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Department of Environment, Land, Water and Planning

Wye River and Separation Creek - Geotechnical, Land Capability and Wastewater Solutions

Main Report

5 April 2016

Results emerge
when local knowledge
intersects with
global expertise

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Wye River and Separation Creek - Geotechnical, Land Capability and Wastewater Solutions

Prepared for
Department of Environment, Land, Water and Planning

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Executive Summary

A bushfire impacted the townships of Wye River and Separation Creek on 25 December 2015 resulting in the loss of houses, damage to houses and a number of retaining structures and wastewater management systems. The timely and effective resettlement of these townships will be largely determined by the ability of relevant authorities to accept and process statutory approvals in an accelerated manner. The rebuilding of residences is considered to be existing development, and therefore, the stringent rules that apply to new developments do not apply in these circumstances.

To assist this process, Coffey, along with its parent company Tetra Tech, was commissioned by the Department of Environment, Water, Land and Planning to conduct geotechnical, land capability and wastewater investigations to identify solutions that would assist landowners to achieve accelerated planning approvals for rebuilding.

The affected area has erodible soils and a history of landslides however, whilst the bushfire impacted area of fossil landslides and other sensitive area, it did not impact large active landslide areas. In the Colac Otway Shire's Domestic Wastewater Management Plan prepared in 2015, the majority of both townships were assigned as a High Sensitivity area due to small block sizes, terrain and geotechnical risks. Under the Colac Otway Planning Scheme, all the bushfire-affected area and extensive areas beyond are covered by Schedule 1 of the Erosion Management Overlay. This Overlay has specific information requirements for planning permit applications in relation to geotechnical assessment and landslide/landslip risk assessment.

The field investigations for this assignment were conducted in early March 2016 prior to the Victorian Government sponsored clean-up of the bushfire affected sites. The bushfire left a number of large burnt out trees, fallen trees, partially collapsed structures, fragmented fibre sheeting (possibly containing asbestos), loose corrugated metal, downed electricity lines and numerous trip hazards. As a result, most affected sites were difficult to access for safety reasons. Assessments were therefore typically conducted from vantage points on the road or in the driveway.

The extent to which site-specific recommendations could be made in relation to geotechnical assessments or wastewater treatment systems was constrained by factors including site access and the lack of availability of site-specific plans for replacement buildings and associated works.

In relation to geotechnical conditions, a consistent set of issues were observed at most sites. The roads are typically constructed as 'cut to fill, with upslope being cut and fill being placed on the downslope'. On downslope properties, there was typically steep fill slopes above the property, with earthworks and/or retaining walls to allow for car parking immediately downslope of the road. Some of these slopes would have been of marginal stability prior to the bushfire and stability issues have deteriorated with the loss of vegetation from the fire. Properties upslope of roads often had car parks created as cut and fill with the additional fill placed on an already relatively steep cut slope.

Most retaining walls on sites were constructed as metal I beam posts with timber lagging. The timber lagging has been burnt in many of the retaining walls, particularly on 'downslope' properties. Burnt out retaining walls that no longer offer support to retain soils were generally assessed as high risk. (Risk to Property was assessed on the conditions at the time of the assessment based on general risk to the property as precise future uses were not known). This risk could be readily mitigated with the reconstruction of the damaged retaining wall. Steep cut and/or fill slopes associated with roads varied from very high to low risk.

The geotechnical assessment has provided site assessments of Risk to Property and Risk to Life for hazards identified on 109 sites where dwellings were destroyed. It has not prepared site-specific reports or cross sections for each site as required under the Erosion Management Overlay. This risk information, which is accessible in relation to individual sites, means that owners of most bushfire-affected properties will have to provide more geotechnical information in respect of their planning permit application for a new/replacement dwelling and works.

Comments and recommendations for the redevelopment of buildings and works are provided and should be applied on a site-specific basis to reduce the risk rating of identified hazards. Redevelopment works should follow good hillside practice guidelines. This advice will assist property owners in the formulation of redevelopment plans for their sites. It also means that the Colac Otway Shire will have a consistent information base to assist individual applicants for planning permits in pre-lodgement consultations. It may also assist Colac Otway Shire to append standard/uniform conditions to planning permits including the mandatory condition required by Schedule 1 of the Environmental Management Overlay.

The land capability investigation found that onsite wastewater containment is very highly constrained for 14 sites assessed within the study area, highly constrained for 124 sites and moderately constrained (classified as being partially able to contain treated wastewater on site) for 12 sites. The results of this land capability assessment were found to be consistent with previous investigations for Wye River and Separation Creek.

We have identified a range of wastewater management options for properties that can and cannot sustainably contain wastewater on site. Where effluent can be contained on site we have recommended secondary treatment and irrigation disposal as a minimum standard to minimise risks to human health, the environment and land stability. Where effluent cannot be contained on site, we have recommended the consideration of cluster systems. Based on the results of the LCA, two groups of properties that may potentially be suitable for cluster wastewater management systems have been identified. For properties that cannot contain wastewater on site, and are not suitable for inclusion in a cluster system, we have identified options including combinations of partial onsite containment, offsite discharge, waterless toilets and pump-out. In the case of offsite discharges, the options are designed to provide a higher effluent standard than exiting offsite discharges.

In conclusion, this study provides a consistent broadscale information base for the bushfire-affected areas of the townships of Wye River and Separation Creek in relation to geotechnical conditions and guidelines for good hillside practice and the generally highly constrained nature of sites for wastewater management. This information base and interpretation will assist key stakeholders in the formulation and assessment of redevelopment plans.

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1. Introduction

The townships of Wye River and Separation Creek are located approximately 160 km south west of Melbourne on the Great Ocean Road (Figure 1). Wye River is located approximately 1 km southwest of Separation Creek. The current permanent population of the two townships is approximately 200 which can increase to around 3,500 during summer months. Wye River and Separation Creek consist of a total of 442 dwellings and 76 vacant lots within the township boundaries.

On 25 December 2015, the communities of Wye River and Separation Creek were impacted by a bushfire. The severity of the bushfire was rated as high or moderate in parts of the towns (Figure 2). The bushfire resulted in the loss of over 100 properties in these two towns. A number of dwellings were damaged and other sites were affected by damage to retaining structures and wastewater management systems and water tanks. (Plates 1 to 6).

