LAND CAPABILITY ASSESSMENT

LOTS 13,14 DP 786575
LOT 2 DP 1243702
7 ICETON PLACE
YASS NSW 2582

VERSION 1

11 JUNE 2020

FRANKLIN CONSULTING AUSTRALIA PTY LIMITED

GPO Box 837 Canberra ACT 2601
www.soilandwater.net.au

CONTENTS

ASSESSOR DETAILS

JOHN FRANKLIN M Apps Sci, B Sci EIANZ

Director
Franklin Consulting Australia Pty Limited
GPO Box 837
Canberra ACT 2601
02 6179 3491
0490 393 234

admin@soilandwater.net.au
www.soilandwater.net.au

Date assessed: 20 August 2019

Assessor signature:

Soil and Water provides services to 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.

Soil and Water has a wealth of natural resource management experience throughout the Southern Tablelands, South West Slopes and the Riverina, which includes the ACT and extends to the upper Murrumbidgee and alpine areas. Soil and Water also have extensive networks and connections across the natural resource management sector in these areas including all levels of government, Landcare and other professional service providers.

Franklin Consulting Australia Pty Limited holds current Workers Compensation Insurance, Professional Indemnity cover and Public Liability cover.

All works are undertaken or supervised by John Franklin who has qualifications in natural resource management and agriculture and over 26 years' experience in the ACT, Southern Tablelands and 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.

PROJECT DESCRIPTION

Soil and Water was engaged by Genium Civil Engineering to assess land at

Lots 13,14 DP 786575
Lot 2 DP 1243702
7 Iceton Place
Yass NSW 2582

To determine the suitability of the planned subdivision based on:

- The capacity of newly created dwelling lots to sustainably manage effluent on-site as per Council requirements and Australian Standards; and
- The capacity of newly created dwelling lots to provide a suitable unconstrained building site for the construction of a dwelling

These assessments are required to support the Development Application to be submitted to Council for the subdivision of the above lots.

The intent of the subdivision is to create 73 lots consisting:

- 21 lots of less than 2ha with the smallest lots being 1ha
- 40 lots between 2ha and 3ha in size
- 12 lots greater than 3ha with the largest lot being 9.3ha (Lot 63)

Potable water supply for the proposed dwellings will be through the independent capture and storage of roof water in potable water tanks. Lot 66 will have access to the existing small farm dam. All lots will dispose of domestic effluent on-site.

The area is currently zoned R5 – Large Lot Residential under Yass Valley Local Environmental Plan 2013 with a minimum lot size of 10ha. Rezoning will therefore be required to support the lot sizes proposed. A key rezoning consideration is the suitability of the site for onsite effluent disposal and dwelling construction as determined in this assessment.

The land capability assessment is designed to determine the suitability of the planned rural residential dwelling lots based on the capacity of lots to sustainably manage effluent on-site as per Council requirements and Australian Standards. The suitability and constraints for dwelling construction are also considered in this assessment.

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 %, is saline or eroding and is as a result, constrained for the construction of dwellings.

  It is considered that there are adequate areas of suitable site and soil conditions located on the proposed Lots to enable the on-site dispersal of effluent in association with the proposed dwelling sites. It is further considered that there is an adequate area of unconstrained land suited to the construction of dwellings available on each lot.

ASSESSMENT FINDINGS

The key constraints to onsite effluent disposal are the mandatory buffers required between effluent disposal and drainage features such as intermittent streams and watercourses and dams.

The buffers required from groundwater bores, including the two Town Water Supply bores located on the adjacent property, are also a significant constraint to several of the proposed lots. To reduce the impact of these constraints on the development it is proposed to decommission the bore located on the property, and to apply a reduced buffer distance from the two Town Water Supply bores (in conjunction with implementing special effluent management measures on adjacent lots).

The riparian corridors associated with streams and watercourses, are also considered constrained for dwelling construction.

There are areas of outcropping rock which are constrained for onsite effluent disposal however these are limited and localised.

Small areas of steep slopes present a constraint to both onsite effluent disposal and dwelling construction however these are also limited and localised.

An analysis of soils on the site has determined that they are generally suitable for onsite effluent disposal. There are areas of shallow soils within insufficient depth for effluent disposal however these generally coincide with outcropping rock and are therefore already constrained for effluent disposal.

The assessment found that there is an adequate area of unconstrained land available to enable the on-site disposal of effluent on the majority of the proposed lots. There is also adequate area of unconstrained land available for the construction of dwellings and related infrastructure on the site.

A small number of lots where the land available for effluent disposal within the Building Envelope is constrained by various features. Constraints on these lots are identified during site inspection are included in the mapping provided in **Figures 21 & 22** in this report, these include:

- Lot 16 - constrained by drainage buffer of 40 metres
- Lot 60 – constrained by drainage buffer of 40 metres
- Lot 24 - constrained by drainage buffer of 40 metres
- Lot 63 – constrained by rocky outcrops and shallow soils

There is still adequate areas of unconstrained land available within the Building Envelopes identified on these lots for the onsite disposal of effluent.

The Building Envelopes on the remaining lots have been modified to accommodate all identified constraints and are therefore unconstrained for the onsite disposal of effluent.

The riparian zone along the major central watercourse has largely been included within a single lot (Lot 73). This lot does not include a Building Envelope and has been designed to enable the appropriate management of the riparian zone and associated areas of habitat.

KEY REFERENCES

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

Yass Valley Local Environmental Plan (2013)

METHODOLOGY

A detailed on-site assessment of the proposed lots across the site was undertaken.

The assessment included measurements of slope, aspect, exposure, visual appraisal of landform and soil conditions. The location of constraints identified during site inspection are included in the mapping provided in **Figures 21 & 22** in this report.

The buffer distances required from drainage lines and dams have been mapped and are provided later in this report. Areas of steep land, erosion and rocky outcrops have also been mapped.

The report includes a preliminary assessment of the suitability of soils for on-site effluent management. Soil profiles were augured on-site in representative parts of the landscape. Laboratory soil testing was also undertaken to ensure soils had suitable physical and chemical attributes to receive treated effluent. Representative soil profiles and laboratory soil test results are described in **Appendix 2.**

It should be noted that this report does not constitute a detailed Effluent Management Design Report as may be required by Council to approve the installation of systems associated with any newly constructed dwellings. It is expected that such a report will still be required for the new dwelling entitlements created prior to the approval of a new dwelling.

