LAND CAPABILITY ASSESSMENT

Lot 3 DP 1203365, Lot 2 DP 1202319
and Lot 11 DP 1180243
GLENROY ROAD
GOOD HOPE NSW

5 May 2025 (V01)

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Limitations:

This report has relied on the information provided by the client prior to this report, and from site investigation as undertaken on a specific date. The results provided are indicative of the sub-surface conditions only at the specific sampling or testing locations, and only to the depths investigated and at the time the inspection was carried out. It cannot be considered that these findings represent the actual state of the site at all points. The accuracy of the report may be limited by undetected variations in ground conditions between sampling locations. Should any site conditions be encountered during construction that vary significantly from those outlined in this report, Franklin Consulting Australia should be advised and further advice sought accordingly. Franklin Consulting Australia does not take responsibility for subsequent development design changes by the client or third parties. Franklin Consulting Australia Pty Ltd accepts no liability or responsibility for or in respect of any use of or reliance upon this report, or parts of this report, including its supporting material, by any party.

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This report is valid for 3 years from the date of issue, assuming no changes to the site or development design.

CONTENTS

SUMMARY

The development involves the subdivision of Lot 3 DP 1203365, Lot 2 DP 1202319 and Lot 11 DP 1180243 at Glenroy Road, Good Hope, to create four new lots including one new dwelling lot. Proposed lot summary below, refer to surveyed plans.

Lot 100 – (126.1 ha):	by Dedn excluding road.
Lot 101 – (206 ha):	by Dedn ex road, including proposed new Building Envelope of 4,000 m^2 with existing track access from Glenroy Road.
Lot 102 – (136.9 ha):	by Dedn ex road.
Lot 103 – (129.4 ha):	by Dedn.

This assessment found the size and layout of the selected building envelope on proposed Lot 101 provides adequate areas of unconstrained land suited to on-site effluent dispersal and the construction of dwellings.

Effluent treatment and dispersal recommendations

The site and soil conditions were assessed as suitable for the installation of **a secondary treatment system linked to surface spray or drip irrigation.** The site was generally unsuited to primary treatment systems and subsoil absorption beds due to the limited soil depth available across the nominated building envelope.

Recommended management measures

To minimise any potential environmental impacts the following specific management measures are recommended for the newly created dwelling lots:

- on-site effluent management is to be ***limited to secondary treatment systems which include disinfection*** to maximise the quality of effluent produced and minimise potential detrimental impacts to surface and ground water systems and the surrounding environment.

- on-site effluent ***dispersal is to be limited to surface spray or drip irrigation*** to maximise evapotranspiration and evaporation, and minimise potential drainage to groundwater systems.

- effluent dispersal areas should be ***restricted to areas which are not mapped as constrained and within the proposed building envelope*.**

- dwelling and associated infrastructure construction shall be located within the nominated building envelopes in areas not mapped as constrained for this purpose.

- ***remnant native vegetation should be retained*** in all parts of the property as far as practical to minimise groundwater recharge and potential dryland salinity issues.

- the ***area and vigour of perennial grazing pasture species should be maximised*** to reduce groundwater recharge and potential dryland salinity issues.

- areas of ***active erosion should be addressed*** through earthworks/revegetation as appropriate.

- ***groundcover should be maintained at >70%*** across the property to minimise future erosion risk.

- ***groundcover should be maintained at 100% in areas identified for effluent irrigation practices***.

REPORT SCOPE AND TECHNICAL REFERENCES

The report incorporates the results of an assessment of land capability for the proposed subdivision.

This assessment looks at the capability of the site to support the proposed development including:

- **Assessment of land capability for on-site effluent management,** based on Appendix C of ANZ Standard 1547:2012, *Site and Soil Evaluation for Planning, Rezoning and Subdivision of Land* and *The Silver Book*;
- **Assessment of land capability for dwelling construction,** based on excluding land within riparian buffer zones, areas of gully erosion or steep land; and
- **General land management recommendations** for constrained and sensitive areas. These will include effluent disposal areas, steep slopes, riparian zones, poorly drained waterlogged soils and areas of native vegetation. Recommendations will be general in nature and are designed to assist in determining appropriate land management practices for different parts of the site

The report also refers to, or relies on, standards and technical references listed below.

- *On-site Sewage Management for Single Households* (The Silver Book) NSW Govt, 1998.
- *Soils and Construction: Managing Urban Stormwater - 4th Ed. Landcom NSW Government, 2004.*
- *ANZ Standard 1547:2012 On-site Domestic Wastewater Management.*
- *Soil Landscapes of the Goulburn 1:250,000 Sheet*. Hird,C. (1991) Soil Conservation Service of NSW.
- *Soil Landscapes of the Canberra 1:100,000 Sheet*. Jenkins, B.R. (2000) Department of Land and Water Conservation.
- *Yass Valley Environmental Plan (2013).*

LOCATION AND DEVELOPMENT INFORMATION

Address: Glenroy Road, Good Hope NSW.
LGA: Yass Valley Council.
Owner/Developer: C/- Geomatic & Property Services, Yass.

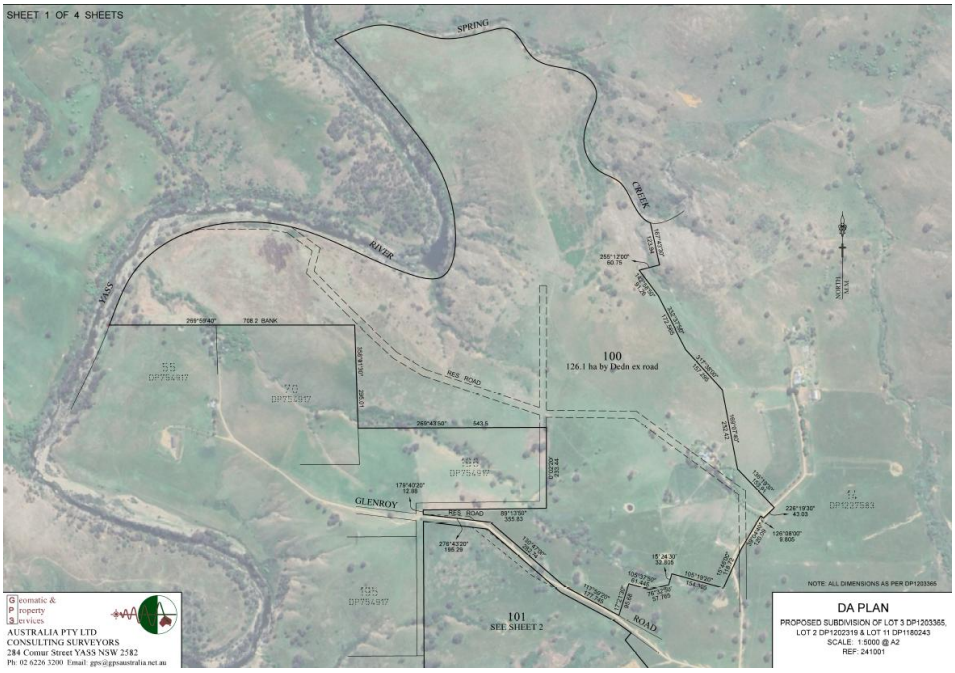

Figure 1: Proposed Lot 100 – extract (refer to surveyed plans).