In January 2015, the Victorian Government announced a $2.75 million assistance package to help these communities affected by the 25 December 2015 bushfires. This assistance includes the establishment of a 'one stop shop' to provide support and advice on resettlement. As part of this, the Government is providing a regulatory framework that will streamline and fast track the approval process for land owners to obtain the necessary regulatory approvals to repair or rebuild bushfire damaged or destroyed dwellings. To simplify this process, a common settlement-wide approach to land capability and geotechnical assessments and wastewater management has been adopted.

1.1. Scope of study

The Wye River and Separation Creek – Geotechnical, Land Capability and Wastewater Solutions Project (the project) was commissioned by the Department of Environment, Land, Water and Planning (DELWP) to support the rebuilding of Wye River and Separation Creek communities impacted by the 25 December 2015 bushfires. The scope of this study is as follows:

- Develop an approach for accelerated planning approvals for affected properties.
- Conduct a settlement-wide geotechnical investigation for bushfire affected properties which identifies potential geotechnical risks and recommends options and a regulatory framework to support the rebuilding of dwellings, associated buildings and wastewater solutions.
- Conduct a settlement-wide land capability assessment (LCA) for bushfire affected properties which identifies restrictions on land suitability for wastewater treatment and disposal and informs the development of potential wastewater management solutions.
- Develop options and potential solutions for wastewater management in the Wye River and Separation Creek area that will achieve regulatory compliance.

The options and solutions developed as a part of this study are designed to assist Colac Otway Shire and the Victorian Environment Protection Agency (EPA) in streamlining regulatory approvals processes resulting in accelerated planning approvals for affected residents.

1.2. Study area

The study area for this project varies according to the field of investigation but generally incorporates the residential areas of Wye River and Separation Creek (Figures 3 and 4). Investigations conducted as a part of the geotechnical assessment focused on sites where properties were destroyed. Investigations conducted as a part of the land capability assessment focused on sites where properties were destroyed or damaged (Figure 5).

The residential areas of Wye River and Separation Creek are generally moderately to steeply sloping. There is a history of landslides in the area and further potential for landslides to occur (Coffey, 2011). Monitoring of Wye River and Separation Creek indicates that water quality is poor with regular exceedences of State Environment Protection Policy (SEPP) objectives (Dahlhaus et al, 2003). The towns are known to contain registered Aboriginal archaeological sites and are considered highly sensitive for their cultural heritage, landscape and visual values (Dahlhaus et al, 2003). The towns contain only small areas of intact remnant vegetation due to extensive clearing and the presence of pest plants.

The residential areas of Wye River and Separation Creek have power and telephone services but no gas supply, reticulated water or sewage services (Coffey, 2011). The Colac Otway Shire Domestic Wastewater Management Plan (Whitehead and Associates, 2015a) identifies these towns as having a moderate or high sensitivity rating with the majority of both towns identified as having a high sensitivity. The constraints in these areas, including small block size, terrain and geotechnical risks limit their potential to sustainably manage domestic wastewater in line with legislative requirements.

Source:
Roads, watercourses, parcel boundaries and parks/reserves from VICMAP.
Imagery from DEWLP (captured 9 January 2016).

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Date: 05.04.2016
Project: ENAUABTF0DELWPAA
File Name: 11630AA_01_F001_GIS

Department of Environment, Land, Water & Planning

Wye River and Separation Creek
Geotechnical, Land Capability and Wastewater Solutions Project

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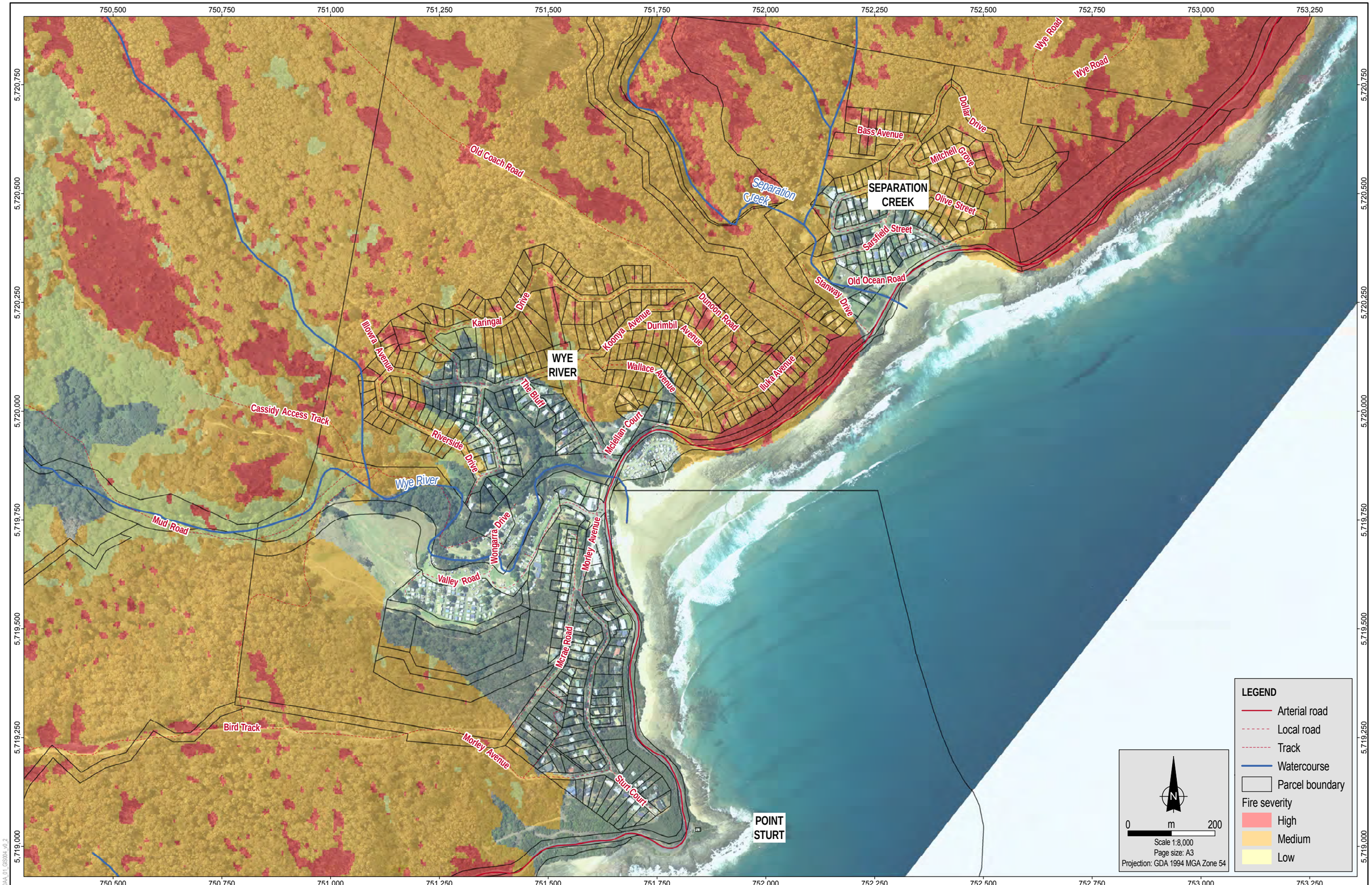
Wye River and Separation Creek location

