2155 SUTTON ROAD, SUTTON - INTEGRATED ASSESSMENT

Land Capability

Flora and Fauna

Watercourse and Groundwater

Dryland Salinity

Version 2
08 July 2019

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Servicing the agriculture, conservation and development sectors with soil and water management advice, land capability and soil assessment, erosion control and soil conservation planning, catchment and property planning, and natural resource management policy advice.

Contents

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John Franklin has over 30 years' experience in natural resource management in the ACT and Upper Murrumbidgee region. This experience includes providing extensive soil and water management advice to State and Local Government and the urban / rural residential development sector across the region. John has detailed knowledge of water resource policy and developed the NSW Farm Dams Policy in 1999 for the Department of Land and Water Conservation and provided strategic support and direction to the NSW water reform process.

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LAND CAPABILITY ASSESSMENT

PROJECT DESCRIPTION

Summary

Soil and Water was engaged by PHL Surveyors on behalf of their client, Paul Keir, to provide a range of services to support the proposed 23 lot subdivision of 2155 Sutton Road, Sutton (Lot 1 DP32236).

The subdivision of the existing 73-hectare parcel will create the following lots:

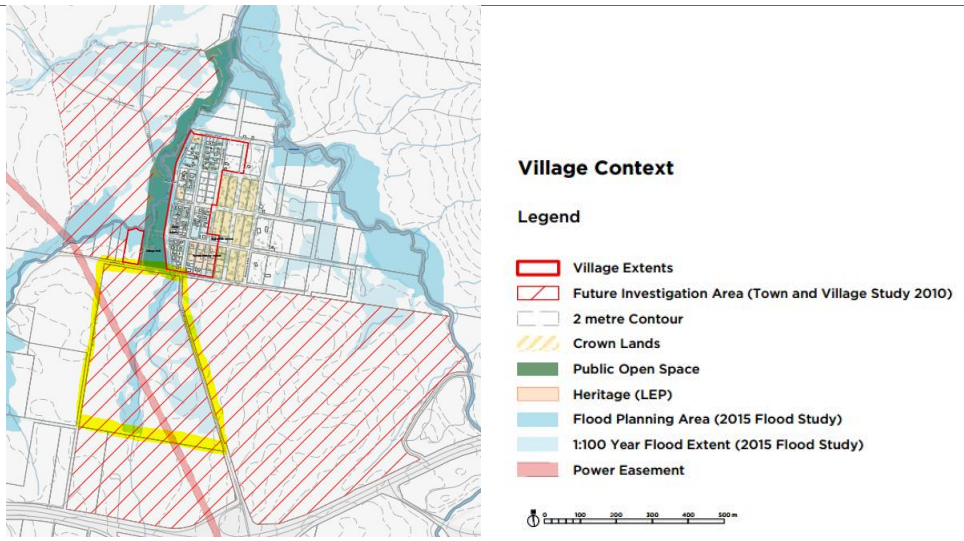
- **Lots 1-20** 20 large residential lots with average size of 0.5 hectares each containing a building entitlement. These lots will front Majura Lane (Guise Street).
- **Lot 21** located between the central drainage depression, proposed Sutton bypass route and Sutton Road. This lot will include a new dwelling entitlement.
- **Lot 22** located in the south east corner of the block and containing the existing dwelling and associated sheds and outbuildings.
- **Lot 23** located in the south west corner of the block containing the existing horse yards and shelters. This lot will include a new dwelling entitlement.

It is proposed that potable water supply for the existing and proposed dwellings will be through the independent capture and storage of roof water in potable water tanks.

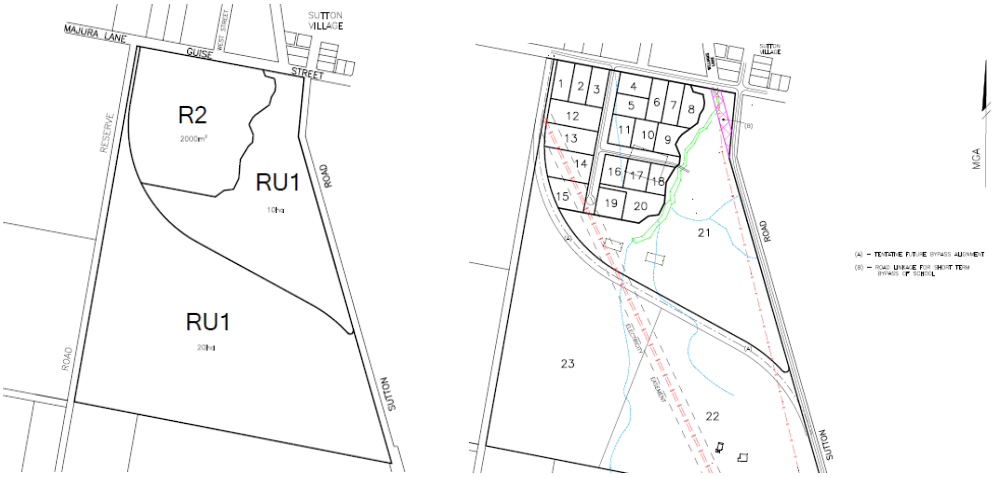
All lots will dispose of domestic effluent on-site via independent effluent treatment and disposal systems. High quality treated and disinfected effluent generated by these systems will help offset the potable water requirements for each lot and make these independent water supplies more viable.

The area is currently zoned RU1 – Primary Production under Yass Valley Local Environmental Plan 2013. The Lot Size Map LSZ_005 has a minimum lot size of 40 hectares in this area. It is understood that a Master Planning process for the village of Sutton has been ongoing for some time. The draft Master Plan, dated December 2016[1], identifies Lot 1 DP32236 as part of the investigation area, refer below.

[1] Prepared by e8urban pty ltd for Yass Valley Council



The rezoning proposed will create a mixture of rural zoned land (RU1) and low-density residential land (R2). The R2 low density residential zoning has a minimum lot size of 2000m^2, except where there is no reticulated sewage, where the minimum lot size is 5000m^2 – this provision applies to the low-density residential lots proposed, refer below.



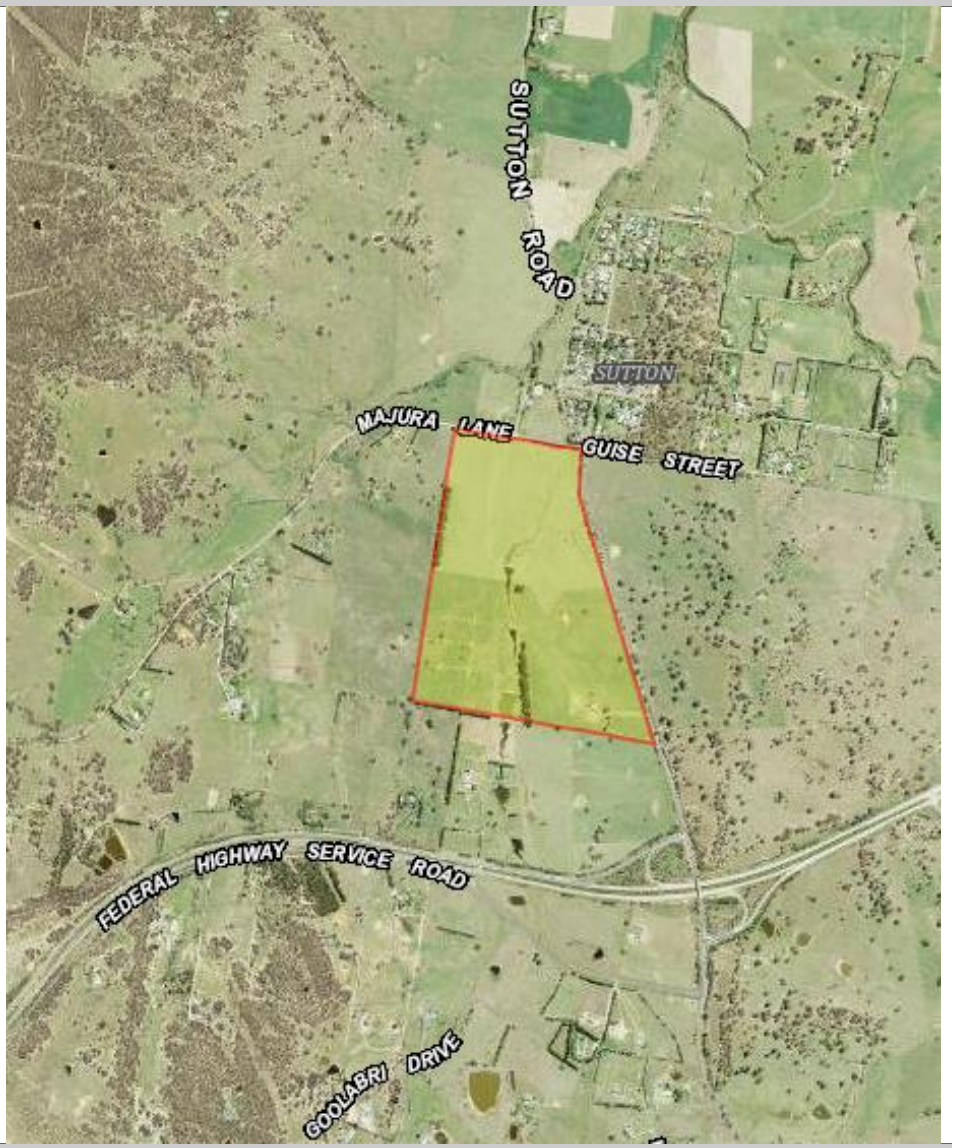
Constraints to on-site effluent management and dwelling construction have been assessed in accordance with:

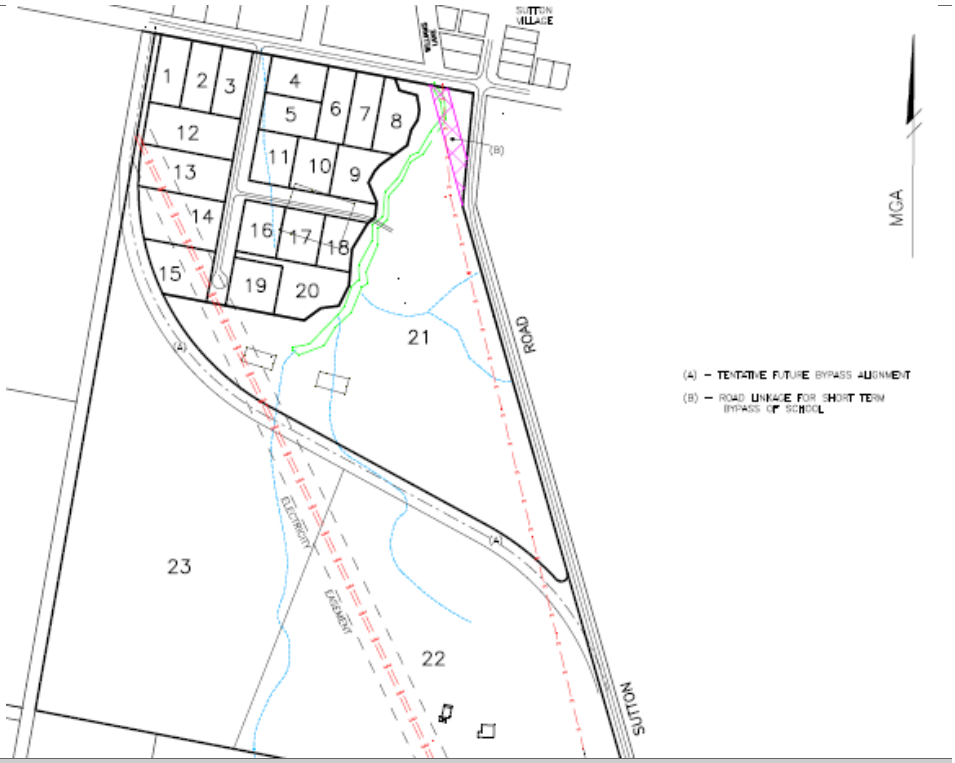
- assessment of on-site effluent capability, based on Appendix C of ANZ Standard 1547:2012, *Site and Soil Evaluation for Planning, Rezoning and Subdivision of Land* and also the NSW guideline*, The Silver Book*;
- assessment of land capability for dwellings is based on excluding land which has a slope grade in excess of 15 %, saline, waterlogged or eroding and is as a result constrained for the construction of dwellings.

Separate assessments have been conducted to determine the suitability of the planned rural residential dwelling lots based on:

- Degree of impact on flora, fauna and biodiversity values attributable to each lot and the availability of mitigation options

	• Degree of impact on watercourses and groundwater aquifers, including the availability of mitigation options and water licensing and/or approvals • Degree of impact on, or from, dryland salinity. It is considered that there are adequate areas of suitable site and soil conditions located on the proposed low-density residential Lots 1 – 20, to enable the on-site dispersal of effluent in association with the proposed dwelling sites. Some of the lots adjacent to and/or containing minor drainage depressions will be moderately constrained by drainage buffers and the location of Building Envelopes and effluent system layout and design will need to accommodate these constraints. Proposed Lot 21 is moderately constrained by the dam and drainage buffers associated with the drainage depressions flowing west from culverts beneath the Sutton Road. There is an adequate area of suitable site and soil conditions to enable the onsite disposal of domestic effluent and the Building Envelope will need to accommodate the onsite constraints identified. The existing effluent management system on proposed Lot 22 will not be impacted by the proposed subdivision and is therefore adequate to continue to manage effluent generated from the existing dwelling. Proposed Lot 23 includes an area constrained by the drainage buffer along the main central watercourse. There are also small areas of dryland salinity and seasonal waterlogging which are constrained for onsite effluent disposal. There is a large area of unconstrained land which is suitable for onsite effluent disposal. The siting of the Building Envelope will need to consider the constraints identified on the lot. The development will not adversely impact groundwater or surface water resources providing it is implemented in accordance with the recommendations of this report and relevant Council conditions. The development also not adversely impact dryland salinity, nor will it be adversely impacted by this issue.

SITE & DEVELOPMENT INFORMATION	
Local Government Area	Yass Valley Council.
Address	Lot 1 - DP 32236, 2155 Sutton Road, Sutton, NSW
Site Location (six.nsw.gov.au)	
Developer(s)	Paul Keir C/- PHL Surveyors Attention: Alan Longhurst 13 Gibraltar Street Bungendore, NSW www.phlsurveyors.com.au

Proposed subdivision layout:	
Intended water supply	Potable water will be provided through roof catchment and tank storage. Potable water supplies will be independent for each new dwelling lot and will be managed by the landholder. The amount of potable and non-potable water required to support a household varies depending on the type and size of garden, number of occupants and occupancy patterns, and water usage patterns. Many households in rural areas provide all potable and non-potable water requirements through roof catchment and tank storage. Therefore, it is considered a viable water supply for these purposes. Independent non-potable water supply systems generally lead to more conservative household water use as people actively monitor and manage water use commensurate with the amount of stored water available, thereby reducing the amount of non-potable water required and the impact on the broader environment. Using an independent water supply (as opposed to a reticulated non-potable supply), reduces the estimated daily effluent load generated by an average house. For example, a 4-bedroom household with an independent water supply will generate 600 litres of wastewater per day whereas the same household with reticulated supply will generate 750 litres per day, an increase of 25%. The reduced wastewater load is beneficial to the environment and more cost efficient for the household, which can manage with a smaller less expensive wastewater treatment system.

	Independent water supplies for each dwelling lot can also be more resilient during periods of drought as minimum roof area and large tank storage capacity, combined with more conservative household water use and active monitoring and management of water use, results in households managing consumption commensurate with diminishing water availability through the course of the drought. Reliance on a reticulated water supply can create a complacency around water use which encourages landowners to establish higher water use gardens, landscape plantings and habits which then require an unsustainable level of water use during dry periods. This accelerates the decline in the availability of the reticulated water supply and can lead to the complete failure of the reticulated water supply severely impacting all users. Water users in these scenarios tend to blame the adequacy of the water supply rather than reflect on their water use habits. Failures of a limited number of independent water supplies during drought are easier to manage and tend to lead to a change in practice amongst the effected landholders, who observe other households (with different practices) being able to manage through drought. There are also several measures which can be employed to increase the viability of roof catchment and tank storage as the primary water supply. These include mandating minimum roof catchment areas (dwelling and sheds); mandating minimum tank storage requirements; and mandating water saving water fixtures throughout all dwellings. Another key water efficiency measure is requiring each new dwelling to install Aerated Wastewater Treatment Systems which enables the beneficial re-use of treated effluent for garden irrigation. For a 4-bedroom household this can deliver an estimated 219,000 litres of treated effluent for garden. ***The development will require each new dwelling lot to have a minimum roof catchment area and tank storage capacity. In addition, all lots will have an Advanced Aerated Wastewater Treatment System which will provide high quality treated effluent for beneficial reuse, thereby reducing the amount of non-potable water required from other sources, to sustain areas of lawn/garden.***
Effluent Management	Effluent for the new building envelopes created by subdivision will be managed on-site via a combination of Aerated Wastewater Treatment Systems (AWTS) or Advanced Aerated Wastewater Treatment Systems (AWTS + Nutrient Reduction [NR]), combined with effluent dispersal of surface spray or drip, or subsurface irrigation. The higher quality effluent generated by AWTS + NR treatment systems, combined with the lower risk subsurface drip irrigation dispersal system, will be used in the more constrained areas associated with the Low Density Residential Lots 1-20, which correspond to the area of groundwater vulnerability and are within the buffer distance required from existing groundwater bores.

	The lower density rural Lots 21 & 23, will use Aerated Wastewater Treatment Systems (AWTS), combined with effluent dispersal of surface spray or drip, or subsurface irrigation. The dwelling constructed on proposed Lot 22 will continue to use the existing treatment system in accordance with Council requirements. ***Lots 1-20 will use Advanced Secondary Effluent Treatment Systems, including Nutrient Reduction and Disinfection, combined with sub-surface drip irrigation, to minimise potential impacts to the vulnerable groundwater systems and surrounding bores.***
Local experience	The major constraints related to on-site effluent dispersal are the buffer distances required from drainage depressions and dams. Many similar rural residential developments have been established in the region which share a similar range of constraints. Generally, these have not posed significant problems to the successful establishment and operation of rural residential land use and related infrastructure.

Figure 1: Gently undulating improved pasture grazing country including some farm dams

Figure 2: 2nd order stream intersecting the property flowing south to north to McLaughlins Ck.

SITE & SOIL ASSESSMENT	
Climate	Cool temperate climate with mean annual rainfall of approximately 650 mm, pan evaporation 1200mm; large moisture deficit typically occurs in summer months, small moisture surplus typically occurs in winter months. ***Climate is well suited to dispersal by surface and subsurface irrigation of secondary treated, disinfected effluent.***
Exposure	The majority of the site is exposed with only small areas on Lot 22 (western boundary) and Lot 23 (north western boundary) have some protection from shelter belt plantings of exotic pine trees. The remainder of the property has very limited scattered paddock trees and some roadside vegetation along Sutton Road. ***The level of exposure is highly favorable for dispersal of secondary treated effluent via surface or subsurface irrigation.***
Slope	The site displays a range of slope gradients, from flat to small areas of low to moderate slopes up to 10%. Elevations generally range between 650-670 metres. ***The low to moderately sloping land (6-10% gradient) presents a low to moderate constraint to surface irrigation development but is generally a low constraint to other forms of effluent dispersal and are generally not a constraint to dwelling construction - therefore no slope areas have been mapped as constrained.***
Landscape	The landscape is dominated by the central 2nd order stream which flows south to north to join McLaughlins Creek and eventually flow to the Yass River. This 2nd order stream includes three significant on-stream dams which are all located on proposed Lots 21-23. The low slope areas adjacent to the central drainage depression rise to gently undulating sideslopes intersected by minor drainage depressions. These areas have been significantly improved for grazing. The westerly sideslope adjacent to Sutton Road receives upslope run-on water through several road culverts which then flow through minor drainage depressions to join the central 2nd order stream. The slope form of the areas considered suitable for effluent dispersal on Lots 1-20, is generally flat or divergent (i.e. spreading rather than concentrating flows). Areas of convergent slope form generally coincide with drainage depressions and are most often mapped within the watercourse buffers.