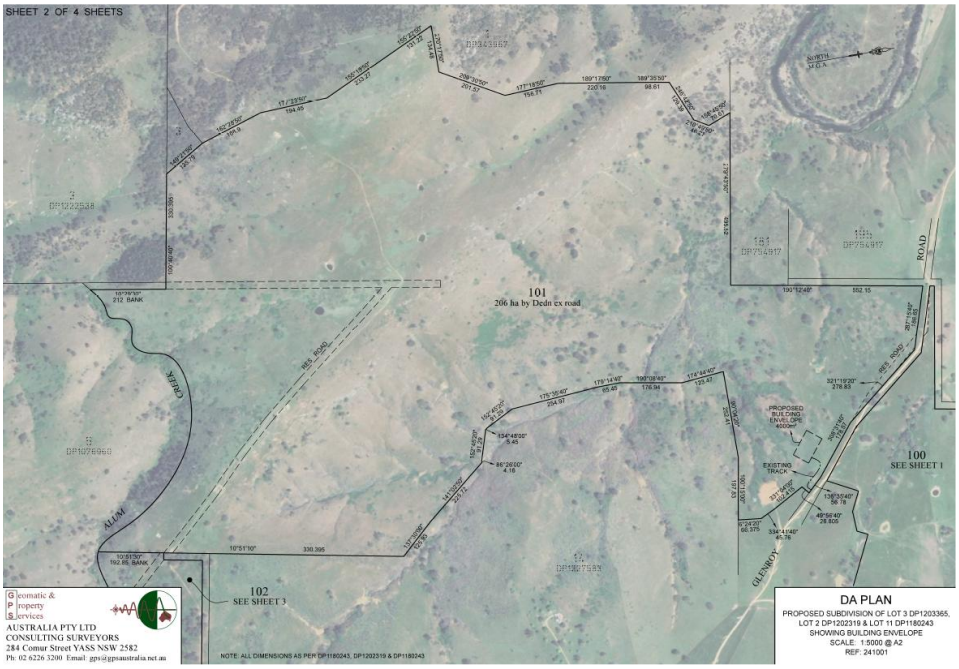

Figure 2: Proposed Lot 101 – extract (refer to surveyed plans).

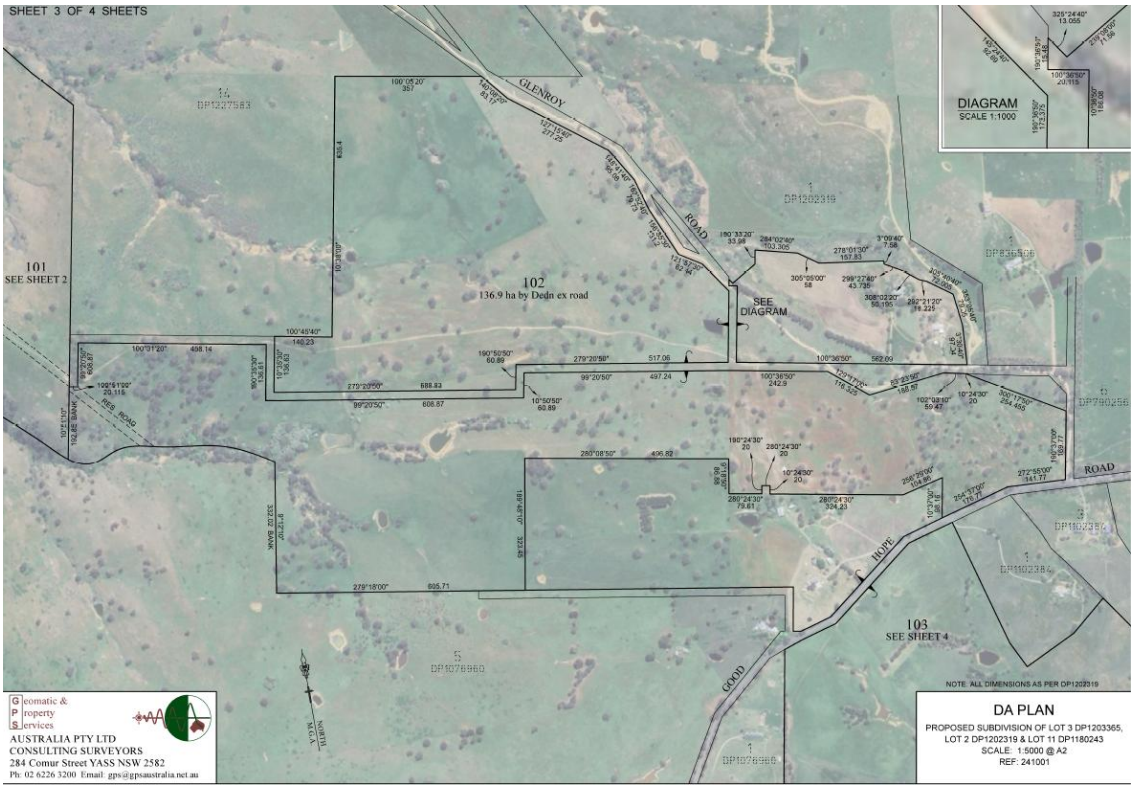

Figure 3: Proposed Lot 102 – extract (refer to surveyed plans).