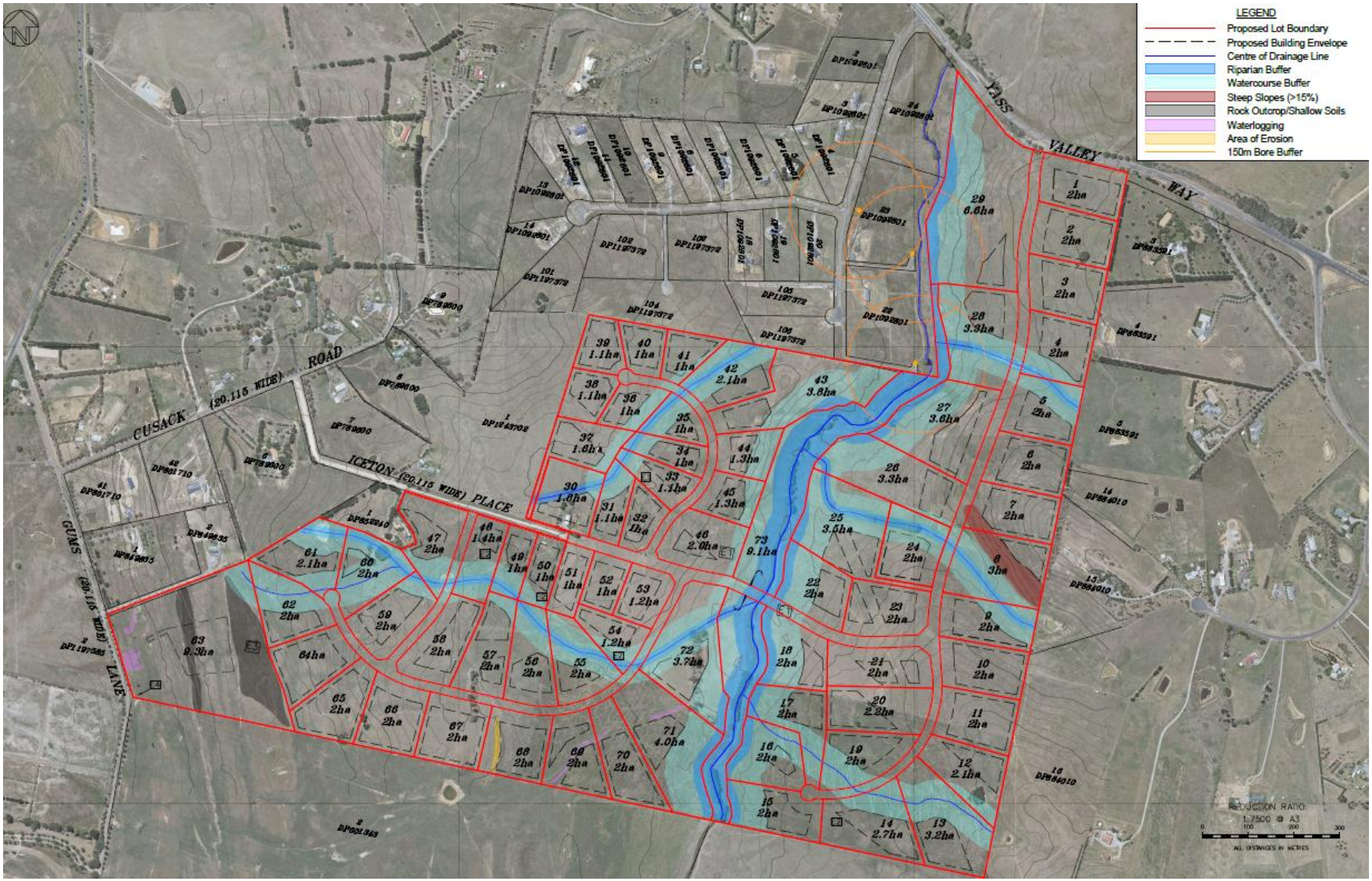


Figure 1: Proposed subdivision plan, 7 Iceton Place, Yass (DPS, Yass NSW)

SITE AND DEVELOPMENT INFORMATION

Local Government Area: Yass Valley Council
Address: 7 Iceton Place, Yass NSW 2582
(Lots 13, 14 DP 786575, Lot 2 DP 1243702)
Project contact: C/- Genium Engineering
PO Box 15
Yass NSW 2581

Site Location:

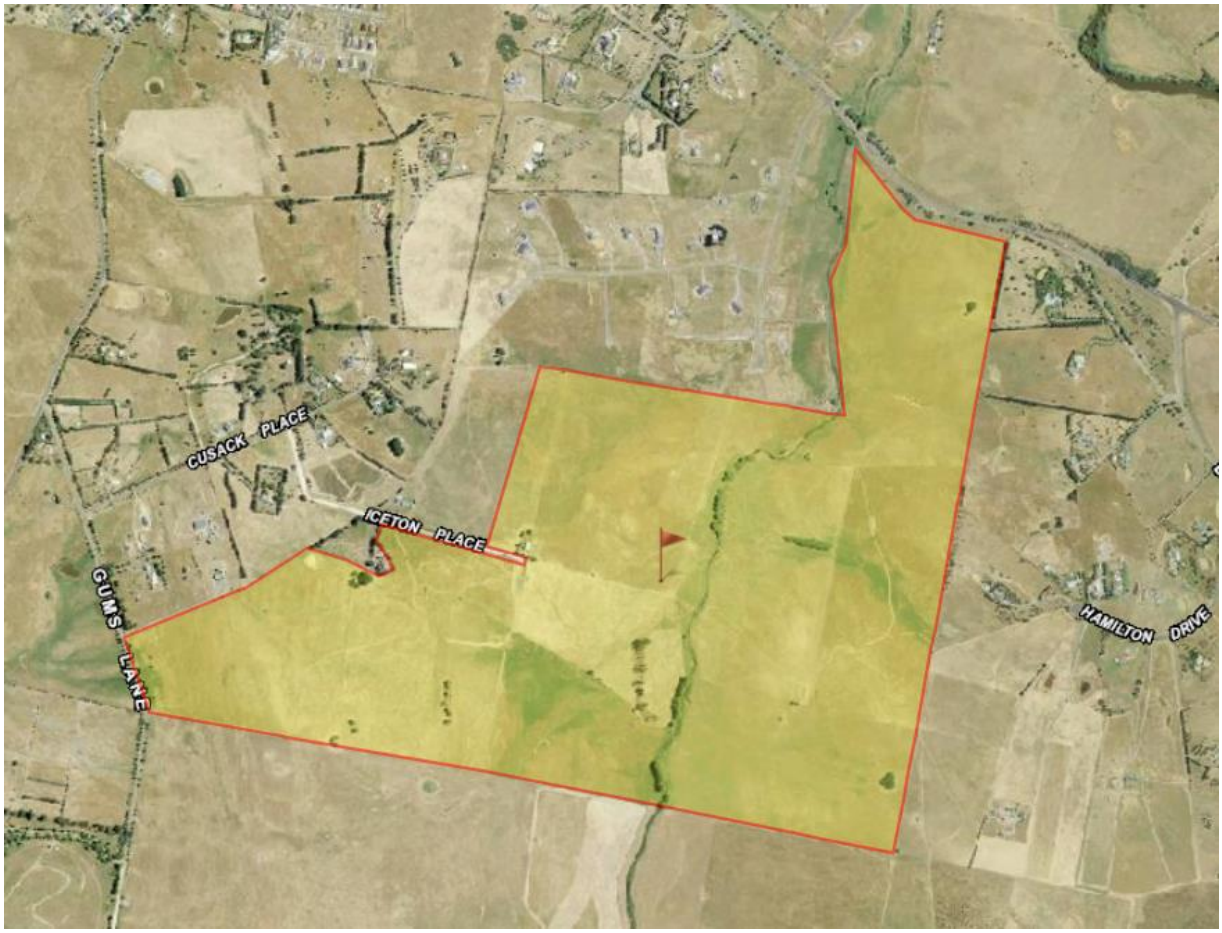


Figure 2: Location of the proposed subdivision

INTENDED WATER SUPPLY

Potable water provided through roof catchment and tank storage.

Non-potable water provided through roof catchment and tank storage. Lots 66 have access to a small farm dam.

EFFLUENT MANAGEMENT

Effluent for the new building entitlements will be managed on-site via secondary treatment systems (including disinfection) and effluent dispersal options including surface spray or drip irrigation, or subsurface drip irrigation.

(NB Other options for effluent management may be considered on case by case basis supported by individual effluent report).

LOCAL EXPERIENCE

The major constraints to on-site effluent disposal are the buffer distances required from the watercourses and dams, areas of shallow soil and outcropping rock, areas of steep land, areas of seasonal waterlogging and areas of erosion, all of which are unsuited to effluent disposal.

The riparian corridors adjacent to watercourses, steep land, areas of seasonal waterlogging and erosion, are also constrained for dwelling construction.

Many 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 3: Area of outcropping rock and shallow soils

Figure 4: Area of historical erosion unsuited to effluent dispersal or dwelling construction

Figure 5: Low slope areas of unconstrained land suited to effluent dispersal

Figure 6: Bore requiring 250 metre buffer from effluent disposal practices on adjacent land – it is proposed to decommission this bore to eliminate the buffer requirement

Figure 7: Steep slope unsuited to effluent dispersal or dwelling construction (background)