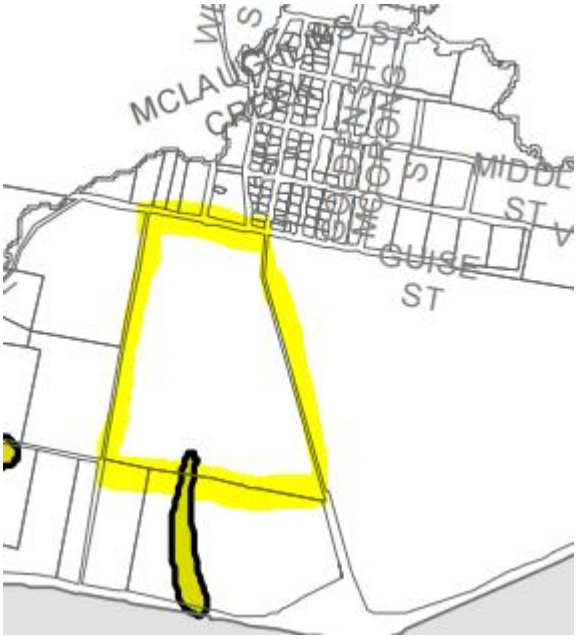
Surface rock and outcrop	Outcropping rock is confined to a limited area adjacent to the western boundary on proposed Lot 1 and 12. This area has a moderate 10% slope and a localised rock outcrop making it constrained for effluent dispersal. ***Rocky outcrops (and associated shallow soils) have been mapped as a constraint to effluent disposal, refer Figure 4.***
Hydrology	The weakly structured fine sandy to silty loam textured topsoil across the site has a moderate permeability, of 0.5 to 1.5 m/day, (table M1 of ANZ Std 1547:2012). Soil permeability combined with slope form, topography and groundcover greatly influence the amount of rainfall that becomes runoff or alternatively soaks into the soil profile to be used by evapotranspiration in plants, evaporation or moves to the groundwater system. Approximately 5-10% of annual rainfall forms surface runoff, although in individual high intensity storm events over 50% of rainfall may form runoff. Rainfall which infiltrates soil generally drains vertically through the soil profile until it meets a less permeable subsoil layer (e.g. hard pan or clay layer), where a significant proportion drains laterally downslope as subsurface flows. The flat to low slope landscapes of the site, in conjunction with good groundcover and moderately permeable soils, contribute to lower rates of runoff and higher rates of infiltration. This is demonstrated by the general lack of sheet, rill or gully erosion across the property. Development within catchments can change the hydrology by increasing the amount of compacted and non-permeable hard stand areas, thereby reducing infiltration and subsurface flows. This results in an increase in surface water runoff which can increase the erosion risk and decrease the reliability of baseflows in major creeks which are often driven by groundwater. In order to reduce the impact of development on hydrology it is important to minimize the extent or footprint of disturbance and contain this within areas defined as suitable for the purpose. Given the lot size of the proposed additional dwelling lots of 5,000m^2 and minimal additional road infrastructure to be created as a result of the subdivision, it is considered the potential for the subdivision to change local hydrology will be minimal. Furthermore, the location of the proposed additional dwelling lots are in areas of low slope and good groundcover which will help to assimilate any additional surface water runoff generated and convert this to infiltration or subsurface flows.

	There are small areas of the property mapped which show signs of regional waterlogging and are constrained for effluent dispersal and dwelling construction. ***Areas mapped as seasonally waterlogged are constrained for effluent dispersal and dwelling construction, refer Figures 4 & 5.***
Soils	Detailed soil profile descriptions from the proposed subdivision lots are provided in **Appendix 2** of this report. The soils on the property correspond primarily to the Winnunga Soil Landscape Unit with a small area of the Gundaroo Soil Landscape Unit associated with the alluvial creek flats along the 2nd order stream (*Soil Landscapes of the Canberra 1:100,000 Sheet*. Jenkins,B. 2000). Land which is considered suitable for effluent dispersal on the proposed building envelopes on Lots 2-19, is associated with the Winnunga Unit. The soil types are red and brown chromosols. These were formed mostly in situ on Ordovician metasediments of the Pittman formation. Suitable soils comprise a massive to weakly structured fine sandy loam textured upper layer overlying a moderately structured red-brown coloured sandy light clay subsoil. Soil depth varies considerably but is typically greater than 100 cm, with shallower soil in the localised areas of rock outcrop. The areas adjacent to the 2nd order stream creeks coincide with Gundaroo Soil Landscape. These soils also include Bleached Red and Brown Chromosols. These soils are generally unsuited to effluent dispersal as they fall within the buffer zones from creeks and drainage depressions. ***The suitable effluent dispersal areas of Red and Brown Chromosol soils of the Winnunga Unit have an adequate depth combined with moderate phosphorous sorption level, non-saline subsoils and low exchangeable sodium. As such the soils are free of any significant chemical limitations to effluent dispersal.***

CONSTRAINTS ANALYSIS

Soil erosion

The property carries good level of groundcover across all areas which have assisted in maintaining soil stability and minimising erosion. The property is not included in the Yass Valley Local Environment Plan 2013 – Natural Resources Land Map – Sheet NRL_005 as having highly erodible land.



Sensitive Land
Dryland Salinity
High Soil Erodibility

The soils of the Winnunga Unit which cover most of the property, are moderately susceptible to erosion, particularly moderate to severe gully erosion where these soils coincide with drainage depressions. The low slope, flat to divergent slope form and good groundcover, have largely prevented erosion from occurring across most of the landscape. There was no major gullying, sheet or rill erosion observed and the only minor erosion issues related to sites on the 2nd order stream as discussed below.

The major drainage depression is occupied by soils of the Gundaroo Soil Landscape Unit which are highly erodible soils with streambank and gully erosion common. This soil type is restricted to low slope riparian areas adjacent to and occupying the main drainage depression. There was only minor evidence of erosion on these soils, and this was associated with areas where stock tracks, creek crossings and dam overflows had created minor areas of active gully erosion. There was some more significant historical creek bank erosion below the wall of the dam which is situated on the southern property boundary in Lot 22 (Dam 5). This area or erosion has largely stabilised as a result of upstream dam construction diverting flows around the site.

	These riparian erosion issues are discussed in more detail in the Watercourse and Groundwater Assessment section of this report, general recommendations relating to these sites are included below. **Recommendations** • The two minor gully heads located on Lot 21 are associated with the overflow of the Dam 3 (last onstream structure) on Lot 21. These areas need to be stabilised by shaping and rock armouring the gully head with 150-200mm heavy ballast rock underlain by a suitable grade geotextile • An area of minor rill/gully erosion exists on the eastern side of the main drainage depression on Lot 21 where the drainage from upslope road culverts and the overflow of a small farm dam (Dam 1 on Lot 21 and possibly to be removed) enter the main stream. This area should be carefully managed through the removal of stock and allowing vegetation to regenerate and stabilise the site. • A series of minor lateral gully heads exist in various places along the main drainage depression. These have been caused by stock tracks concentrating upslope run-off and directing this over the steep sides of the drainage depression. These areas should be carefully managed through the removal of stock and allowing vegetation to regenerate and stabilise the streambanks. • The subdivision does not require the construction of any crossings however if these are subsequently required they should be appropriately designed, built and maintained to reduce the risk of erosion in the sensitive riparian environment and advice should be sort from the DPI Water and Water NSW regarding the need for a controlled activity works approval.
Salinity	Salinity impacts grazing and crop production, water quality and contributes to increased erosion which in turn further reduces production and water quality. It is caused by changed land use, including clearing of native perennial deep-rooted vegetation and agricultural land management activities, resulting in increased accessions (recharge) to groundwater tables from rainfall. This results in groundwater tables rising and bringing salts which are contained in geology and subsoil stores into the root zone of vegetation impacting growth and production. In certain parts of the landscape, groundwater tables may discharge on the surface in what are called discharge sites. These are particularly vulnerable to reduced vegetative growth and can eventually deteriorate until they are denuded of groundcover and become saline scalds. Once bare, these sites are prone to erosion, particularly given they often coincide with drainage lines and areas of overland flow. Salinity effected land is constrained for effluent dispersal as vegetation vigour is reduced therefore reducing the effectiveness of evapotranspiration in dispersing effluent; water tables are high therefore effluent may contribute to this elevated level as well as potentially contaminate groundwater; and irrigation onto bare and scalded areas is likely to convert into contaminated runoff.

Salinity management often involves the reinstatement of deep rooted perennial vegetation in recharging parts of the landscape in conjunction with reinstating or maintaining good groundcover on saline discharge areas to prevent erosion. Dryland salinity is a significant issue in the Yass Valley Local Government area and the Yass River has been considered a priority salinity catchment within the Murray Darling Basin.

The Yass Valley Local Environment Plan recognises the significant potential for dryland salinity in the Part 6 Additional Local Provisions, Section 6.6 Salinity. This section requires that:

Before determining a development application for development on land to which this clause applies, the consent authority must consider the following:

(a) whether the development is likely to have any adverse impact on salinity processes on the land,

(b) whether salinity is likely to have an impact on the development,

(c) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or

(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or

(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

A small section of the property is included in the Yass Valley Local Environment Plan 2013 – Natural Resources Land Map – Sheet NRL_005 as having land impacted by dryland salinity, see map.

There was evidence of dryland salinity on the property when inspected. Signs include indicator species such as spiny rush, areas of poor pasture growth, bare scalded sites and the crusting of salts on the surface. These areas have been mapped as constrained to both effluent dispersal and dwelling construction

	The separate Dryland Salinity section addresses this issue in more detail however some general recommendations for salinity management follow: **Recommendations** • Effluent dispersal should not occur in areas mapped as salinity effected • Dwelling construction should not be undertaken in areas mapped as salinity effected • Areas mapped as salinity effected should be managed to maintain reinstate and/or manage >70% groundcover • The area of deep rooted perennial pasture should be maintained as far as practical • Trees and shrubs should be retained and increased where possible • The watering practices adopted in newly created dwellings should minimise potential accessions to the shallow water table but not overwatering/irrigating
Groundwater	The site is mapped as having Moderate groundwater vulnerability on the Department of Land and Water Conservation (2001) Groundwater Map of the Murrumbidgee Catchment. The northern end of the site including most of the low density residential Lots 1-20 are also mapped as groundwater vulnerable on the Riparian Lands and Watercourses Map Groundwater Vulnerability – Sheet CL2_005 in the Yass Valley Local Environment Plan 2013, refer below.  **Watercourses** Watercourse **Groundwater** Groundwater Vulnerability As the area is mapped as groundwater vulnerable the Part 6 Additional Local Provisions 6.4 Groundwater vulnerability require that : *Before determining a development application for development on land to which this clause applies, the consent authority must consider the following:* *(a) the likelihood of groundwater contamination from the development (including from any on-site storage or disposal of solid or liquid waste and chemicals),*

	(b) any adverse impacts the development may have on groundwater dependent ecosystems, *(c) the cumulative impact the development may have on groundwater (including impacts on nearby groundwater extraction for a potable water supply or stock water supply),* *(d) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.* *(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:* *(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or* *(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or* *(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.* There are 18 bores within 500m of the low-density residential Lots 1-20. The property also has a registered bore (GW 403659) located on proposed Lot 22. The closest bore to potential effluent dispersal area is GW 401311 located 80m north of Lots 6-8. This bore is 32m deep with a non-saline yield of 0.315L/sec and a water bearing zone between 9-15m. The bore is located on the Sutton Recreation Ground and is not used for domestic purposes. Higher yielding water bearing zones / aquifers are located deeper than 27m, for example the bore on the property (GW 403659) is 54m deep with water bearing zones at 27-29m/30-33m/39-42m. This bore yields 1.5 L/sec.

There is a low risk of contamination to the groundwater system, given the deep cover of low permeability clay subsoil and bedrock between areas suitable for effluent dispersal and water yielding zones; the relatively low rate of effluent application to the surface which will occur at each dwelling site; high quality advanced secondary treated and disinfected effluent and a minimum spatial separation of > 50m.

The Watercourse and Groundwater section addresses the groundwater issues in more detail however some general recommendations include:

Recommendations

- All low-density residential Lots 1-20 will use Advanced Aerated Wastewater Treatment Systems combined with subsurface drip irrigation. This provides the highest quality treated effluent and the subsurface irrigation minimises the risk of treated effluent being mobilised to contaminant nearby downslope bores.

- Maintain a minimum 50 m buffer[2] between the existing bore and any constructed bores from existing or future effluent dispersal areas.
- A water supply work approval must be sought prior to constructing a bore or well even though each landholder is entitled to take water from an aquifer which is underlying their land for domestic consumption and/or stock watering without the need for a water access licence under Basic Landholder Rights (the application is available at www.water.nsw.gov.au and the fee is currently $241.83)

Riparian lands

Yass Valley Local Environment Plan 2013 does not include the 2nd order stream on the property in the Riparian Lands and Watercourses Groundwater Vulnerability Map – Sheet CL2_005, although McLaughlins Creek to the west and north is included.

NSW DPI Office of Water (Guidelines for riparian corridors on waterfront land) defines appropriate riparian buffer for various stream orders to maintain the integrity of these sensitive areas, as below:

Figure 2. The Strahler System

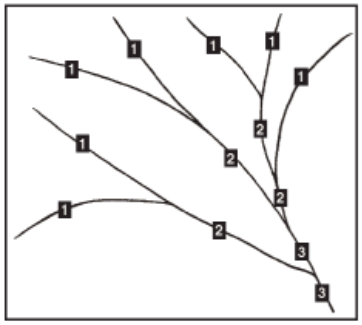


Table 1. Recommended riparian corridor (RC) widths

Watercourse type	VRZ width (each side of watercourse)	Total RC width
1st order	10 metres	20 m + channel width
2nd order	20 metres	40 m + channel width
3rd order	30 metres	60 m + channel width
4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

For 2nd order streams, such as the drainage depression which flows through the centre of the property, a riparian corridor of 20 metres either side of the creek is required. The small 1st order stream which flows from the south east to join the central 2nd order stream will require a 10 metre riparian corridor. Within this corridor built infrastructure, with the exception of approved crossings, are generally incompatible with the NSW DPI Office of Water Guidelines -this includes dwellings. These riparian corridors have been mapped as constraints to dwelling construction in **Figure 5.**

Recommendations

- No infrastructure will be constructed within the 20m riparian corridor (as mapped in **Figure 5**).

[2] Assuming the maximum buffer distance from Groundwater recommended in the Australian Standard (AS1547:2012) is considered appropriate and conservative given the site and soil constraints are considered at the lower end of the constraint scale with category 4 & 5 soil permeability, (Table R2, pp187, AS1547:2012).

	• No infrastructure will be constructed within the 10m riparian corridor (as mapped in **Figure 5**). • If any creek crossing points are required in the future for the subdivision, temporary and permanent sediment and erosion control measures will be required to ensure the integrity and stability of the creeks are maintained. This will likely require the development of an erosion and sediment control plan for the DPI Water as part of the Controlled Activity Approval.
Drainage buffers - effluent dispersal	The *ANZ Standard 1547:2012 On-site Domestic Wastewater Management and On-site* and *Sewage Management for Single Households* (The Silver Book) NSW Govt, 1998, require appropriate buffers between drainage depressions, creeks and rivers and effluent dispersal areas. These include a 40 metre buffer between effluent dispersal areas and any water bodies including minor intermittent waterways and drainage channels, dams and culverts. The 2nd order stream which parallels Lots 1 and 20 will require a 40m buffer for effluent dispersal. This may impact the location of effluent dispersal areas on Lots 8,9 & 18. A small drainage depression which parallels the main drainage depression further to the west will require a 40m buffer for effluent dispersal. This will potentially impact effluent dispersal on Lots 3,4 & 5. The drainage depressions below the numerous road culverts on the Sutton Road will also require 40m buffers from effluent dispersal areas. This will impact effluent dispersal on Lot 21. Dam and drainage buffers will also influence the location of an appropriate Building Envelope on Lot 23. The existing effluent disposal practices on Lot 22 are located outside the dam and drainage buffers located on the lot. The dams located across the property will all require a 40m buffer from effluent dispersal which will influence the location of appropriate unconstrained Building Envelopes. All dam and drainage buffers have been mapped as constrained for effluent disposal in **Figure 4**. **Recommendations** • The land designated for effluent dispersal on proposed Lots 1-23 will require a minimum 40m buffer distance off all drainage depressions mapped in **Figure 4**. • The land designated for effluent dispersal on proposed Lots 1-23 will require a minimum 40m buffer distance from all dams mapped in **Figure 4**.

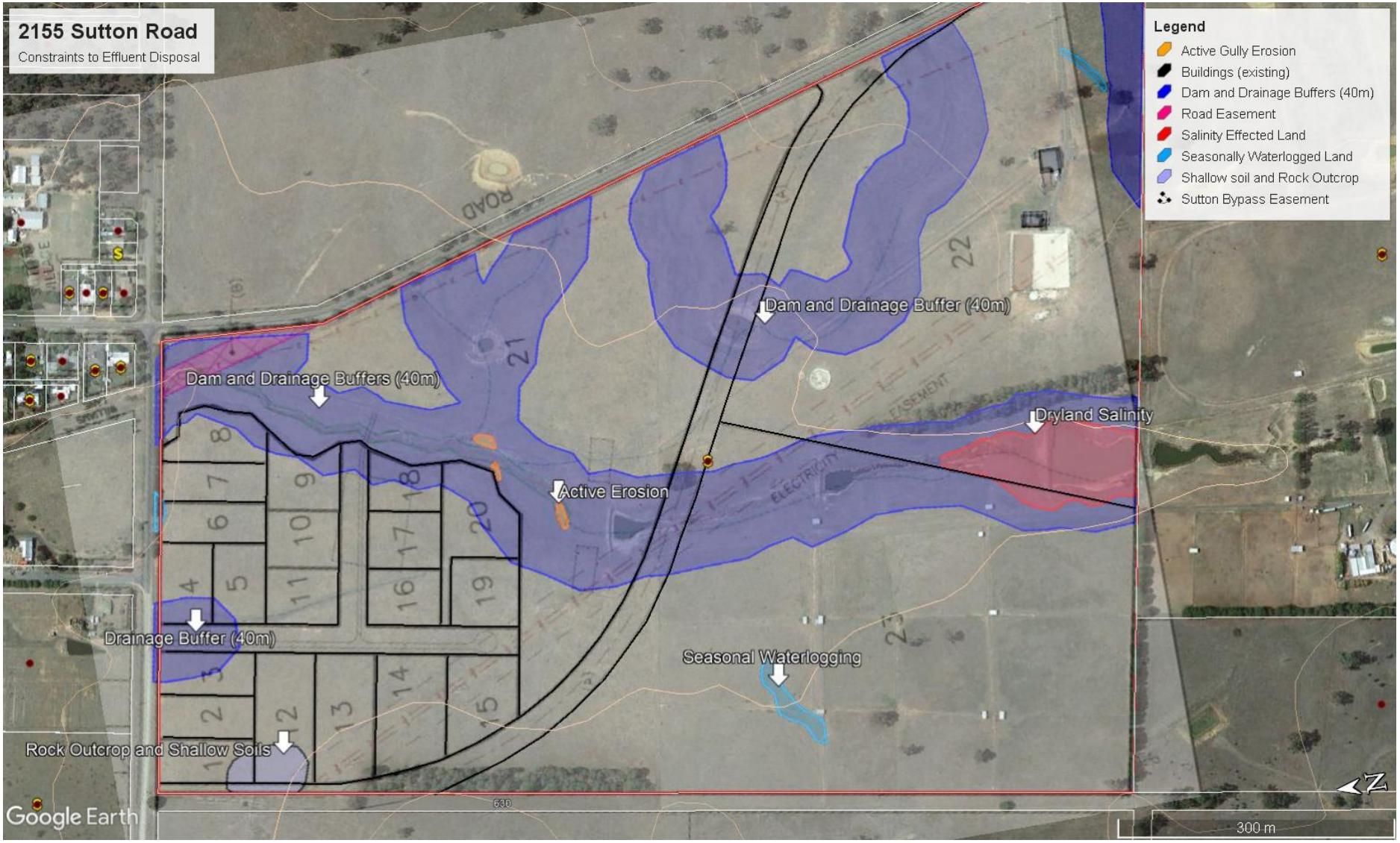


Figure 4: Constraints to Effluent Dispersal – dam and drainage buffers, erosion, salinity, seasonal waterlogging and rocky outcrops

MANAGEMENT OF EFFLUENT

Summary

This report assesses the general availability of adequate sized areas of land which are well drained, gently sloping and with moderately deep soil cover and suitable site conditions for the dispersal of effluent on the proposed new dwelling lots, Lots 1-23 (excluding Lot 22 with the existing dwelling).

For all sites, a minimum area of 1,300 m^2 has been used as the benchmark for the area required for the effluent dispersal. This is a conservative approach, given that an irrigation area for a six-bedroom dwelling will be around 550 m^2, but accounts for the requirement to have a reserve area, plus allows for buffers from buildings, boundaries and driveways.

The constraints analysis has identified the level of constraint to effluent disposal attributable to each proposed lot as follows:

- LOW – few constraints to onsite effluent dispersal and achievable by careful location of Building Envelope
- MODERATE – significant constraints to onsite effluent dispersal which significantly limit the area available for Building Envelope on the lot and/or require specialized treatment and disposal systems
- HIGH – major constraints to effluent dispersal which require major modifications to lot size, shape, location.

For the low and moderate constraints, some modification strategies are suggested. No lots are considered to be highly constrained.

Lot Number(s)	Constraint Level	Possible Modifications
1,12	Low – rocky outcrop	Avoid areas of rocky outcrop with Building Envelope
6,7	Low-seasonal waterlogging	Avoid areas of seasonal waterlogging with Building Envelope
4,5,8,9	Low- drainage buffers	Effluent disposal practices to occur outside drainage buffers
23	Low-drainage buffers, seasonal waterlogging, salinity	Building envelope and effluent disposal practices to avoid constrained areas
3,18,20	Moderate-drainage buffers	Locate Building Envelope and effluent disposal practices outside buffers

21	Moderate-dam and drainage buffers, erosion	Locate Building Envelope and effluent disposal practices outside buffers and areas of erosion

The most widely used form of effluent treatment on relatively unconstrained rural residential developments in the region is a NSW Health accredited aerated wastewater system, with the secondary treated, disinfected effluent irrigated onto the surface or shallow subsoil. Reliability and maintenance issues with such systems are well known and the risk of failure is relatively low.

Advanced aerated wastewater treatment systems include an additional level of treatment to further reduce contaminants, particularly Nitrogen and Phosphorous levels. These systems are particularly useful in sensitive areas and where the effluent irrigation area needs to be reduced to the smallest footprint possible.

