay and fine to medium grained gravel, M<Wp		D	0.75				
	1								1
	1.15	At 1.10m, strength increasing with depth Pit discontinued at 1.15m, slow progress on gravel							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⊻ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341900
NORTHING: 6387196
DIP/AZIMUTH: 90°/--

PIT No: 5
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown sand, trace rootlets, damp		D	0.05				
	0.15	CLAY - Hard, brown mottled orange clay, with some gravel, M<Wp		D, pp	0.2		>400 kPa		
	0.85	SANDY CLAY AND GRAVEL - Light brown sandy clay and fine to medium grained gravel, M<Wp							
	0.95	Pit discontinued at 0.95m, slow progress on gravel							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⊻ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342021
NORTHING: 6387203
DIP/AZIMUTH: 90°/--

PIT No: 6
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.07	TOPSOIL - Grey/brown sand, trace rootlets, damp		D	0.05				
		CLAY - Stiff, brown mottled orange clay, trace sand and rootlets, M>Wp		D, pp	0.1		100 - 200 kPa		
	0.7	SANDY CLAY AND GRAVEL - Light grey/brown mottled orange sandy clay and fine to medium grained gravel, M<Wp		D	1.0				
1	1.31	Pit discontinued at 1.31m, slow progress on gravel							1
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342344
NORTHING: 6387167
DIP/AZIMUTH: 90°/--

PIT No: 7
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown sandy clay, trace organics and rootlets, trace gravel		D	0.15				
	0.24	CLAY - Very stiff, red/brown clay, trace organics, M>Wp		D, pp	0.9		260 - 340 kPa		
1	1.03	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	1.1				1
	1.15	Pit discontinued at 1.15m, slow progress							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341863
NORTHING: 6386924
DIP/AZIMUTH: 90°/--

PIT No: 8
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark brown sand, trace organics, damp		D	0.05				
	0.25	SANDY CLAY - Stiff, light grey/brown mottled orange, trace organics, trace medium to coarse grained gravel, M<Wp		D, pp	0.3		150 - 200 kPa		
	0.5	SANDSTONE - Extremely low strength, extremely weathered, grey/brown sandstone		D	0.6				
	0.7	Pit discontinued at 0.7m, slow progress on sandstone							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341792
NORTHING: 6386519
DIP/AZIMUTH: 90°/--

PIT No: 9
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand, trace gravel, rootlets, damp		D	0.1				
	0.2	CLAYEY SAND AND GRAVEL - Light grey/brown clayey sand and fine to coarse grained gravel		D	0.3				
	0.43	SANDY CLAY - Stiff to very stiff, grey/brown mottled orange sandy clay, M<Wp		D, pp	0.6		140 - 220 kPa		
	0.88	SANDSTONE - Low strength, extremely weathered, light grey/brown sandstone		D	0.9				
1	1.0	Pit discontinued at 1.0m, slow progress on sandstone							1
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⊻ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341863
NORTHING: 6386509
DIP/AZIMUTH: 90°/--

PIT No: 10
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown clayey sand, trace gravel and rootlets, damp		D	0.1				
	0.15	CLAYEY SAND - Dark grey/brown clayey sand, with some fine to coarse grained gravel, damp		D	0.2				
	0.4	SANDY CLAY - Stiff to very stiff, grey/brown mottled orange sandy clay, M>Wp		D, pp	0.5		180 - 240 kPa		
	0.85	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	0.95				
1	1.0	Pit discontinued at 1.0m, slow progress on sandstone							1
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341826
NORTHING: 6387101
DIP/AZIMUTH: 90°/--

PIT No: 11
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL - Light grey/brown sand, with gravel, trace rootlets, damp							
		SAND AND GRAVEL - Dark grey/brown fine to coarse grained sand, with fine to coarse grained gravel, damp		D	0.2				
	0.3	CLAY - Very stiff light orange/brown clay, trace sand, M>Wp		D, pp	0.5		200 -300 kPa		
1	1.0	SANDSTONE - Extremely low strength, highly weathered, light grey/brown sandstone							1
		At 1.5m, strength increasing with depth		D	1.4				
	1.6	Pit discontinued at 1.6m, slow progress on sandstone							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342080
NORTHING: 6386975
DIP/AZIMUTH: 90°/--

PIT No: 12
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand, trace rootlets, damp		D	0.1				
	0.2	CLAY - Stiff, grey mottled brown clay, M>Wp		D, pp	0.4		120 - 150 kPa		
		From 0.8m, hard		D, pp	0.9		400 - 460 kPa		
	1	From 1.0m, some sand		D	1.3				1
		From 1.8m, grading to extremely low strength, extremely weathered, grey mottled red claystone		D	1.85				
	1.9	Pit discontinued at 1.9m, slow progress							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342061
NORTHING: 6386784
DIP/AZIMUTH: 90°/--