Figure 8: Bedrock control in base of watercourse

Figure 9: Stable bed and banks including macrophyte vegetation

Figure 10: Section of stabilised creekbank erosion

Figure 11: Section of bedrock stabilising the bed of the watercourse

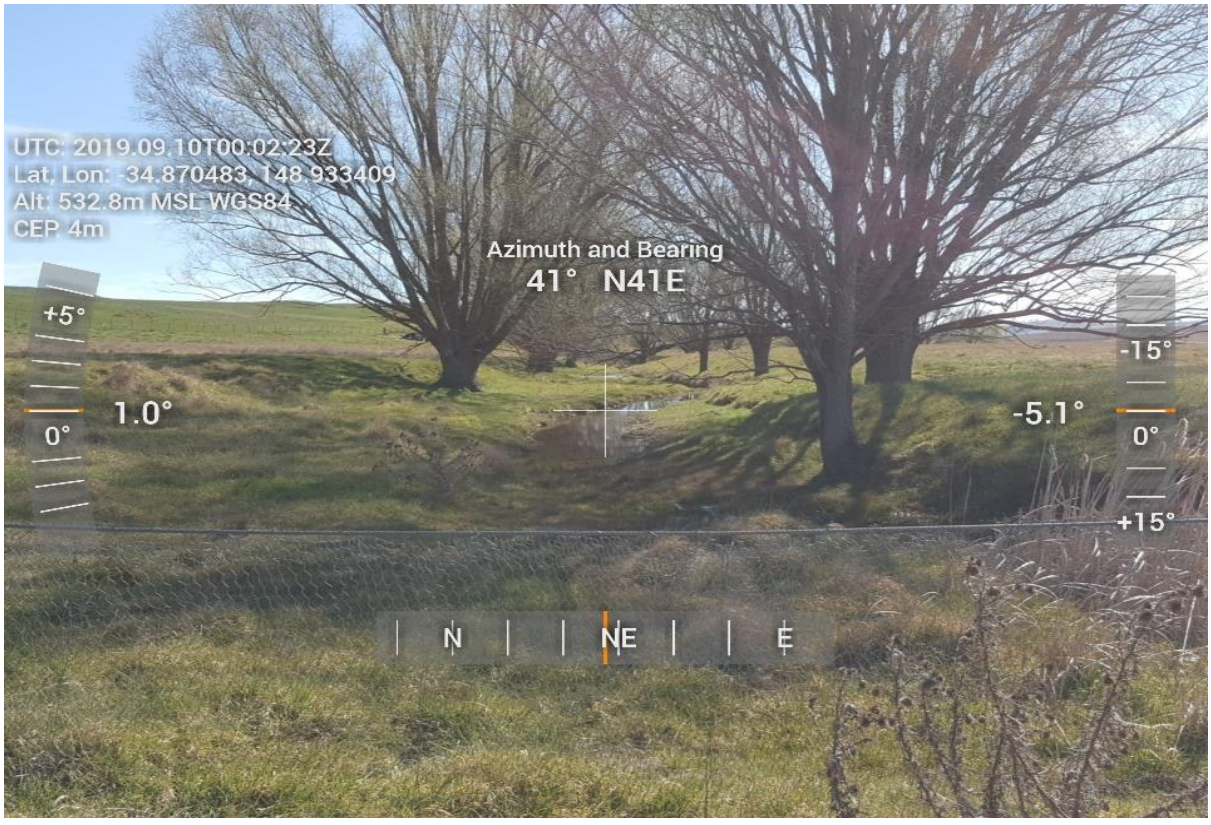


Figure 12: Stable watercourse with deep pools and exotic vegetation

Figure 13: Stable watercourse with deep pools and exotic vegetation

SITE AND 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 site is extensively cleared with some scattered remnant native vegetation and exotic species particularly along the central watercourse.

The level of exposure is favourable for dispersal of secondary treated effluent via surface or shallow subsurface irrigation.

SLOPE

The site displays a range of slope gradients, with extensive areas of low 3-5% slopes land adjacent to the major watercourse. Mid and lower slopes range from 5-10%. There are small areas of slope >15% which are generally constrained for effluent dispersal and dwelling construction.

The majority of the subdivision has slopes in the range 3-10% which do not present a constraint to dwelling construction or effluent dispersal.

LANDSCAPE

The landscape is dominated by the central watercourse which flows south to north to join the Yass River at Duoro. Several minor streams and drainage depressions drain from the adjacent paddocks to join this watercourse and these include numerous farm dams. The watercourse is relatively stable and includes some significant waterholes.

The block is extensively cleared improved pasture grazing country.

The slope form of the areas considered suitable for effluent dispersal are generally flat to divergent (i.e. spreading rather than concentrating flows). There are areas of convergent slope across the site which are unsuitable for effluent disposal however these are generally contained within the mapped watercourse buffers and are therefore already confined for effluent dispersal.

Slope form is suited to the dispersal of secondary treated effluent through irrigation.

SURFACE ROCK AND OUTCROP

The underlying geology is coarse porphyritic rocks of the Douro Volcanics formation. The area includes a transition zone with the Duoro Formation

underlying the Derringullen Foramtion and including occasional lenses of limestone and shale. There are areas of outcropping rock and associated shallow soils on the site which are mapped as constrained for effluent dispersal.

Areas of outcropping rock are not suitable for effluent dispersal and are mapped as constrained land, refer Figure 21

HYDROLOGY

The sandy 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. The areas of low to moderate slope which coincide with the shallow soil and/or rock outcrop will higher rates of 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 runoff from upslope catchments have been concentrated through road culverts. This concentration has likely contributed to the minor areas of erosion on the property some of which have been addressed through construction of erosion control earthworks.

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.

It is considered the potential for the subdivision to change local hydrology will be moderate given the number of increased dwelling lots to be created is 73, and the size of lots ranges between 1-9.3 hectares, and the significant amount of additional road infrastructure required to service the subdivision.

The extensive areas of low slope alluvial flats adjacent to the main central watercourse, combined with extensive groundcover and permeable deep alluvial soils in this part of the landscape, will help to assimilate any additional surface

water runoff generated from impermeable surfaces and convert this to infiltration or subsurface flows.

Hydrological factors are not a constraint to the construction of dwellings.

Effluent disposal will need to be properly designed and located on suitable soil types (including permeability and depth) to minimise hydrological impacts from surface irrigation, such as effluent run-off or rapid effluent drainage through permeable soil profiles into groundwater systems. Adequate areas of suitable soils exist on the site to mitigate these risks.

Natural permeable area should be retained as far as possible and groundcover should be maintained to maximise infiltration and evapotranspiration and minimise run-off.

SOILS

Detailed soil profile descriptions representative of the proposed subdivision lots, are provided in **Appendix 2** of this report.

The soils on the property correspond to the Binalong, Boorowa and Cockatoo Soil Landscapes in the Soil Landscapes of the Goulburn 1:250,000 Sheet. Hird,C. (1991).

Land which is considered suitable for effluent dispersal associated with dwelling construction on the proposed lots generally consists of Tenosols, grading to Dermosols with deeper Organosols on the alluvial flats.

Suitable soils comprise a massive to weakly structured silty to sandy loam textured upper layer overlying a weak to moderately structured clay loam to medium clay subsoil. Soil depth varies between 50 - <100 cm, with shallower soils in the localised areas of rock outcrop.

The unconstrained soils suitable for effluent dispersal have 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.

Soils are generally unconstrained for dwelling construction. Suitability for dwellings will be confirmed through Site Classification prior to construction.

Soil depth in the limited areas adjacent to rock outcrops are a limitation to effluent disposal by absorption trench but are well suited to surface or shallow subsurface irrigation.

CONSTRAINTS ANALYSIS

SOIL EROSION

No areas of erosion are mapped on the Yass Valley Local Environment Plan 2013 (refer below).

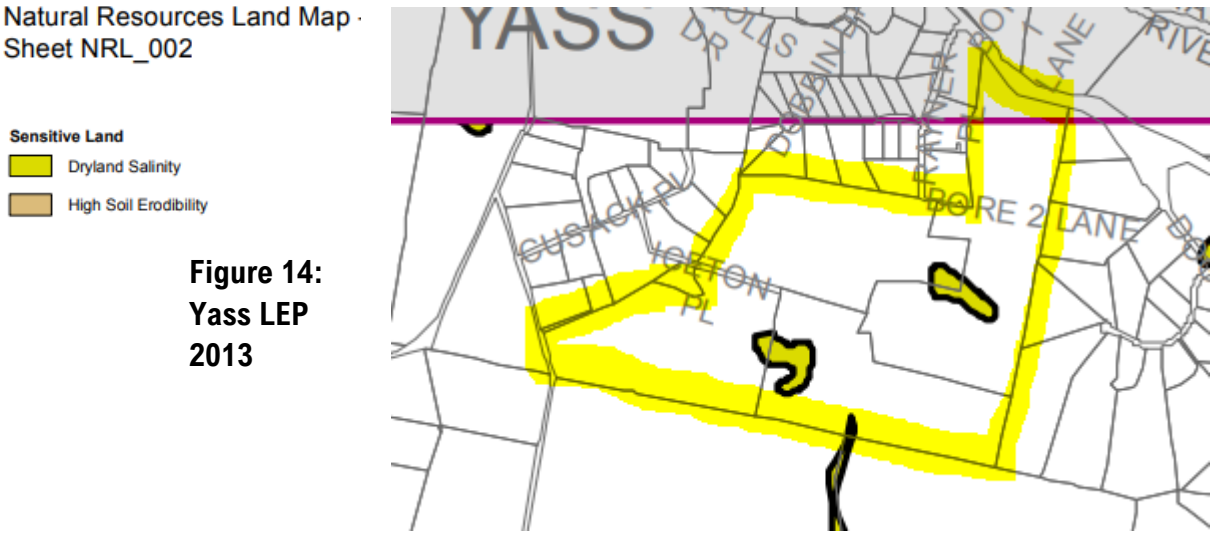


Figure 14: Yass LEP 2013

The soils of the Soil Landscapes Units which exist onsite are susceptible to minor sheet erosion with some gully erosion, this is generally supported by the limited erosion issues identified on the property. Historical erosion along drainage lines is relatively common but stable. Streambank erosion on the main watercourse is very limited. Erosion risk on the property is further mitigated by the good level of groundcover on most areas however and low to moderate slope. The management

RECOMMENDATIONS

- Greater than 70% groundcover be maintained on all areas as far as practical
- Sediment and erosion control plans should be prepared and implemented prior to ground disturbance activities associated with development of any infrastructure on site.
- All areas of existing erosion should be monitored, and remedial measures implemented should erosion issues persist or worsen.