There are a number of more innovative options for effluent treatment and disposal. The most promising of these is the Wisconsin sand mound, of which there are a small number in the region. These systems have a small footprint, (less than 150m^2), have a high degree of reliability and have a low energy requirement. There is however a lack of experienced installers for such systems in the region and the climate presents some issues in terms of maintaining grass cover through hot dry summers if effluent is not being regularly loaded into the mound. This is generally only an issue if the attached dwelling is not permanently or fully occupied.

In general, the area is not best suited to subsoil absorption of primary treated effluent due to the lower permeability light clay subsoils and proximity to sensitive vulnerable groundwater receiving environment associated with Sutton village.

The following section addresses the specific requirements for a number of suitable effluent management options in order to show that on-site effluent can be achieved sustainably on the subdivision.

This report assumes that a detailed planning of effluent management will occur at the time of submitting building plans to council at which stage the exact location, footprint, occupancy and usage patterns of the proposed dwelling will be known. These are all critical elements of the final design process which cannot be addressed in this report.

Secondary treatment and surface irrigation	NSW Health accredited systems treat effluent to a minimum secondary standard, suitable for disposal by surface or subsurface irrigation (see list at http://www.health.nsw.gov.au/PublicHealth/environment/water/wastewater.asp). This includes aerated wastewater treatment systems (AWTS), sand and textile filters and biological filters. The sizing of the effluent irrigation area is based on nutrient balance which gives a general guide to a sustainable area required for irrigation. Significant improvement in effluent dispersal can be achieved by having at least two or three lines of sprinklers on risers attached to rigid supports, 30-50cm above ground level, with each riser tied into the delivery line. A manual valve on each line allows all or some of the lines to be used. The buried distribution lines with risers minimises the risk of damage by mowing and encourages the irrigation area to be better managed than currently common practice. The size of the area required for effluent irrigation will vary according to the number of bedrooms in the dwelling, which determines the design effluent loading. Based on the hydraulic and nutrient balance shown in **Appendix 3**, the sizing of the irrigation area is shown below: Three bedrooms…….325m^2 Four bedrooms……400m^2 Five bedrooms…….475m^2 Six bedrooms……550m^2 Council also requires adequate suitable land for a reserve effluent dispersal area. Additionally, buffers with the boundary are required. *The Silver Book* prescribes 6 m from a downslope boundary and 3 m with a cross or upslope boundary. **Hence, a conservative minimum area of suitable land for each lot is 1,300m^2.**
Advanced Secondary Treatment and subsurface drip irrigation	NSW Health accredited systems treat effluent to an advanced secondary standard, suitable for disposal by surface or subsurface irrigation (see list at http://www.health.nsw.gov.au/PublicHealth/environment/water/wastewater.asp). This includes advanced aerated wastewater treatment systems (AWTS + NR). The sizing of the effluent irrigation area is based on nutrient balance and the size required is reduced significantly by the further reduction in Nitrogen and Phosphorous levels achieved by AWTS + NR treatment systems. A significant reduction in the risk associated with potential offsite movement of treated

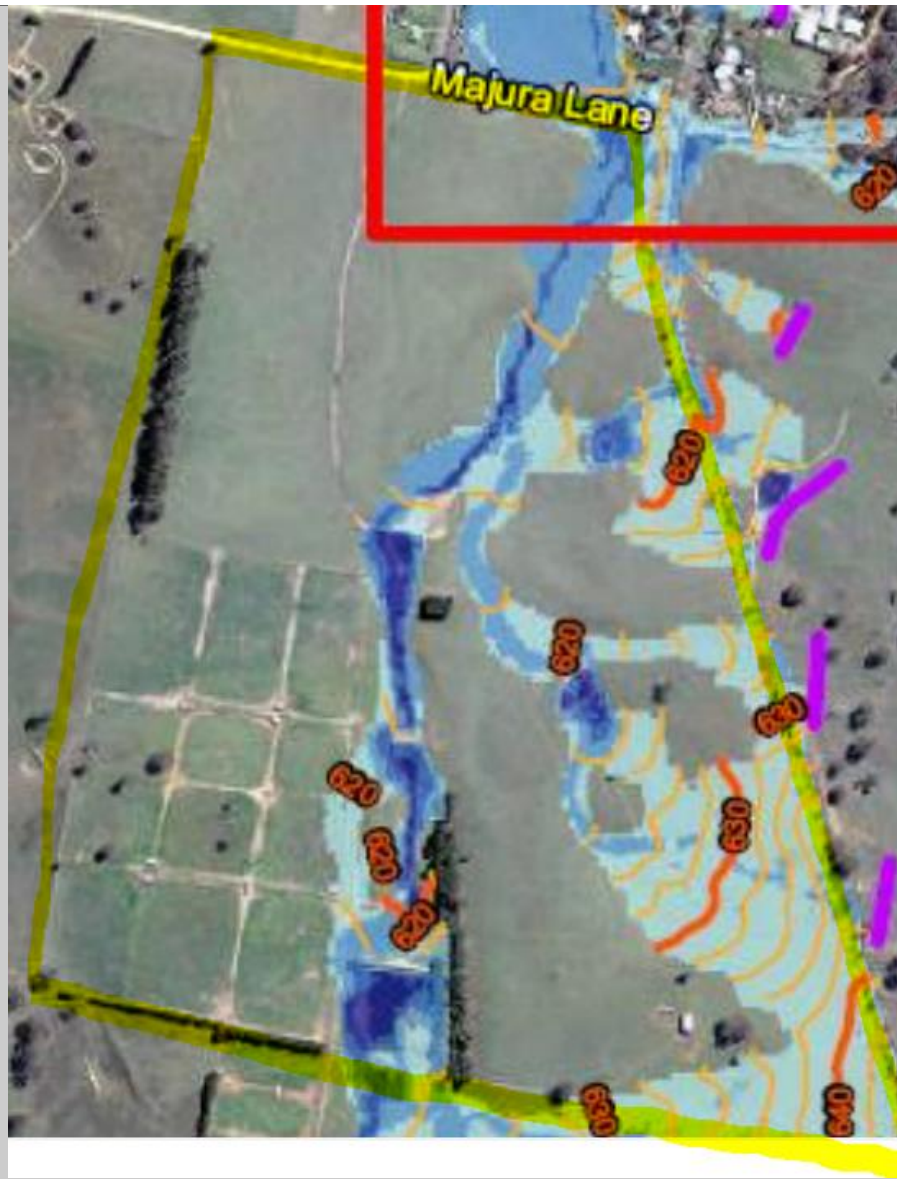
	effluent downslope can be achieved by disposing of treated effluent through subsoil drip irrigation. The size of the area required for effluent irrigation will vary according to the number of bedrooms in the dwelling, which determines the design effluent loading. The type of AWTS + NR treatment system used will also vary the area required for effluent irrigation. Council also requires adequate suitable land for a reserve effluent dispersal area. Additionally, buffers with the boundary are required. *The Silver Book* prescribes 6 m from a downslope boundary and 3 m with a cross or upslope boundary. **The minimum area of suitable land required for each lot using AWS + NR treatment systems will be significantly reduced from the 1,300m^2 required for a standard AWTS system. In the interest of conservative design the 1,300m^2 threshold has been retained for the purpose of determining that an adequate suitable area is available to each lot.**
Primary treatment and subsoil absorption	Not generally suitable due limitations of low soil permeability at depth with light clay subsoils and vulnerable down gradient groundwater environment underlying Sutton village and surrounds.
Innovative effluent management systems	A Wisconsin mound pump dosed from a septic tank would be well suited to the particular site and soil conditions. Mound design would need to be developed on a site by site basis, including a soil profile at the mound site. Indicatively, based on the soil profiles for this assessment, the Basal Loading Rate would be 16mm/day and Linear Loading rate 47mm/day. The footprint would be slightly less than 150m^2 on a flat or gently sloping site.
Effluent management	**Recommendations** • A lot specific *site and soil assessment for on-site effluent management* will be required at the time of submitting building plans to Council for Lots 1-21 & 23, and the prescriptions of this report should be applied to the respective lot. • Lots 1-20 should be required to install advanced secondary treatment systems (AWTS + NR) combined with subsurface drip irrigation, to minimise the impact on vulnerable groundwater systems in the area. • Lots 21 & 23 should be required to install secondary treatment systems, (AWTS or other NSW Health accredited system) • Buffers to be applied to effluent dispersal areas will include:

	• 40m from dams and drainage depressions as mapped • 50 m from the bore GW 401311 • 6 m with downslope lot boundaries • 3 m with cross slope and upslope boundaries • 15 m from dwellings and other buildings • The irrigation area size should be based on daily effluent load based on potential occupancy derived from bedroom number, combined with site and soil constraint assessment as detailed in the *site and soil assessment for on-site effluent management* developed for each lot. • A subsoil absorption bed receiving primary treated effluent is not suitable for the site.
Existing Management Systems	The existing dwelling located on Lot 22 will continue to operate the existing effluent management system in accordance with Council operating conditions.

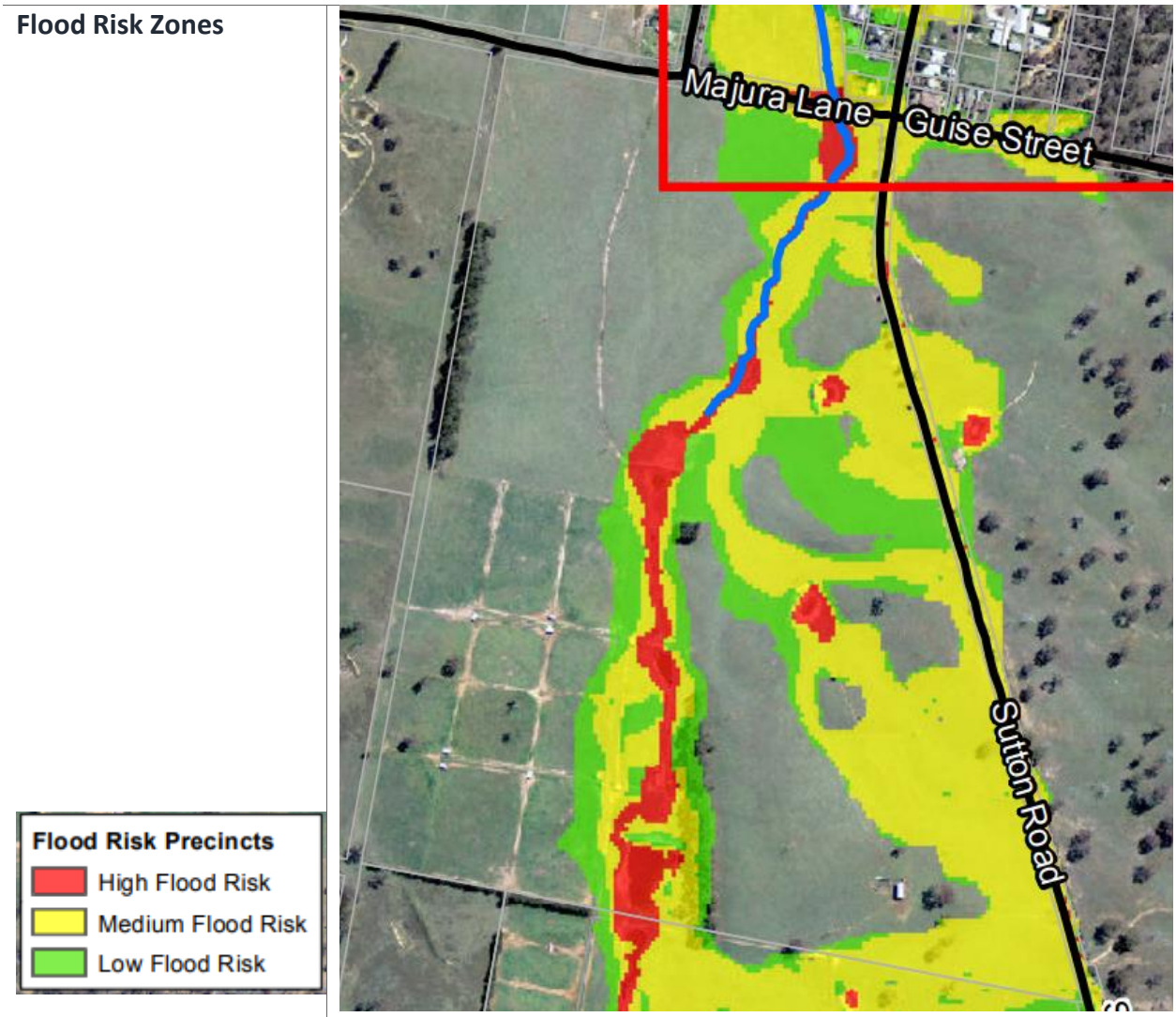
CAPABILILTY FOR DWELLING CONSTRUCTION

Summary	This study has adopted a slope grade of 15% as the threshold above which building envelopes should not be located, this is consistent with many building codes and Council requirements. This cutoff is also considered appropriate for the land covered by this proposal as it corresponds to the slope grade above which erosion hazard increases from low to moderate (Landcom, 2004). There were no areas of slope in excess of 15% identified on the site. The proposed new dwelling lots are all located on flat to gently undulating land with less than 8% slope. Land which is prone to seasonal waterlogging or flood flows (including the minor 1st and 2nd order streams and drainage depressions which drain the site), salt affected land and areas of active erosion are all excluded from land suitable for dwelling construction. These areas are mapped in **Figure 5** and generally do not occur in the area proposed for low density residential dwelling lots except for a minor area of seasonal waterlogging on Lots 6 & 7and some intersection of flood prone land on Lots 8,9,18 & 20. In addition, under NSW DPI Office of Water (Guidelines for riparian corridors on waterfront land) the 2nd order stream requires a 20m buffer and the 1st order stream (which joins the 2nd order stream in the middle of the property), requires a 10m buffer either side of the channel. Dwelling construction within these buffer areas would be inconsistent with NSW DPI Office of Water policy and should therefore be considered as unsuitable for dwelling construction. These riparian corridors are mapped in **Figure 5** and generally do not occur in the area proposed for dwelling lots. The riparian corridors also correspond closely with the area mapped as flood risk and The 40m buffer on drainage lines and around dams required for effluent disposal areas, do not apply for dwelling construction. The remaining gently sloping, free draining land can be considered suitable for dwelling construction without threatening soil stability.

Flood Levels in 1 in 100 Year Flood Event



MOF Upstream Boundary
Peak Flood Level (mAHD)
Major Contour Interval (10m)
Minor Contour Interval (2m)
Depth (m)
< 0.1
0.1 - 0.5
0.5 - 1
> 1

Flood Risk Zones	
Dwelling Construction	**Recommendations** • Building envelopes will be restricted to land shown in this report as suitable, based on excluding areas of land which are effected by dryland salinity, seasonal waterlogging, flooding, active erosion or within the 20m riparian corridor of the 2nd order stream or the 10m riparian corridors identified for the 1st order stream (refer **Figure 5**).

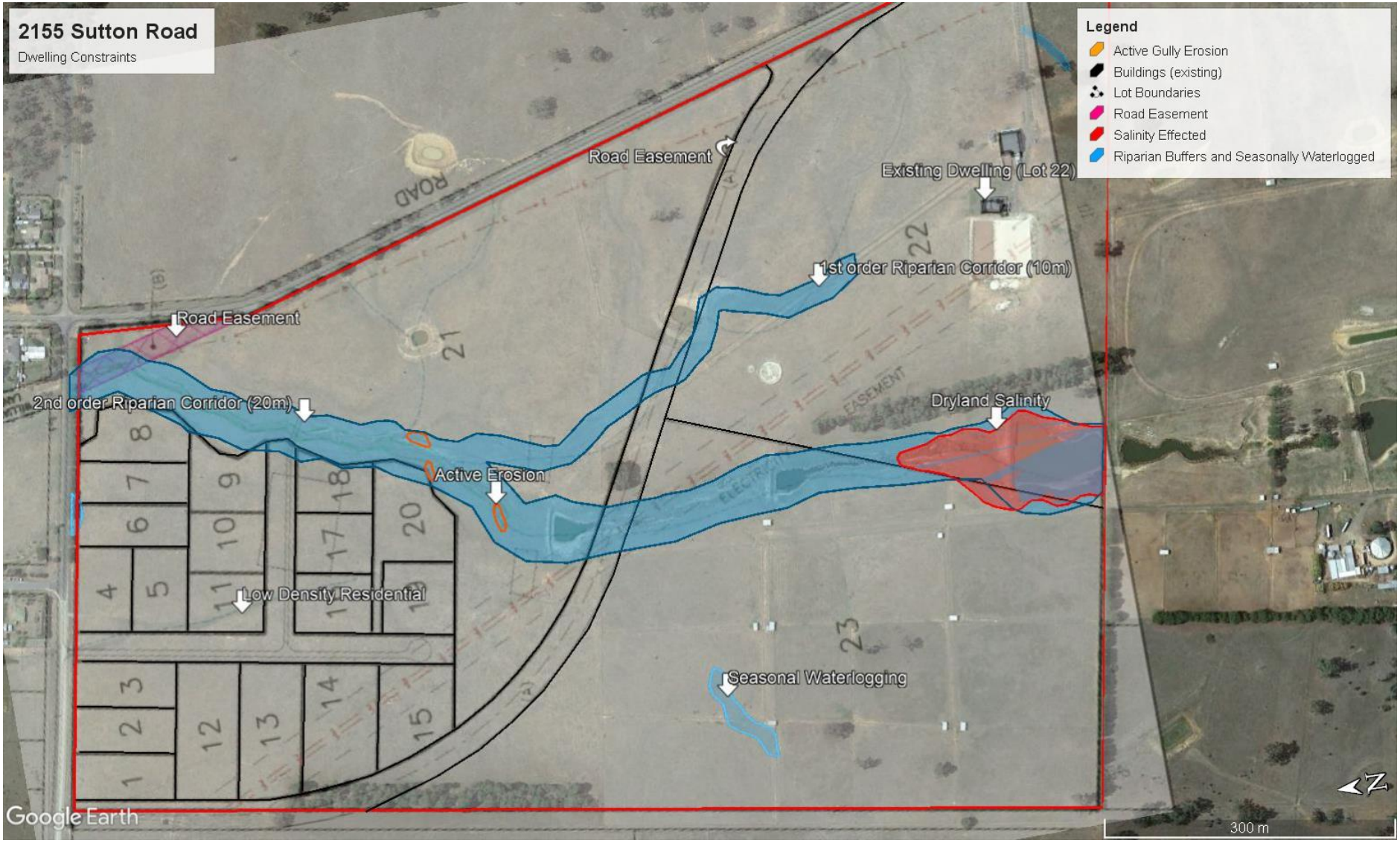


Figure 5: Constraints to dwelling and infrastructure construction (buffers locations shown are approximate)

FLORA AND FAUNA ASSESSMENT

INTRODUCTION

Soil and Water was engaged to undertake a Flora and Fauna Assessment (FFA) for a proposed 23 lot subdivision at 2155 Sutton Road, Sutton (Lot 1 DP32236, 73 ha, hereon referred to as the "subject land").

The subject land is wholly located within the Murrumbidgee Catchment in the South East Highlands Bioregion, and is zoned RU1 Primary Production under the Yass Valley Local Environment Plan (LEP) (Yass Valley Council 2013). Areas of the subject land are covered by the Terrestrial Biodiversity layer in the Yass Valley LEP.

The subject land is currently utilised for horse agistment, cattle grazing, and polo training and matches. A range of infrastructure is present, including a single residence, equestrian polo field, farm sheds, fencing and a bitumen driveway.

The proposal consists of the following:

- Creation of 20 low density residential lots (typical size 0.5 ha, "Lot 1 to 20");
- Subdivision of the remaining lands into three lots, with approximate areas of 16 ha ("Lot 21"), 19 ha ("Lot 22"), and 20 ha ("Lot 23')
- Lot 22 will contain the existing house.

This FFA will be used to support a Development Application (DA) to be submitted to Yass Valley Council.

The proposed Sutton Village by-pass road (30 m width) is also proposed to pass through the subject land. It is assumed that this will be subject to future assessment and approvals, and is not part of the proposal subject to the above DA. Therefore, impacts associated with the construction and operation of this by-pass road have not been assessed in this FFA.

This FFA was undertaken to identify the impacts of the proposed subdivision and associated development (building and infrastructure construction) on flora and fauna (including any impact on threatened species, populations, critical habitat and ecological communities) and to provide recommendations for mitigation or remediation of impacts.

It should be noted that at the time of assessment, specific areas and boundaries of the proposed building envelopes within Lot 1 to 20 and details regarding any required APZs were not available. As such, for the purposes of this assessment the "subject site" is considered to be all lands located within proposed Lots 1 to 20. It is understood that the remaining land within the subject land will not be subjected to changes to current and permitted land use.

Summary of key terms

For the purposes of this assessment, key terms are defined as follows:

1. Subject land: all lands contained within the existing Lot 1 DP32236.

2. Subject site: all lands contained within proposed Lots 1 to 23.
3. Study area: all lands contained within proposed Lots 1 to 23 (plus 10 m buffer area) and lands within 10 m of all proposed lot boundaries.