PIT No: 13
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown gravelly sand, some cobbles, trace rootlets, damp		D	0.05				
	0.1	CLAY - Very stiff/hard grey/brown clay, trace gravel, trace cobble, M>Wp		D, pp	0.5		150 - 220 kPa		
	0.77	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	0.9				
	1								1
		At 1.9m, strength increasing with depth							
	2 2.0	Pit discontinued at 2.0m, limit of investigation							2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342072
NORTHING: 6386064
DIP/AZIMUTH: 90°/--

PIT No: 14
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand topsoil, trace gravel, damp		D	0.1				
	0.15	CLAY - Very stiff to hard, yellow/grey/brown clay, trace sand, trace cobbles, M>Wp		D, pp	0.5		310 - 410 kPa		
1	1.0	SILTSTONE - Extremely low strength, highly weathered grey/brown siltstone		D	1.05				1
	1.1	Pit discontinued at 1.1m, slow progress							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341683
NORTHING: 6386204
DIP/AZIMUTH: 90°/--

PIT No: 15
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL - Dark grey/brown clayey sand topsoil, trace gravel, damp		D	0.05				
		SANDY GRAVELLY CLAY - Dark grey/brown sandy gravelly clay, fine to coarse grained gravel, some cobbles		D	0.25				
	0.3	SANDY CLAY - Very stiff, grey/brown/yellow, sandy clay, trace cobbles, M<Wp		D, pp	0.5		230 - 280 kPa		
	0.6	SILTSTONE - Extremely low strength, extremely weathered, siltstone							
		At 0.81m, strength increasing with depth		D	0.79				
	0.9	Pit discontinued at 0.9m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341832
NORTHING: 6385842
DIP/AZIMUTH: 90°/--

PIT No: 16
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown sandy clay, trace organics, rootlets, damp		D	0.1				
	0.15	CLAYEY SAND - Light grey/brown clayey sand, some fine to coarse grained gravel		D	0.25				
	0.42	CLAY - Stiff to very stiff, yellow/brown clay, trace sand and roots, M>Wp		D, pp	0.7		180 - 240 kPa		
	1			D, pp	1.1		160 - 200 kPa		1
	1.32	SILTSTONE - Very low strength, extremely weathered, grey mottled orange siltstone At 1.45m, strength increasing with depth		D	1.4				
	1.55	Pit discontinued at 1.55m, slow progress							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 127797
NORTHING: 6385797
DIP/AZIMUTH: 90°/--

PIT No: 17
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown silty clay, trace rootlets, damp		D	0.2				
	0.25	SILTY CLAY - Dark grey/brown silty clay, M<Wp							
	0.5	SANDY CLAY - Grey mottled orange sandy clay, M<Wp		D	0.7				
	0.9	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	1.0				
1	1.04	At 1.0m, strength increasing with depth Pit discontinued at 1.04m, slow progress							1
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342423
NORTHING: 6386620
DIP/AZIMUTH: 90°/--

PIT No: 18
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown sandy clay, trace gravel, damp		D	0.1				
	0.15	SANDY CLAYEY AND GRAVEL - Light grey/brown sandy clay, fine to coarse grained gravel, trace cobble, M<Wp		D	0.2				
	0.3	CLAY - Very stiff, red/brown mottled grey clay, trace sand, M>Wp		D, pp	0.5		200 - 260 kPa		
	0.7	CLAYEY SAND - Light grey/orange fine to coarse grained clayey sand, damp		D	0.8				
	0.89	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	0.92				
	0.96	Pit discontinued at 0.96m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⊻ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342265
NORTHING: 6386110
DIP/AZIMUTH: 90°/--

PIT No: 19
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown gravelly silty clay, fine to coarse grained gravel, some cobbles, damp		D	0.15				
	0.2	CLAY - Very stiff, red/grey/brown, trace rootlets, M>Wp		D, pp	0.5		210 - 310 kPa		
	1								1
				D	1.1				
	1.3	SILTSTONE - Extremely low strength, moderately weathered, grey/brown siltstone							
	1.4	Pit discontinued at 1.4m, slow progress							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342511
NORTHING: 6386039
DIP/AZIMUTH: 90°/--

PIT No: 20
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown gravelly silty clay, fine to coarse grained gravel, some cobbles, damp		D	0.15				
	0.3	CLAY - Very stiff, red/brown clay, trace coarse grained gravel, organics, M<Wp		D, pp	0.5		220 - 340 kPa		
	0.7	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	0.8				
	0.93	Pit discontinued at 0.93m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342465
NORTHING: 6385418
DIP/AZIMUTH: 90°/--

PIT No: 21
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown silty clay, trace organics, clay increases with depth		D	0.2				
	0.4	CLAY - Very stiff, dark grey/brown clay, some fine to coarse grained gravel, M>Wp		D, pp	0.6		200 - 260 kPa		
	0.8	SILTSTONE - Extremely low strength, highly weathered, grey/yellow siltstone		D	0.85				
	0.91	Pit discontinued at 0.91m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342310
NORTHING: 6386262
DIP/AZIMUTH: 90°/--