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 pasture and grazing reduces water quality and contributes to increased erosion which in turn further reduces 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.

Areas of salinity effected land have been mapped in the Yass Valley LEP (2013), refer map below.

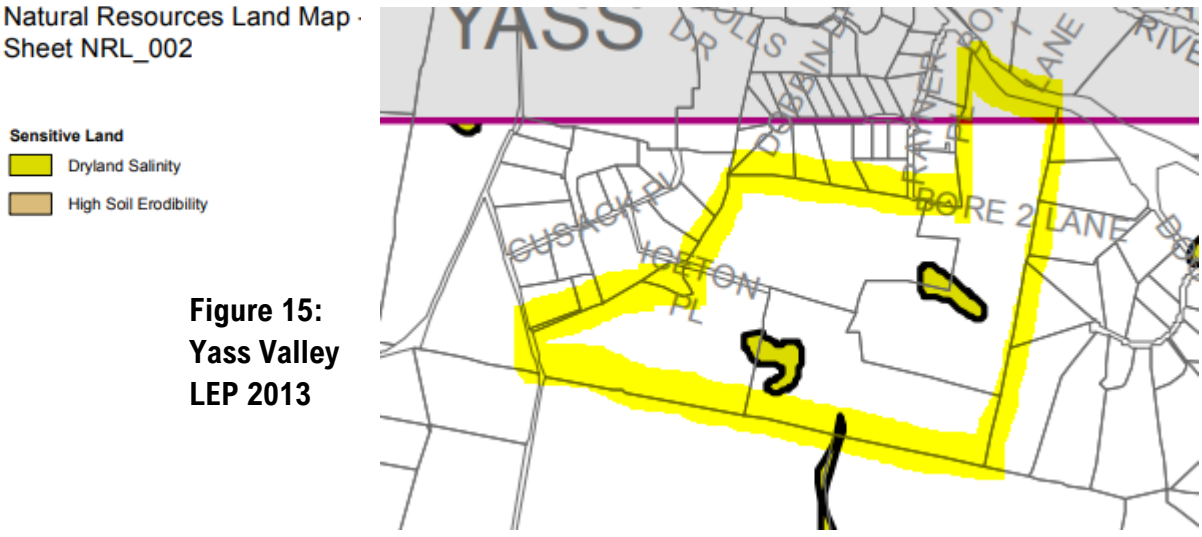


Figure 15: Yass Valley LEP 2013

There are two main areas of salinity marked on the Yass Valley LEP in the southern and eastern parts of the property.

The Yass Valley LEP includes the following clause to ensure salinity is adequately addressed through the development process:

Salinity

(1) The objective of this clause is to provide for the appropriate management of land that is subject to salinity and the minimisation and mitigation of adverse impacts from development that contributes to salinity.

(2) This clause applies to land identified as "Dryland Salinity" on the Natural Resources Land Map.

(3) 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.

The areas mapped as salt effected are associated with drainage depressions and there is no evidence of saline scalding, no impact to pasture growth or species composition in adjacent paddocks, and no salt crusting.

These areas are stable and not eroding but do present a limitation to effluent disposal and dwelling construction. These areas are already included in the buffer areas associated with the drainage depressions, refer **Figures 21 & 22**.

It is considered the development will not have a significant adverse impact, or be adversely impacted by salinity, given that land clearing has essentially already occurred, areas of mapped salinity are stable and not severely salt effected, and these areas are identified as unsuited to the construction of dwellings or disposal of effluent. The following recommendations will ensure appropriate avoidance, minimisation and/or mitigation measures are implemented:

RECOMMENDATIONS

- The area and vigour of deep-rooted perennial pasture should be maximised as far as practical.
- Tree and shrub revegetation on crests and hilltops should be encouraged.
- Effluent disposal and dwelling construction should not be undertaken in areas mapped as dam and drainage buffers.
- Effluent irrigation practices should be appropriately located outside dam and drainage buffers and designed to minimise potential accessions to the groundwater table.

- Groundcover should be retained at 100% in all effluent irrigation areas.
- Groundcover should be retained above 70% in all areas as far as practical.

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 southern part of the property is mapped as groundwater vulnerable on the Riparian Lands and Watercourses Map Groundwater Vulnerability – Sheet CL2_002 in the Yass Valley Local Environment Plan 2013, see below

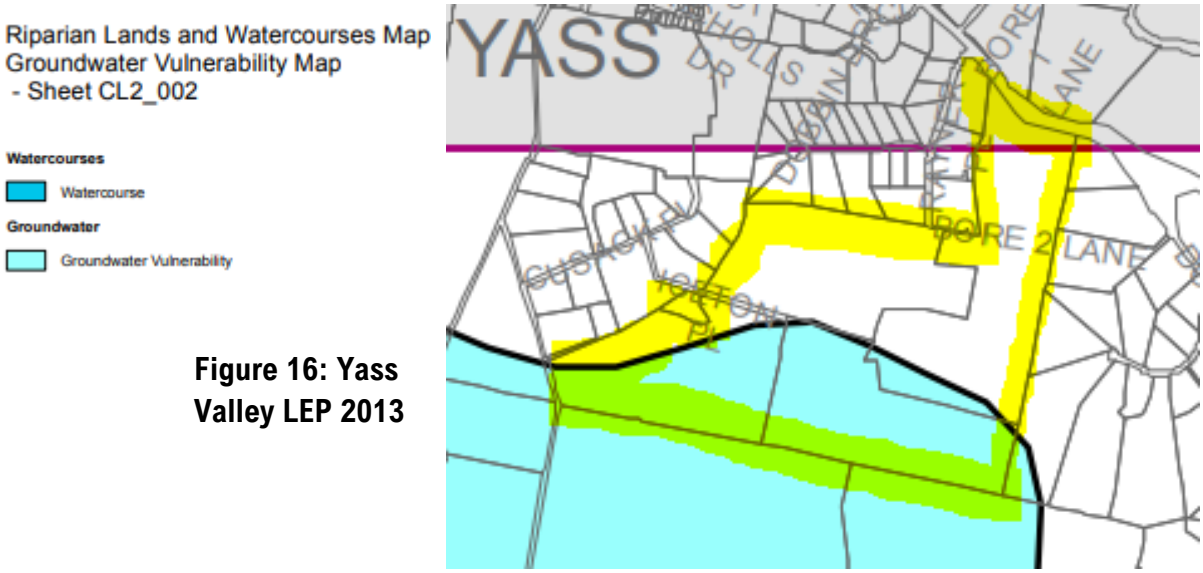


Figure 16: Yass Valley LEP 2013

The Yass Valley LEP includes the following clause to ensure development appropriately address groundwater issues:

Groundwater vulnerability

(1) The objectives of this clause are as follows:

(a) to maintain the hydrological functions of key groundwater systems,

(b) to protect vulnerable groundwater resources from depletion and contamination as a result of development.

(2) This clause applies to land identified as "Groundwater vulnerability" on the Groundwater Vulnerability Map.

(3) 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 11 bores registered within 500m of the boundaries of the property including one bore (GW 035916) on the property on proposed Lot 72. There are two town water supply bores (GW403844 and GW403843) approximately 100m west of the boundary of the property which are 110-120m deep.

Stock and Domestic bores in the vicinity are relatively low yielding with depths ranging 22m to 100m. The main water bearing zones occur within this same depth range.

Figure 17: Nearby bore locations https://realtimedata.waternsw.com.au/

Bores generally require a 250m buffer distance from the nearest effluent management practices, to ensure there is minimal risk of contamination. A buffer of 250m from the two Town Water Supply bores impacts many of the proposed lots and will limit the opportunity for onsite effluent disposal on these lots, as will the buffer required from the existing bore location on proposed Lot 72, refer **Figure 18**.

It is recommended that the bore located on the property be permanently decommissioned. This will eliminate the need for a 250m buffer from effluent dispersal practices.