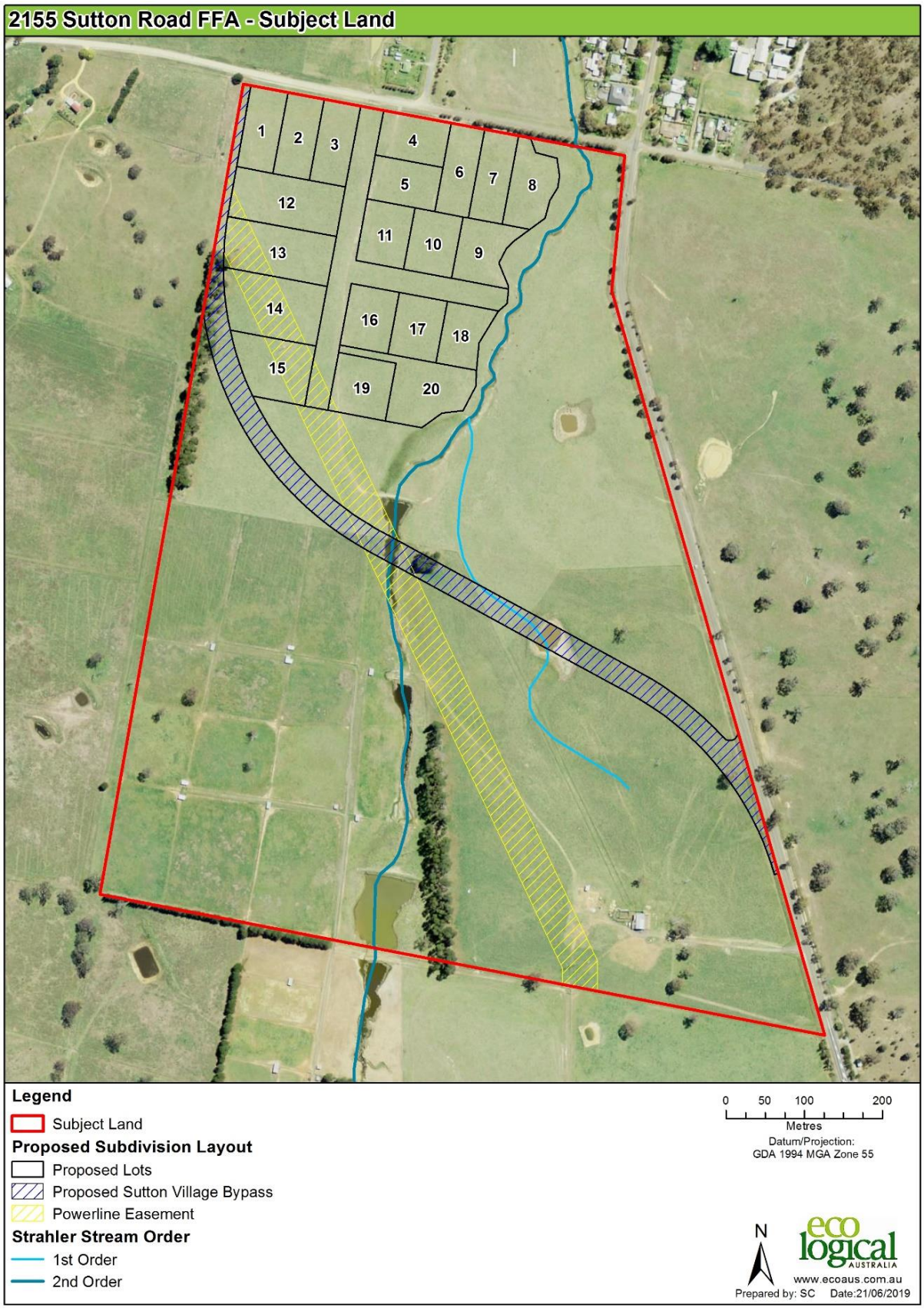


Figure 6: Subject land and proposed subdivision layout

METHODS

Data audit

The following databases were reviewed prior to conducting the field surveys:

- Atlas of NSW Wildlife Search (OEH, 2017a) covering an area from latitude -35.07 to -35.27 and longitude 149.15 to 149.35 (Datum GDA94); and
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool (DotEE, 2017a) using a radius of 10 km around coordinates -35.1714 and 149.2503 (Datum GDA94).

The list of threatened species and ecological communities returned by the database searches was supplemented and modified based on local ecological knowledge, including known species occurrences, and the presence of suitable habitat. Each species' likely occurrence was determined by reviewing records in the area, considering the habitat available and using expert knowledge of the species' ecology (**Appendix 4**).

Five terms for the likelihood of occurrence of species are used in this report, as defined below:

- "yes" = the species, population or ecological community was or has been observed on the site.
- "likely" = a medium to high probability that a species, population or ecological community occurs on the site
- "potential" = suitable habitat for a species, population or ecological community occurs on the site, but there is insufficient information to categorise the species as likely, or unlikely to occur.
- "unlikely" = a very low to low probability that a species, population or ecological community occurs on the site
- "no" – the species, population or ecological community is not present on the site

The desktop assessment also utilised the following resources:

- Yass Valley Local Environment Plan 2013
- NSW Planning Portal

Field survey

A field survey was undertaken by ELA ecologist Sarah Dickson-Hoyle on June 8, 2017. Weather conditions during the field survey were cool (between 8.3 and 12.2 degrees Celsius) and windy (up to 56 km per hour wind gusts).

The field survey traversed the subject land with a particular focus on the lands contained within the proposed Lots 1 to 23 and the boundaries between all proposed lots (10 m buffer either side); (hereon "study area") and assessing:

- Vegetation (including assessment of floristic structure and composition, and of vegetation communities against key listing criteria for relevant Threatened Ecological Communities (TECs))
- The presence of, or potential habitat for, threatened flora and fauna;
- Koala habitat (SEPP 44); and

- Opportunistic fauna sightings.

It should be noted that areas considered outside potential disturbance footprints (e.g. not within the study area) were not comprehensively surveyed as these will not be subject to impacts as a result of the proposal, and will remain under current permitted land use.

Photographs were taken of all key habitat features (e.g. hollow-bearing trees) and of representative examples of all vegetation types identified.

Impact assessments

An assessment of significance (7-part test) under the *Environmental Planning and Assessment Act 1979* (EP&A Act) is required for threatened species and ecological communities known to occur or potentially occurring within the study area. The assessment of significance provides a means for assessing whether any action will have a significant effect on a threatened species or its habitat. Assessments of significance were applied to all threatened species and ecological communities that occur, or were deemed to have the potential or as being likely to occur within the subject land (**Appendix 5**).

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places (defined in the Act as Matters of National Environmental Significance (MNES) and Commonwealth land. Any actions that will, or are likely to have a significant impact on matters of MNES require referral to and approval from the Department of Environment and Energy (DoEE). Impact assessments were applied to all MNES that occur, or were deemed to have the potential or as being likely to occur within the subject land (**Appendix 6**).

RESULTS AND DISCUSSION

Data audit

The data audit (following amendments with local ecological knowledge) revealed two TECs, nine flora species and 54 fauna species listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/or EPBC Act (threatened, marine, and migratory) as being known, likely or having the potential to occur within the subject land. These threatened and marine/migratory species and C/EEC are listed in **Appendix 4,** together with an assessment of the 'likelihood of occurrence'.

There are no endangered populations within the study area.

Flora and vegetation

A total of 35 flora species were recorded within the subject land during the field survey, 19 of which were exotic. No threatened flora species were recorded nor were considered to have the potential to occur within the study area.

A list of all flora species observed within the subject land during the site inspection is presented in **Appendix 7**.

Four vegetation types were identified and described by ELA within the subject land. Two of these vegetation types are derived native grasslands (DNG) that were typed with reference to the classification of "Plant communities of the upper Murrumbidgee catchment in NSW and the Australian Capital Territory" (Armstrong et al. 2012) and to Plant Community Types (PCTs) for the Murrumbidgee Catchment and the South Eastern Highlands IBRA Biogeographic Region. The remaining two are exotic pasture and exotic pine plantings that do not correspond to a native vegetation community or PCT.

It should be noted that the heavy grazing by domestic stock, and the timing of surveys, posed some limitation to grassland assessment.

The distribution of these three vegetation communities and any associated TECs within the subject land is shown in **Figure 7**. Note that existing infrastructure (dwellings, roads, farm dams) have been excluded from vegetation mapping and associated area calculations.

Limitations

The following two limitations to grassland assessment should be noted:

1. Heavy grazing of domestic stock.
2. Timing (season) of surveys.

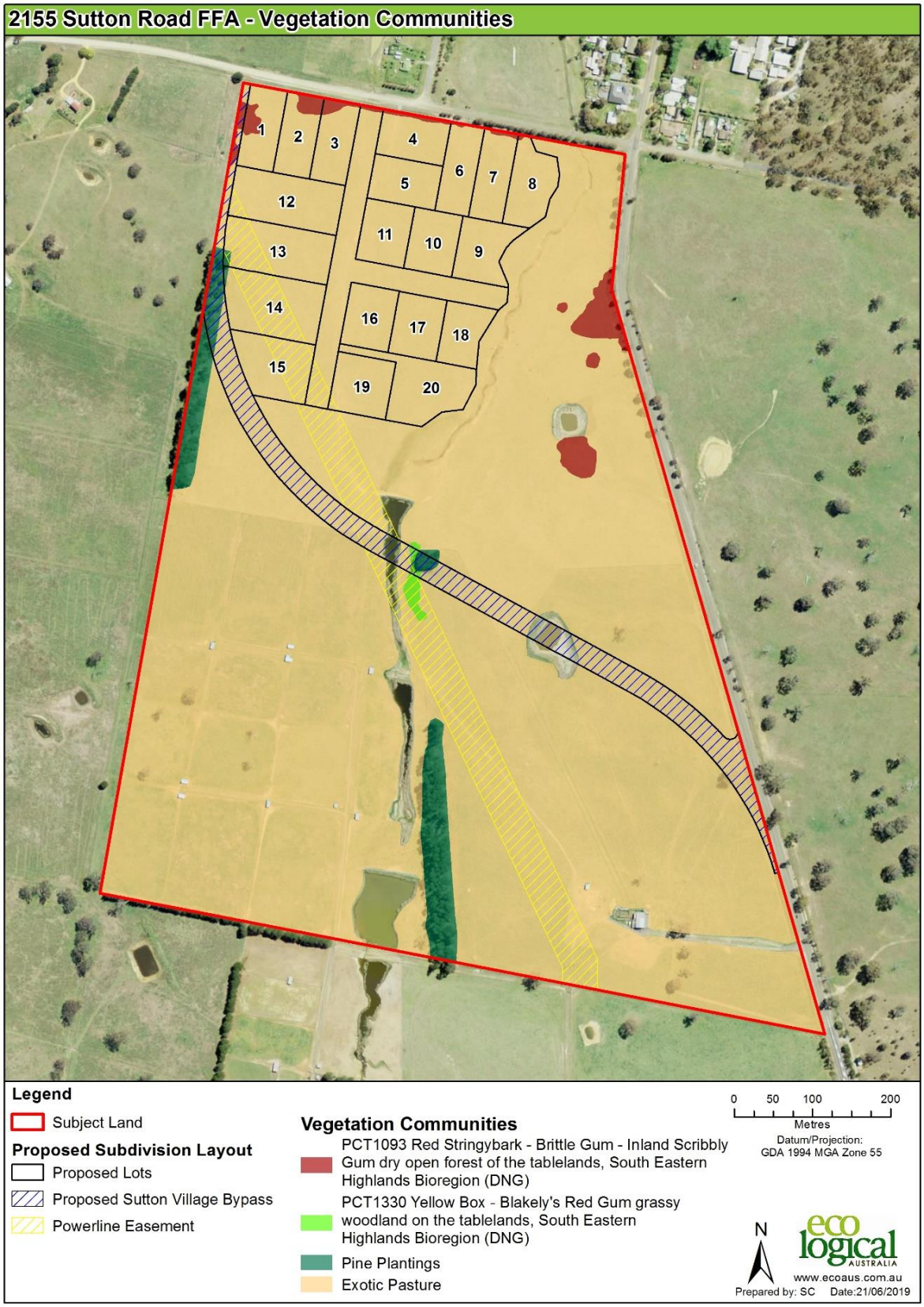


Figure 7: Vegetation communities

Vegetation community 1: Exotic pasture

Exotic Pasture dominates across the subject land (**Photo 1**). It consists of a ground layer dominated by the perennial exotic pasture species *Phalaris aquatic* (Phalaris) and *Paspalum dilatatum* (Paspalum), in association with a range of other exotic graminoid and forb species including *Bromus hordaceus* (Soft Brome), *Eleusine tristachya* (Goose Grass), *Cynodon dactylon* (Couch), *Hypochaeris radicata* (Catsear) and *Trifolium subterraneum* (Subterranean Clover). Native grass species including *Austrostipa bigeniculata, Bothriochloa macra* (Red Grass) and *Chloris truncata* (Windmill Grass) are scattered throughout, however never in high cover or abundance.

Eucalyptus melliodora (Yellow Box) trees are present as scattered mature paddock trees throughout the southern half of the subject site: some of these have been fenced off to protect from stock (**Photo 2**). This, and the mapped extent of *E. melliodora* dominated grassy woodland in the property across Sutton Road (ELA 2016), indicates that much of the area mapped as exotic pasture (particularly in the southern half of the subject land) would have once been equivalent to PCT1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (see vegetation community 3 below).

A total of 67.68 ha of Exotic Pasture is present within the subject land, 10.26 ha of which is within the subject site. There are no equivalent PCTs or TECs for this vegetation type.

Photo 1: Exotic pasture, looking east over subject land from the fenceline along Sutton Road

Photo 2: Mature *E. melliodora* paddock tree amidst exotic pasture

Vegetation community 2: PCT 1093 Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (DNG)

Vegetation community 2 is confined to numerous small, fragmented fenceline remnants and isolated patches in the northern half of the subject land. The distribution largely corresponds to areas along fencelines that have been subject to slashing (and potentially, less intensive historical pasture improvement) and to low rocky/shallow soiled rises near these fenceline patches (**Photo 3** and **Photo 4**).

This vegetation is a grassland characterised by the native perennial species *Austrostipa bigeniculata*, *Chloris truncata, Rytidosperma racemosum* var. *racemosum* and/or *Bothriochloa macra*. However the native groundcover is degraded: it has limited native forb diversity and an abundance (but not dominance) of exotic pasture species, predominantly *Phalaris aquatica*.

Vegetation community 2 is considered to be a DNG form of PCT1093 Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, as indicated by the presence of *Eucalyptus mannifera* (Brittle Gum) in the adjacent road reserve and surrounding landscape, and vegetation mapping undertaken by ELA (2016) in a property immediately across Sutton Road.

Photo 3: PCT1093 DNG (degraded) on a rocky outcrop (deeply embedded rock) in the north-west corner of the subject land, surrounded by exotic pasture

Photo 4: A narrow strip of PCT1093 DNG along the eastern fenceline of the subject land, with *Themeda triandra* growing in the adjacent road reserve below *E. mannifera* (not pictured).

A total of 0.95 ha of this vegetation community is present within the subject land, 0.26 ha of which is contained within the subject site.

Equivalent vegetation types are tabled below.

Table 1: PCT1093 and equivalent vegetation

PCT	Armstrong et al. (2012)	TSC Act listing	EPBC Act listing
PCT 1093 Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	p14 Red Stringybark – Scribbly Gum – *Rytidosperma pallidum* tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands Bioregion	None	None

Vegetation community 3: PCT 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (DNG)

Vegetation community 3 is present as a small isolated patch located in a lower lying part of the landscape adjacent to a creekline, towards the center of the subject land.

It is similar in structure and composition to vegetation community 2, being a degraded DNG dominated by the native perennial grasses *Austrostipa scabra, Chloris truncata, Austrostipa bigeniculata* and *Bothriochloa macra*, with very limited native forb diversity and the exotic grasses *Phalaris aquatica, Cynodon dactylon* and *Bromus hordaceus* scattered throughout.

Vegetation community 3 is considered to be a DNG form of 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion, as indicated by the presence of *Eucalyptus melliodora* as paddock trees in the surrounding landscape, and vegetation mapping undertaken by ELA (2016) in a property immediately across Sutton Road.

A total of 0.13 ha of Vegetation Community 3 is present within the subject land. None of this is located within the subject site nor study area, and as such this community is not expected to be impacted as a result of the proposal.

Equivalent vegetation types are tabled below.

Table 2: PCT1330 and equivalent vegetation

PCT	Armstrong et al. (2012)	TSC Act listing	EPBC Act listing
PCT 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	u178 Yellow Box ± Apple Box tall grassy woodland of the South Eastern Highlands Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	None

PCT 1330 corresponds to the TEC White Box – Yellow Box – Blakely's Red Gum Woodland (TSC Act EEC) and White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act CEEC). It is likely that these communities would have been present across much of the subject land prior to pastoralism, however the single patch of PCT 1330 DNG is too degraded to meet the condition requirements for listing as the above EPBC Act listed CEEC (DotEH 2006), due to:

- The patch contains only one native non-grass understorey species (a *Juncus* sp.);
- The patch is only 0.13 ha in size (< 2 ha);
- No mature trees or regeneration of tree species are present.

Assessment against the NSW Scientific Committee determination for the TSC Act listed EEC (NSW Scientific Committee 2002) indicates that vegetation community 3 is a highly degraded form of this EEC: its small size, isolated occurrence and heavily degraded DNG form means that this patch is not considered to be a viable remnant of the above EEC in the long term without restoration intervention as natural ecological processes are disrupted. However, as this patch is not located in the study area, it is not subject to further assessment under the EP&A Act (Section 5 and Appendix 2).

Vegetation community 4: Pine Plantings

Vegetation community 4 consists of small block or linear plantings of *Pinus radiata* (Radiata Pine). Due to the dense needle litter, there is limited ground cover underneath these plantings. Where present, it is predominantly exotic pasture species as described in vegetation community 1 above.

A total of 1.81 ha of Pine Plantings is present within the subject land, 0.02 ha of which is contained within the subject site. There are no equivalent PCTs or TECs for this vegetation type.

Photo 5: Linear shelterbelt of *P. radiata* along the western fence boundary

Summary of impacts to vegetation

The proposal will result in a direct impact to approximately 10.88 ha of vegetation, 10.6 ha of which (97%) is exotic and 0.02 ha of Pine Plantation and 0.26 ha (2.4%) of which is degraded DNG that does not correspond to a TEC.

Impacts to native vegetation will involve direct loss (clearing) of native ground cover, associated with dwelling construction and associated infrastructure (e.g. fencing, septic systems). A summary of the area of each vegetation community to be directly impacted by the proposal is presented in **Table 3**.

Table 3: Areas of each vegetation community within the subject land and subject site

PCT	TSC Act listing	EPBC Act listing	Area (ha) – Subject land	Area (ha) – Subject site
N/A – Exotic Pasture	None	None	67.68	10.6

PCT	TSC Act listing	EPBC Act listing	Area (ha) – Subject land	Area (ha) – Subject site
PCT 1093 Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	None	None	0.95	0.26
PCT 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	None	0.13	0.0
N/A – Pine Plantings	None	None	1.81	0.02
		Total vegetation	**70.57**	**10.88**

Fauna habitat and fauna species

The fauna habitats present in the subject land are those generally associated with farmland (native and exotic pasture, and paddock trees) and waterbodies (including aquatic vegetation) within the locality. These habitats are unlikely to support a diversity of native fauna given:

- The relative lack of key habitat resources (large woody debris, hollow-bearing trees, remnant woodlands and vegetation structural diversity);
- The highly cleared and disturbed vegetation, subject to ongoing agricultural use; and
- Exposure to feral predators which prefer open habitats, i.e. foxes and cats.

The most significant habitat components are the hollow-bearing trees as these may provide important breeding habitat for a range of hollow-dependent fauna. Four hollow-bearing trees (HBTs) were recorded within the subject land, one of which is within 10 m of the proposed by-pass alignment. These HBTs comprise living *E. melliodora* or stags (dead trees), and may provide potential denning, roosting or nesting habitat for a range of bird, arboreal mammal and microchiropteran bat species that are known from the locality and utilise agriculturally modified woodlands and habitats. The HBTs contain hollows ranging from small hollows (two HBTs) that may be used by smaller birds and mammals through to medium to large hollows (two HBTs), which are potentially suitable for species that require large hollows such as cockatoos, parrots (including the threatened species *Polytelis swainsonii* (Superb Parrot), and possums.

The location of these HBTs is identified in **Figure 8**. **Photo 6** and **Photo 7** depict two of these HBTs.

Photo 6 (L) and 7 (R): *E. melliodora* containing medium hollow; Stag containing small branch hollows

One patch of outcropping (deeply embedded) rock was observed in the north-west corner of the subject land (**Photo 3**). However, this is not considered to be the partially embedded rock type that supports *Aprasia parapulchella* (Pink-tailed Worm Lizard), and is surrounded by very low pasture offering poor cover.

While the majority of drainage lines within the subject land are ephemeral and did not contain water at the time of survey, two permanent pools were observed along the 2nd order drainage line towards the south of the subject land. These were fringed with dense stands of *Typha* sp. with some *Phragmites australis*¸ and provide potential for aquatic fauna (i.e. frogs and waterfowl) which tolerate agricultural ecosystems (**Photo 8**).

Eleven fauna species were recorded opportunistically during the site inspection, consisting of 10 native bird species and one native frog species. The majority of native birds recorded during the site inspection were larger common bird species such as *Cracticus tibicen* (Australian Magpie), *Corvus coronoides* (Australian Raven) and *Grallina cyanoleuca* (Magpie Lark). Only one small woodland bird species (*Petroica*

phoenicea, see below) was observed. This is likely due to the highly cleared vegetation types and relative lack of key habitat resources such as tree and shrub canopies or large woody debris.