PIT No: 22
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown clayey sand, trace gravel, rootlets, damp		D	0.1				
	0.14	CLAY - Very stiff, red/brown clay, trace sand, M>Wp		D, pp	0.5		280 - 300 kPa		
	0.75	SILTSTONE - Extremely low strength, extremely weathered, light grey/brown siltstone		D	0.8				
	0.9	Pit discontinued at 0.91m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342019
NORTHING: 6386307
DIP/AZIMUTH: 90°/--

PIT No: 23
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL - Dark grey/brown clayey sand, trace gravel and rootlets, damp		D	0.05				
		CLAYEY SAND WITH GRAVEL AND COBBLES - Dark grey/brown mottled orange clayey sand, with medium to coarse grained gravel and cobbles, damp		D	0.3				
	0.45	SILTSTONE - Extremely low strength, extremely weathered, light grey/brown siltstone		D	0.55				
		At 0.63m, strength increasing with depth							
	0.7	Pit discontinued at 0.7m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⊻ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341881
NORTHING: 6386764
DIP/AZIMUTH: 90°/--

PIT No: 24
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown sand, with some fine to coarse grained gravel, damp		D	0.1				
	0.16	GRAVELLY SAND - Grey/brown gravelly sand, fine to coarse grained gravel, some cobbles, damp		D	0.2				
	0.32	CLAY - Stiff, orange/brown clay, with some fine grained sand, trace gravel, M>Wp		D, pp	0.6		150 - 210 kPa		
	0.84	SANDSTONE - Very low strength, highly weathered, light grey/brown sandstone							
1				D	1.2				1
	1.25	Pit discontinued at 1.25m, slow progress							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341826
NORTHING: 6386069
DIP/AZIMUTH: 90°/--

PIT No: 25
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.12	TOPSOIL - Dark grey/brown clayey sand topsoil, trace gravel, damp		D	0.07				
	0.27	SANDY GRAVELLY CLAY - Dark grey/brown sandy gravelly clay, fine to coarse grained gravel, trace cobbles, M<Wp		D	0.2				
		CLAY - Very stiff, red brown clay, trace sand, M>Wp		D, pp	0.4		200 - 290 kPa		
	0.8	SILTY CLAY - Very stiff, yellow/brown clay, trace sand, M<Wp		D, pp	0.9		200 - 260 kPa		
1	1.04	SANDSTONE - Low strength, extremely weathered, grey/brown sandstone		D	1.1				1
	1.15	Pit discontinued at 1.15m, slow progress							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341662
NORTHING: 6385817
DIP/AZIMUTH: 90°/--

PIT No: 26
PROJECT No: 49385
DATE: 20 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown sandy clay, damp		D	0.1				
	0.3	SANDY CLAY - Very stiff, light grey/orange sandy clay, some medium to coarse grained gravel, trace rootlets, M<Wp		D, pp	0.5		280 - 340 kPa		
	0.9	SILTSTONE - Low strength, highly weathered, grey/brown siltstone		D	0.95				
1	1.0	Pit discontinued at 1.0m, slow progress							1
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341856
NORTHING: 6387300
DIP/AZIMUTH: 90°/--

PIT No: 27
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Light grey/brown sand, with gravel, trace rootlets, damp		D	0.05				
	0.15	CLAY - Very stiff, light orange/brown clay, some sand, trace organics, M≤Wp		D, pp	0.2		280 - 360 kPa		
	0.62	SANDY CLAY AND GRAVEL - Light brown mottled yellow sandy clay and medium to coarse grained gravel, M<Wp		D	0.8				
	0.9	CLAYSTONE/TUFF - Medium to high strength, moderately weathered, white claystone/tuff		D	1.0				
1									1
	1.1	Pit discontinued at 1.1m, slow progress							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342441
NORTHING: 6387266
DIP/AZIMUTH: 90°/--

PIT No: 28
PROJECT No: 49385
DATE: 19 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Dark grey/brown, clayey sand, damp		D	0.15				
	0.2	CLAYEY SAND - Grey/brown clayey sand, trace rootlets, damp		D	0.5				
	1								1
	1.7	SANDSTONE - Low to medium strength, moderately weathered, grey sandstone		D	1.75				
	1.85	Pit discontinued at 1.85m, slow progress							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342210
NORTHING: 6386884
DIP/AZIMUTH: 90°/--

PIT No: 29
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.12	TOPSOIL - Grey/brown gravelly sand, fine to coarse grained gravel, trace rootlets, damp		D	0.08				
		CLAY - Brown/red clay, some fine to coarse grained gravel, trace cobbles and rootlets, M<Wp		D	0.25				
	0.65	SANDY CLAY/CLAYEY SAND - Light grey/brown mottled red sandy clay/clayey sand, trace gravel, M<Wp							1
				D	1.3				
	1.45	SILTSTONE - Extremely low strength, extremely weathered, light grey siltstone							
				D	1.8				
	2.0	Pit discontinued at 2.0m, limit of investigation							2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341761
NORTHING: 6386844
DIP/AZIMUTH: 90°/--