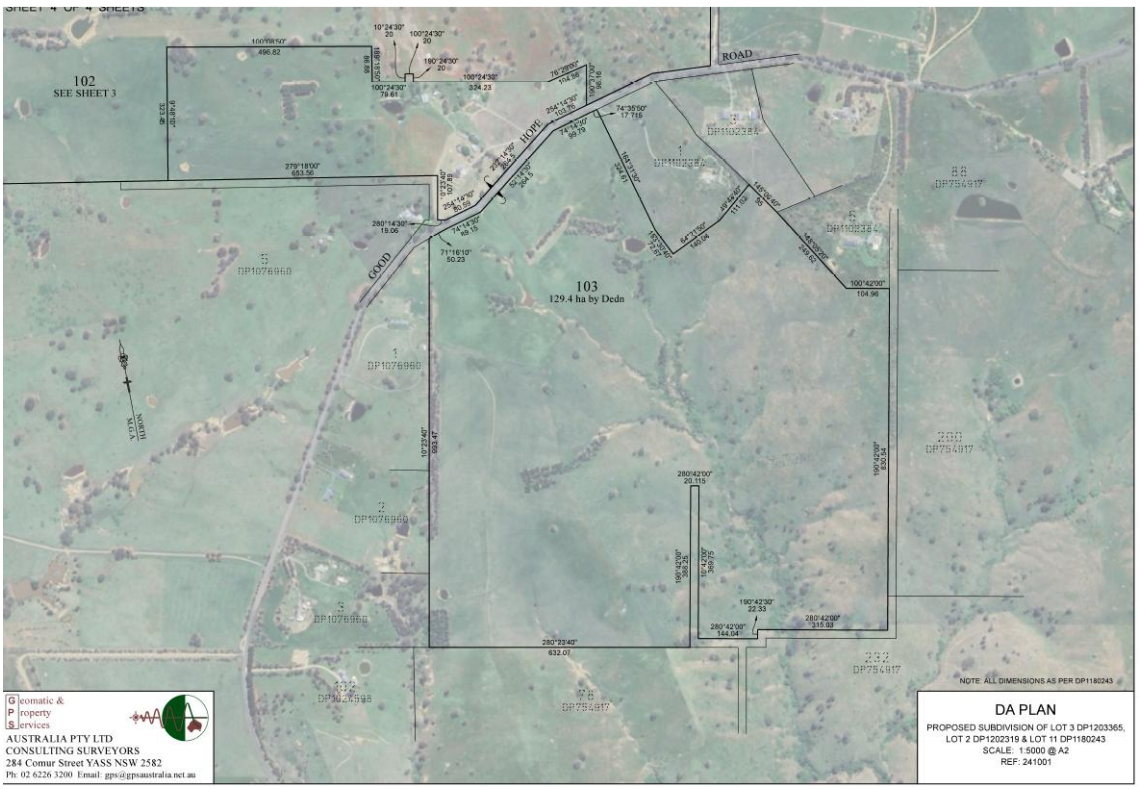

Figure 4: Proposed Lot 103 – extract (refer to surveyed plans).

Intended water supply: Potable water is to be provided through roof catchment and tank storage. Non-potable water is to be provided through roof catchment and tank storage.

It is recommended that the minimum tank storage requirement for the dwelling lot be sufficient to satisfy potable, non-potable and firefighting requirements and thereby reduce the need for each lot to develop individual additional non-potable water infrastructure such as dams and bores.

Proposed Effluent Management: The development will rely on the on-site treatment and disposal of effluent on the new dwelling lot.

Effluent disposal on the new dwelling lot will be restricted to unconstrained areas within the nominated building envelope.

Effluent will be managed on-site by a combination of NSW Health accredited secondary treatment system with effluent dispersal via surface spray or drip irrigation.

Primary treatment and subsoil absorption systems are not considered appropriate for the development due to low permeability subsoil within the Building Envelope.

Local experience: Many rural developments in the area share similar site and soil constraints. The constraints identified do not present any significant problems for the establishment of new dwellings.

Figure 5: Looking west over proposed effluent dispersal area on Lot 101.

Figure 6: Looking north from proposed effluent dispersal area on Lot 101.

Figure 7: Looking east over proposed effluent dispersal area.

Figure 8: Looking south over proposed effluent dispersal area. .

SITE AND SOIL ASSESSMENT

Climate	Cool temperate climate with mean annual rainfall of approximately 650 mm, pan evaporation 1200 mm; large moisture deficit typically occurs in summer months, small moisture surplus typically occurs in winter months. ***Climate is well suited to dispersal by surface irrigation of secondary treated, disinfected effluent.***
Exposure	The proposed Building Envelope has a high level of exposure being historically cleared for grazing with scattered native trees and perennial grassland. Groundcover is perennial grassland. There is remnant native vegetation on the property outside the nominated building envelopes. ***The level of exposure within the nominated building envelope is favorable for dispersal of secondary treated effluent via surface irrigation.***
Slope	The site displays a gentle slope gradient, 8-10%, downwards to the northwest. ***The area proposed for the building envelope is not slope constrained for dwelling construction or effluent dispersal.***
Landscape/ Landform	The location of the building envelope has divergent slope form. This slope form is suited to the surface irrigation of treated effluent and constraint is limited due to location on crest. ***The nominated building envelope corresponds to areas of divergent slope form which are unconstrained for dwelling construction and effluent disposal.***
Surface rock and outcrop	There are no surface rock or outcrops. ***Rock outcrop and surface stone is not a constraint to effluent disposal within the identified building envelope.***
Hydrology	The sandy loam textured topsoil across the site has a moderate permeability, of 0.5 to 1.5 m/day. The clay loam to light clay subsoils have

a lower permeability in the range of 0.06-0.5 m/day (from table M1 of ANZ STD 1547:2012).

Approximately 5-10% of annual rainfall forms surface runoff, although in individual high intensity storm events over 50% of rainfall may form runoff.

Rainfall that does not form surface runoff is either lost through evaporation and transpiration or infiltrates the soil. 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.

Subsurface lateral flow can exacerbate local seasonal waterlogging issues in lower parts of the landscape. Drainage in the lower parts of the landscape is inherently slower due to lower slopes. The cumulative impact of the concentration of surface water, groundwater discharge and subsurface flows in these parts of the landscape can be considerable seasonal waterlogging and salinity issues.

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 is balanced by an increase in surface water runoff.

Hydrological factors are not a constraint to the construction of dwellings. The low number of dwelling lots to be created (1) and limited infrastructure required to service these lots, results in limited potential for changes to local hydrology.

Effluent disposal will need to be appropriately designed and located to minimise hydrological impacts from surface or shallow sub-surface irrigation such as effluent run-off or rapid effluent drainage through permeable soil profiles into groundwater systems. There is an adequate area of suitable soils within the nominated building envelopes on Lot 101 to mitigate these risks.

It is recommended that an area of suitable site and soil conditions for effluent dispersal be identified on the new dwelling lot Building Envelope in the individual Effluent System Design Report to be submitted as part of the Development Application to construct new dwelling(s).

Soils

A detailed soil profile description is provided in **Appendix 2** of this report.

Soils are mapped as the Barrenjack Creek Soil Landscape in the Goulburn 1:250,000 Sheet Soil Landscape Report (Hird, 1989). Soils are predominantly Kandosols on the lower sloping lower hillslopes, comprising a sandy loam upper layer to around 20-40cm, overlying an earthy clay subsoil. Total soil depth ranges 40-50cm.