Figure No: 1

MXD Reference: 11630AA_01_GIS001_v0_2



Source:
Fire severity from DEWLP.
Roads, watercourses, parcel boundaries and parks/reserves from VICMAP.
Imagery from DEWLP (captured 9 January 2016).

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Fire severity

Figure No: 2

MXD Reference: 11630AA_01_GIS004_v0_2

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Scale 1:6,000
Page size: A3
Projection: GDA 1994 MGA Zone 54

750,500 750,750 751,000 751,250 751,500 751,750 752,000 752,250 752,500

5,720,250 5,720,000 5,719,750 5,719,500 5,719,250 5,719,000

Old Coach Road
Karingal Drive
Coryule Avenue
Durimbil Avenue
Dunoon Road
Separation Creek
Illowra Avenue
Karingal Drive
WYE RIVER
Wallace Avenue
Iluka Avenue
The Boulevarde
The The Bluff
Cassidy Access Track
McClellan Court
Wallace Avenue
Riverside Drive
Wye River
Mud Road
Mogareeka Drive
Valley Road
McRae Road
Morley Avenue
Bird Track
Morley Avenue
Sturt Court
POINT STURT

LEGEND
- Arterial road
- Local road
- Track
- Watercourse
- Parcel boundary
- Township Zone

Source:
Roads, watercourses, parcel boundaries and zoning from VICMAP.
Imagery from DEWLP (captured 9 January 2016).

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Wye River study area

Figure No: 3

MXD Reference: 11630AA_01_GIS002_r0_2

751,900 752,000 752,100 752,200 752,300 752,400 752,500 752,600 752,700 752,800 752,900 753,000

5,720,800 5,720,700 5,720,600 5,720,500 5,720,400 5,720,300 5,720,200

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Scale 1:3,000
Page size: A3
Projection: GDA 1994 MGA Zone 54

Wye Road
Wye Road
Dollar Drive
Bass Avenue
Mitchell Grove
Harrington Street
SEPARATION CREEK
Olive Street
Separation Creek
Harrington Street
Sarsfield Street
Olive Street
Old Ocean Road
Stanway Drive

LEGEND
- Arterial road
- Local road
- Track
- Watercourse
- Parcel boundary
- Township Zone

751,900 752,000 752,100 752,200 752,300 752,400 752,500 752,600 752,700 752,800 752,900 753,000

Source:
Roads, watercourses, parcel boundaries and zoning from VICMAP.
Imagery from DEWLP (captured 9 January 2016).

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Project: ENAUABTF0DELWPAA
File Name: 11630AA_01_F004_GIS

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Wye River and Separation Creek
Geotechnical, Land Capability and Wastewater Solutions Project

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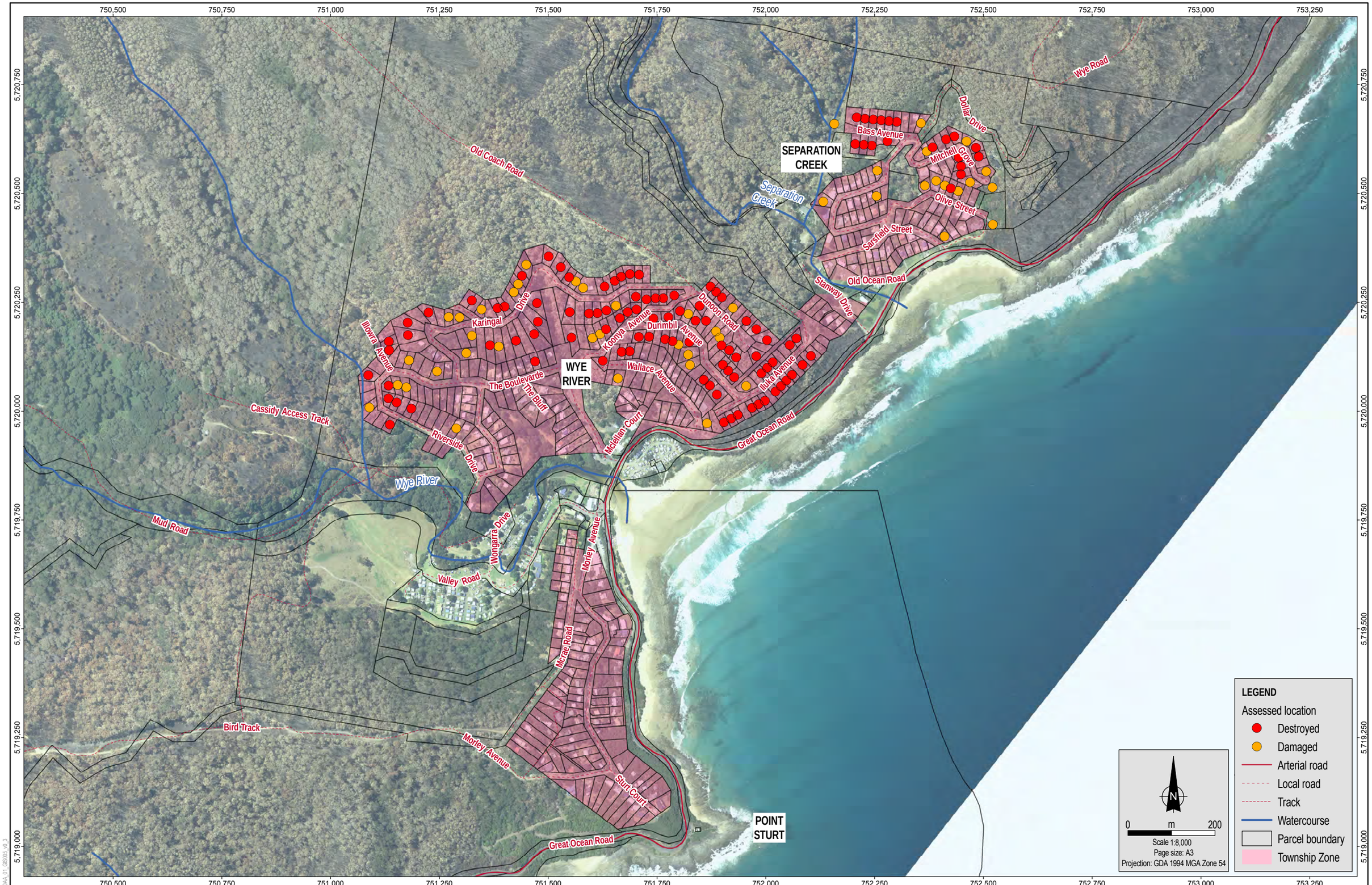
Separation Creek study area