PIT No: 30
PROJECT No: 49385
DATE: 18 May 09
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - Grey/brown sand, with fine to coarse grained gravel, trace organics and rootlets, trace coal, damp		D	0.05				
	0.2	GRAVELLY SAND - Light brown fine to coarse grained gravelly sand, damp		D	0.25				
	0.4	CLAY - Firm to stiff light grey/brown mottled red/orange clay, trace sand, fine to medium grained gravel rootlets, coal, M<Wp		D, pp	0.5		70 - 140 kPa		
	0.75	SANDSTONE - Extremely low strength, extremely weathered, grey/brown sandstone		D	0.8				
	0.9	Pit discontinued at 0.9m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **1**
Name: **1/0.1 - 19/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Tests are performed under a quality system certified as complying with ISO 9001: 2000. Results and conclusions assume that sampling is representative. This document shall not be reproduced except in full.

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TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.7	Very Strong Acidity
EC mS/cm 1:5	.05	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.24	7.10	Elevated
Potassium			.32	9.40	Acceptable
Calcium			.78	22.90	Very Low
Magnesium			1.65	48.50	Extreme
Aluminium			.36	10.6	Extreme
		ECEC	3.40		Very Low
		Ca/Mg	0.80		Low

Phosphate Retention Index % 7.70 Very Low PRI mgP/kg 355.1 PRI kg/ha 777.7 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.46

Structure:

Emerson Stability Class : H20 2.3 Low SAR 3.1 High SAR 5.2

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

For the purpose of onsite effluent disposal report, this soil shows very strong acidity and very low salt content. The soils ability to absorb phosphorus is very low, but to a depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with obvious milkiness and more than 50% of the aggregate affected. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates disperse with obvious milkiness and less than 50% of the aggregate affected when the water content intermediates between field capacity and that of suspension. Materials disperse when severely provoked by dilution into slurry form combined with significant mechanical action. They represent a much lower erosion risk on exposed soil but will erode if raindrop impact and running water are combined. Precautions to reduce the velocity on running water (i.e. soil conservation structures, roughened surface etc) should be employed where there is a risk (i.e. long slopes). This soil poses slight to nil limitations to effluent disposal depending of topography.

The very strong acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 80g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 200g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **2**
Name: **5/0.2 - 18/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Tests are performed under a quality system certified as complying with ISO 9001: 2000. Results and conclusions assume that sampling is representative. This document shall not be reproduced except in full.

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.9	Medium Acidity
pH in $CaCl_2$ 1:5	4.7	Very Strong Acidity
EC mS/cm 1:5	.08	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.96	5.90	Elevated
Potassium			.35	2.10	Very Low
Calcium			9.67	59.30	Low
Magnesium			4.24	26.00	Elevated
Aluminium			1.06	6.5	High
		ECEC	16.30		Moderate
		Ca/Mg	3.80		Normal

Phosphate Retention Index % 19.40 Low PRI mgP/kg 892.0 PRI kg/ha 2461.9 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.84

Structure:

Emerson Stability Class : H20 5.3 Low SAR 5.1 High SAR 5.1

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

For the purpose of onsite effluent disposal report, this soil shows very strong acidity and low salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates disperse with obvious milkiness and less than 50% of the aggregate affected when the water content intermediates between field capacity and that of suspension. Materials disperse when severely provoked by dilution into slurry form combined with significant mechanical action. They represent a much lower erosion risk on exposed soil but will erode if raindrop impact and running water are combined. Precautions to reduce the velocity on running water (i.e. soil conservation structures, roughened surface etc) should be employed where there is a risk (i.e. long slopes). This soil poses slight to nil limitations to effluent disposal depending of topography. The stability of aggregates is expected to only slightly increase with the application of high ionic strength water (i.e. effluent) as seen in the reduction of the subclass.

The very strong acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 180g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 50g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant	Authorised Signatory	Date of Report
Ryan Jacka	Simon Leake	04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **3**
Name: **12/0.4 - 18/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	4.9	Very Strong Acidity
pH in $CaCl_2$ 1:5	4.3	Extreme Acidity
EC mS/cm 1:5	.71	High Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			4.37	19.00	Extreme
Potassium			.5	2.20	Very Low
Calcium			3.88	16.90	Very Low
Magnesium			12.43	54.00	Extreme
Aluminium			1.85	8	High
		ECEC	23.00		Moderate
		Ca/Mg	0.50		Low

Phosphate Retention Index % 20.10 Low PRI mgP/kg 925.2 PRI kg/ha 2678.5 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.93

Structure:

Emerson Stability Class : H20 6 Low SAR 6 High SAR 6

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

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and high salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography. The stability of aggregates is not expected to increase with the application of high ionic strength water (i.e. effluent).