The representative analytical data in the survey report shows a 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. The limited soil depth is a constraint to subsoil absorption.

Soils in the proposed building envelope are generally unconstrained for effluent dispersal through surface irrigation. Limited soil depth is a major constraint for subsoil absorption which is not recommended for effluent disposal on the site.

The suitability of the soils within the Building Envelope for dwelling construction should be determined by the Site Classification assessment required to support the Development Application for dwelling construction.

CONSTRAINTS ANALYSIS

SOIL EROSION

The soil types which dominate the site are a moderate to high erosion risk. Therefore, steeper slopes and areas where runoff is concentrated are highly susceptible to erosion.

Areas of erosion are constrained for the dispersal of effluent due to the potential of effluent irrigation practices to exacerbate erosion and the reduced capacity of eroded soil profiles to assimilate nutrients due to the loss of productive topsoil.

Areas of erosion also pose risk to dwelling construction due to potential instability and the undermining of dwelling foundations and associated infrastructure by erosion.

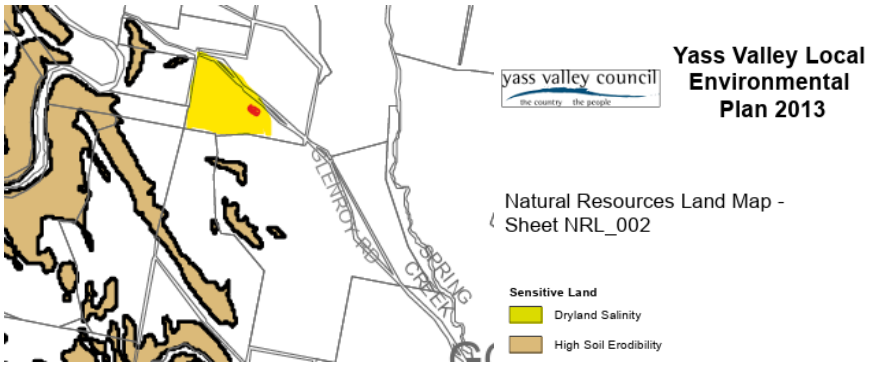

Figure 9: Yass Valley LEP Natural Resources Land Map

The proposed BE on Lot 101 does not include areas mapped as high soil erodibility in the Yass LEP 2013.

No areas of mapped or observed high soil erodibility coincide with the nominated building envelopes on Lot 101.

However, many of the drainage depressions on the property include areas of active sheet, rill and gully erosion. These areas of active erosion will require stock and groundcover management and/or erosion control earth works and revegetation to assist stabilisation.

The are no areas mapped as constrained for effluent dispersal and/or dwelling construction due to soil erosion in the identified Building Envelope on Lot 101, refer **Figures 14 & 15.**

RECOMMENDATIONS

- Greater than 80% groundcover be maintained across gentle to moderately sloping areas of the property (refer **Figure 14 & 15**).
- Groundcover by maintained at 100% in areas nominated for effluent irrigation.
- Erosion control measures should be implemented to address any areas of active erosion.
- Effluent disposal should not occur in areas of mapped or active erosion
- The construction of dwellings or other buildings or infrastructure should not occur in areas of mapped or active erosion.

SALINITY

Dryland salinity is a significant issue across many parts of the Yass River Catchment and is related to changed landscape hydrology, climate, geology, soils and land management.

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 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.

There is no area of mapped salinity within the BE on proposed Lot 101, refer **Figure 14.**

There were no areas of salinity affected land identified during the site inspection.

The elevated areas of the property are considered to be recharge areas where rainfall enters the soil and drains to join the groundwater system which drives the dryland salinity issue which expresses on the surface as waterlogging and saline scalds.

RECOMMENDATIONS

- The area of deep-rooted perennial species should be maintained across the property including retaining existing trees and shrubs.

GROUNDWATER

The site is mapped as Moderate groundwater vulnerability on the Department of Land and Water Conservation (2001) Groundwater Vulnerability Map of the Murrumbidgee Catchment.

No part of the property is mapped on the Yass Valley LEP 2013 Groundwater Vulnerability Map, see **Figure 10** below.

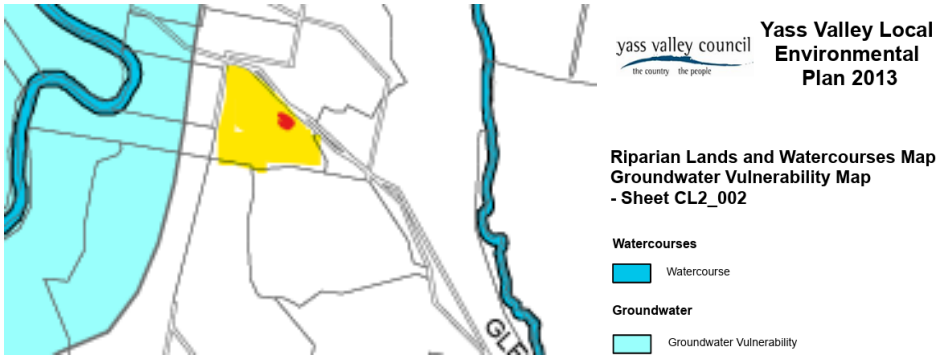

Figure 10: Yass Valley Environmental Plan 2013 - Groundwater

Figure 11: Bores https://realtimedata.waternsw.com.au/water.stm

There is 1 bores within 500m of the building envelope proposed on Lot 101, refer **Figure 11**. The closest bore is GW052625 which is approx. 233m north of the Building Envelope. This bore is 60 metres deep with water bearing zones at 20-21m, 30-31m, 59-60m.

The risk of contamination or any other adverse impacts to quantity and quality of groundwater available for other users resulting from the on-site effluent dispersal practices related to the development, are limited due to:

- horizontal separation of >200m,
- vertical separation of greater than 20 metres to water bearing zones level in the nearest bore,
- relatively low application rate of secondary treated disinfected effluent,
- application of high-quality effluent to the surface through irrigation maximizing evapotranspiration and minimising opportunity for deep drainage,
- low number of additional dwelling lots (1),
- recommended measures available to mitigate impacts (as detailed below).

RECOMMENDATIONS

- Maintain a minimum 200m buffer[1] between bores and the adjacent effluent dispersal areas within the building envelope
- Require a water supply work approval to be sought prior to constructing a bore or well.

[1] A reduced bore buffer of 200 metres is considered adequate for the site given the use of secondary treated and disinfected effluent, depth to water bearing zone and limited number of additional dwelling lots (1). The 200 metre buffer is twice the required buffer for Sydney Catchment Area and four times the largest buffer required by AS1547:2012.