Figure No: 4

MXD Reference: 11630AA_01_GIS003_v0_3



Source:
Building condition geolocated by Coffey from "Wye River Bushfires 2015 - Property owner geotechnical and tree status spreadsheet.xlsx" from A.S Miner.
Roads, watercourses, parcel boundaries, zoning and parks/reserves from VICMAP.
Imagery from DEWLP (captured 9 January 2016).

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Wye River and Separation Creek
Geotechnical, Land Capability and Wastewater Solutions Project

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Geotechnical and land capability assessments investigation area

Figure No: 5

MXD Reference: 11630AA_01_GIS005_v0_3

Photo credit: Coffey

Plate 1
Remains of a dwelling in Wye River destroyed in 25 December 2015 bushfire

Photo credit: Coffey

Plate 2
Remains of a dwelling in Wye River destroyed in 25 December 2015 bushfire

Photo credit: Coffey

Plate 3
Remains of a car in Wye River destroyed in 25 December 2015 bushfire

Photo credit: Coffey

Plate 4
Damaged retaining wall at a Wye River property

Photo credit: Coffey

Plate 5
Burnt retaining wall at a Wye River property

Photo credit: Coffey

Plate 6
Remaining hole where a water tank was destroyed

2. Legislative context

2.1. Planning approvals for rebuilding

The overarching objective of this study is to provide technical assessments that will assist the processing of accelerated statutory approvals for new buildings and works at Wye River and Separation Creek. This will enable owners of bushfire affected sites to rebuild in a timely manner and with confidence. The applicable statutory approvals framework which provides the parameters for the technical assessments is presented in the following sections.

2.2. Statutory planning framework

The statutory planning framework for approvals to enable rebuilding to take place in the fire affected areas of Wye River and Separation Creek is provided broadly by the provisions of the *Planning and Environment Act 1987* and, more specifically, by the provisions of the Colac Otway Planning Scheme (the Scheme).

2.2.1. Planning and Environment Act 1987

The *Planning and Environment Act 1987* sets the legislative framework for statutory and strategic planning in Victoria. Under Section 4(1) of this Act, planning schemes in Victoria must seek to achieve the objectives of planning in Victoria set out in the Act. These objectives relate to, among other things, the fair, orderly, economic and sustainable use and development of land and the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity.

The Act provides the framework for the preparation of planning schemes such as the Colac Otway Planning Scheme. This is based on inclusion of the mandatory sections of the *Victoria Planning Provisions* and the local vision and policy framework through the Municipal Strategic Statement and the local planning provisions and the local control framework through schedules to the zones and overlays.

The Act also provides the legal framework for development approval by means of planning permits by the relevant responsible authority (for example, the Colac Otway Shire [COS]). Planning permits to allow the use or development of a specified parcel of land in accordance with the applicable provisions of the relevant planning scheme are usually issued with conditions. Time limits apply to the development approval provided by planning permits and responsible authorities also have enforcement powers to ensure that the use or development is undertaken in accordance with the permit. In addition, the Act provides for the Minister of Planning to amend a planning scheme, this may be required to facilitate the accelerated planning approval process.

If an applicant for or an objector to the issue of a planning permit so chooses, the Act provides for the right to an independent review of certain decisions including decisions about planning permits for the use and development of land. This review is by means of an application to the Victorian Civil and Administrative Tribunal (VCAT) in accordance with the provisions of the Act and the *Victorian Civil and Administrative Tribunal Act 1998*.

2.2.2. Colac Otway Planning Scheme

As with the rest of the land within the COS, the Colac Otway Planning Scheme (the Scheme) applies to the fire-affected areas in the townships of Wye River and Separation Creek. COS is the responsible authority in relation to the administration and implementation of the Scheme. The overall intent of the

policy and control framework contained in the Scheme in relation to these towns is to protect their environmental and amenity characteristics.

Construction of new dwellings and other buildings impacted by the 25 December 2015 bushfires in the two townships will generally require planning permits under a number of provisions in the Colac Otway Planning Scheme. It is understood that some sites may not require the issue of new permits as these sites at the time of the bushfire had been issued with planning permits within the last five years. This would apply to existing developments or approved developments under construction. The integrated nature of the planning policies and controls that apply to Wye River and Separation Creek will need to be considered in any accelerated planning process for the issue of permits for fire-affected properties.

State and Local Planning Policy Framework

Aspects of the State Planning Policy Framework (SPPF) included in Clause 14 of the Scheme relating to Natural Resource Management - in particular water and water quality – and Clause 19 Infrastructure – particularly water supply, sewerage and drainage and stormwater - provide the broader context for the more detailed local policies relating to the townships and the specific requirements of the Erosion Management Overlay (EMO).