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 300g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 1800g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **4**
Name: **18/0.2 - 19/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

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TEST	RESULT	COMMENTS
pH in water 1:5	5.6	Medium Acidity
pH in $CaCl_2$ 1:5	4.5	Extreme Acidity
EC mS/cm 1:5	.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.13	4.30	Acceptable
Potassium			.13	4.30	Low
Calcium			1.25	41.70	Very Low
Magnesium			.89	29.70	Elevated
Aluminium			.55	18.3	Extreme
		ECEC	3.00		Very Low
		Ca/Mg	2.30		Low

Phosphate Retention Index % 3.70 Very Low PRI mgP/kg 171.9 PRI kg/ha 410.0 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.59

Structure:

Emerson Stability Class : H20 2.1 Low SAR 5.3 High SAR 5.2

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

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and very low salt content. The soils ability to absorb phosphorus is very low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with slight milkiness immediately adjacent to the aggregate. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates disperse with obvious milkiness and less than 50% of the aggregate affected when the water content intermediates between field capacity and that of suspension. Materials disperse when severely provoked by dilution into slurry form combined with significant mechanical action. They represent a much lower erosion risk on exposed soil but will erode if raindrop impact and running water are combined. Precautions to reduce the velocity on running water (i.e. soil conservation structures, roughened surface etc) should be employed where there is a risk (i.e. long slopes). This soil poses slight to nil limitations to effluent disposal depending of topography.

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 100g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 20g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

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SAMPLE: Batch N°: **10283** Sample N°: **5**
Name: **30/0.5 - 18/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

TEST	RESULT	COMMENTS
pH in water 1:5	5.6	Medium Acidity
pH in $CaCl_2$ 1:5	4.4	Extreme Acidity
EC mS/cm 1:5	.09	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.08	7.90	Elevated
Potassium			.21	1.50	Very Low
Calcium			4.85	35.70	Very Low
Magnesium			5.09	37.40	High
Aluminium			2.34	17.2	Extreme
		ECEC	13.60		Moderate
		Ca/Mg	1.60		Low

Phosphate Retention Index % 26.00 Low PRI mgP/kg 1197.6 PRI kg/ha 3323.3 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.85

Structure:

Emerson Stability Class : H20 2.2 Low SAR 5.1 High SAR 6

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

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and low salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with obvious milkiness and less than 50% of the aggregate affected. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography.

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 360g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 340g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **6**
Name: **9/0.1 - 19/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

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TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.8	Very Strong Acidity
EC mS/cm 1:5	.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.04	1.50	Acceptable
Potassium			.32	11.90	Acceptable
Calcium			1.77	65.60	Acceptable
Magnesium			.53	19.60	Acceptable
Aluminium			.05	1.9	Acceptable
		ECEC	2.70		Very Low
		Ca/Mg	5.50		Normal

Phosphate Retention Index % 2.40 Very Low PRI mgP/kg 110.1 PRI kg/ha 265.9 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.61

Structure:

Emerson Stability Class : H20 3.1 Low SAR 3.1 High SAR 3.1

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

For the purpose of onsite effluent disposal report, this soil shows very strong acidity and very low salt content. The soils ability to absorb phosphorus is very low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates, after remoulding at a water content equivalent to field capacity, show dispersion with slight milkiness immediately adjacent to the aggregate when immersed in water. These aggregates can be provoked into dispersion if water is combined with mechanical stress. When the impact energy of rainfall is combined with the aggregates, water erosion may be predicted. It may also show crusting and emergence problems. This soil poses a moderate limitation to effluent disposal. The stability of aggregates is not expected to increase with the application of high ionic strength water (i.e. effluent).

The very strong acidity, slightly unbalanced cations and slight potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 20g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 20g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **7**
Name: **23/0.3 - 19/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	6.1	Slight Acidity
pH in $CaCl_2$ 1:5	4.5	Extreme Acidity
EC mS/cm 1:5	.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.65	8.00	Elevated
Potassium			.23	2.80	Very Low
Calcium			2.28	28.10	Very Low
Magnesium			3.72	45.90	Extreme
Aluminium			1.2	14.8	Extreme
		ECEC	8.10		Low
		Ca/Mg	1.00		Low

Phosphate Retention Index % 15.00 Low PRI mgP/kg 688.8 PRI kg/ha 1828.8 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.77

Structure:

Emerson Stability Class : H20 2.1 Low SAR 5.3 High SAR 6

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

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and very low salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with slight milkiness immediately adjacent to the aggregate. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography.

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 200g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 300g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **8**
Name: **26/0.5 - 20/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

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TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.3	Extreme Acidity
EC mS/cm 1:5	.09	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.75	14.50	High
Potassium			.29	2.40	Very Low
Calcium			.42	3.50	Very Low
Magnesium			6.76	55.90	Extreme
Aluminium			2.9	24	Extreme
		ECEC	12.10		Moderate
		Ca/Mg	0.10		Low

Phosphate Retention Index % 25.10 Low PRI mgP/kg 1156.7 PRI kg/ha 3036.3 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.75

Structure:

Emerson Stability Class : H20 2.1 Low SAR 5.1 High SAR 6

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

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and very low salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with slight milkiness immediately adjacent to the aggregate. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography.