Photo 8: Shallow watercourse at southern end of the study area, surrounded by exotic pasture and subject to impacts from stock.

A range of livestock species, including horse and cattle, were also observed within the subject land. A list of all fauna species observed within the subject land during the site inspection is presented in **Appendix 7**.

One threatened fauna species listed under the TSC Act was observed: *Petroica phoenicea* (Flame Robin). Three individuals of this species were observed foraging in exotic pasture (**Photo 9**). This species is known to occupy pine plantations and, in winter, drier more open habitats including pasture areas. However, this species breeds in upland, taller forests and woodlands, and therefore is not considered likely to breed in the subject land.

Photo 9: Three *Petroica phoenicea* individuals were observed foraging in the exotic pasture at this location

An additional six species listed as migratory and/or marine under the EPBC Act are considered to have the potential to occur within the subject land.

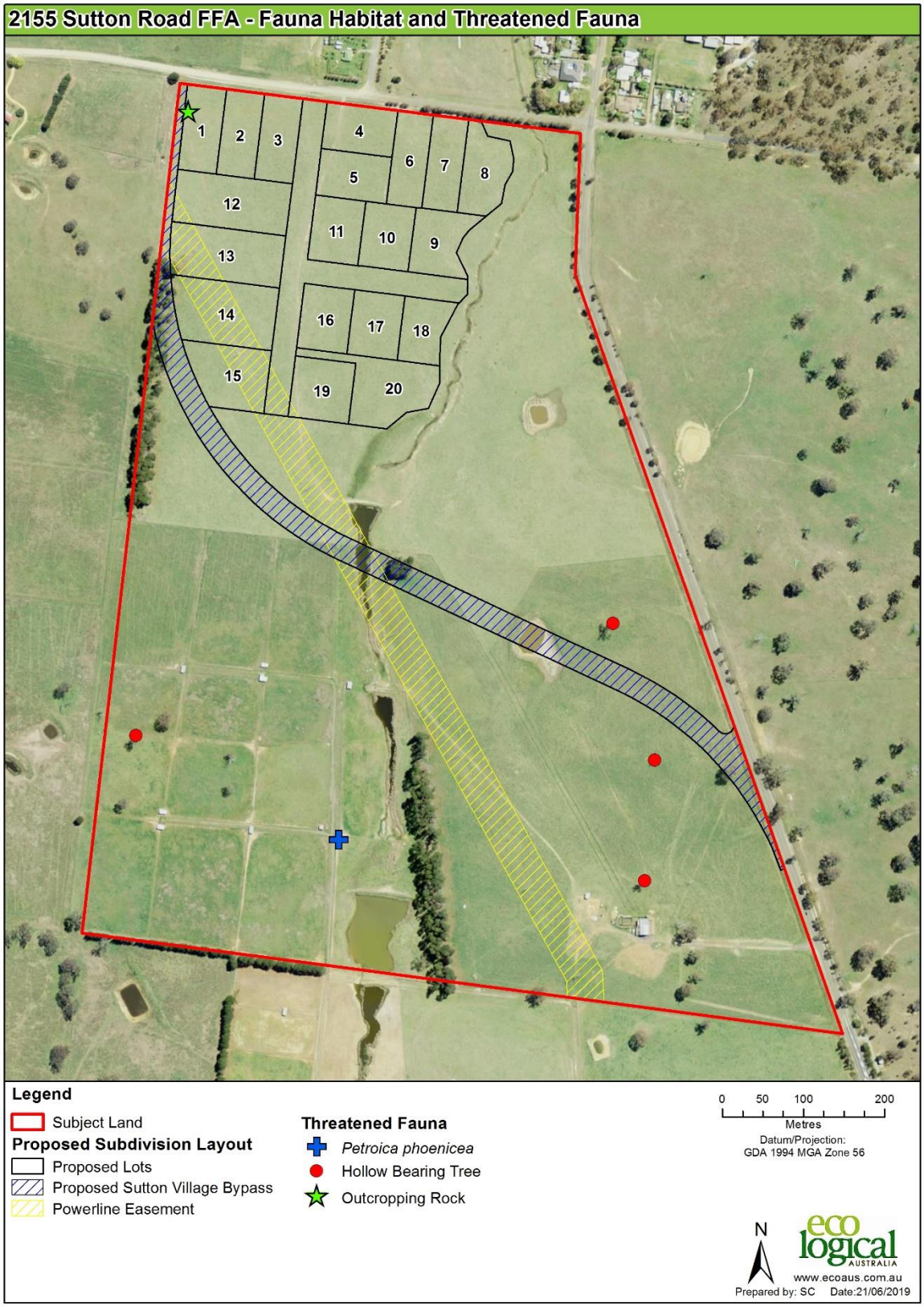


Figure 8: Key habitat components and threatened fauna

STATUTORY ASSESSMENTS

7-part tests

An Assessment of Significance (EP&A Act) was undertaken for ten threatened bird species and four threatened microbat species listed under the TSC Act that are considered to have potential to occur in the study area (**Appendix 4**). The EEC *White Box – Yellow Box – Blakely's Red Gum Woodland* was not assessed as this EEC does not occur within the study area and as such will not be subject to impacts associated with the proposal.

This assessment concluded that the proposal was unlikely to have significant impacts on any threatened species or EEC under the TSC Act, and therefore a Species Impact Statement is not required.

MNES Impact Assessment

The *EPBC Act Administrative Guidelines on Significance* (Commonwealth of Australia 2013) set out 'Significant Impact Criteria' that are to be used to assist in determining whether a proposal is likely to have a significant impact on matters of national environmental significance. MNES listed under the EPBC Act include:

- Listed threatened species and ecological communities.
- Listed migratory species.
- Wetlands of International Importance.
- The Commonwealth marine environment.
- World Heritage properties.
- National Heritage places.
- Nuclear actions.
- Great Barrier Reef.

Specific 'Significant Impact Criteria' are provided for each MNES except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act. The relevant Significant Impact Criteria have been applied to the EPBC listed threatened and migratory species known or potentially occurring in the study area to determine the significance of impact of the proposal in **Appendix 5**.

As detailed in **Appendix 5**, no significant impacts are likely, hence a referral to the Commonwealth Department of the Environment and Energy is not required.

RECOMMENDATIONS

Measures to minimise or mitigate the impacts associated with the proposed subdivision and associated development are recommended as follows:

- Maintain the fencing around hollow-bearing trees to ensure protection from on-going pastoral landuses.
- During construction of the future by-pass, clearly demarcate (bunting/fencing) the *E. melliodora* HBT located immediately adjacent to the proposed road alignment to ensure no damage occurs;
- Any development within 40 m of a stream will require a controlled activity approval from DPI – Water;
- Landscaping within proposed Lot 1-20 should utilise native, non-invasive plant species; and
- If dewatering of dams is required, a qualified ecologist should be engaged to relocate any fish or other aquatic fauna into other permanent waterbodies within the subject land.

CONCLUSION

This Flora and Fauna Assessment has assessed the potential impacts of the proposed 23 lot subdivision of Lot 1 DP32236, and concluded that no significant adverse impacts on threatened species, populations or endangered ecological communities are likely to result from the proposed development. This conclusion is based on the following:

- No threatened flora or potential habitat for threatened flora were recorded within the study area;
- No potential nesting or roosting habitat for hollow-obligates, or significant foraging habitat for threatened fauna will be impacted by the proposal;
- No TECs will be impacted by the proposal;
- The vegetation within the subject site is predominantly exotic pasture, with limited areas of degraded DNG, and hence has very low conservation value;
- Compliance with the above recommendations are expected to be a condition of development approval.

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WATERCOURSE AND GROUNDWATER

INTRODUCTION

Soil and Water undertook an assessment of the potential impacts to watercourses and groundwater aquifers associated with the property. The assessment focused on the specific considerations in *Additional Local Provisions* in *Part 6 of the Yass Valley Local Environment Plan 2013,* specifically *Part 6.4 Groundwater vulnerability* and *Part 6.5 Riparian land and watercourses.* These include:

1. *Groundwater impacts including:*
    i. *the likelihood of groundwater contamination from the development*
    ii. *any adverse impacts the development may have on groundwater dependent ecosystems*
    iii. *the cumulative impact the development may have on groundwater (including impacts on nearby groundwater extraction for a potable water supply or stock water supply)*
    iv. *any appropriate measures proposed to avoid, minimise or mitigate of the development.*
2. *Riparian land and watercourse impacts to:*
    i. *water quality and water flow*
    ii. *aquatic and riparian species, habitats and ecosystems of the watercourse*
    iii. *the stability of the beds and banks of the watercourse*
    iv. *the free passage of fish and other aquatic organisms within or along the watercourse*
    v. *any future rehabilitation of the watercourse and riparian areas*
    vi. *the volume of water to be extracted from the watercourse*
    vii. *any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development*

Potential issues relating to post-subdivision ground or surface water licensing, are also discussed.

RIPARIAN IMPACT ASSESSMENT

The 2nd order stream which flows centrally through the property is not mapped on the Riparian Lands and Watercourses Groundwater Vulnerability Map – Sheet CL2_005 in the *Yass Valley Local Environment Plan 2013*. Nonetheless it is considered useful to use the *Part 6.5 Riparian land and watercourses* issues in the LEP to frame the assessment. Accordingly the entire reach of the 2nd order stream was inspected for any issues with potential to impact:

i. *water quality and water flow*
ii. *aquatic and riparian species, habitats and ecosystems of the watercourse*
iii. *the stability of the beds and banks of the watercourse*
iv. *the free passage of fish and other aquatic organisms within or along the watercourse*
v. *any future rehabilitation of the watercourse and riparian areas*
vi. *the volume of water to be extracted from the watercourse*
vii. *any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development*

Figure 9: Watercourse and Dam Assessment

The results of this riparian assessment, including recommendations, are summarised in the following table.

The only issue not addressed by the recommendations in the table is the volume of water to be extracted from the watercourse. This is addressed in the Water Licensing and Approvals Implications section which follows the Groundwater Assessment.

RIPARIAN ASSESSMENT SUMMARY

Dryland Salinity	An extensive area in and around Dam 5 (refer **Figure 9**) is effected by dryland salinity. The area is a saline discharge site where the saline groundwater table meets the surface and discharges. The effect of this saline groundwater discharge is to limit pasture growth and as salts accumulate in surface soils through evaporation, soil salinity levels increase to the point that normal pasture and grass species cannot survive and eventually die out. This leaves a bare area referred to as a saline scald which, due to the location in the riparian zone, is very prone to erosion. This process is occurring in and around Dam 5, refer below:  **Scalded areas immediately upslope of Dam 5 (neighboring property)** The construction of large dams in areas of high saline groundwater tables can increase the pressure on groundwater system exacerbating discharge immediately around the dam top water level.

Dam 5 showing signs of saline discharge in and around top water level

The area immediately below Dam 5 and above the back up of Dam 4 is an area of previous erosion which was most likely partly caused by salinity and the related reduced groundcover. This area is largely stabilised however is still vulnerable to erosion and is still effected by salinity, refer below:

Below Dam 5 showing salty crust on bare eroded earth

	Recommendations: • The area around dam 5 and below the wall which is mapped as salinity effected should be fenced out from stock to ensure groundcover is maintained and saline scalding is minimised. Stock can be periodically introduced to the fenced-out area to crash graze and reduce the vegetation levels to prevent them becoming rank
Section between dams 5, 4 & 3	This area is a generally stable riparian with good groundcover and a dense growth of aquatic species such as Cumbungi, refer below:  **Back up of Dam 4 with dense Cumbungi growth** The growth of Cumbingi assist in stabilizing creek banks however it can become so dense as to restrict flows in the stream, increase flood risk and create erosion through the diversion of flows. **Recommendations:** • Monitor growth of Cumbingi and control to ensure there is an adequate clear area in the central channel for unrestricted flows
Area of active erosion	There are three areas of minor gully erosion along the 2nd order stream. The two most active gully heads are associated with the overflow of Dam 3, refer **Figure 9** and below:

Eroding overflow of Dam 3

Eroding overflow of Dam 3

These small active gully heads will continue to erode each time the stream flows and Dam 3 overflows.

Recommendations:

- Reshape the gully head and face with loose heavy ballast rock of 150-20mm diameter on an underlay of geotextile fabric to create a batter grade/ramp of 1 in 10 or flatter. Manage grazing activities to maintain groundcover.

Reach below Dam 3 wall to Guise Street boundary	Generally stable riparian zone with good groundcover of introduced species on gently graded banks, refer below:  **Well vegetated stable creek banks** There is some evidence of saline groundwater discharge into the base and side of the creek. These areas can be popular with stock who use the saline soil as a salt lick and can create bare erosion prone areas as a result, refer below:  **Saline discharge on stream bank being disturbed by stock**

	There are numerous areas where stock tracking down the stream bank is generating small lateral gully heads. These areas will continue to expand slowly with each rainfall runoff event, refer below:  **Stock track concentrating flow and creating an active gully head** **Recommendations:** • The streambank from below Dam 3 wall to the Guise Street boundary should be fence of from stock to manage grazing pressure and maintain the stability of the creek banks. Stock can be periodically introduced to the fenced-out area to crash graze and reduce the vegetation levels to prevent them becoming rank

GROUNDWATER IMPACT ASSESSMENT

The potential impact of the development on groundwater has been assessed in relation to the specific heads of consideration as contained in the Yass Valley Local Environment Plan 2013.

i. the likelihood of groundwater contamination from the development

There is minimal chance of contamination of groundwater resulting from the development because:

- intensity of development is low with the creation of a maximum of 22 additional dwelling lots over a land parcel of 73 hectares
- new effluent management systems in the low density residential area which partially overlaps the area mapped as groundwater vulnerable, will be advanced secondary treatment systems (AWTS + NR) which will reduce the level of contaminants in treated effluent
- the existing effluent management system will be unchanged
- the closest bore is located on the Sutton Recreation Ground and is not used for domestic purposes
- effluent generated by AWTS + NR systems will be dispersed through subsurface drip irrigation which will minimise the potential for downslope movement of treated effluent offsite. This will minimise the groundwater contamination risk which is highest where treated effluent is mobilised and moves downslope to meet the casing of existing bores and travels down the outside of the casing to water bearing zones.
- the maximum buffer distance of 50 metres between effluent dispersal and bores recommended in the Australian Standard (AS 1547:2012) will be maintained
- soils on the site are permeability category 4 & 5 which are a low groundwater related constraint to effluent disposal (refer AS 1547:2012)
- rate of effluent application will be low and application to the surface will maximise plant effluent use through evapotranspiration
- transmissivity of fractured rock aquifer systems is low and depth to shallow low yielding water bearing zones is >9 m and higher yielding zones >25 m

ii. any adverse impacts the development may have on groundwater dependent ecosystems

There will be minimal risk to groundwater dependent species and ecosystems as the overall impact to the groundwater system through contamination or increased extraction will be negligible. There are no strongly groundwater dependent ecosystems known in the vicinity.

iii. the cumulative impact the development may have on groundwater (including impacts on nearby groundwater extraction for a potable water supply or stock water supply)

There is currently only one Domestic and Stock bore located on the property which is located on proposed Lot 22**.** Newly created lots will be entitled to access groundwater under the Basic Landholder Rights (BLR) provisions of water legislation, a works approval will be required prior to bore construction. It is considered that there is low potential for a significant increase in the number of bores associated with the development due to the associated capital and operating costs, and the limited capacity for lots to achieve the necessary 250m buffer distance from effluent disposal practices. The limited number of lots who could meet the buffer distance requirements would be the larger rural Lots 21 & 23 who would

possibly extract groundwater for Stock and Domestic watering purposes, therefore volumes would be minimal.

Any bores for irrigation purposes would require licensing, at which stage the sustainability, including the potential cumulative impact on the aquifer and surrounding bores, will be assessed by NSW Water.

iv. any appropriate measures proposed to avoid, minimise or mitigate of the development.

The primary measure proposed to minimise the potential for the development to impact groundwater include:

- require that all low density residential lots (Lots 1-20) install advanced secondary treatment systems (AWTS + NR) linked to subsurface drip irrigation to minimise the risk to the groundwater system and surrounding bores
- maintain a minimum 50 m buffer between effluent dispersal areas and any existing or proposed bores

WATER LICENSING AND APPROVALS IMPLICATIONS

This report has examined the existing non-potable water infrastructure to determine what if any actions may be required to comply with relevant legislation post development and what management restrictions may be placed on the future use of existing infrastructure.

There are a total of 5 dams installed on the property including two significant size structures. Three of these structures (Dams 1,2,3) are located on proposed Lot 21 whilst Dam 4 is located on Lot 23 and Dam 5 is on Lot 22. All existing dams are used for Domestic and Stock purposes.

Once the site is developed these water storages will need to comply with current controls under the Water Management Act (2000). This requires that the volume of any farm dams does not exceed the Harvestable Right (HR) of the Lot. The HR is the water storage volume (Ml) which can be retained without the need for a licence and used on the Lot for any purpose. The HR is calculated by multiplying the lot size (ha) X 0.07Ml/ha (the HR factor for the region). Any water storage which exceeds the HR for the Lot will need to be modified or removed to meet the HR or a surface water entitlement is purchased to cover the volume in excess of the HR.

There are exceptions to the need to comply with the HR for newly created Lots where the water storages were constructed for erosion control purposes.

The below table identifies the relevant attributes of each water storage to determine what if any follow up action may be required to regularise these storages post development:

Dam Number	Stream classification	Dam surface area (m^2)	Depth (m)	Estimated volume (m^3)	Dam function (main function first)	Constructed[3]	Exempt
1	Drainage Depression	815	3.5	1141	Stock Water	Pre 1999	No
2	1st	1078	4.5	1940	Stock Water	Pre 1999	No
3	2nd	2061	5.0	6185	Stock Water/Erosion	Pre 1999	To Be Confirmed (TBC)
4	2nd	1050	4	1470	Stock Water/Erosion	Pre 1999	TBC
5	2nd	4880	8	13664	Stock Water/Erosion	Pre 1999	TBC
Total				**24.4 ML**			
Maximum Harvestable Right Dam Capacity				**5.11 ML**			

Dam Audit

Lot Number	Size	Harvestable Right (ML)	Dam Volume (ML)	Exempt	Balance	Action Required[4]
21	16	1.12	13	TBC (Dam 3)	11.88	• Confirm exempt status of Dam 3 • Confirm whether Dam 2 will be removed • Confirm follow up action required
22	19	1.33	13.664	TBC (Dam 5)	12.33	• Confirm exempt status of Dam 5 • Confirm follow up action required
23	20	1.4	1.47	TBC (Dam 4)	0.07	• Confirm exempt status of Dam 4 • Confirm follow up action required

Lot Audit

Based on the assessment of the existing farm dams located on the property and the proposed lot sizes, the following actions are recommended:

- Confirm whether Dam 2 is to be removed to facilitate the future construction of the Sutton Bypass road
- Confirm whether Dams 3,4 & 5 which are considered to serve some erosion control function, are to be considered as exempt for the purpose of determining the Harvestable Right for each lot

[3] This was assessed using historical aerial imagery which dates back to 2002, then determining that the structures were well vegetated and established at that stage therefore existed prior to 1999, refer **Figure 10**.

[4] This was assessed using historical aerial imagery which dates back to 2002, then determining that the structures were well vegetated and established at that stage therefore existed prior to 1999, refer **Figure 10**.

- Confirm any follow up actions required by Water NSW to comply with relevant legislation.

The existing Domestic and Stock bore located on Lot 20 is a registered (GW 403659) and licensed for Stock and Domestic use (40BL190836). Provided the use of this bore does not change there is no need for action following subdivision.

The proponent will undertake whatever actions are determined necessary to comply with relevant legislation. This may include the removal and / or modification of existing dam structures and/or the purchasing of existing surface water licenses to cover any volumes (or part thereof) determined to be in excess of the Harvestable Right attributable to the newly created lots.

Figure 10: Dam Construction Date Assessment

DRYLAND SALINITY

INTRODUCTION

Soil and Water undertook an assessment of the impacts of dryland salinity on the property and the potential for the subdivision to increase or exacerbate dryland salinity in the area.

The potential impact of the development on dryland salinity has been assessed in relation to the specific heads of consideration as contained in the *Yass Valley Local Environment Plan 2013*.

(a) whether the development is likely to have any adverse impact on salinity processes on the land,

The development is considered unlikely to have an adverse impact on salinity as there will be negligible additional accessions to the saline groundwater system or any exacerbation of salinity related scalding or erosion, provided the development adopts the recommendations included in this report which include:

- no effluent disposal in areas impacted by salinity (as mapped)
- areas mapped as salinity effected should be managed (stock access) to maintain reinstate and/or manage >70% groundcover
- the area of deep rooted perennial pasture should be maintained as far as practical particularly in areas mapped as Moderate Recharge, refer **Figure 11** in this section
- trees and shrubs should be retained and increased where possible particularly in areas mapped as Moderate Recharge, refer **Figure 11** in this section
- irrigation of domestic gardens and lawns should be managed to minimise accessions to the groundwater table

(b) whether salinity is likely to have an impact on the development,

Salinity will not adversely impact on the development because built infrastructure is proposed for a limited area of the property located away from the localised occurrences of salinity. Effluent management practices are generally located adjacent to dwelling infrastructure and therefore also remote form the salinity areas. Therefore, salinity will not impact on the development provided the recommendations included in this report are adopted, which include:

- no development of dwellings in areas impacted by salinity (as mapped)
- no effluent disposal in areas impacted by salinity (as mapped)

(c) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

A range of recommendations have been included in this report which will avoid, minimise and mitigate the impacts of the development on salinity. These include:

- reducing accessions to the saline groundwater table by avoiding effluent irrigation in areas of high water table and/or saline discharge
- encouraging water wise domestic irrigation practices to reduce accessions to the saline groundwater table

- maintain the area of deep rooted perennial vegetation to reduce accessions to the saline groundwater table, particularly in moderate recharge areas
- encouraging an increased area under trees and shrubs, particularly in moderate recharge areas
- fencing of salinity effected areas to manage stock access and minimise the risk of exacerbating salinity related erosion.