The Local Planning Policy Framework (LPPF) contained in Clause 20 of the Scheme presents more detailed direction to the planning and development of the townships of Wye River and Separation Creek as follows:

> *The Kennett River, Wye River and Separation Creek Structure Plans (2008) include the following vision for Kennett River, Wye River and Separation Creek:*
>
> *· Kennett River, Wye River and Separation Creek will remain as distinct coastal towns nestled in the foothills of the Otway Ranges.*
>
> *· The primary role of the coastal towns will be to provide housing for permanent and part time residents and to provide a diverse range of holiday accommodation.*
>
> *· The impact of the coastal towns on the natural environment will be as minimal as possible with coastal hazards, river flooding and water and wastewater being sustainably managed and vegetation acknowledged and valued.*
>
> *· The coastal towns have a low growth capacity and all future growth will be contained within existing settlement boundaries*. (Clause 21.02-2 – emphasis added)

In Clause 21.03 Settlement, objectives, strategies and preferred character statements for the development future of Wye River and Separation Creek are set out based on the findings of the Wye River and Separation Creek Structure Plan (Planisphere, 2005) (which is included in Clause 21.07 of the Scheme as a Reference Document). Relevant objectives include:

- To preserve and enhance the environmental qualities of the townships and ensure development responds to the preferred neighbourhood character.
- To ensure that waste water from existing and proposed development is managed in a way that minimises its impact on the environment.
- To ensure that stormwater drainage systems respond to the constraints posed by the townships unique climatic, geological and environmental setting. (Clause 21.03-6).

Clause 21.04-5 Erosion gives specific policy direction about the significant landslide hazard that exists in the southern half of the Shire including the Otway Ranges from Marango to Wye River. The objectives of this policy are:

- To ensure that use and development has regard to the potential for landslip.
- To ensure that in areas where a risk of landslip is identified, all new buildings and works do not increase the possibility of landslip on the land or surrounding land.
- To manage landslip risk especially along the coastal areas (Clause 21.04-5).

The strategies identified to achieve these objectives are:

- Ensure that in areas where a risk of landslip is identified, all new buildings and works do not increase the possibility of landslip on the land or surrounding land.
- Avoid vegetation removal in areas susceptible to landslip.
- Reduce and stabilise movement and disturbance in landslip areas by replanting vegetation and by good site drainage including limited onsite disposal of treated wastewater effluent and stormwater, where appropriate.
- Ensure new development demonstrates tolerable risk to property and loss of life.
- Consider land capability in the assessment of use and development proposals.
- Promote land management practices that protect soil resources from landslip, contamination, compaction and other forms of degradation.

The Decision Guidelines in applicable zones and overlays noted below generally require that the responsible authority must consider, as appropriate, 'the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.

Existing zone and overlay controls

As summarised in Table 2.1, under the Scheme, the subdivided residential areas of Wye River and Separation Creek areas are covered by largely by the Township Zone (TZ) as well as a range of overlays related to local environmental and amenity characteristics. All of the destroyed properties and most of the damaged properties are covered by the Township Zone with several damaged properties are covered by the Rural Conservation Zone (RCZ).While the focus of this study relates to the provisions of the EMO and Schedule 1 to the EMO (EMO1), permit applicants will also need to have regard to permit triggers, information requirements and other provisions under other applicable overlays.

Table 2.1 Summary of planning controls applying to Wye River and Separation Creek

Zones	Relevance to this study	Planning permit trigger
Township Zone (TZ) (Clause 32.05)	Applies to the residential subdivisions within the two township areas - most of the fire affected properties are located within this zone.	• A permit for the **use of a lot for a dwelling** is only required if the requirements of Clause 32.05-2 cannot be met in relation to onsite wastewater treatment, potable water supply and electricity supply. • A permit is required to construct or extend one dwelling on a lot of less than 300 square metres. (Clause 32.05-5). • A permit is required to construct or extend two or more dwellings on a lot dwellings on common property and residential buildings (Clause 32.05-6).
Rural Conservation Zone (RCZ) (Clause 35.06)	Applies to larger allotments outside the township areas	• A permit is required for a dwelling which must be the only dwelling on a lot. This does not apply to the replacement of an existing dwelling if the existing dwelling is removed or altered (so it can no longer be used as a dwelling) within one month of the occupation of the replacement dwelling. • A dwelling must meet requirements in relation to all weather access, onsite wastewater treatment, potable water supply for domestic and fire fighting purposes and reticulated electricity supply (see Clause 35.06-2).
Overlays		
Erosion Management Overlay (EMO)	Applies to all fire affected areas within the two townships and beyond. Schedule 1 to the EMO (EMO1) sets out the information requirements in relation to permit applications for land susceptible to landslip and erosion.	A permit is required to construct a building or to construct or carry out works including: • Roadworks. • Buildings and works associated with a dependent person's unit. • A domestic swimming pool or spa and associated mechanical and safety equipment. • Any matter specified in Clause 62.02-3 if specified in a schedule to the EMO.
Significant Landscape Overlay (SLO2)	Applies to the subdivided residential areas of the two townships.	A permit is required to construct a building or construct or carry out works and to construct certain type of fences and to remove, destroy or lop a tree.
Design and Development Overlay (DDO4)	Applies to the subdivided residential areas of the two townships.	A permit is not required to construct a building or carry out works.
Neighbourhood Character Overlay (NCO1).	Applies to the subdivided residential areas of the two townships.	A permit is required to construct a building or construct or carry out works.

Table 2.1 Summary of planning controls applying to Wye River and Separation Creek (cont'd)

Zones	Relevance to this study	Planning permit trigger
Heritage Overlay (HO)	None of the following areas covered by the HO were bushfire affected (for the purposes of this study). HO 312 applies to the Great Ocean Road as it passes through and beyond the two townships to both the south and north. HO 243 applies to the War Memorial Cairn, Great Ocean Road, Wye River. HO 244 applies to the Wye River Hotel, 19 Great Ocean Road, Wye River. HO 227 applies to the Stanway Harrington Memorial Cairn, Separation Creek.	A permit is required for development and uses set out in Clause 43.01-1 including to demolish or remove a buildings and to construct a building.
Land Subject to Inundation Overlay (LSIO)	Applies to sections of and adjacent to the lower reaches of the Wye River and Separation Creek largely outside the residential and bushfire affected areas of the townships.	A permit is required to construct a building or to construct or carry out works.
Wildfire Management Overlay (WMO)	Applies to all fire affected areas within the two townships and beyond.	
Environmental Significance Overlay 2 (ESO2)	Applies to all Wye River watercourses within Wye River township and covered by the PCRZ. No fire affected properties covered by this Overlay.	A permit is required to construct a building or carry out works not listed in Clause 3.0 of Schedule 2 to the ESO.
Environmental significance Overlay 4 (ESO4)	Applies to lower reaches of the Wye River watercourse within the PCRZ.	A permit is required to construct a building or carry out works.