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 450g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 680g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **9**
Name: **14/0.1 - 20/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

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Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.9	Very Strong Acidity
EC mS/cm 1:5	.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.12	2.70	Acceptable
Potassium			.22	5.00	Low
Calcium			2.68	60.90	Low
Magnesium			1.38	31.40	High
Aluminium			.02	.5	Acceptable
		ECEC	4.40		Very Low
		Ca/Mg	3.20		Normal

Phosphate Retention Index % 8.70 Very Low PRI mgP/kg 401.3 PRI kg/ha 854.8 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.42

Structure:

Emerson Stability Class : H20 3.1 Low SAR 3.1 High SAR 5.1

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

For the purpose of onsite effluent disposal report, this soil shows very strong acidity and very low salt content. The soils ability to absorb phosphorus is very low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates, after remoulding at a water content equivalent to field capacity, show dispersion with slight milkiness immediately adjacent to the aggregate when immersed in water. These aggregates can be provoked into dispersion if water is combined with mechanical stress. When the impact energy of rainfall is combined with the aggregates, water erosion may be predicted. It may also show crusting and emergence problems. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates disperse with slight milkiness immediately adjacent to the aggregate when the water content intermediates between field capacity and that of suspension. Materials disperse when severely provoked by dilution into slurry form combined with significant mechanical action. They represent a much lower erosion risk on exposed soil but will erode if raindrop impact and running water are combined. Precautions to reduce the velocity of running water (i.e. soil conservation structures, roughened surface etc) should be employed where there is a risk (i.e. long slopes). This soil poses slight to nil limitations to effluent disposal depending on topography.

The very strong acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations: - use acid tolerant plants, such as "kikuyu" or "paspalum", which are very hardy;
- apply 20g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 80g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **10**
Name: **20/0.5 - 20/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Tests are performed under a quality system certified as complying with ISO 9001: 2000. Results and conclusions assume that sampling is representative. This document shall not be reproduced except in full.

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.4	Extreme Acidity
EC mS/cm 1:5	.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.43	3.20	Acceptable
Potassium			.33	2.40	Very Low
Calcium			5.19	38.40	Very Low
Magnesium			4.04	29.90	Elevated
Aluminium			3.49	25.9	Extreme
		ECEC	13.50		Moderate
		Ca/Mg	2.10		Low

Phosphate Retention Index % 30.40 Low PRI mgP/kg 1396.7 PRI kg/ha 3792.0 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.81

Structure:

Emerson Stability Class : H20 2.1 Low SAR 5.1 High SAR 6

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

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and very low salt content. The soils ability to absorb phosphorus is low, but to a depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with slight milkiness immediately adjacent to the aggregate. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography.

This soil poses slight to nil limitations to effluent disposal depending of topography. Stability of aggregates is not expected to increase with the application of high ionic strength water (i.e. effluent).

The extreme acidity and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 540g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable, and improve the calcium levels.

Explanation of the Methods:
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:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

ANALYTICAL REPORT

29 May 2009

Douglas Partners Pty Ltd
Box 324
Hunter Region Mail Centre
NSW 2310

Attention: **Bahareh Mansouri**

Your Reference: 49385 - Lower Belford

Our Reference: SE69463 Samples: 20 Soils
Received: 26/05/09

Preliminary Report Sent: Not Issued

These samples were analysed in accordance with your written instructions.

For and on Behalf of:
SGS ENVIRONMENTAL SERVICES

Client Services:	Simon Matthews	Simon.Matthews@sgs.com
Sample Receipt:	Angela Mamalicos	AU.SampleReceipt.Sydney@sgs.com
Laboratory Manager:	Edward Ibrahim	Edward.Ibrahim@sgs.com

Results Approved and/or Authorised by:

Nick Solarmis
Inorganics Signatory

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Inorganics Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-1 2/0.1 Soil 19/05/2009	SE69463-2 2/0.5 Soil 19/05/2009	SE69463-3 3/0.1 Soil 19/05/2009	SE69463-4 4/0.25 Soil 18/05/2009	SE69463-5 6/0.05 Soil 18/05/2009
Date Extracted (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Electrical Conductivity 1:5 soil:water	µS/cm	12	29	20	35	17
Date Extracted- (pH 1:5 soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (pH 1:5 Soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	6.3	6.3	5.6	5.8	6.3

Inorganics Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-6 7/0.15 Soil 19/05/2009	SE69463-7 13/0.5 Soil 18/05/2009	SE69463-8 14/0.5 Soil 20/05/2009	SE69463-9 15/0.05 Soil 20/05/2009	SE69463-10 16/0.25 Soil 20/05/2009
Date Extracted (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Electrical Conductivity 1:5 soil:water	µS/cm	72	270	830	13	7.2
Date Extracted- (pH 1:5 soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (pH 1:5 Soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	5.4	5.1	5.9	5.9	6.0