RIPARIAN LANDS

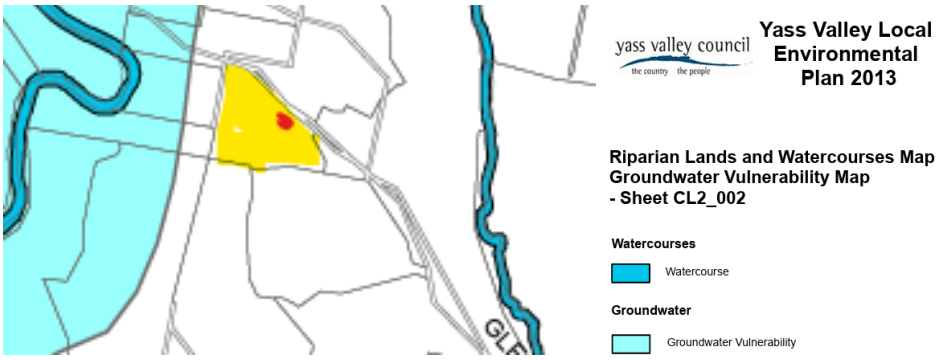

Figure 12: Yass Valley Environmental Plan 2013 - Groundwater

The proposed building envelope on Lot 101 does not include any mapped watercourses on the Riparian Lands and Watercourses Map-Sheet CL2_005 (refer **Figure 12**).

NSW DPI Office of Water (Guidelines for riparian corridors on waterfront land) defines the riparian corridors required for different stream orders, to maintain the integrity of these sensitive riparian areas, refer **Figures 14 & 15.**

Figure 2. The Strahler System

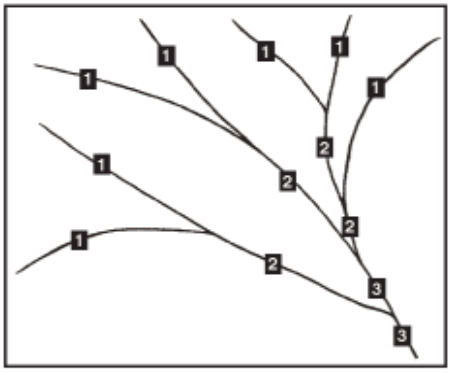

Table 1. Recommended riparian corridor (RC) widths

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

Figure 13: Stream ordering and riparian corridor widths (NSW DPI Water Guidelines)

The building envelope on Lot 101 is not located within the buffers required from the 1st and 2nd Order Streams which intersect the property. A small section of the Building Envelope is located within the 40 metre buffer required from the adjacent drainage depression and effluent disposal practices on the site.

RECOMMENDATIONS

- No effluent disposal is to occur within the 40m buffer from minor drainage depressions, dams or the 1st and 2nd Order Streams as mapped in **Figure 14**.
- No dwelling or related infrastructure construction is to occur within the 10m/20m buffer from 1st/ 2nd or higher Order Streams respectively (mapped in **Figure 15**).
- Any watercourse crossings of 1st and/or 2nd Order Streams should be designed in accordance with NRAR guidelines and necessary approvals.

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 100metre buffer from permanent surface waters including rivers, streams and major creeks, and a 40m buffer from any other water including intermittent waterways, dams and drainage channels.

The property includes numerous minor drainage depressions and 1st and 2nd order streams including some small farm dams. All of these drainage features require buffers from effluent disposal practices.

Approximate locations for drainage buffers are shown in **Figure 14**. The nominated building envelope on Lot 101 is located mostly outside these buffers. These buffers do not present a constraint to dwelling construction.

Recommendations

- All land designated for effluent dispersal will be located outside 40m drainage depression buffers as mapped in **Figure 14**.
- All land designated for effluent dispersal will be located outside the 40m buffer from farm dams a mapped in **Figure 14**.

- The buffers required between effluent dispersal practices and drainage depressions and dams do not apply to dwellings or other built infrastructure.

MANAGEMENT OF EFFLUENT

Summary

This report assesses the general availability of an adequately sized area of land within the proposed new building envelope on Lot 101.

A minimum area of 1200 m^2 has been used as the benchmark for the area required for the effluent dispersal. The minimum effluent disposal area is based on an irrigation area for a six-bedroom dwelling being around 520 m^2 plus an allowance for an equal size reserve area. The location of future buildings, paths, tanks, pools and other infrastructure will also need to allow for the required buffers from the nominated effluent disposal areas within the building envelopes.

Key constraints to effluent dispersal on the lot are dam and drainage depression buffers of 40m.

The proposed building envelope on Lot 101 has an adequate area of land that is suited to effluent dispersal and an adequate remaining area that is available for the construction of dwellings and associated infrastructure, including an allowance for the necessary buffers between these features, refer **Figures 14 & 15**.

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. Reliability and maintenance issues with such systems are well known and the risk of failure is relatively low.

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 suited to the subsoil absorption of primary treated effluent due to the limited soil depth available across the building envelope on Lot 101. As a result, both subsoil absorption and evapotranspiration/absorption beds for primary treated effluent are not recommended for the site.

The use of subsoil irrigation beds for dispersal of wet composting closet treatment systems (eg worm farms) are also considered unsuited to the site.

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 for effluent management will occur at the time of submitting building plans to council. At this 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 by this report.

Secondary treatment system 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.

It is preferable that effluent irrigation systems be fixed installations. Surface spray irrigation systems can be significantly improved 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 current 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	300m2
Four bedrooms	370m2
Five bedrooms	450m2
Six bedrooms	520m2

Council also requires adequate suitable land for a reserve effluent dispersal area. Additionally, buffers of 15m are required from dwellings (for surface spray), 6m from downslope buildings, property boundaries and driveways and 3m if these features are located upslope. A 40-metre buffer is required between effluent disposal practices and any minor drainage depressions.