Erosion Management Overlay

The Erosion Management Overlay (EMO) is, arguably, the key control relating to planning approval to construct dwellings to replace those lost in the 25 December 2015 bushfire. The objectives of the EMO are:

- To ensure that development can be carried out in a manner which will not adversely increase the landslip risk to life or property affecting the subject land or adjoining or nearby land.
- To ensure that development is not carried out unless the risk associated with the development is a tolerable risk or lower.
- To ensure that applications for development are supported by adequate investigation and documentation of geotechnical and related structural matters.
- To ensure that development is only carried out if identified geotechnical and related structural engineering risks to life and property are effectively addressed.

As shown in Table 2.1, a permit is required to construct a building or construct or carry out works, including:

- Roadworks.
- Buildings and works associated with a dependent person's unit.
- A domestic swimming pool or spa and associated mechanical and safety equipment.
- Any matter specified in Clause 62.02-3 [Vegetation removal] if specified in a schedule to this overlay.

This requirement does not apply if a schedule to this overlay specifically states that a permit is not required.

Schedule 1 to the EMO (EMO1) sets out detailed requirements for the information that must accompany an application for a planning permit in the area covered by the EMO (unless an exemption applies to minor works). This information is a set of Development Plans, a Geotechnical Assessment, and, if required by the Geotechnical Assessment, a Landslide/Landslip Risk Assessment.

This Schedule also stipulates that the any permit issued must contain the following condition:

> *The approved development must be carried out on the site in accordance with the recommendations of the Geotechnical Assessment (title/date/author) or, where applicable, the Landslip Risk Assessment (title/date/author) or any Geotechnical Practitioner engaged to review those assessments submitted with the application.* (Clause 10 to Schedule 1 of the EMO).

Planning and building approval processes

COS is the responsible authority for the administration of the Scheme. Under the provisions of the Scheme, planning approval will be required to enable construction of new dwellings (except where it is deemed that a valid planning permit exists).

- On its website, COS provides guidance for applicants for a planning permit in relation to steps including: Pre-application consultation with planning officers.
- Other steps to assist the preparation of applications.
- Information requirements to accompany an application.
- The steps in the planning permit process.

Once a planning permit is issued, application can be made for a Building Permit which is required under the Building Regulations for (among other things):

- Demolition/removal of a building.
- Construction of a new dwelling.
- Construction of a range of related works including retaining walls on boundaries or over 1 metre in height, most fences, decks and bushfires shelters.

A Bushfire Attack Level (BAL) assessment is required to accompany applications for a building permit in bushfire prone areas.

2.3. Wastewater management

The overarching statutory framework for the protection of water quality in Victoria is set by the *Environment Protection Act 1970* and the State Environment Protection Policies (SEPPs) Waters of

Victoria and Groundwaters of Victoria adopted by the Victorian Government. As discussed in Section 1.2, there are also requirements under the *Planning and Environment Act 1987* in relation to issuing planning permits with relevant requirements for wastewater treatment.

From 1 July 2016 EPA intends to remove the need for individual treatment systems to hold a CA. Instead, EPA will approve only types of systems, as required by the *Environment Protection Act 1970*. The four types of systems consistent with the Australian Standards will be:

- Septic tanks.
- Waterless composting toilets.
- Aerated wastewater treatment systems.
- Domestic greywater treatment systems.

Currently all systems that hold a CA will fit one of these types with the exception of sand filters. In the interim, EPA will provide standards for sand filters and these will be included in a technical annex to EPA Publication 891.3.

Up until 1 July 2016, COS will be able to approve systems that have been certified by an accredited conformity assessment body (CAB) as conforming to the relevant Australian Standard or that have a current CA. After July 1 2016 all treatment systems will be required to be certified by a CAB as conforming to the relevant AS. The specific performance standards for effluent quality will be as specified in the relevant Australian Standards.

The formulation of site-specific management approaches for residential wastewater as will be required for the fire-affected properties in Wye River and Separation Creek is guided by Publication 891.3 Code of Practice, Onsite Wastewater Management (2013) and the Australian/New Zealand Standards AS/NZS 1547:2012 Onsite Domestic Wastewater Management and AS1546:2008 Onsite domestic wastewater treatment units - Septic tanks. While not a statutory document, the Municipal Association of Victoria's (MAV) Victorian Land Capability Assessment Framework (2014) also provides practical guidance.

The application of these documents in the context of the Wye River and Separation Creek study area is summarised in the following sections.

2.3.1. EPA Victoria Code of Practice, Onsite Wastewater Management

Purpose

The purpose of the EPA Victoria Publication 891.3 Code of Practice, Onsite Wastewater Management (the Code) is to ensure the management of onsite wastewater (up to 5000 litres/day) protects public health and the environment and uses Victoria's resources efficiently. The Code applies to wastewater (containing sewage) generated by a single domestic household or by multi-dwelling residential, commercial, industrial or institutional facilities. It provides best practice guidance on:

- The selection, approval, management and maintenance of onsite wastewater management systems which treat up to 5,000 litres (L) of wastewater per day.
- Systems which treat up to 5,000 L/day of greywater to a quality fit for toilet flushing and cold water supply to clothes washing machines and/or land application, and
- Land capability assessment procedures and wastewater flow calculations for designing effluent recycling and disposal systems.

Legal status

The Code has legal status by virtue of its reference in Clause 32 of the State Environment Protection Policy - Waters of Victoria (SEPP WoV 2003) which is subordinate legislation to the *Environment Protection Act 1970*. Clause 32 states that:

- Occupiers of premises need to manage their onsite wastewater system in accordance with Council permit conditions and the Code.
- Councils need to assess the suitability of land for onsite wastewater management and ensure that permits are consistent with the guidance provided in the Code.

Guidance provided by the Code

The Code includes guidance on (with emphasis added in relation to the particular application in the Wye River and Separation Creek study area):

- Wastewater treatment systems that may be permitted in new subdivisions and on single allotments or for upgrading or retrofitting existing premises.
- Effluent recycling/disposal system options that may be permitted in new subdivisions and on single allotments or for upgrading or retrofitting existing onsite systems**,** including design requirements for land application systems.
- Calculating the appropriate size of onsite system.
- Effective management of the systems.