Inorganics Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-11 17/0.2 Soil 20/05/2009	SE69463-12 18/0.5 Soil 19/05/2009	SE69463-13 19/0.15 Soil 20/05/2009	SE69463-14 21/0.2 Soil 20/05/2009	SE69463-15 22/0.1 Soil 19/05/2009
Date Extracted (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Electrical Conductivity 1:5 soil:water	µS/cm	27	170	25	11	18
Date Extracted- (pH 1:5 soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (pH 1:5 Soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	5.9	5.8	6.3	6.0	6.5

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Inorganics Our Reference:	UNITS	SE69463-16	SE69463-17	SE69463-18	SE69463-19	SE69463-20
Your Reference	----------	22/0.5	24/0.2	25/0.2	28/0.15	29/0.25
Sample Matrix	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		19/05/2009	18/05/2009	20/05/2009	19/05/2009	18/05/2009
Date Extracted (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Electrical Conductivity 1:5 soil:water	µS/cm	45	10	6.3	31	20
Date Extracted- (pH 1:5 soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (pH 1:5 Soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	5.9	6.3	6.4	5.9	5.9

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Moisture Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-1 2/0.1 Soil 19/05/2009	SE69463-2 2/0.5 Soil 19/05/2009	SE69463-3 3/0.1 Soil 19/05/2009	SE69463-4 4/0.25 Soil 18/05/2009	SE69463-5 6/0.05 Soil 18/05/2009
Date Analysed (moisture)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Moisture	%	9	14	3	17	12

Moisture Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-6 7/0.15 Soil 19/05/2009	SE69463-7 13/0.5 Soil 18/05/2009	SE69463-8 14/0.5 Soil 20/05/2009	SE69463-9 15/0.05 Soil 20/05/2009	SE69463-10 16/0.25 Soil 20/05/2009
Date Analysed (moisture)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Moisture	%	7	20	14	10	9

Moisture Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-11 17/0.2 Soil 20/05/2009	SE69463-12 18/0.5 Soil 19/05/2009	SE69463-13 19/0.15 Soil 20/05/2009	SE69463-14 21/0.2 Soil 20/05/2009	SE69463-15 22/0.1 Soil 19/05/2009
Date Analysed (moisture)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Moisture	%	17	15	9	8	11

Moisture Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-16 22/0.5 Soil 19/05/2009	SE69463-17 24/0.2 Soil 18/05/2009	SE69463-18 25/0.2 Soil 20/05/2009	SE69463-19 28/0.15 Soil 19/05/2009	SE69463-20 29/0.25 Soil 18/05/2009
Date Analysed (moisture)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Moisture	%	15	6	9	9	14

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Method ID	Methodology Summary
SEI-037	Ammonia - Determined by salicylate colourimetric method using Discrete Analyser.
AN106	Conductivity and TDS by Calculation (cTDS) - Conductivity is measured using a conductivity cell and dedicated meter, in accordance with APHA 21st Edition, 2510. TDS is calculated by TDS(mg/L)=0.6 x Conductivity(µS/cm).
AN101	pH - Measured using pH meter and electrode based on APHA 21st Edition, 4500-H+. For water analyses the results reported are indicative only as the sample holding time requirement specified in APHA was not met (APHA requires that the pH of the samples are to be measured within 15 minutes after sampling).
AN002	Preparation of soils, sediments and sludges undergo analysis by either air drying, compositing, subsampling and 1:5 soil water extraction where required. Moisture content is determined by drying the sample at 105 ± 5°C.

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QUALITY CONTROL Inorganics	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD
Electrical Conductivity 1:5 soil:water	µS/cm	1	AN106	<1.0	SE69463-1	12 || 8.9 || RPD: 30
Date Extracted- (pH 1:5 soil: Water)				[NT]	SE69463-1	27/05/2009 || 27/05/2009
Date Analysed (pH 1:5 Soil: Water)				[NT]	SE69463-1	27/05/2009 || 27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	0	AN101	[NT]	SE69463-1	6.3 || 6.3 || RPD: 0

QUALITY CONTROL Moisture	UNITS	LOR	METHOD	Blank
Date Analysed (moisture)				[NT]
Moisture	%	1	AN002	<1

QUALITY CONTROL Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Electrical Conductivity 1:5 soil:water	µS/cm	SE69463-10	7.2 || 7.7 || RPD: 7
Date Extracted- (pH 1:5 soil: Water)		SE69463-10	27/05/2009 || 27/05/2009
Date Analysed (pH 1:5 Soil: Water)		SE69463-10	27/05/2009 || 27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	SE69463-10	6.0 || 6.0 || RPD: 0

QUALITY CONTROL Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Electrical Conductivity 1:5 soil:water	µS/cm	SE69463-20	20 || 21 || RPD: 5
Date Extracted- (pH 1:5 soil: Water)		SE69463-20	27/05/2009 || 27/05/2009
Date Analysed (pH 1:5 Soil: Water)		SE69463-20	27/05/2009 || 27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	SE69463-20	5.9 || 5.9 || RPD: 0

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Result Codes

[INS]	:	Insufficient Sample for this test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Requested	*	:	Not part of NATA Accreditation
[NT]	:	Not tested	[N/A]	:	Not Applicable