It is considered appropriate to adopt a lower bore buffer of 150m from the two Town Water Supply bores located on the adjacent property (refer **Figure 19**), due to the following mitigating measures:

- The bores are located on the opposite side of the central drainage depression which will form a hydrological barrier to any potential contamination resulting from run-off from effluent irrigation areas
- The Town Water Bores are used infrequently, particularly since the upgrade of the Yass Water Supply Weir
- Effluent management practices on all proposed lots intersecting the 250m buffer from the Town Water bores will include Special Measures which are Advanced Secondary Treatment Systems with disinfection, with effluent dispersal via subsurface drip irrigation – thereby ensuring the highest quality treated effluent with minimal chance of contamination
- Depth to the main water bearing zones in the area exceeds 20 metres

The other factors which minimise the risk of groundwater contamination are:

- Horizontal and vertical separation between effluent dispersal areas and water bearing zones of >20m and >150m respectively,
- Low application rate of minimum secondary treated and disinfected effluent, to the surface or near surface
- Low transmissivity of fractured rock groundwater aquifers that underlay the area.

Figure 18: Bores and buffers locations

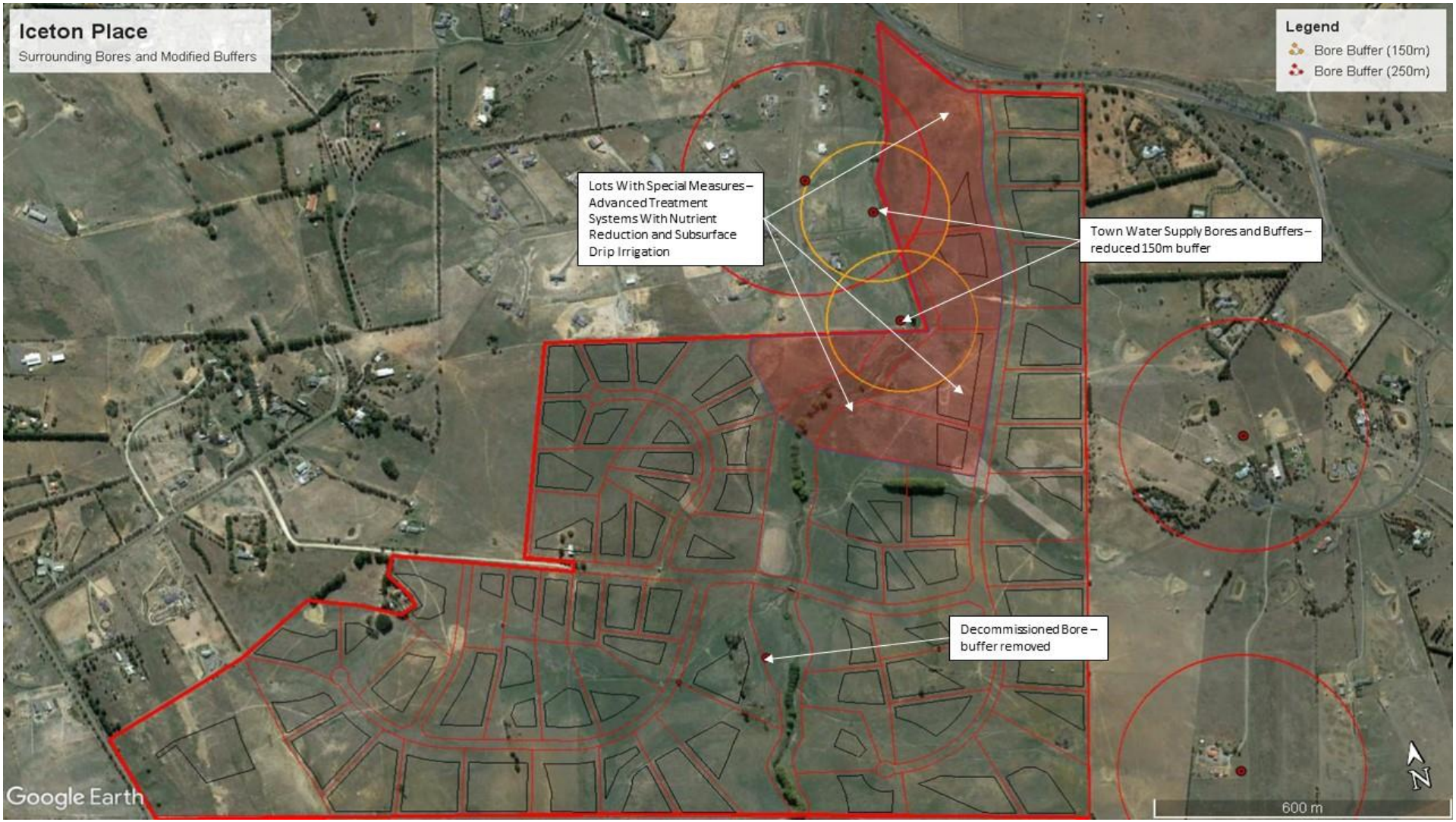


Figure 19: Modified bores and buffers and special measures

RECOMMENDATIONS

- Permanently decommission the bore located on proposed Lot 72
- Adopt a 150m buffer from the Town Water Supply Bores to the west of the development - in conjunction with adopting Special Measures on adjacent Lots 26-29 & 43 (refer **Figure 19**) which are Advanced Secondary Treatment Systems with disinfection, with effluent dispersal via subsurface drip irrigation
- Maintain a minimum 250 m buffer between the remaining bores on adjacent properties and effluent dispersal areas.
- Require all future bores to attain a water supply works approval prior to constructing a bore, which considers the proximity to nearby effluent irrigation areas (the application is available at www.water.nsw.gov.au and the fee is currently $241.83)

RIPARIAN LANDS

The water courses which intersect the block are not included in the Yass Valley Local Environment Plan 2013 - Riparian Lands and Watercourses Groundwater Vulnerability Map – Sheet CL2_002.

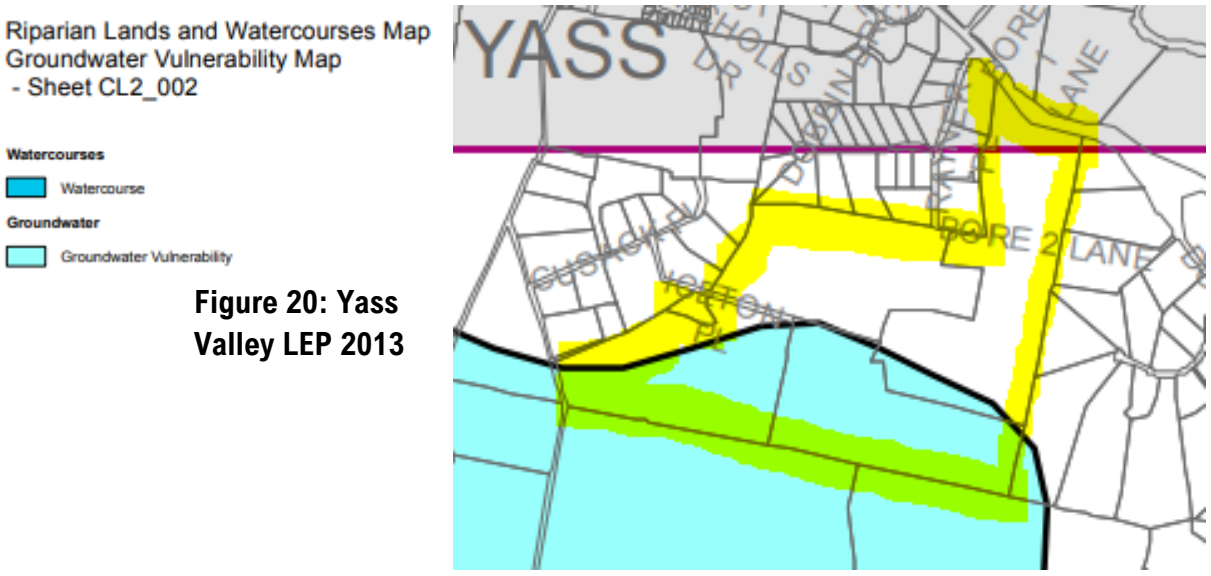


Figure 20: Yass Valley LEP 2013

NSW DPI Office of Water[1] defines appropriate riparian corridors for various stream orders to maintain the integrity of these sensitive areas, see below:

[1] Guidelines for riparian corridors on waterfront land

Figure 2. The Strahler System

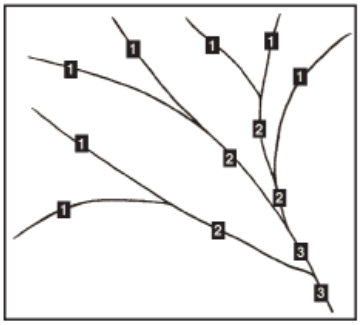
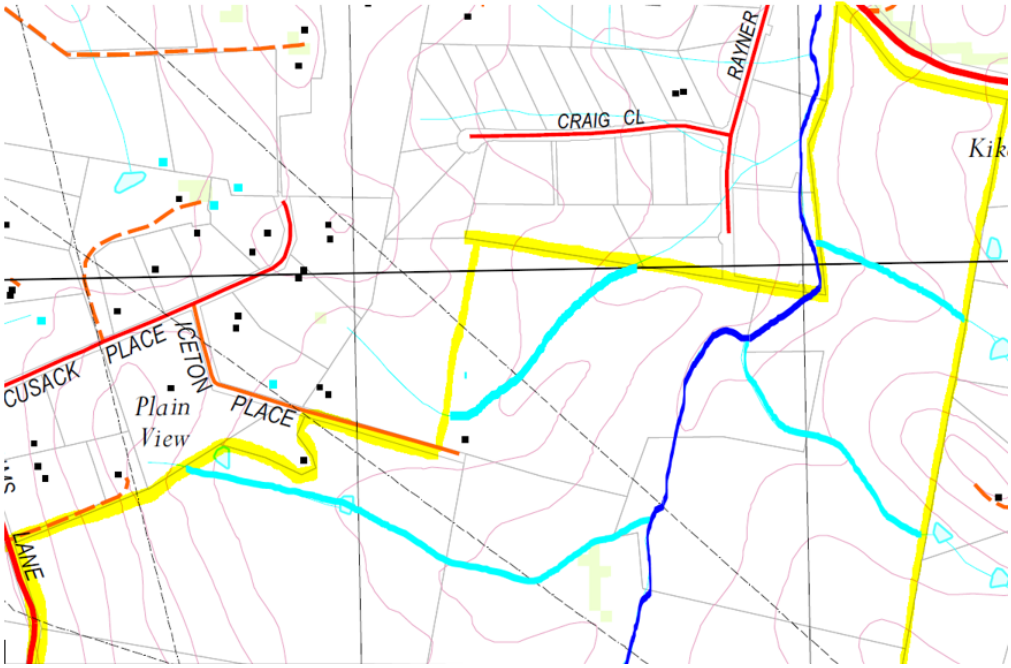


Table 1. Recommended riparian corridor (RC) widths

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

There are four 1st order streams and one 4th order stream intersecting the block which are mapped on the Yass topographic 1:25,000 Sheet (refer image below). The 1st order streams will require 10m riparian corridors and the 4th order stream will require a 40m riparian corridor.



1st Order Streams 4th Order Streams

These riparian buffer distances are considered a constraint to building development as construction within these riparian zones would be inconsistent with DPI Water Guidelines and the Yass Valley LEP, refer **Figure 22**.

The development is considered unlikely to adversely impact riparian areas due to the capacity to establish infrastructure on each of the lots outside the sensitive riparian zones, and the maintenance of appropriate buffer distances for potentially impacting activities such as effluent disposal. This includes encompassing most of the mapped riparian corridor within a single Lot 73 which

does not include a Building Envelope and which will be managed to maintain the ecological values of the area.

RECOMMENDATIONS

- Proposed Lots adjacent to or containing 1st order streams will maintain a 10m riparian corridor (either side of the 1st order streams) which excludes dwellings and major built infrastructure
- Proposed Lots adjacent to or containing the 4th order stream will maintain a 40m riparian corridor (either side of the 4th order stream) which excludes dwellings and major built infrastructure

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 m buffer from any waterbodies including dams, minor intermittent waterways and drainage channels, and 100 m from major watercourses.

The property is intersected by a major watercourse which will require a 100m buffer within which no effluent dispersal activities can occur. In addition, the 1st order streams and other minor drainage depressions and dams will all require a 40 m buffer.

Approximate locations for watercourse, dam and drainage buffers are shown in **Figure 21.**

RECOMMENDATIONS

- The land considered suitable for effluent dispersal on proposed lots is restricted to land outside the 40m buffer distance from all drainage depressions and dams, and the 100m buffer from major the watercourse, refer **Figure 21.**

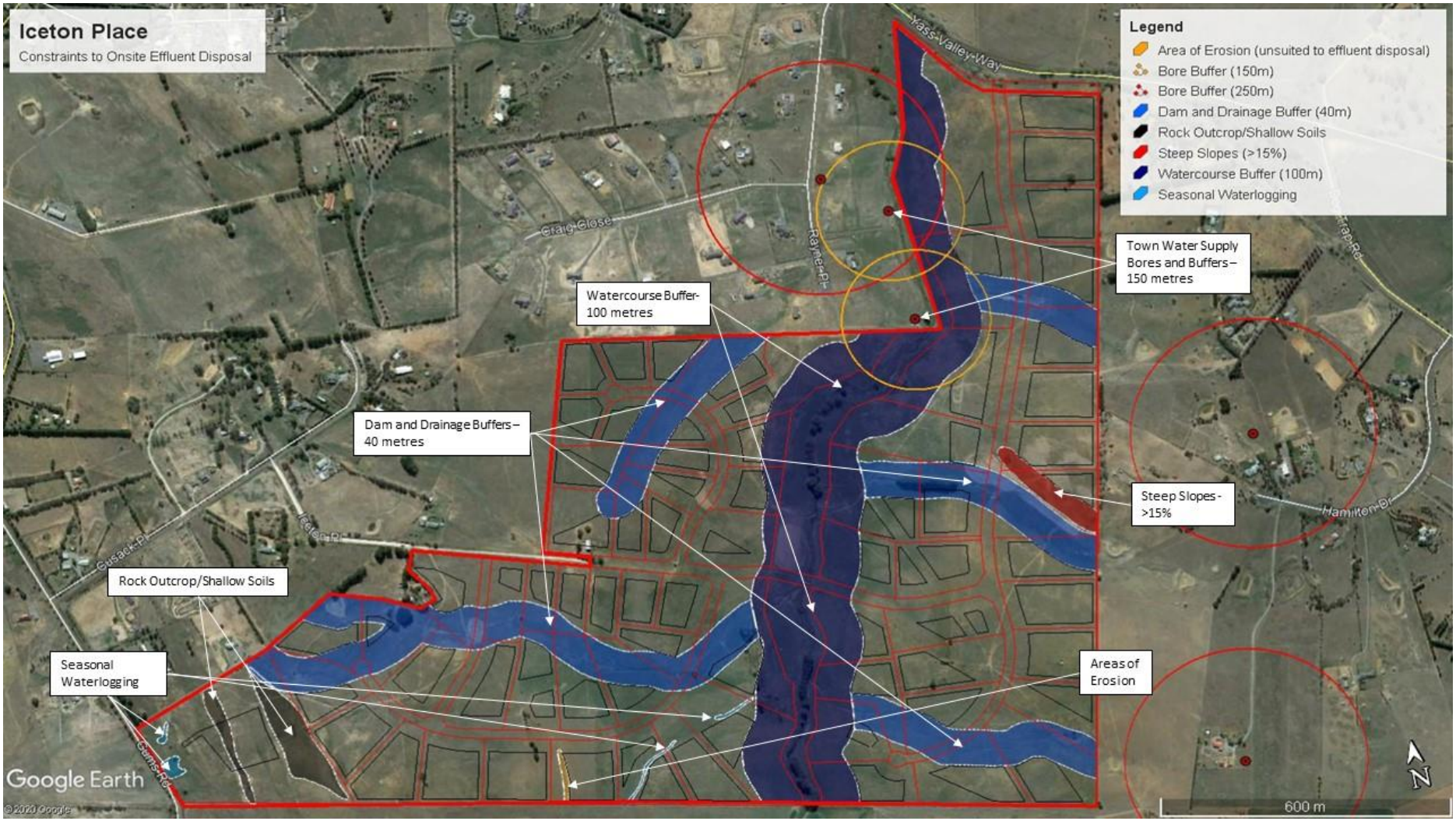


Figure 21: Constraints to Effluent Dispersal

MANAGEMENT OF EFFLUENT

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 lots.

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 510 m^2, but accounts for the requirement to have a reserve area, plus allows for buffers from buildings, boundaries and driveways.