There are more wastewater treatment options available for unsewered townships such as Wye River and Separation Creek compared with sewered areas. These are limited to treatment system brands and models that are certified by an accredited conformity assessment body (CAB) as conforming to the relevant Australian Standard or that have a current Certificate of Approval from EPA.

Cumulative impacts

While the Code primarily refers to single allotments, it also requires that cumulative impacts within a township or precinct should be taken into account when assessing the capability of a lot to absorb treated effluent without negatively impacting its surroundings. Given the particular environmental characteristics of the Wye River and Separation Creek study area, this is a particularly pertinent requirement that has been considered in this current study.

In order to minimise the cumulative impact of wastewater, the Code requires that effluent must be contained on site within the boundaries of the allotment. For existing premises with an offsite discharge or a failing system on a small block, the Code directs that the wastewater management system should be upgraded to contain as much of the effluent as possible on the allotment.

Australian Standards

Clause 1.7.4 of the Code directs that onsite wastewater treatment systems and associated recycling/disposal systems should be designed, accredited and managed in accordance with a number of relevant Australian Standards (see Section 1.4.2). If there is an inconsistency between an Australian Standard and the Code, the Code takes precedence.

Council requirements

In addition to issuing permits for waste water treatment systems and ensuring that such systems are installed and managed in accordance with relevant approvals, under the Code councils also have a responsibility for developing Domestic Wastewater Management Plans in accordance with the SEPP WoV. The relevant document for the Colac Otway Shire is the Domestic Wastewater Management Plan – Operational Plan (Whitehead and Associates 2015a).

Onsite wastewater management in unsewered areas

Chapter 3 of the Code provides detailed directions for the onsite treatment of wastewater in unsewered areas such as Wye River and Separation Creek. In summary, the following steps should be followed:

- Decide on the proposed design criteria for the property including location and size of the dwelling and maximum occupancy of the dwelling.
- Arrange for a suitably qualified and experienced land capability assessor to undertake a land capability and risk assessment on the subject lot (unless the Council advises that this is not required).
- Design the proposed onsite wastewater recycling/dispersal system.

Other guidance

The Code also provides extensive technical information to assist in the selection and design of wastewater treatment systems.

2.3.2. Australian Standards

The Code (see Section 1.4.1) suggests that onsite wastewater treatment systems and associated recycling/disposal systems should be designed, accredited and managed in accordance with a number of relevant Australian Standards. For the purposes of this study, particular regard has been given to the following two Australian Standards in the assessment of the wastewater management systems that may be suitable for properties in Wye River and Separation Creek (see Section 3.4) - AS/NZS1547:2012 Onsite domestic wastewater management and AS1546:2008 Onsite domestic wastewater treatment units - Septic tanks.

AS/NZS1547:2012 Onsite domestic wastewater management

This Standard provides the requirements for treatment units and their respective land application systems to achieve sustainable and effective onsite domestic wastewater management, to protect public health and the environment. This Standard identifies the performance statements that cover the overall design and sustainable management of onsite domestic wastewater systems.

The onsite systems covered by this Standard include primary, secondary, and disinfection wastewater treatment systems. The Standard gives specific details for septic tanks, other wastewater treatment units, and land application systems. Specific details are provided for conventional trenches, beds, evapotranspiration areas, mounds, drip and spray irrigation. These commonly used systems, while given as examples, are not intended to preclude the growing number of new or developing technologies in onsite wastewater management.

AS1546:2008 Onsite domestic wastewater treatment units - Septic tanks

This Standard essentially provides guidance for the design, assessment and manufacture of septic tanks in line with the following objectives:

- To provide a set of performance statements which define the requirements of a septic tank and which provide a base against which any septic tank, conventional or innovative may be assessed.
- To provide manufacturers of conventional septic tanks and associated fittings systems made of various materials with basic manufacturing and test specifications.

These objectives enable certification bodies to check that a product conforms to the Standard.

2.3.3. Planning approval for wastewater treatment systems

An onsite wastewater treatment system intended to treat and dispose of wastewater generated by a dwelling on the same site does not require a planning permit. In the absence of the ability to link into reticulated sewage treatment, the installation of such a system is normally specified as a condition on a planning permit for a dwelling,

Where onsite wastewater treatment is not possible and in the absence of reticulated sewage treatment, a ‘cluster wastewater treatment system’ may be considered.

Under the Colac Otway Planning Scheme, a ‘cluster wastewater treatment system’ would be considered to be a ‘minor utility installation’ - which is defined to include ‘a sewage treatment plant, and any associated disposal works, required to serve a neighbourhood’ and ‘a pumping station required to serve a neighbourhood’ - does not require a planning permit. What constitutes a ‘neighbourhood’ is not defined in the Scheme so presumably it would have a common usage definition such as a ‘district or community within a town or city’.

A ‘utility installation’ (i.e. other than a ‘minor utility installation’) which includes ‘land used to collect, treat, or dispose of storm or flood water, sewage, or sullage’, would require a planning permit.

3. Approach and method

This section describes the approach and method for the accelerated planning approvals review, geotechnical assessment, land capability assessment (LCA) and assessment of wastewater management solutions conducted for Wye River and Separation Creek.

3.1. Accelerated planning approvals for dwellings

To accelerate the planning approvals process, Coffey held a meeting and discussions with personnel from the following key agencies directly involved in the planning approval process:

- DELWP.
- COS.
- EPA Victoria.
- Barwon Water.
- Corangamite Catchment Management Authority.

These meetings were a forum to establish the content and format of streamlined and integrated information requirements for planning approval purposes. The outcomes of these stakeholder meetings enabled Coffey to develop a process to capture, record and disseminate relevant information from the specialist technical investigations.

Information requirements of Schedule 1 to the Erosion Management Overlay (EMO1) for affected sites were distilled in an interactive form in relation to geotechnical and land capability assessments and wastewater management as appropriate to:

- Draw relevant regulatory and technical/investigation data from existing data.
- Collect site-specific technical/investigation data.
- Present information requirements under the EMO1 and technical investigation data in an interactive digital format that met the planning requirements and facilitated regulatory assessment and decision-making and the timely issue of approvals. Pro-forma templates were set up for site-specific geotechnical assessment and landslide/landslip assessment reports that were populated with the relevant data from the geotechnical and land capability investigations.