Primary treatment and subsoil absorption	**Generally, not suitable due to shallow soils and dryland salinity**
Innovative effluent management systems	A Wisconsin mound pump dosed from a septic tank may be suited to the 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 the new dwelling entitlement on Lot 101 and the prescriptions of this report should be applied to the design process of the lot.
- The effluent dispersal system should be located within the nominated building envelope, refer **Figure 14**.
- Buffers to be applied to effluent dispersal areas will include:
  - 40 m from all dams and drainage depressions
  - 100 m from any existing or future upslope bores
  - 200 m from bores
  - 15 m from dwellings (for surface spray irrigation)
  - 6 m from property/lot boundaries (3 m if these are upslope)
  - 6 m from buildings and driveways (3 m if these are upslope)
- The effluent management system suitable for the lot include an aerated wastewater treatment system (including disinfection) with NSW Health accreditation, dispersing effluent to a designated effluent surface or shallow subsurface irrigation area. The irrigation area size should be based on potential occupancy derived from bedroom number.
- As a guide, the following areas would be appropriate for the soil and site conditions of the site:
  - Three bedrooms.....300m^2
  - Four bedrooms.....370m^2
  - Five bedrooms.....450m^2
  - Six bedrooms.....520m^2
- To ensure effective distribution of treated effluent, and provide protection of irrigation lines, the minimum requirement for irrigation dispersal should be buried distribution lines with decoupling sprinkler heads. There should be a minimum of two runs of distribution lines connected by a manual valve to allow for alternating dispersal areas.
- More innovative systems such as a Wisconsin sand mound treating primary effluent from a septic tank, or a recirculating sand filter with a subsurface irrigation field, are also suitable.
- A subsoil absorption bed receiving primary treated effluent is generally not considered suitable for the site.

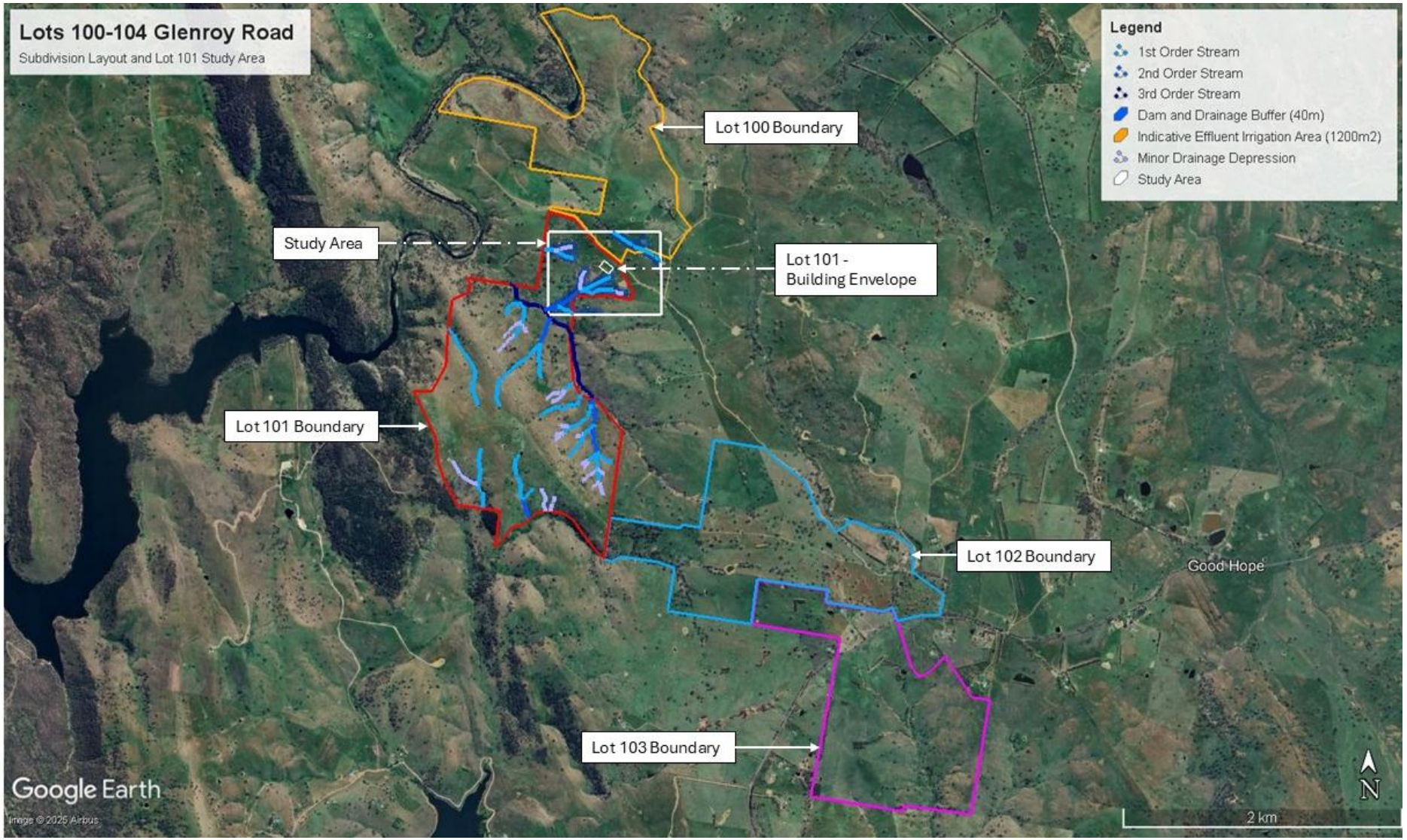

Figure 14a: Subdivision layout and constraints to effluent dispersal.