Key constraints to effluent dispersal on the property are:

- Watercourse buffers of 100m
- Drainage depression and dam buffers of 40m
- Areas of shallow soils and rock outcrops
- Area of seasonal waterlogging
- Areas of erosion
- Bore buffers of 150m from Town Water Supply and 250m from other Stock and Domestic water bores[2]

The site and soil constraints assessment has determined that all lots are either unconstrained or have a minor to moderate constraint to effluent dispersal and therefore have an adequate area (1,300m^2) of land suited to effluent dispersal. The 4 proposed lots which have constraints which interest the Building Envelope are:

- Lot 16 - constrained by drainage buffer of 40 metres
- Lot 60 – constrained by drainage buffer of 40 metres
- Lot 24 - constrained by drainage buffer of 40 metres
- Lot 63 – constrained by rocky outcrops and shallow soils

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 and 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

[2] It is proposed to decommission the bore located on proposed Lot 72

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 ideally suited to subsoil absorption of primary treated effluent due to the sensitive groundwater receiving environment and location immediately upstream of the Yass water supply weir.

More detailed assessment of proposed building envelopes may identify sites suitable for subsoil absorption, but at this stage both subsoil absorption and evapotranspiration/absorption beds for primary treated effluent would not be recommended for the site.

The use of beds for dispersal of wet composting closet treatment systems (eg worm farms) may be suitable but would also need to be assessed on a site-specific basis.

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. Significant improvement in effluent dispersal can be achieved by having two to four 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 better management of the irrigation area.

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……...300m^2

Four bedrooms……350m^2

Five bedrooms…….420m^2

Six bedrooms……500m^2

Council also requires adequate suitable land for a reserve effluent dispersal area. Additional land is required to account for buffers. *The Silver Book* prescribes 6 m from a downslope boundary and 3 m with a cross or upslope boundary and a 15 m buffer from dwellings.

Hence, a conservative minimum area of suitable effluent irrigation land for each lot is 1,300m^2.

PRIMARY TREATMENT AND SUBSOIL ABSORPTION

Not generally suitable due to sensitive groundwater and surface water receiving environments.

A detailed site-specific soil assessment developed prior to submitting building plans may demonstrate the suitability of a specific site to primary treatment and absorption trench systems including options such as the use of wet composting closet for treatment.

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 MANGEMENT

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 and the prescriptions of these reports should be adopted.
- Buffers to be applied to effluent dispersal areas will include:
  - 40 m flow path from all dams and drainage depressions
  - 150 m from Town Water Supply bores located on adjacent property
  - 250m from Stock water bores located on adjacent properties
  - 6 m with downslope lot boundaries
  - 3 m with cross slope and upslope boundaries.
- Suitable Effluent management systems include aerated wastewater treatment systems (and other systems capable of secondary standard treatment) with NSW Health accreditation, dispersing effluent to a designated effluent irrigation area. The irrigation area size should be based on potential occupancy derived from the number bedrooms in the dwelling.
  - As a guide, the following areas would be appropriate for the soil and site conditions of the site:
    - Three bedrooms……...300m^2
    - Four bedrooms……350m^2
    - Five bedrooms…….420m^2
    - Six bedrooms……500m^2
  - To ensure effective distribution of treated effluent, and provide protection of irrigation lines, the minimum requirement for surface irrigation dispersal should be buried distribution lines with decoupling

sprinkler heads. There should be two to four 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 not generally suitable for the site but could be considered on a case by case basis, if supported by a site-specific effluent management report.

- Lots 26-29 & 43 within the ***special measures area*** identified in **Figure 19** are required to have Advanced Secondary Treatment Systems (which include nutrient reduction technology), dispersing effluent to a subsurface drip irrigation area. The irrigation area size should be based on potential occupancy derived from the number bedrooms in the dwelling and the effluent treatment capabilities of the make and model of system chosen. These details should be included in the *site and soil assessment for on-site effluent management* developed for each dwelling lot.

CAPABILITY FOR DWELLING CONSTRUCTION

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

- Steep land, seasonally waterlogged or flood prone land and areas of erosion.

In addition, under NSW DPI Office of Water (Guidelines for riparian corridors on waterfront land) requires a 10m buffer from the 1st order streams and 40m buffer from the central 4th order stream which occurs intersects the property.

Dwelling construction within these buffers is inconsistent with DPI Water policy and these areas are therefore constrained for dwelling construction.

The 40m buffer on drainage depressions and dams, and the 100m buffer on major rivers, required for effluent disposal areas, do not apply to dwelling construction.

Buffer areas for 1st and 4th order streams have been mapped as constraints to dwelling construction in **Figure 22**.

Areas of steep land, seasonal waterlogging and erosion, have also been mapped as constrained for the construction of dwellings in **Figure 22**.

The remaining gently sloping, free draining land can be considered as suitable for dwelling construction.

RECOMMENDATIONS

Building envelopes will be restricted to land shown in this report as suitable, based on excluding areas of seasonal waterlogging, steep land, erosion, and land within riparian corridors identified for the 1st and 4th order streams, refer **Figure 22**.

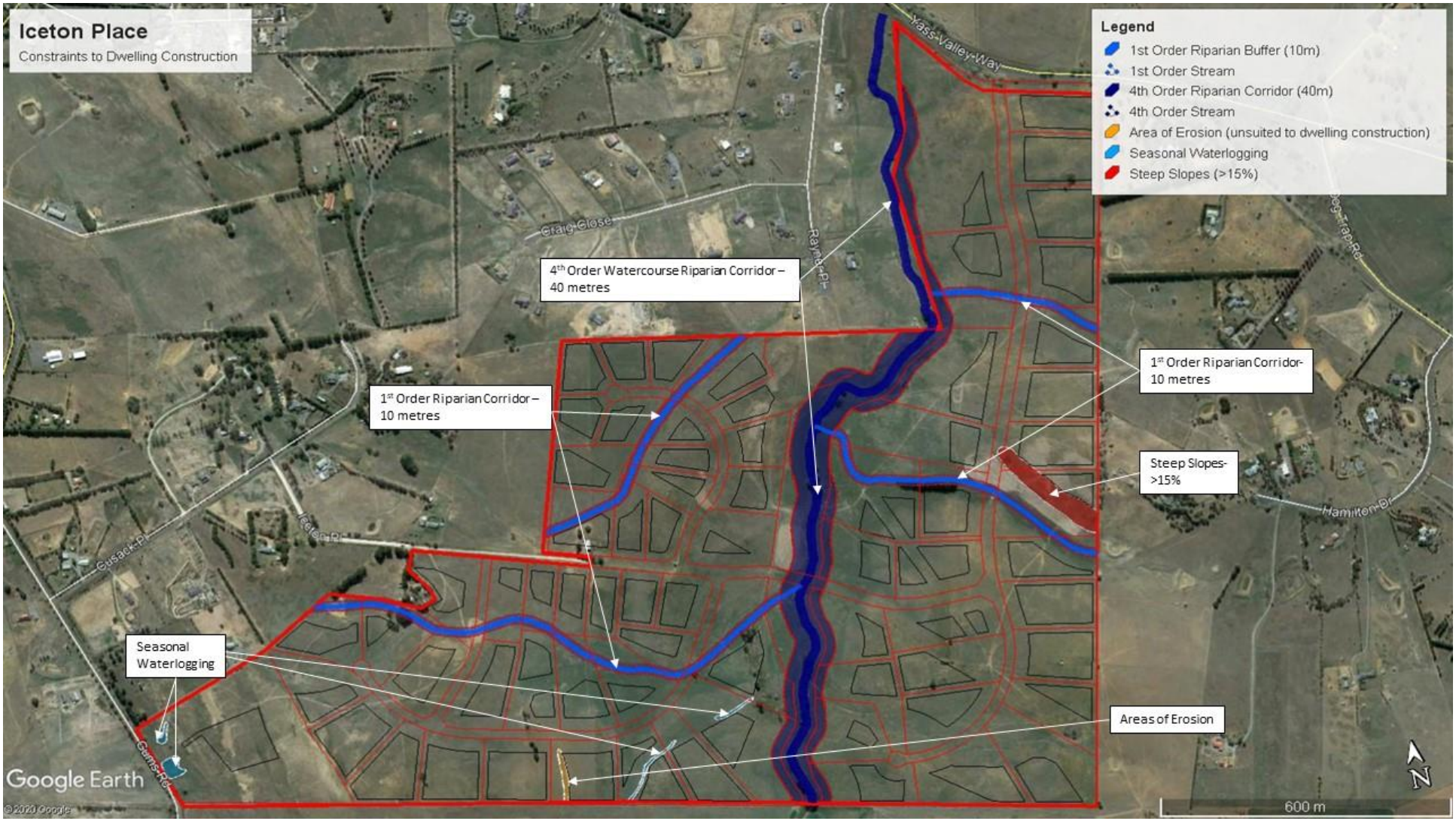


Figure 22: Constraints to Dwelling Construction

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
Erosion potential	All land application systems	No sign of erosion potential	Minor stabilized sheet and	Indications of erosion e.g. rills, mass failure	Soil degradation and off-site impact

Site feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
			gully erosion		
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
Sodicity (ESP)	Irrigation 0-40cm; absorption 0-1.2mtr	0-5	5-10	> 10	Potential for structural degradation

Soil feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
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 PROFILES

The site was assessed and stratified into respective soil landscapes. Within each landscape type a representative soil profile was excavated and samples taken for laboratory testing to determine suitability for onsite effluent dispersal. The soil profile descriptions and laboratory soil test results are provided below.