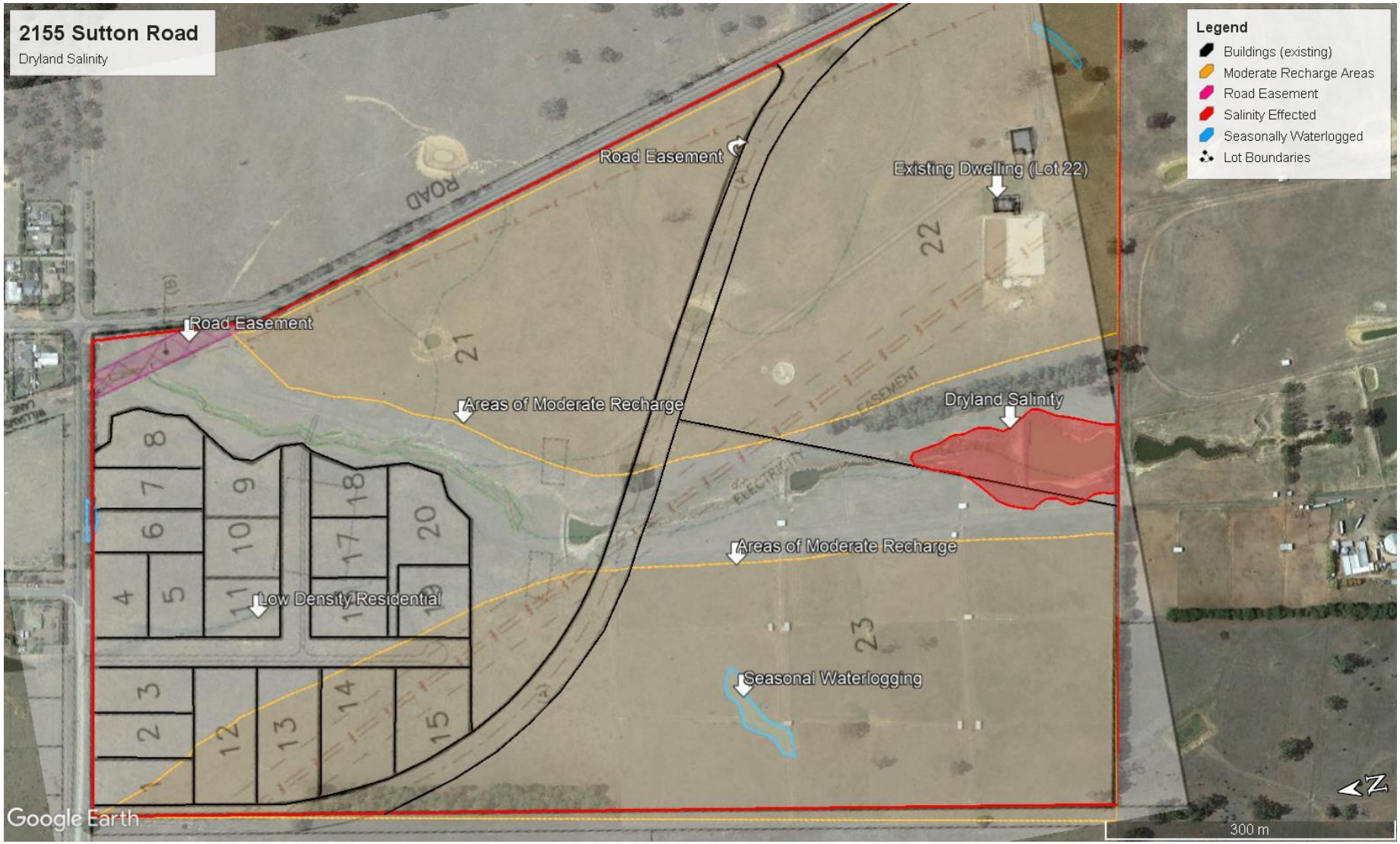

Figure 11: Dryland Salinity

APPENDICES

Appendix 1: Site and Soil Limitation Assessment

The following two limitation tables are a standardised guide to the site and soil characteristics which may limit the suitability of the site for effluent disposal and which would require attention through specific management practices. The tables have been reproduced from *On-site Sewage Management for Single Households* (tables 4 and 6, Anon, 1998). The highlighted categories represent site and soil conditions of the land covered in this report. The tables show that the land designated for effluent application has slight to moderate limitations, but no severe limitations.

Site limitation assessment

Site feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Flood potential	All land application systems	> 1 in 20 yrs.		Frequent, below 1 in 20 yrs	Transport in wastewater off site
	All treatment systems	components above 1 in 100 yrs.		Components below 1 in 100 yrs.	Transport in wastewater off site, system failure
Exposure	All land application systems	High sun and wind exposure		Low sun and wind exposure	Poor evapo-transpiration
Slope %	Surface irrigation	0-6	6-12	>12	Runoff, erosion potential
	Sub-surface irrigation	0-10	10-20	>20	Runoff, erosion potential
	Absorption	0-10	10-20	>20	Runoff, erosion potential
Landform	All systems	Hillcrests, convex side slopes and plains	Concave side slopes and foot slopes	Drainage plains and incised channels	Groundwater pollution hazard, resurfacing hazard

Site feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Run-on and seepage	All land application systems	None-low	Moderate	High, diversion not practical	Transport of wastewater off site
Erosion potential	All land application systems	No sign of erosion potential	Minor stabilized sheet and gully erosion	Indications of erosion e.g. rills, mass failure	Soil degradation and off-site impact
Site drainage	All land application systems	No visible signs of surface dampness		Visible signs of surface dampness	Groundwater pollution hazard, resurfacing hazard
Fill	All systems	No fill	Fill present		Subsidence
Land area	All systems	Area available		Area not available	Health and pollution risk
Rock and rock outcrop	All land application systems	<10%	10-20%	>20%	Limits system performance
Geology	All land application systems	None	Small areas of isoclinal fractured regolith outcrop	Major geological discontinuities, fractured or highly porous regolith	Groundwater pollution hazard

Soil limitation assessment

Soil feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Depth to bedrock	Surface and sub surface irrigation	> 1.0	.5-1.0	< 0.5	Restricts plant growth
or hardpan (m)	Absorption	> 1.5	1.0-1.5	< 1.0	Groundwater pollution hazard
Depth to seasonal water table (m)	Surface and sub surface irrigation	> 1.0	0.5-1.0	< 0.5	Groundwater pollution hazard
	Absorption	> 1.5	1.0-1.5	< 1.0	Groundwater pollution hazard
Permeability	Surface and sub surface irrigation	2b, 3 and 4	2a, 5	1 and 6	Excessive runoff and waterlogging
Class	Absorption	3, 4		1, 2, 5, 6	Percolation
Coarse fragments %	All systems	0-20	20-45	>40	Restricts plant growth, affects trench installation
Bulk density (g/cc)	All land application systems				restricts plant growth, indicator of permeability
SL		< 1.8		> 1.8	
L, CL		< 1.6		> 1.6	
C		< 1.4		>1.4	
pH	All land application systems	> 6.0	4.5-6.0	-	Reduces plant growth
Electrical conductivity (dS/m)	All land application systems	<4	4-8	>8	Restricts plant growth

Soil feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Sodicity (ESP)	Irrigation 0-40cm; absorption 0-1.2mtr	0-5	5-10	> 10	Potential for structural degradation
CEC mequiv/100g	Irrigation systems	> 15	5-15	< 5	Nutrient leaching
P sorption kg/ha	All land application systems	> 6000	2000-6000	< 2000	Capacity to immobilise P
Aggregate stability	All land application systems	Classes 3-8	class 2	class1	Erosion hazard

Appendix 2: Soil Profile Descriptions

Soil Profile 1: Proposed Lot 15

Soil classification	Depth (cm)	Properties
Red Brown Chromosol	0-10	A1 medium brown fine sandy-silty loam, no coarse fragments, weak structure, dry and friable consistence, gradational colour change to
	10-40	A2 bleached light brown fine sandy-silty loam, no coarse fragments, weak structure, dry and friable consistence, gradational colour and textural boundary to
	40->100	B red / brown sandy light clay, 5% coarse fragments, moderate structure, dry and friable consistence, continues.

Soil profile augered at representative site in area suitable for effluent dispersal, refer **Figure 9**.

Soil Profile 2: Proposed Lot 9

Soil classification	Depth (cm)	Properties
Red Brown Chromosol	0-10	A1 medium brown fine sandy-silty loam, no coarse fragments, weak structure, dry and friable consistence, gradational colour change to
	10-30	A2 bleached light brown fine sandy-silty loam, no coarse fragments, weak structure, dry and friable consistence, gradational colour and textural boundary to
	30->100	B red / brown sandy light clay, 5% coarse fragments, moderate structure, dry and friable consistence, continues.

Soil profile augered at representative site in area suitable for effluent disposal, refer **Figure A2a**.

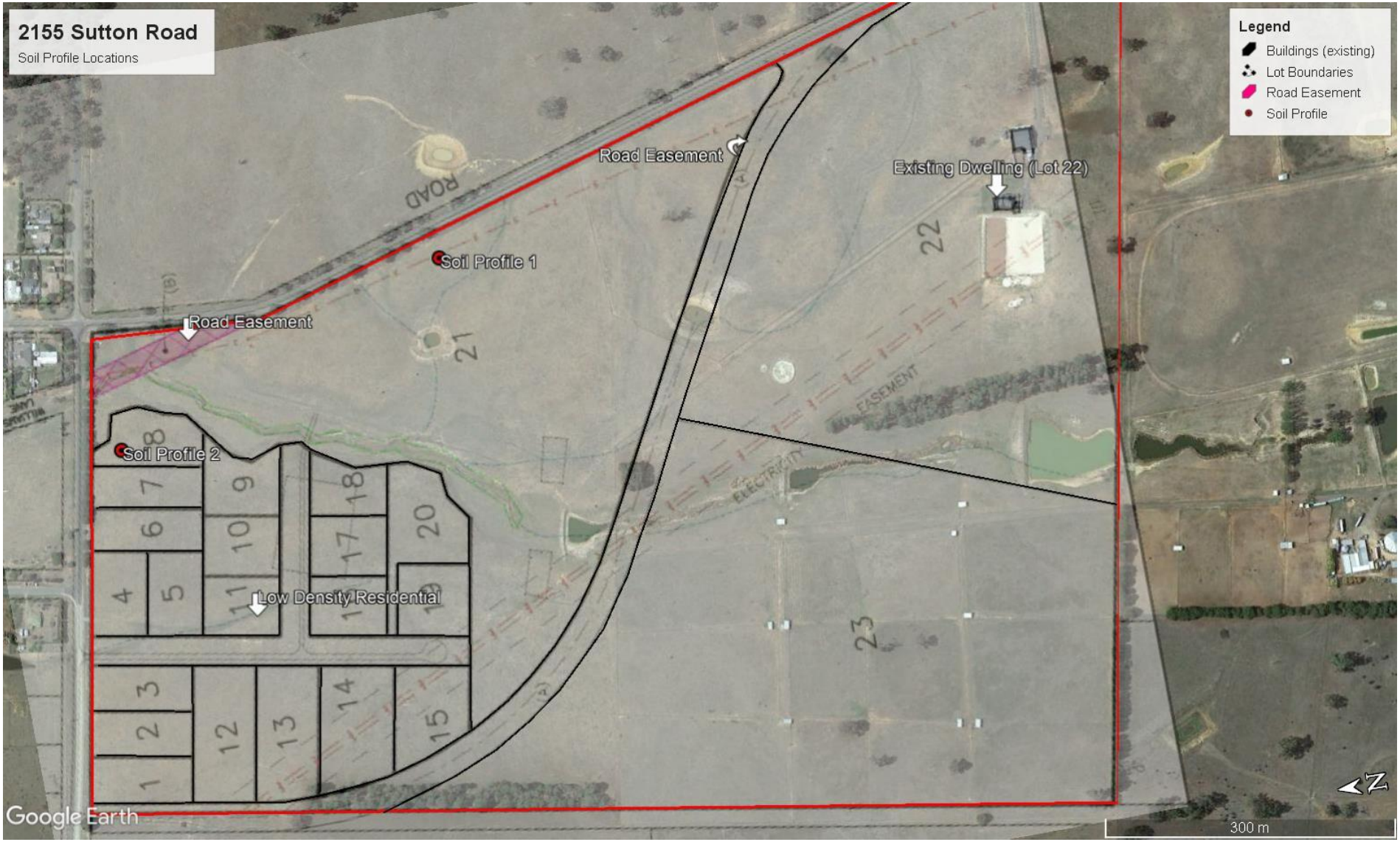

Figure A2a: Soil Profile Locations

Appendix 3: Effluent Area Design

Water balance	Using the same DIR for spray irrigation on clay loam soils of 3.5 mm/day and adopting the most conservative (i.e. largest) estimate of additional design loading of 720 L/day, the following land application areas are required to manage additional hydraulic loading, nitrogen and phosphorous generated: • **Sizing based on hydraulic loading:** A = Q (l/day)/DIR (mm/day) where A = area; Q = 720 l/day; DIR = 3.5 mm/day A = 720/3.5 = 206 m^2 **Area required = 206 m^2**
Nitrogen balance	• **Sizing based on nitrogen balance:** A = Q(l/day) X TN (mg/l)/L_n (critical loading of TN, mg/m^2/day) where A = area; Q = 720 l/day; TN = 25mg/l (from Silver Book) Assume 20% loss by denitrification; 25mg/l – (25 X .2) = 20mg/l L_n = 15,000mg/m^2/yr (ie 150kg/ha/yr, for introduced species) A = 720 X 20 X 365/15,000 = 350m^2 **Area required = 350 m2**
Phosphorous balance	• **Sizing based on phosphorous balance** A = P_{gen}/(P_{uptake} + P_{sorb}) [P sorption capacity in upper 50cm & 50 year design period] P_{gen} = 10mg/l X 720 X 365 X 50 = 131.4kg P_{uptake} = 4.4mg/m^2/day X 365 X 50 = .080kg/m^2 P_{sorb} = 2250kg/ha = .225kg/m^2 A = 131.4/(.08+ .225) = 481 m^2 **Area required = 431 m^2**
Design effluent disposal area	Therefore, a land application area of approximately **450 m^2** will account for phosphorous, nitrogen and water applied based on estimated connections and usage patterns associated with the construction of a 5-bedroom house. An allowance of a reserve land application area will double this area to **900m^2**. Allowing for up to a 6 bedroom houses (7 occupants) and buffer distances from Lot boundaries, buildings and other infrastructure a typical effluent disposal area of **1,300m^2** has been adopted for the purposes of this assessment.

Appendix 4: Likelihood of occurrence tables – flora, fauna and C/EECs

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Flora							
Caladenia actensis	Canberra Spider Orchid	-	CE	Endemic to the Australian Capital Territory, currently only known from two populations on the western lower slopes of Mount Majura and Mount Ainslie, and the Canberra Nature Park.	Grows on shallow gravelly brown clay loam soils, amidst a cover of grasses, forbs and low shrubs. Grows in transition vegetation between open grassy woodland and dry sclerophyll forest.	No – no suitable habitat and outside known population distribution	No
Eucalyptus aggregata	Black Gum	V	V	In NSW, found in the Central and Southern Tablelands, in the South Eastern Highlands Bioregion and on the western fringe of the Sydney Basin Bioregion.	Alluvial soils, on cold, poorly-drained flats and hollows adjacent to creeks and small rivers. Usually occurs in open woodland with a grassy groundlayer.	No	No
Lepidium hyssopifolium	Aromatic Peppercress	E	E	In NSW, occurs near Bathurst, Bungendore, and Crookwell. May also be extant near Armidale.	Woodland with a grassy understorey and grassland.	Unlikely	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Leucochrysum albicans var. *tricolor*	Hoary Sunray	-	E	In NSW it occurs on the Southern Tablelands and adjacent areas in an area roughly bounded by Albury, Bega and Goulburn.	Grassland, woodland and forest, generally on relatively heavy soils.	Unlikely	No
Pelargonium sp. Striatellum	Omeo Stork's Bill	E	E	Known from only four locations in NSW, with three on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst.	Narrow habitat requirements, usually just above the high water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture, and the wetland communities.	No – no suitable habitat	No
Prasophyllum petilum	Tarengo Leek Orchid	E	E	Four sites in NSW: at Boorowa, Captains Flat, Ilford and Delegate. Also experimentally introduced at Bowning Cemetery NSW.	Natural Temperate Grassland, grassy woodland, and Box-Gum woodland.	Unlikely	No
Prasophyllum sp. Wybong		-	CE	Endemic to NSW. Known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area.	Open eucalypt woodland and grassland.	Unlikely	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Swainsona sericea	Silky Swainson-pea	V	-	In NSW, recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. Also an isolated record from the far north-west of NSW.	Natural Temperate Grassland and *Eucalyptus pauciflora* (Snow Gum) Woodland on the Monaro, and Box-Gum Woodland in the Southern Tablelands and South West Slopes.	Unlikely	No
Thesium australe	Austral Toadflax	V	V	In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands.	Grassland on coastal headlands or grassland and grassy woodland on the tablelands and western slopes. Semi-parasitic on grass species, in particular *Themeda triandra*.	Unlikely	No
Vegetation Communities							
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory		-	CE	This community is associated with valleys influenced by cold air drainage and open plains in the Southern Tablelands. It is a natural grassland community dominated by a range of perennial grasses and native forbs. The community is predominantly treeless, however trees may occur in isolated clumps or as individuals. No natural grasslands were present within the subject land.		No	No
White Box Yellow Box Blakely's Red Gum Woodland (TSC Act) / White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)		EEC	CEEC	White Box, Yellow Box, Blakely's red gum woodland (referred to as Box-Gum Woodland) are characterized by a canopy dominated, or historically dominated by *E. albens* (White Box), *E. melliodora* (Yellow Box) or *E. blakelyi* (Blakely's Red Gum), with an open to near absent shrub layer, and ground cover dominated by native grasses and herbs. This vegetation community was present as a small DNG patch within the subject land, however this is not within the study area and is therefore not expected to be impacted as a result of the proposal.		No	No
Fauna (amphibians)							

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Litoria aurea	Green and Golden Bell Frog	E	V	Since 1990 records have predominantly been limited to small coastal or near coastal populations in NSW. One known population on the NSW Southern Tablelands.	Inhabits marshes, dams and stream sides, particularly those containing *Typha* spp. (bulrushes) and *Eleocharis* spp. (spikerushes).	Unlikely	No
Litoria castanea	Yellow-spotted Tree Frog	CE	E	Northern population centred within the New England Tablelands, and a southern population has a restricted distribution between Canberra, ACT and Bombala, NSW. The Atlas of Living Australia contains a museum record from within the subject land, however there have been no confirmed records in the southern population since 1980.	Occupies permanent ponds, swamps, lagoons, farm dams and still backwaters of rivers with tall reeds.	Unlikely	No
Litoria raniformis	Growling Grass Frog	E	V	In NSW the range centred on the Murray and Murrumbidgee River valleys and their tributaries. One record is listed within the Atlas of Living Australia from within the subject land, however this is from 1976.	Predominantly found amongst emergent vegetation including *Typha* spp. (bulrushes), *Phragmites* spp. (reeds) and *Eleocharis* spp. (spikerushes), in or at the edges or still or slow flowing water bodies, including farm dams. The shallow permanent waterbodies at the southern end of the subject land may support highly marginal potential habitat, however these waterbodies have been subject to indirect impacts from agricultural activities (associated with stock and pasture improvement) and would likely be subject to high predation risk. Furthermore, these waterbodies are not within the study area and as such are not	Unlikely	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
					expected to be impacted as a result of the proposal.		
Fauna (birds)							
Anthochaera phrygia	Regent Honeyeater	E4A	E	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions.	Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana (*River Oak).	Unlikely	No
Apus pacificus	Fork-tailed Swift	-	C,J,K, Mar	Recorded in all regions of NSW; aerial forages over a wide range of habitat types.	Riparian woodland, swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes.	Potential	Yes
Ardea alba	Great Egret	-	C, J, Mar	Widespread, occurring across all states/territories. Also a vagrant on Lord Howe and Norfolk Island.	Swamps and marshes, grasslands, margins of rivers and lakes, salt pans, estuarine mudflats and other wetland habitats.	Potential	Yes