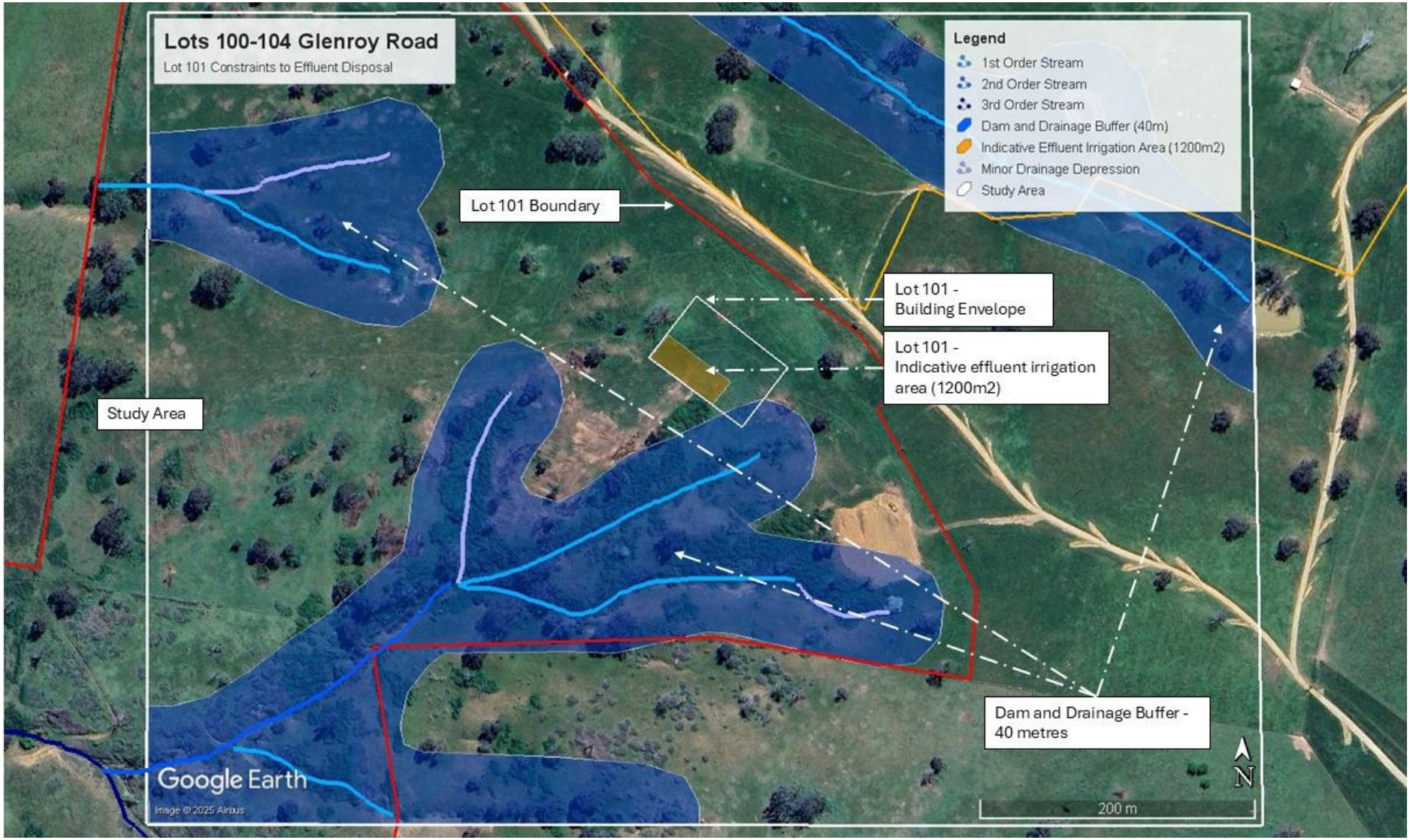

Figure 14b: Lot 101 constraints to effluent dispersal.

CAPABILITY FOR DWELLING CONSTRUCTION

Summary

Land considered unsuitable or constrained for the construction of dwellings generally consists of areas with the following attributes:

- a slope grade of 15% - the threshold is consistent with many building codes and Council requirements and also corresponds to the slope above which erosion hazard significantly increases (Landcom, 2004),
- seasonally waterlogged or flood prone land - including the minor flow lines which drain the site and dams,
- unsuitable soils – including highly erodible dispersive soils, low wet bearing strength soils and unstable soils prone to movement,
- areas within riparian corridors consistent with NSW DPI Office of Water Guidelines for riparian zone management, refer **Figure 15**.

The 40m buffer on minor drainage lines and the 40m buffer from dams required for effluent disposal areas, do not apply to dwelling construction.

The building envelope on Lot 101 and is generally unconstrained for dwelling construction.

Dwelling construction

Recommendation

- Building envelopes will be restricted to land within the designated Building Envelope which are shown in this report as unconstrained, refer **Figure 15**.
- A Site Classification shall be conducted prior to the construction of dwelling on Lot 101 which confirms the suitability of soil within the building envelope for construction.

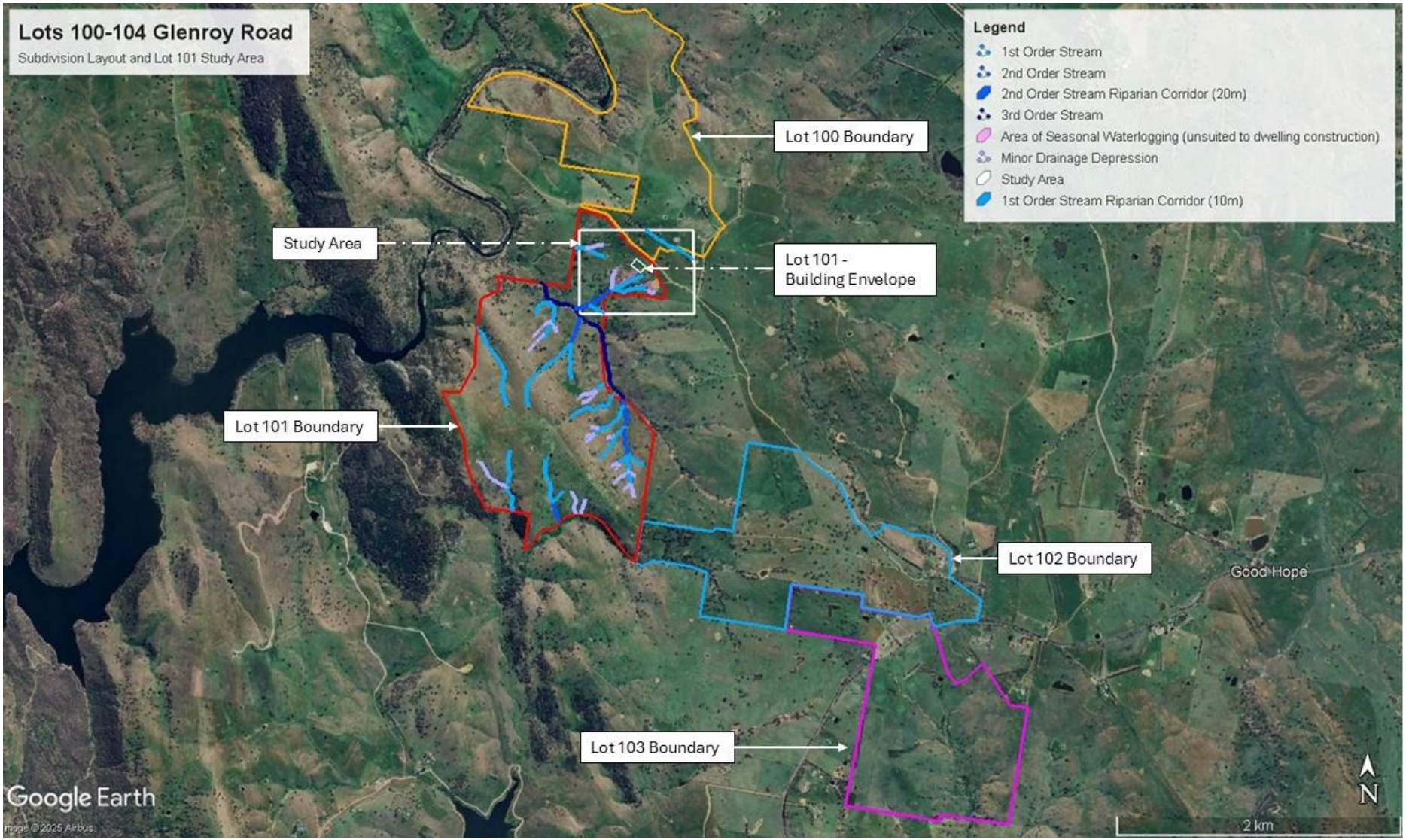

Figure 15a: Subdivision layout and constraints to dwelling construction.