Soil Profile 1 – Upper Slope/Crest Landscape Position

Soil classification	Depth (cm)	Properties
TENOSOL	0-5	A Light brown/grey fine sandy loam, dry and friable, massive to weak crumb structure, <5% coarse fragments, gradational colour change to
	5-40	B Light grey fine sandy loam, dry and friable, massive to weak crumb structure, 5-10% coarse fragments, degrades to bedrock
	>40	C decomposed granitic parent material.

Figure 22: Soil Profile 1 – Upper Slope/Crest Landscape Position

NB: Soil profiles are presented as expanded profiles (expansion factor approximately X2)

Soil Profile 2 – Alluvial Floodplain Landscape Position

Soil classification	Depth (cm)	Properties
ORGANOSOL	0-35 35->100	A Dark grey organic loam, dry and friable, weak to moderate structure, no coarse fragments, gradational colour change to B Yellow/ grey silty light to medium clay, moist and firm, weak crumb structure, no coarse fragments, continues

Figure 23: Soil Profile 2 – Alluvial Floodplain Landscape Position

NB: Soil profiles are presented as expanded profiles (expansion factor approximately X2)

Soil Profile 3 –Mid Slope Landscape Position

Soil classification	Depth (cm)	Properties
DERMOSOL	0-30 30-70 >70	A Light brown fine sandy loam, dry and friable, massive to weak crumb structure, <5% coarse fragments, gradational colour change to B Medium brown silty clay loam, dry and friable, moderate structure, <5% coarse fragments, degrades to bedrock C decomposed granitic parent material.

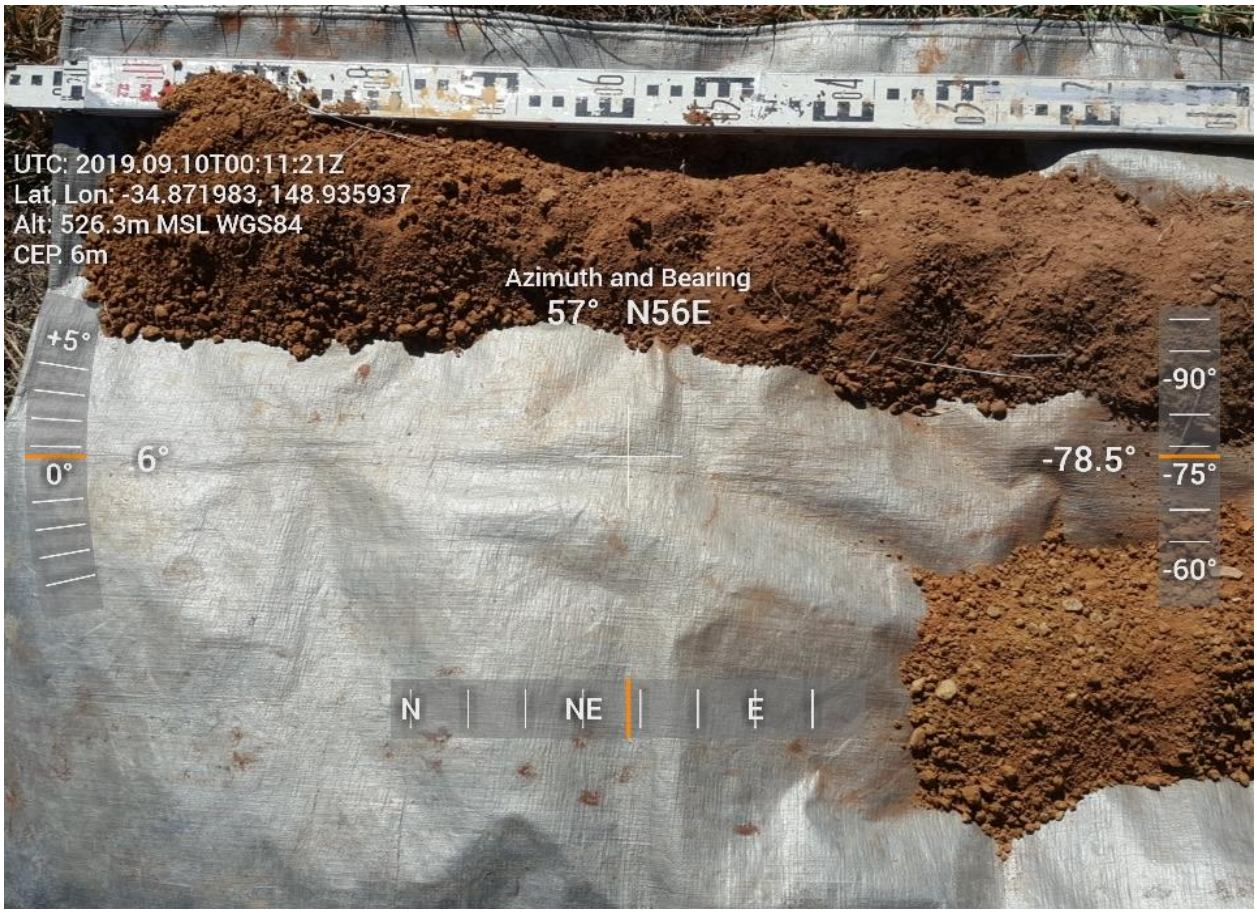


Figure 24: Soil Profile 3 – Mid Slope Landscape Position

NB: Soil profiles are presented as expanded profiles (expansion factor approximately X2)

Table: Laboratory Soil Test Results

Laboratory No. Client's ID	Units	Limit of Reporting	3 Midslope Dermosol	4 Organosol Alluv Pln	5 Rudosol Crest
Soil Analysis					
Electrical Conductivity	dS/m	0.0010	0.024	0.030	0.046
pH (Water)	pH units	0.04	6.2	7.4	5.3
pH ($CaCl_2$)	pH units	0.04	4.9	6.3	4.2
Texture			Silty clay	Silty clay	Loam
Emerson aggregate test			Class 3 Sub(4)	Class 5	Class 8
P Sorption	mg/kg	25	320	540	220
Exchangeable Cations					
Aluminium	cmol(+)/kg	0.10	0.17	<0.1	0.59
Calcium	cmol(+)/kg	0.030	5.5	14	2.2
Potassium	cmol(+)/kg	0.010	0.26	0.37	0.41
Magnesium	cmol(+)/kg	0.0070	3.8	4.5	1.1
Sodium	cmol(+)/kg	0.030	0.18	0.16	0.18
CEC (effective)	cmol(+)/kg	0.20	9.9	19	4.4
Calcium/ Magnesium			1.5	3.0	2.0
Percent Aluminium Saturation	% of ECEC		2	N/A	13
Exchangeable Calcium	% of ECEC		56	73	49
Exchangeable Potassium	% of ECEC		2.6	2.0	9.3
Exchangeable Magnesium	% of ECEC		38	24	24
Exchangeable Sodium Percentage	% of ECEC		1.9	0.85	4.1

APPENDIX 3: SIZING EFFLUENT DISPOSAL AREAS

Using the DIR for surface spray or drip irrigation on loam soils of 4 mm/day and design loading of 600 L/day (4-bedroom dwelling), 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 = 600 l/day; DIR = 4 mm/day
A = 600/4 = 150 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 = 600 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 = 600 X 20 X 365/15,000 = 290

Area required = 300 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 600 X 365 X 50 = 109.5
P_{uptake} = 4.4mg/m^2/day X 365 X 50 = .080kg/m^2
P_{sorb} = 2,342.25kg/ha = .234kg/m^2
A = 109.5/(.08+ .234) = 349 m^2

Area required = 350 m^2

Design effluent disposal area

Therefore, a land application area of **350 m^2** will account for phosphorous, nitrogen and water applied based on estimated connections and usage patterns associated with the construction of a 4-bedroom dwelling.

The following areas are required for larger dwellings:

- 5-bedroom – 420m^2
- 6-bedroom – 500m^2