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Ardea ibis	Cattle Egret	-	C,J, Mar	Widespread and common across NSW.	Grasslands, wooded lands and terrestrial wetlands.	Potential	Yes
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Occurs in eastern Australia from north Queensland to Tasmania, and in southwestern Western Australia.	Occurs in eucalypt woodlands and forests, with south-eastern populations migrating north during winter.	Potential	Yes
Botaurus poiciloptilus	Australian Bittern	E	E	Found over most of NSW except for the far north-west.	Permanent freshwater wetlands with tall, dense vegetation, particularly *Typha* spp. (bullrushes) and *Eleocharis* spp. (spikerushes).	Unlikely	No
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee.	Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas. The species may forage within the study area from time to time.	Potential	Yes

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina	This species occurs in forests and woodlands where Black or Forest She-oak feeding resources are prevalent and large tree hollows exist for breeding. Suitable foraging habitat was not present within the subject land.	Unlikely	No
Chthonicola sagittata	Speckled Warbler	V	-	The Speckled Warbler is patchily distributed on and inland of the Great Dividing Range, from level with Mackay in Qld, to the Grampians National Park in Victoria.	The Speckled Warbler lives in dry sclerophyll forests and woodlands.	Unlikely	No
Climacteris piculmus victoriae	Brown Treecreeper (Eastern subspecies)	V	-	Endemic to eastern Australia, occurring on the inland plains and slopes of the Great Dividing Range.	Occurs in eucalypt woodlands, including Box Gum Woodlands, and dry open forests. Prefers woodlands dominated by stringybarks or other rough barked species, usually with a grassy understorey.	Unlikely	No
Daphoenositta chrysoptera	Varied Sittella	V	-	Varied Sitellas are endemic and widespread in mainland Australia. This species was recorded within Yellow Box – Blakely's Red Gum grassy woodland by ELA (2016) immediately over Sutton Road.	Varied Sitellas are found in eucalypt woodlands and forests throughout their range. They prefer rough-barked trees like stringybarks and ironbarks or mature trees with hollows or dead branches.	Potential	Yes

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Glossopsitta pusilla	Little Lorikeet	V	-	Widely distributed across the coastal and Great Divide regions of eastern Australia. NSW provides a large proportion of the species' habitat.	Forages primarily in open eucalypt forests and woodlands, in particular riparian habitats. May also utilize flowering trees in open country, such as paddock trees.	Potential	Yes
Grantiella picta	Painted Honeyeater	V	V	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas.	Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	Unlikely	No
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	C	Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia.	Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.	Unlikely	No
Hieraaetus morphnoides	Little Eagle	V	-	Found throughout the mainland. In NSW, it occurs as a single population.	Occupies open eucalypt forest, woodland or open woodland. It nests within tall living trees within remnant patches, building large stick nests in winter. No nests were observed within the subject land, however this species may forage over the subject land.	Potential	Yes

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Hirundapus caudacutus	White-throated Needletail	-	C,J,K	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide.	Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland. Forages aerially over a wide range of habitat types	Potential	Yes
Lathamus discolor	Swift Parrot	E	CE	Migrates from Tasmania to mainland in Autumn-Winter. In NSW, the species mostly occurs on the coast and south west slopes.	Box-ironbark forests and woodlands.	Unlikely	No
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible.	Generally prefers lightly wooded country, usually open eucalypt woodland, and often occurs in or near clearings or open areas. It requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	Potential	Yes
Merops ornatus	Rainbow Bee-eater	-	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May.	Mainly occurs in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats including farmland.	Potential	Yes

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Monarcha melanopsis	Black-faced Monarch	P	Bonn, Mar	In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland.	Rainforest, open eucalypt forests, dry sclerophyll forests and woodlands, gullies in mountain areas or coastal foothills, Brigalow scrub, coastal scrub, mangroves, parks and gardens.	Potential	Yes
Motacilla flava	Yellow Wagtail	-	C,J,K	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA.	Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns.	Unlikely	No
Myiagra cyanoleuca	Satin Flycatcher	-	Bonn, Mar	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains.	Eucalypt-dominated forests, especially near wetlands, watercourses, and heavily-vegetated gullies.	Unlikely	No
Pachycephala olivacea	Olive Whistler	V	-	In NSW this species has a disjunct distribution, primarily occupying the beech forests around Barrington Tops and the Macpherson ranges in the north, and wet forests from the Illawarra to Victoria in the south. While three records were returned by database searches, the most recent of these is from 1964.	Mostly inhabits wet forests above approximately 500 m. During the winter months they may move to lower altitudes.	Unlikely	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Petroica boodang	Scarlet Robin	V	-	In NSW, it occurs from the coast to the inland slopes.	Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps.	Likely	Yes
Petroica phoenicea	Flame Robin	V	-	In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Three individuals were observed foraging in exotic pasture.	Breeds in upland tall moist eucalypt forests and woodlands. In winter uses dry forests, open woodlands, heathlands, pastures and native grasslands. Occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgelands at high altitudes.	Yes	Yes
Polytelis swainsonii	Superb Parrot	V	V	Found throughout eastern inland NSW, with core breeding habitat on the south-west slopes bordered by Yass in the east. A pair of this species was observed by ELA (2016) in the property immediately over Sutton Road. An additional four records existing between 7-12 km from the subject land.	Occupy box-gum, cypress pine and boree woodlands, and River Red Gum forests. They can nest in open box-gum woodland or in isolated paddock trees, such as Blakely's Red Gum, Yellow Box, Apple Box or Red Box. The subject land supports foraging, and potential nesting habitat for this species.	Likely	Yes
Rhipidura rufifrons	Rufous Fantail	-	Bonn, Mar	Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW.	Wet sclerophyll forests, subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands.	Unlikely	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Rostratula australis	Australian Painted Snipe	E	E, Mar	In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys.	Swamps, dams and nearby marshy areas.	Unlikely	No
Stagonopleura guttata	Diamond Firetail	V	-	Widely distributed in NSW, mainly recorded in the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina, and less commonly found in coastal areas and further inland.	Grassy eucalypt woodlands, open forest, mallee, Natural Temperate Grassland, secondary derived grassland, riparian areas and lightly wooded farmland.	Potential	Yes
Fauna (fish)							
Maccullochella peelii	Murray Cod	-	V	Distributed across a range of bioregions including the South Eastern Highlands.	Utilises a diverse range of habitats from clear rocky streams to slow flowing turbid low land rivers.	No – no suitable habitat	No
Macquaria australasica	Macquarie Perch	E	E	In NSW, the species' distribution has considerably declined and it is now isolated to the upper reaches of the Lachlan and Macquarie Rivers in southern NSW, as well as low numbers in the Mongarlowe River.	A riverine, schooling species, preferring clear water and deep, rocky holes with lots of cover.	No – no suitable habitat	No
Fauna (insects)							

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Synemon plana	Golden Sun Moth	E	CE	Known from 125 sites across its range (48 in NSW), with NSW and ACT populations generally occurring between 480-720m.	Suitable habitat includes native temperate grassland and open grassy woodlands dominated by wallaby grass. The patches of DNG containing *Rytidosperma* spp. within the study area are considered too small, isolated and degraded to support this species.	Unlikely	No
Fauna (mammals)							
Cercartetus nanus	Eastern Pygmy Possum	V	-	Found throughout south-eastern Australia. In NSW, distributed from the coast insland as far as Parkes and Wagga Wagga on the south-western slopes.	Found in a broad range of rainforest, dry sclerophyll forest, woodland and heath, appears to prefer woodland and heath. Feeds largely on nectar, as well as insects, and shelters in tree hollows, rotton stumps, holes in the ground and abandoned nests and dreys. Suitable habitat was not present within the subject land.	Unlikely	No
Dasyurus maculatus maculatus	Spotted-tailed Quoll	V	E	Records throughout the ACT; within NSW, records generally confined to within 200km of the coast and range from the Qld border to Kosciusko National Park.	Prefers mature wet forest habitat, but has been recorded from a wide range of habitats including open and closed eucalypt woodlands. Requires hollow logs, hollow-bearing trees, rock outcrops or caves for denning.	No – no suitable habitat	No
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Prefers tall (greater than 20m) moist habitats, however is known to utilise habitat in dry sclerophyll forests. The species may roost in the hollow-bearing trees present.	Potential	Yes

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Miniopteris schreibersii oceanensis	Eastern Bent-wing Bat	V	-	In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga. This species was recorded by ELA (2016) in a property immediately over Sutton Road.	Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. The species may forage within the subject land from time to time and may roost in the hollow-bearing trees present.	Potential	Yes
Myotis macropus	Southern Myotis	V	-	Found in a coastal band in eastern Australia, rarely more than 100 km inland except along major rivers. This species was recorded by ELA (2016) in a property immediately over Sutton Road, adjacent to a dam.	Generally roosts in groups of 10-15 close to water, in caves, hollow-bearing trees, mine shafts, buildings and dense foliage. The hollow-bearing trees, dams and permanent watercourses provide potential habitat for this species.	Potential	Yes
Petauroides volans	Greater Glider	-	V	The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria	Eucalyptus forests and woodlands.	No	No
Phascolarctos cinereus	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands.	Eucalypt woodlands and forests.	Unlikely	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria.	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	No	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Wide ranging species found across northern and eastern Australia. This species was positively identified by ELA (2016) in ridgetop dry sclerophyll forest habitat in a property immediately across Sutton Road.	Roosts in tree hollows and buildings; in treeless areas, can occupy mammal burrows. Forages in most habitats across its range, including treeless areas. The subject land supports foraging and potential roosting habitat for this species.	Potential	Yes
Fauna (reptiles)							
Aprasia parapulchella	Pink-tailed Worm-lizard	V	V	In NSW, only known from the Central and Southern Tablelands, and the South Western Slopes.	Sloping, open woodland areas with predominantly native grassy groundlayers, rocky outcrops or scattered, partially-buried rocks. Potential habitat was identified within the subject lands.	Unlikely	Yes
Delmar impar	Striped Legless Lizard	V	V	Occurs in the southern tablelands, with populations known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas.	Predominantly found in natural temperate grasslands, as well as secondary grassland and occasionally box-gum woodland. Prefers habitat dominated by perennial, tussock forming grasses such as *Themeda australis*, *Austrostipa* spp., and *Poa* spp.	Unlikely	No
Suta flagellum	Little Whip Snake	V	-	Distributed in an area bounded by Crookwell in the north, Bombala in the south, Tumbarumba to the west and Brainwood to the east. The subject land falls within this distribution.	Occurs in natural temperate grasslands and grassy woodlands, as well as secondary (derived) native grasslands. Found on well drained hillsides, mostly associated with scattered loose rocks. This form of rock habitat was not found within the study area.	Unlikely	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution[1]	Habitat[1]	Likelihood of occurrence	Impact assessment required
Tympanocryptis pinguicolla	Grassland Earless Dragon	E	E	There are three extant and genetically distinct populations of this species, two in the ACT (one of which crosses into NSW) and one in the Monaro region of NSW.	Occupies natural temperate grasslands. Critical habitat components include wolf spider or wood cricket burrows; embedded surface rocks; and tussocks. While one patch of embedded surface rock was recorded, the grasslands within the study area and subject land are not considered suitable habitat for this species.	Unlikely	No
Varanus rosenbergi	Rosenberg's Goanna	V	-	In NSW, found on the Sydney Sandstone in Wollemi National Park, in the Goulburn and ACT regions and near Cooma in the south.	Heath, open forest and woodland. Associated with termite mounds, which form critical habitat for nesting. No termite mounds or suitable habitat were recorded within the study area.	Unlikely	No

[1]Distribution and habitat information taken from relevant OEH (OEH, 2017) or SPRAT (DoEE 2017b) profile

[2] No impact assessment required for species for which the proposal is likely to only impact upon marginal habitat or unsuitable habitat. For further clarification refer back to Results and Discussion.

Appendix 5: EP&A Act Assessment of Significance

The assessment of significance (7-part test) is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out seven factors, which, when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 7-part test, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

The threatened species and ecological communities that are the subject of 7-part tests for the proposed works are:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus schreibersii oceanis* (Eastern Bent-wing Bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Artamus cyanopterus cyanopterus* (Dusky Woodswallow)
- *Hieraaetus morphnoides* (Little Eagle)
- *Polytelis swainsonii* (Superb Parrot)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Melanodryas cucullata cucullata* (Hooded Robin (south-eastern form))
- *Petroica boodang* (Scarlet Robin)
- *Petroica phoenicea* (Flame Robin)
- *Stagonopleura guttata* (Diamond Firetail)

Eastern False Pipistrelle, Eastern Bentwing-bat, Southern Myotis and Yellow-bellied Sheathtail-bat

The Eastern False Pipistrelle is a relatively large microchiropteran bat, weighing up to 28 grams. It is found on the south-east coast and ranged of Australia, from Queensland to Victoria and Tasmania. It prefers moist habitats, with trees taller than 20 m, and generally roosts in tree hollows but has also been found under loose tree bark or in buildings. It forages on beetles, moths and other insects above or just below the tree canopy.

The Eastern Bentwing-bat is thought to roost primarily in culverts, caves, pipes and other similar structures and breeds in substantial cave structures, however it has also been recorded to roost in tree hollows. It forages in open forest to woodland.

The Southern Myotis generally roosts in structures such as caves, hollow-bearing trees, and storm water channels near water. It forages over streams and pools, catching insects and small fish.

The Yellow-bellied Sheathtail-bat roosts in tree hollows and buildings. The species forages across a wide range of habitats, including treeless areas.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at the risk of extinction.

A key stage in the species' life cycle is breeding, which takes place in late spring to early summer (as early as November for the Southern Myotis, and as late as March for the Yellow-bellied Sheathtail-bat). The main roosting and breeding habitat for the Eastern Bentwing Bat is caves and similar structures, while the Eastern False Pipistrelle, Southern Myotis and Yellow-bellied Sheathtail-bat breed in the roosting structures (including HBTs) described above.

The open grassland within the subject land provides marginal foraging habitat for these microbat species. In addition, the pools and farm dams provide potential foraging habitat for the Southern Myotis. The hollow-bearing may provide roosting habitat for the Southern Myotis and Yellow-bellied Sheathtail-bat. However, no trees will be removed as part of the proposal.

No caves, culverts or other potential maternity roosting structures for the Eastern Bentwing Bat are present within the study area.

Given the limited extent of native vegetation removal, the fact that the majority of vegetation to be removed is exotic pasture, and that no potential roosting habitat will be removed: the proposed action is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

N/A – this is not an endangered population.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

N/A – this is not an endangered ecological community or critically endangered ecological community.

d) in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The potential habitat to be modified consists of up to 9.24 ha of exotic pasture and 0.81 ha of DNG.

The proposed action will not directly impact preferred or high quality foraging or roosting habitat for these species, as no open forest or woodland canopy or potential roosting structures are to be cleared.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposed action will not fragment an area of potential foraging or roosting habitat for this species, as no open forest or woodland canopy is to be cleared, and due to the highly mobile nature of these species (no known barrier to movement).

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,

The potential habitat to be modified consists of up to 9.24ha of exotic pasture and 0.81 ha of DNG. However the 0.81 ha of DNG is highly fragmented and located at the margins of the subject land, adjacent to existing roads and surrounded by exotic pasture. This ground cover vegetation is not considered important habitat for these species in the long term.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Critical habitat in this question refers to areas of land listed under the register of critical habitat kept by the Director General of the Office of Environment and Heritage and the Director General of DPI. No critical habitat for these species is listed on these registers.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No recovery plan, or relevant threat abatement plans has been prepared for these species.

The species action statement for the Eastern False Pipistrelle states that conservation actions should "protect and maintain areas of high quality habitat", "encourage landholders to retain and protect hollow-bearing trees" and "ensure roosting bats are not present before removing or disturbing hollow-bearing trees in winter"

The proposal will remove a relatively small area of highly marginal potential foraging habitat, however this is not considered to be high quality habitat. No hollow-bearing trees will be disturbed or removed.

Eastern Bentwing-bat conservation actions listed under the Species Action Statement by OEH are focused on protecting and managing critical breeding caves. The action proposed is consistent with these actions.

Southern Myotis conservation actions listed under the Species Action Statement by OEH are focused on retaining and protecting live and standing dead trees likely to contain suitably sized hollows, particularly in riparian zones; protecting and restoring riparian habitat; and promoting and protecting roosting habitats in caves and artificial structures. The action proposed is consistent with these actions.

Yellow-bellied Sheathtail-bat conservation actions listed under the Species Action Statement by OEH are focused on increasing protection and awareness of hollow-bearing trees and potential roost sites; removing exotic weeds, particularly in riparian areas; and habitat augmentation. The action proposed is consistent with these actions.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed action will result in the clearing of vegetation strata (canopy/sub-canopy, shrub layer and ground cover) within 0.81 ha of degraded DNG. This broadly meets the definition of the Key Threatening Process (KTP) 'Clearing of native vegetation'. However, the limited extent of clearing, low quality of potential habitat to be affected, and the fact it is unlikely to be allowed to regenerate under permissible landuses means that is not considered a significant impact.

Conclusion

Due to the limited extent of the impacts on native vegetation and potential habitat for these species, the fact that no potential roosting sites will be removed, the relatively low quality of potential foraging habitat to be affected, the action proposed is not considered likely to have a significant impact on the Eastern Bentwing Bat, Southern Myotis or Yellow-bellied Sheathtail-bat.

Gang-gang Cockatoo, Little Eagle, Superb Parrot

The Gang-gang Cockatoo is distributed from southern Victoria through south and central-east NSW. In summer it occupies tall montane forests and woodlands, however it may also occur in sub-alpine Snow Gum woodland and occasionally temperate rainforests. In winter, the species occurs at lower altitudes in drier, more open eucalypt forests, particularly box-ironbark assemblages (NSW Scientific Committee 2005).

The Little Eagle is found throughout mainland Australia, with the exception of the most densely forested parts of the Great Dividing Range escarpment. It occupies open eucalypt forest and woodland, nesting in tall living trees within a remnant patch where it builds a large stick nest in winter.

The Superb Parrot is found throughout eastern inland NSW, with core breeding habitat bounded by Cowra and Yass in the east. Birds breeding within this area migrate north during winter. The species inhabits Box Gum woodland (amongst other habitat types), and nests in hollow-bearing trees (including paddock trees).

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

A key stage in the life cycle of these species is breeding. The Gang-gang Cockatoo favours old-growth forests and woodlands for nesting; nests occur in hollows of 10 cm diameter or greater, at least 9 m above the ground. As described above, the Little Eagle nests during winter, building a large stick nest in tall trees within remnant native vegetation. The Superb Parrot breeds between September and January, nesting in box gum woodland or paddock trees (on the tablelands and south-west slopes).

No native forest or woodland suitable for Gang-gang Cockatoo or Little Eagle nest sites is present within the subject land. Two paddock trees contain hollows suitable for Superb Parrot nesting, however these will be retained.

As such, the action proposed is unlikely to have an adverse effect on the life cycle of these species such as a viable local population is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

N/A – this is not an endangered population.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

N/A – this is not an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The potential habitat to be modified consists of up to 9.24 ha of exotic pasture and 0.81 ha of DNG: these species may move throughout this area however this habitat does not containing breeding habitat and only contains marginal foraging habitat for the Little Eagle.

All species are highly mobile with no barriers to movement, hence no area of habitat will become isolated or fragmented.

The proposal will impact upon native and exotic grasslands and ground cover which are unlikely to support important foraging habitat for any of these species.

No potential nesting habitat will be removed for any of these species. This, combined with their highly mobile nature and the presence of higher quality, larger patches of remnant woodland and open forest within the broader region, means that the habitat to be affected is unlikely to be important to the long-term survival of the species in the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat in this question refers to areas of land listed under the register of critical habitat kept by the Director General of the Office of Environment and Heritage and the Director General of DPI. No critical habitat for this species is listed on these registers.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plans have been developed for the Little Eagle or Gang-gang Cockatoo.

A national recovery plan has been developed for the Superb Parrot. This recovery plan identify threats including loss and degradation of habitat, grazing, firewood collection and competition for nest hollows. As discussed above, the limited extent and nature of vegetation loss or modification means that the proposal is unlikely to result in loss of any important habitat for these species.

A targeted strategy for managing the Gang-gang Cockatoo has been developed under the NSW Saving Our Species program. Critical actions for this species include protecting areas of known and potential remnant habitat, restoring habitat in strategic locations, and raising awareness about the importance of retaining live and standing dead hollow-bearing trees. Additional threats identified for this species include loss of key breeding and foraging habitat, and infestation of habitat by invasive weeds. As the proposed action is unlikely to remove key breeding or foraging habitat, is it considered to be consistent with these actions.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed action will result in the clearing of vegetation strata (canopy/sub-canopy, shrub layer and ground cover) within 0.81 ha of degraded DNG. This broadly meets the definition of the Key Threatening Process (KTP) 'Clearing of native vegetation'. However, the limited extent of clearing, low quality of potential habitat to be affected, and the fact it is unlikely to be allowed to regenerate under permissible landuses means that is not considered a significant impact.

Conclusion

Based on the information provided above, the proposal is not considered likely to have a significant impact on the Gang-gang Cockatoo, Little Eagle or Superb Parrot.

Dusky Woodswallow, Varied Sittella, Hooded Robin, Scarlet Robin, Flame Robin, Diamond Firetail, Little Lorikeet

These seven species occupy very distinct ecological niches, some being granivores and some being nectarivores or insectivores. All display specific foraging and nesting requirements (e.g. canopy, ground cover, tree trunk, fallen debris) within the woodland environment. All share the need for suitable, non-fragmented woodland habitat for foraging and breeding, however they are known to occupy and utilize habitat within more open or cleared areas such as farmland or grasslands. All of these species have suffered similar extents of decline across their distributional ranges in NSW.