Report Comments

Samples analysed as received. Solid samples expressed on a dry weight basis.
Date Organics extraction commenced:
NATA Corporate Accreditation No. 2562, Site No 4354
Note: Test results are not corrected for recovery (excluding Dioxins/Furans*)
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Quality Control Protocol

Method Blank: An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.
Duplicate: A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard: Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard of retention time and/or response, which is invariant from run-to-run with the instruments.
Laboratory Control Sample: A known matrix spiked with compound(s) representative of the target analytes. It is used to document laboratory performance. When the results of the matrix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.
Matrix Spike: An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Quality Acceptance Criteria

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

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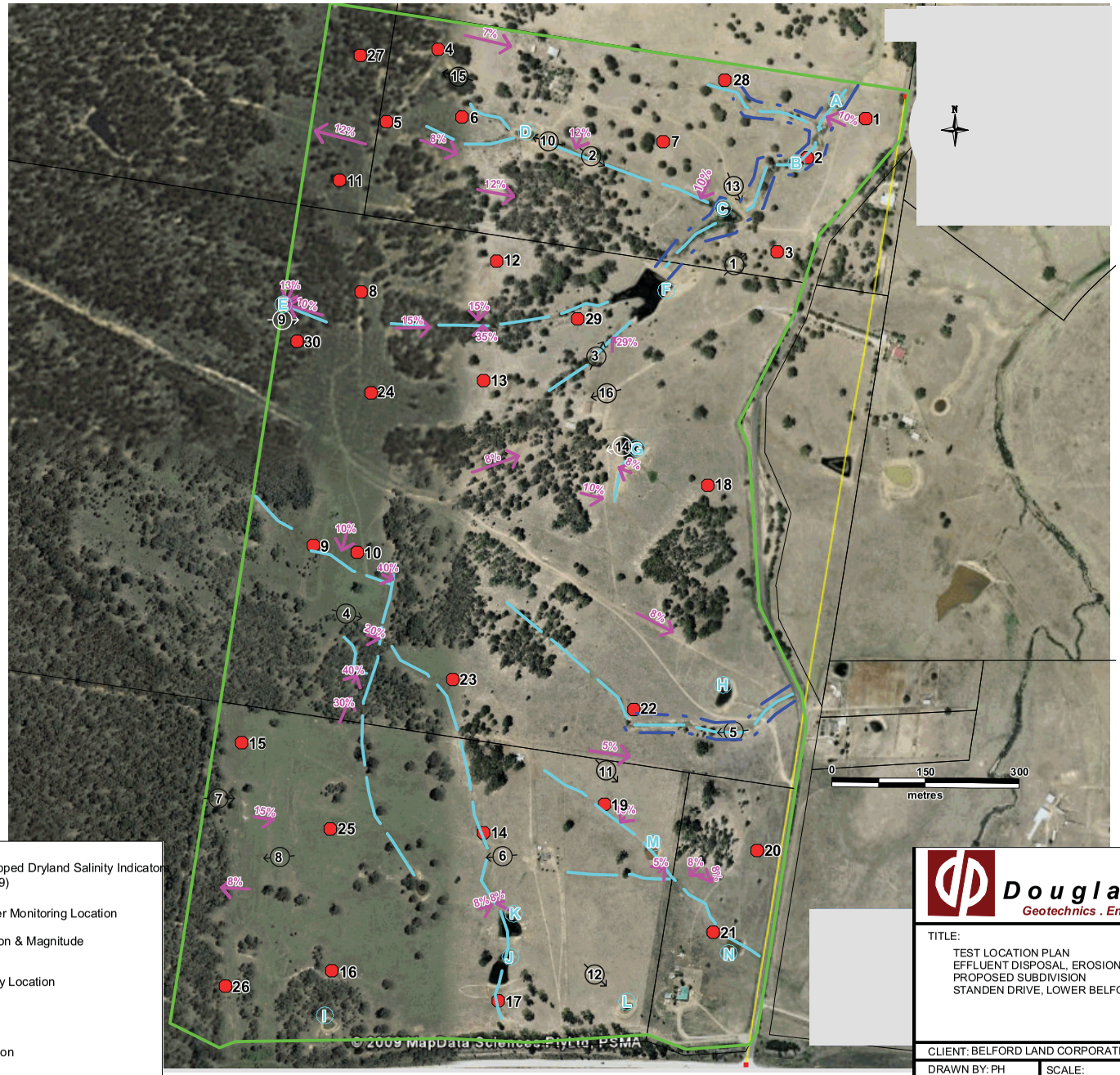

Douglas Partners
Geotechnics . Environment . Groundwater

TITLE:
TEST LOCATION PLAN
EFFLUENT DISPOSAL, EROSION & SALINITY ASSESSMENT
PROPOSED SUBDIVISION
STANDEN DRIVE, LOWER BELFORD

CLIENT: BELFORD LAND CORPORATION

DRAWN BY: PH	SCALE:	PROJECT No: 9385	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1