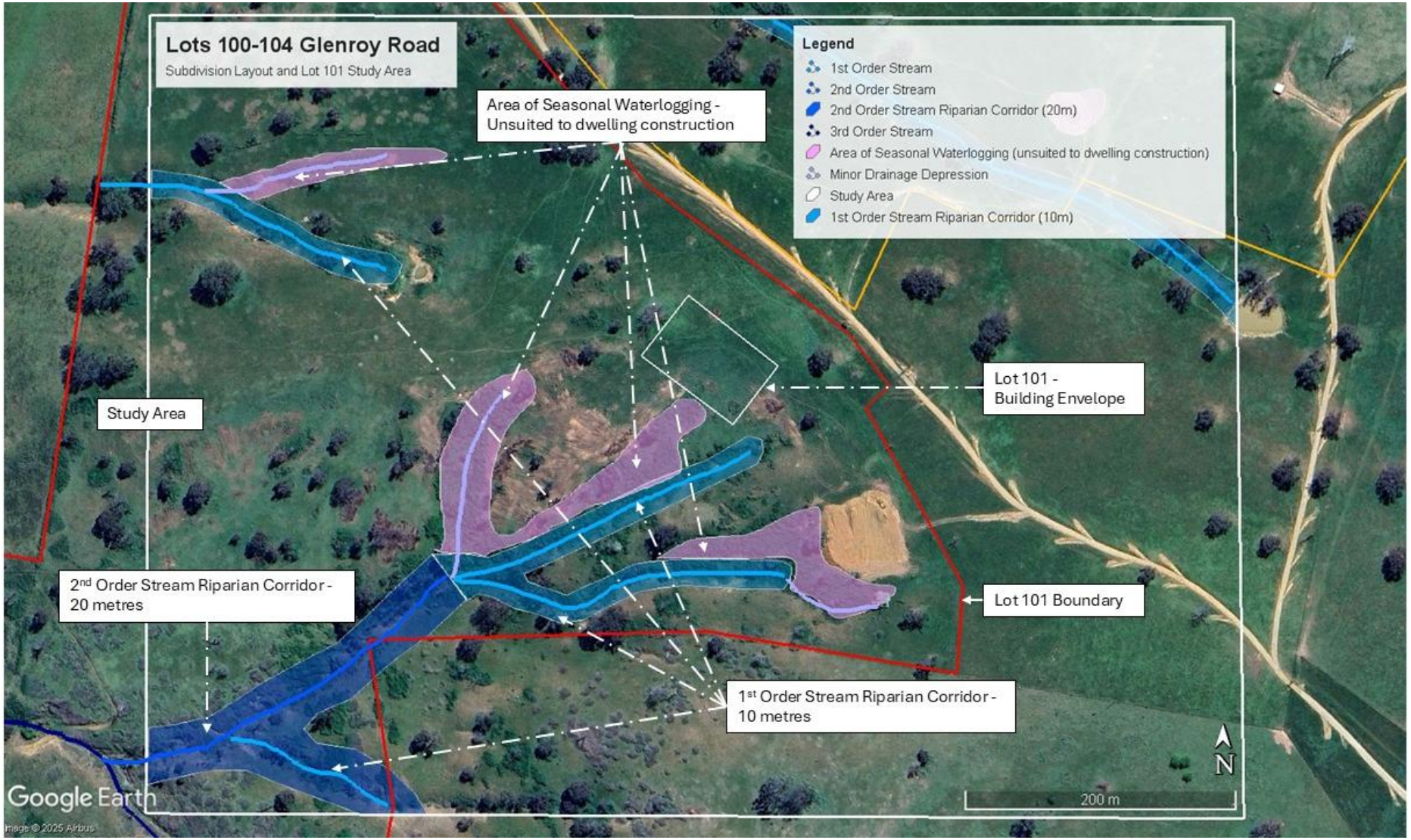

Figure 15b: Subdivision layout and constraints to dwelling construction.

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
Run-on and seepage	All land application systems	None-low	Moderate	High, diversion not practical	Transport of wastewater off site

Site feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
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) **SL** **L, CL** **C**	All land application systems	 < 1.8 < 1.6 < 1.4		 > 1.8 > 1.6 >1.4	restricts plant growth, indicator of permeability
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: Lot 101 – Building Envelope

Soil classification	Depth (cm)	Properties
CHROMOSOL	0-5	A1 Brown sandy loam, dry and friable consistency, massive structure, no coarse fragments.
	5-30	A2 Brown grey sandy loam, dry & friable, massive to weak structure, <5% coarse fragments.
	30-55	B Orange sandy clay loam, dry & friable, moderate structure, <5% coarse.

Figure 16: Soil profile – building envelope proposed Lot 101.

APPENDIX 3: EFFLUENT AREA DESIGN

Using the DIR for irrigation on clay loam soils of 3.5 mm/day and adopting the design loading of 480 L/day, the following land application areas are required to manage additional hydraulic loading, nitrogen and phosphorous generated:

Water balance

- **Sizing based on hydraulic loading:**

A = Q (l/day)/DIR (mm/day)
where A = area; Q = 480 l/day; DIR = 3.5 mm/day
A = 480/3.5 = 137 m^2
Area required = 150 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 = 480 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 = 480 X 20 X 365/15,000 = 234m^2
Area required = 250 m^2

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 480 X 365 X 50 = 87.6kg
P_{uptake} = 4.4mg/m^2/day X 365 X 50 = .080kg/m^2
P_{sorb} = 2,164kg/ha = .216kg/m^2
A = 87.6/(.08+ .216) = 296 m^2
Area required = 300 m^2

Design effluent disposal area

Therefore, a land application area of **300 m^2** will account for phosphorous, nitrogen and water applied based on estimated connections and usage patterns associated with the construction of a 3-bedroom house.
An allowance of a reserve land application area will double this area to **600m^2**.

Alternative Dwellings

The size of the effluent irrigation area required to service dwellings with 4, 5 & 6 bedrooms are provided below:

- 4 bedrooms – 370 m^2
- 5 bedrooms – 450 m^2
- 6 bedrooms – 520 m^2

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