Dusky Woodswallow

This species is widespread from the coast to inland NSW, including the western slopes of the Great Dividing Range. It prefers woodlands and dry open sclerophyll eucalypt forests, generally with a sparse shrub understorey and a ground cover consisting of grasses, sedges or open ground with woody debris. They are also found in farm land or roadside remnants. It feeds primarily on invertebrates, and occasionally on nectar, fruit and seeds.

Diamond Firetail

The Diamond Firetail can be found in grassy eucalypt woodlands, including Box-Gum Woodlands. This species can also be found in open forest, mallee, riparian vegetation, and grasslands. This species is often seen in flocks of between five to forty birds. It is a ground feeder, feeding on ripe and partly-ripe grass, herb seeds, green leaves, and on insects. It nests in dense shrubs or in tree canopy (OEH 2017b).

Varied Sittella

The distribution of the Varied Sittella includes most of mainland Australia except deserts and open grasslands. It prefers eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and *Acacia* spp. woodland and feeds on arthropods from bark, dead branches, or small branches and twigs. It nests in a small cup built onto a branch or peeling bark

Little Lorikeet

The Little Lorikeet is associated with eucalypt forest and woodland, foraging on nectar and pollen in the canopy. It favours more fertile sites such as riparian areas. This species can also forage in flowering trees in open country, such as paddock trees. It nests from May to September in proximity to feeding areas, and roosts in the treetops.

Hooded Robin

This bird is associated with a wide range of eucalypt woodlands, shrubland and open forests. In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover. The Hooded Robin home ranges are relatively large, averaging 18 ha for birds from the New England Tableland (OEH 2017b).

Scarlet Robin

During autumn and winter some birds migrate from higher altitudes to the eastern edges of the inland plains. They inhabit dry eucalypt forests and woodlands with an open grassy understorey with few

scattered shrubs. Abundant logs and fallen timber are important components of its habitat (OEH OEH 2017b).

Flame Robin

This species breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, in NSW. The Flame Robin prefers woodland edge clearings or areas with open understorey and grassy ground layer for nesting. It will often occur in recently burnt areas. Abundant logs and fallen timber are important components of its habitat. Many birds move to the inland slopes and plains in winter, or to drier more open habitats in the lowlands (OEH 2017b).

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The vegetation within the subject land provides potential foraging habitat for these species, with the paddock trees providing marginal potential breeding habitat for the Dusky Woodswallow, Diamond Firetail, Varied Sitella, Little Lorikeet or Hooded Robin.

However the vegetation to be removed (exotic pasture and DNGs) does not support potential breeding habitat for these species as they all nest in shrub or tree canopies, or structures such as large woody debris/hollow stumps or rock/built ledges.

While the Flame Robin was observed foraging in exotic pasture within the subject land, this species does not breed in the drier inland areas that it commonly occupies during winter.

Furthermore, the subject land should largely retain its current values post-development.

The relatively small area and highly degraded condition of the vegetation to be removed/modified, and the availability of higher quality foraging and breeding habitat in the broader landscape, means that the action proposed is unlikely to result in a local population of any of these species being placed at risk of extinction.

As such, the action proposed is unlikely to affect breeding, or the life cycle, of these species such that a viable local population is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

N/A – this is not an endangered population.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

N/A – this is not an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The potential habitat to be modified consists of up to 9.24ha of exotic pasture and 0.81 ha of DNG. This may support marginal foraging habitat for ground foraging species (Flame Robin, Scarlet Robin, Diamond Firetail and to a lesser extent Dusky Woodswallow). However, this habitat is highly degraded vegetation that is already subject to agricultural activities (grazing, slashing and pasture improvement) and is not considered important habitat for these species.

Some of the species are highly mobile, while others may be limited by large gaps between remnants. Given current open space, these birds are likely to have similar potential to occur on the subject land post-development.

Given the large extent of similar grassland habitat in the locality (immediately adjoining the study area), the known occurrence of higher quality native grassland and grassy woodland habitat in the broader landscape, the action proposed is not considered likely to affect habitat important for the long term survival of the species in the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat in this question refers to areas of land listed under the register of critical habitat kept by the Director General of the Office of Environment and Heritage and the Director General of DPI. No critical habitat for this species is listed on these registers.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has yet been prepared for these species.

Recovery strategies and critical actions for addressing threats and managing the Flame Robin, Hooded Robin, Scarlet Robin, Varied Sittella, Diamond Firetail and the Little Lorikeet have been identified as part of the NSW Saving Our Species program. These include (but are not limited to) actions relating to managing Noisy Miner populations; undertaking revegetation; encouraging the protection of higher quality woodland habitat; encouraging the retention of woody ground debris; retaining standing dead trees; weed control; and buffering or maintaining connectivity between remnants. The action proposed is not considered to be inconsistent with these critical actions.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed action will result in the clearing of vegetation strata (canopy/sub-canopy, shrub layer and ground cover) within 0.81 ha of degraded DNG. This broadly meets the definition of the Key Threatening Process (KTP) 'Clearing of native vegetation'. However, the limited extent of clearing, low quality of potential habitat to be affected, and the fact it is unlikely to be allowed to regenerate under permissible landuses means that is not considered a significant impact.

Conclusion

Based on the information provided above, the proposed works will not have a significant impact on these threatened woodland bird species.

Dusky Woodswallow, Varied Sittella, Hooded Robin, Scarlet Robin, Flame Robin, Diamond Firetail, Little Lorikeet

These seven species occupy very distinct ecological niches, some being granivores and some being nectarivores or insectivores. All display specific foraging and nesting requirements (e.g. canopy, ground cover, tree trunk, fallen debris) within the woodland environment. All share the need for suitable, non-fragmented woodland habitat for foraging and breeding, however they are known to occupy and utilize habitat within more open or cleared areas such as farmland or grasslands. All of these species have suffered similar extents of decline across their distributional ranges in NSW.

Dusky Woodswallow

This species is widespread from the coast to inland NSW, including the western slopes of the Great Dividing Range. It prefers woodlands and dry open sclerophyll eucalypt forests, generally with a sparse shrub understorey and a ground cover consisting of grasses, sedges or open ground with woody debris. They are also found in farm land or roadside remnants. It feeds primarily on invertebrates, and occasionally on nectar, fruit and seeds.

Diamond Firetail

The Diamond Firetail can be found in grassy eucalypt woodlands, including Box-Gum Woodlands. This species can also be found in open forest, mallee, riparian vegetation, and grasslands. This species is often seen in flocks of between five to forty birds. It is a ground feeder, feeding on ripe and partly-ripe grass, herb seeds, green leaves, and on insects. It nests in dense shrubs or in tree canopy (OEH 2017b).

Varied Sittella

The distribution of the Varied Sittella includes most of mainland Australia except deserts and open grasslands. It prefers eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and *Acacia* spp. woodland and feeds on arthropods from bark, dead branches, or small branches and twigs. It nests in a small cup built onto a branch or peeling bark

Little Lorikeet

The Little Lorikeet is associated with eucalypt forest and woodland, foraging on nectar and pollen in the canopy. It favours more fertile sites such as riparian areas. This species can also forage in flowering trees

in open country, such as paddock trees. It nests from May to September in proximity to feeding areas, and roosts in the treetops.

Hooded Robin

This bird is associated with a wide range of eucalypt woodlands, shrubland and open forests. In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover. The Hooded Robin home ranges are relatively large, averaging 18 ha for birds from the New England Tableland (OEH 2017b).

Scarlet Robin

During autumn and winter some birds migrate from higher altitudes to the eastern edges of the inland plains. They inhabit dry eucalypt forests and woodlands with an open grassy understorey with few scattered shrubs. Abundant logs and fallen timber are important components of its habitat (OEH OEH 2017b).

Flame Robin

This species breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, in NSW. The Flame Robin prefers woodland edge clearings or areas with open understorey and grassy ground layer for nesting. It will often occur in recently burnt areas. Abundant logs and fallen timber are important components of its habitat. Many birds move to the inland slopes and plains in winter, or to drier more open habitats in the lowlands (OEH 2017b).

(b) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The vegetation within the subject land provides potential foraging habitat for these species, with the paddock trees providing marginal potential breeding habitat for the Dusky Woodswallow, Diamond Firetail, Varied Sitella, Little Lorikeet or Hooded Robin.

However the vegetation to be removed (exotic pasture and DNGs) does not support potential breeding habitat for these species as they all nest in shrub or tree canopies, or structures such as large woody debris/hollow stumps or rock/built ledges.

While the Flame Robin was observed foraging in exotic pasture within the subject land, this species does not breed in the drier inland areas that it commonly occupies during winter.

Furthermore, the subject land should largely retain its current values post-development.

The relatively small area and highly degraded condition of the vegetation to be removed/modified, and the availability of higher quality foraging and breeding habitat in the broader landscape, means that the action proposed is unlikely to result in a local population of any of these species being placed at risk of extinction.

As such, the action proposed is unlikely to affect breeding, or the life cycle, of these species such that a viable local population is likely to be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

N/A – this is not an endangered population.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

iii. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

iv. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

N/A – this is not an endangered ecological community or critically endangered ecological community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The potential habitat to be modified consists of up to 9.24ha of exotic pasture and 0.81 ha of DNG. This may support marginal foraging habitat for ground foraging species (Flame Robin, Scarlet Robin, Diamond Firetail and to a lesser extent Dusky Woodswallow). However, this habitat is highly degraded vegetation that is already subject to agricultural activities (grazing, slashing and pasture improvement) and is not considered important habitat for these species.

Some of the species are highly mobile, while others may be limited by large gaps between remnants. Given current open space, these birds are likely to have similar potential to occur on the subject land post-development.

Given the large extent of similar grassland habitat in the locality (immediately adjoining the study area), the known occurrence of higher quality native grassland and grassy woodland habitat in the broader landscape, the action proposed is not considered likely to affect habitat important for the long term survival of the species in the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat in this question refers to areas of land listed under the register of critical habitat kept by the Director General of the Office of Environment and Heritage and the Director General of DPI. No critical habitat for this species is listed on these registers.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has yet been prepared for these species.

Recovery strategies and critical actions for addressing threats and managing the Flame Robin, Hooded Robin, Scarlet Robin, Varied Sittella, Diamond Firetail and the Little Lorikeet have been identified as part of the NSW Saving Our Species program. These include (but are not limited to) actions relating to managing Noisy Miner populations; undertaking revegetation; encouraging the protection of higher quality woodland habitat; encouraging the retention of woody ground debris; retaining standing dead trees; weed control; and buffering or maintaining connectivity between remnants. The action proposed is not considered to be inconsistent with these critical actions.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The proposed action will result in the clearing of vegetation strata (canopy/sub-canopy, shrub layer and ground cover) within 0.81 ha of degraded DNG. This broadly meets the definition of the Key Threatening Process (KTP) 'Clearing of native vegetation'. However, the limited extent of clearing, low quality of potential habitat to be affected, and the fact it is unlikely to be allowed to regenerate under permissible landuses means that is not considered a significant impact.

Conclusion

Based on the information provided above, the proposed works will not have a significant impact on these threatened woodland bird species.

Appendix 6: EPBC Act MNES Impact Assessment

The following MNES that are subject to an impact assessment under the EPBC Act are:

- *Polytelis swainsonii* (Superb Parrot)
- *Apus pacificus* (Fork-tailed Swift)
- *Ardea alba* (Great Egret)
- *Ardea ibis* (Cattle Egret)
- *Hirundapus caudacutus* (White-throated Needletail)
- *Merops ornatus* (Rainbow Bee-eater)
- *Monarcha melanopsis* (Black-faced Monarch)

Matters to be addressed	Impact (Commonwealth legislation)
(a) any environmental impact on a World Heritage Property;	N/A. The proposed action does not impact on a World Heritage Property.
(b) any environmental impact on Wetlands of International Importance;	N/A. The proposed action will not affect any part of a Ramsar wetland.
(c) any impact on Commonwealth Listed Critically Endangered or Endangered Species	No species considered likely to occur, hence no impact.
(d) any impact on Commonwealth Listed vulnerable Species;	The study area provides potential foraging and/or breeding habitat for Vulnerable species ***Polytelis swainsonii*** **(Superb Parrot)**. **1) lead to a long-term decrease in the size of an important population of a species** The proposed action will not result in the loss of any breeding habitat (i.e. hollow-bearing trees) for this species, and minimal loss of potential foraging habitat (0.81 ha of highly fragmented DNG). **2) reduce the area of occupancy of an important population** No important populations of this species have been identified within the subject lands. Furthermore, the proposed action will result in the loss of up to 0.81 ha of highly marginal potential foraging habitat for this species, which is not considered likely to substantially reduce its area of occupation. **3) fragment an existing important population into two or more populations** The proposed action will not result in the fragmentation of habitat for this species, due to the currently extensively cleared nature of the subject land and the highly mobile nature of this species.

Matters to be addressed	Impact (Commonwealth legislation)
	4) adversely affect habitat critical to the survival of a species Critical habitat for this species primarily comprises nesting sites in hollow-bearing trees. No hollow-bearing trees or eucalypt canopy species will be removed as a result of this proposal. Furthermore, more extensive patches of potential foraging habitat exist within the broader landscape that will not be directly affected by the proposed action. **5) disrupt the breeding cycle of an important population** As stated above, no potential breeding sites will be affected by the proposed action. **6) Adversely affect habitat critical to the survival of a species; modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline** The marginal foraging habitat within the subject land is not considered critical to the survival of this species. Paddock trees with hollows can form important nesting sites, however all hollow-bearing trees will be retained. **7) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat** The proposal will not result in the establishment or additional spread of a new invasive species that is harmful to the Superb Parrot. **8) Introduce disease that may cause the species to decline** The proposal will not result in the introduction of a new disease that may cause the Superb Parrot to decline. **9) Interfere substantially with the recovery of the species** Considering the above factors, and the limited extent and nature of clearing and disturbance to potential foraging habitat: the proposed action is unlikely to substantially interfere with the recovery of the Superb Parrot. **Conclusion**: Referral not required.
(e) any environmental impact on Commonwealth Listed Migratory Species;	The study area provides foraging habitat for four and/or marine species: *Apus pacificus* (Fork-tailed Swift); *Merops ornatus* (Rainbow Bee-eater); *Monarcha melanopsis* (Black-faced Monarch);*Hirundapus caudacutus* (White-throated Needletail); *Ardea alba* (Great Egret) and *Ardea ibis* (Cattle Egret). These species would not breed locally due to their ecology and limited values of the habitats within the study area. The significant impact criteria in terms of migratory species are discussed below: **10) substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species** The proposed action will modify up to 9.24ha of exotic grassland and 0.81 ha of degraded DNG. None of this is considered to constitute important habitat for these species; and the majority of existing pasture and woodland will remain on the subject land. The modification of this vegetation is unlikely to increase fragmentation or isolation due to the fact that no canopy will be cleared and the mobile nature of these species. **11) result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or**

Matters to be addressed	Impact (Commonwealth legislation)
	The proposed action is unlikely to introduce any invasive species. The European rabbit, feral cats and foxes are already likely to occur in the study area at least periodically, but the proposal is unlikely to affect their abundance. The majority of vegetation to be impacted is already dominated by exotic pasture species. **12) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.** The proposed action does not impact breeding habitat – only non-breeding foraging habitat, which would at most form a minute fraction of their range. The proposed action affects substantially less than the ecologically significant proportion of the population given in the guidelines, so is unlikely to result in a significant impact. **Conclusion**: Referral not required.
(f) any critically endangered and endangered ecological communities	No critically endangered or endangered ecological communities occur within the subject land, hence no impact.
(g) does any part of the Proposal involve a Nuclear Action;	N/A. The proposal does not involve a Nuclear Action.
(h) any environmental impact on a Commonwealth Marine Area;	N/A. The proposed action will not impact on a Commonwealth Marine Area.
(i) In addition, any direct or indirect impact on Commonwealth lands	N/A. The proposed action will not directly or indirectly impact on Commonwealth land.

Appendix 7: Flora and fauna species recorded within study area

Flora species

Scientific name	Common name	Native/Exotic
Native		
Austrostipa bigeniculata	-	Native
Austrostipa scabra	Speargrass	Native
Bothriochloa macra	Red Grass	Native
Carex appressa	Tall Sedge	Native
Chloris truncata	Windmill Grass	Native
Eragrostis brownii	Brown's Lovegrass	Native
Eucalyptus melliodora	Yellow Box	Native
Euphorbia drummondii	Caustic Weed	Native
Juncus sp.	-	Native
Lomandra bracteata	-	Native
Panicum effusum	Hairy Panic	Native
Phragmites australis		Native
Rumex brownii	Swamp Dock	Native
Rytidosperma racemosum var. *racemosum*	-	Native
Themeda triandra	Kangaroo Grass	Native
Typha sp.	Bulrush	Native
Exotic		
Arctotheca calendula	Capeweed	Exotic
Brassicaceae sp.	-	Exotic
Bromus hordaceaus	Soft Brome	Exotic
Cirsium vulgare	Spear Thistle	Exotic
Conyza sp.	Fleabane	Exotic
Cratageus monogyna	Hawthorn	Exotic
Cynodon dactylon	Couch	Exotic
Eleusine tristachya	Goose Grass	Exotic
Eragrostis curvula	African Lovegrass	Exotic
Hypochaeris radicata	Catsear	Exotic
Malva parviflora	Small-flowered Mallow	Exotic
Paspalum dilatatum	Paspalum	Exotic
Phalaris aquatica	Phalaris	Exotic
Pinus radiata	Radiata Pine	Exotic
Plantago lanceolata	Plantain	Exotic
Rubus fruticosus ssp. agg	Blackberry	Exotic
Setaria sp.	-	Exotic
Trifolium repens	White Clover	Exotic
Trifolium subterraneum	Subterranean Clover	Exotic

Fauna species

Scientific name	Common name	Native/Exotic
Birds		
Anthus novaeseelandiae	Australasian Pipit	Native
Corvus coronoides	Australian Raven	Native
Cracticus tibicen	Australian Magpie	Native
Eolophus roseicapilla	Galah	Native
Grallina cyanoleuca	Magpie-lark	Native
Hirundo neoxena	Welcome Swallow	Native
Petroica phoenicea	Flame Robin	Native
Psephotus haemotonotus	Red-rumped Parrot	Native
Rhipidura albiscapa	Grey Fantail	Native
Rhipidura leucophrys	Willie Wagtail	Native
Frogs		
Crinia signifera	Common Eastern Froglet	Native

Appendix 8: Flora and Fauna Assessor's CV

CURRICULUM VITAE

Sarah Dickson-Hoyle

ECOLOGIST

QUALIFICATIONS

Bachelor of Arts/Bachelor of Science, University of Melbourne

Master of Forest Ecosystem Science, University of Melbourne

Sarah holds a double bachelor degree in Arts/Science (Geography/Botany) and a Master of Forest Ecosystem Science from the University of Melbourne. She has over five years' experience in ecological and forest management consulting and natural resource management, with experience in flora and fauna monitoring and impact assessments, forest inventory and monitoring, carbon forestry, and community based conservation management. Sarah also has extensive experience designing and implementing social research (community values and risk analyses), facilitating workshops and leading community partnership projects.

Within ELA, Sarah has contributed to both field work and reporting for biannual flora and fauna monitoring of conservation offset and mine rehabilitation areas, and to flora and fauna assessments for a range of small and medium scale developments. She has developed a strong working knowledge of the flora of central western and central and southern tablelands NSW. She has gained experience in conducting targeted vegetation mapping and assessment of biodiversity and habitat values.

Prior to her work with ELA, Sarah worked for two years in carbon forestry and associated services, involving plantation inventory, forest assessment (as part of the Victorian Forest Monitoring Program), and project and methodology development under the Carbon Farming Initiative.

Sarah has led a number of reforestation and land restoration projects with community based and not-fot-profit conservation groups in Victoria and New South Wales, including Landcare groups and Australian Ecosystems Foundation Incorporated.

Sarah has excellent written and verbal communication skills and has worked with a wide range of stakeholders including industry, government, and community based environment groups across both public and private land tenures. She has working knowledge of Victorian, NSW, and federal environmental legislation and planning instruments, and guidelines and best practices for forest management and community consultation.

RELEVANT PROJECT EXPERIENCE

Nerriga Road upgrade Flora and Fauna Assessment and Review of Environmental Factors

Macs Reef Road, Bywong Flora and Fauna Assessment

"Fairvale", Stromlo Block 518, Stromlo Vegetation Assessment

Stromlo Block 517 Ecological Values Survey

Dargue's Gold Mine Vegetation Monitoring

Innovative Commercial Properties existing dwelling Flora and Fauna Assessment

Avisford 4WD and Recreation Park Flora and Fauna Assessment

Ulan Road upgrade Flora and Fauna Assessment and targeted threatened species survey

Moolarben Coal Operations (MCO)

- Biodiversity Offset and Rehabilitation Area flora and fauna monitoring
- Complex Wide Biodiversity Management Plan
- Box Gum Woodland EPBC targeted surveys and vegetation mapping
- Modification 9 and Stage 2 Pre-clearing assessments

Ulan Coal Mines Limited (UCML)

- Biodiversity Offset and Rehabilitation Area flora monitoring
- Biodiversity Management Plan (Flora and Fauna Monitoring)
- Vegetation mapping – Marshall and Highett Properties
- Biodiversity Offset Area hollow-bearing tree assessment