3.2. Geotechnical assessment

The geotechnical assessment considered 109 sites across the two towns where dwellings were destroyed by the bushfire.

Desktop study

An initial desktop review of available data was conducted, including:

- A review of post-fire geotechnical assessments on site with Colac Otway Shire geotechnical consultant Mr Tony Miner of AS Miner Geotechnical Pty Ltd.
- A review of previous site specific geotechnical site assessments where they had been previously conducted.
- A review of previous geotechnical reports for the broader area.

Site visit

An initial site visit was conducted to help understand the geotechnical stability of affected sites, and the ongoing level of risk to property and life posed by the post-bushfire conditions.

Fieldwork

The fieldwork program comprised the following components:

- Field visits to 109 sites with destroyed dwellings to assess the local geotechnical conditions (due to safety concerns not every site was accessible, however most could be viewed from a safe vantage point).
- Sketching geotechnical features of note, including the extent of cut and fill, with heights and slope angles (which are held in our files for reference).
- Exposing soil in site cuts to assess ground conditions at sites where access was possible.
- Collecting soil samples for laboratory testing from six sites.
- Using mobile devices to take geo-located photographs of key geotechnical aspects of the sites.

All field work was conducted by experienced geotechnical professionals, with supervision by a Principal Engineering Geologist who visited approximately 30% of sites and a Senior Principal Engineering Geologist who visited approximately 5% of sites.

Analysis and assessment

Site observations were tabulated into a spreadsheet for ease of analysis and reporting. Geotechnical hazards identified were assessed in accordance with Australian Geomechanics Society guidelines (AGS, 2007) which provides a likelihood and consequence and a resultant risk to property rating. Risk to life was also assessed.

The geotechnical observations were used to provide geotechnical advice for use across the site covering a number of matters relevant to achieving good hillside development practice (Appendix C, Coffey, 2016) in the reconstructed dwellings.

3.3. Land capability assessment

The LCA considered 150 sites across the two towns where buildings were destroyed or damaged by the bushfire. The assessment used a grouping method to classify sites. The rationale for this was to enable a rapid assessment of the large number of affected sites.

The following sections describe the key elements of the LCA method.

Desktop study

A desktop review of all available information and data was undertaken, including:

- Existing available reports covering wastewater and land capability for Wye River and Separation Creek.
- Geology and soils.
- Hydrogeology and depth to watertable.

- Flood mapping.
- Environmental features and potential sensitive receptors.
- Dial before you dig reports.

Site visit

An initial site visit was conducted to gain an overview of the affected areas, the geomorphology, and to develop an informed understanding of the landscape aspects and constraints posed by the environmental setting. This initial reconnaissance of sites enabled the design of the fieldwork program and assessment to account for situational and geological factors.

Fieldwork

The fieldwork program comprised the following components:

- Targeted site visits to assess and record information relevant to the LCA, within the context of site accessibility. Mobile digital GIS equipment was used in the field to enable real-time data capture.
- Soil boring and sampling using hand augers was conducted at 20 of the 149 sites. This was to enable:
  - Assessment of soil profile, horizons and features.
  - Assessment of soil permeability.
  - Determination of soil category.
  - Provision of samples for laboratory analyses.
- Testing of soil samples. All samples (20) obtained for laboratory testing purposes were submitted to laboratory analysis for exchangeable sodium percentage (ESP) and Emerson aggregate testing (EAT) to assess for sodicity and dispersion respectively.

Analysis and assessment

The results of the desktop review and field assessments were used to develop a LCA which adopted a common settlement-wide approach, intended to inform selection of wastewater treatment systems. This allowed for:

- Consideration of information from past wastewater management reports and associated relevant studies with the results of the field assessment and soil testing.
- Provision of soil assessment and categorisation for the sites, considering permeability, sodicity and dispersion, and a description of the soil structure and soil horizons encountered at the tested locations.
- A pragmatic approach considering the relevant requirements of AS/NZS 1547:2012 and EPA Publication 891.3 (Code of Practice for Onsite Wastewater Management).
- An indication of daily wastewater flow rates, taking into account property sizes of:
  - 1 to 3 bedroom residences.
  - 4 bedroom residences.
  - 5+ bedroom residences.
- An assessment of maximum design loading/irrigation rates for land application wastewater management systems.

- Identification of restrictions on land suitability for wastewater treatment and disposal.

3.4. Wastewater management options assessment

The wastewater management options assessment was designed to provide a rigorous assessment of treatment and disposal of wastewater that may be suitable for dwellings in Wye River and Separation Creek to inform the selection of preferred systems or approaches.

The following sections describe the method adopted.

Design standards and performance requirements

Relevant design standards and performance requirements for wastewater management were identified and reviewed, including:

- EPA Victoria's Code of Practice for Onsite Wastewater Management (EPA Publication 891.3, 2013).
- MAV - Victorian Land Capability Assessment Framework (2014).
- AS/NZS1547:2012 Onsite domestic wastewater management.
- AS1546:2008 Onsite domestic wastewater treatment units - Septic tanks.

Guidance provided for onsite wastewater management system selection in the existing Colac Otway Shire Domestic Wastewater Management Plan (Whitehead and Associates, 2015) was also considered.

Qualitative and where possible, quantitative performance standards were identified for wastewater management. This included reference to the existing Colac Otway Shire Domestic Wastewater Management Plan, State Environmental Protection Policies and other relevant documents.

Technology review

Available wastewater treatment and disposal options that could be applicable to Wye River and Separation Creek were reviewed. This included onsite wastewater management systems with Victorian EPA Certificate of Approval, emerging onsite technologies and options for cluster or off site treatment and disposal.

Assessing options

A staged approach to the assessment of wastewater management options was performed. Initially an assessment of the ability of sites to contain wastewater on site was undertaken. For sites that were unable to achieve this, alternatives were assessed including cluster wastewater management systems and other off site systems, excluding sewerage treatment schemes.

In our assessment of options, opportunities for integrated water management (IWM) were identified by emphasising water efficiency as the first step in reducing wastewater disposal volumes, examining the feasibility of grey water separation to facilitate reuse, identifying options for reuse and assessing regulatory constraints to reuse.

Assessing onsite systems

Based on the LCA, geotechnical information, water balance and other information an assessment of the ability of sites to contain wastewater on site was completed, whilst meeting the identified performance requirements. It was acknowledged that it may be possible to meet the identified performance requirements while not meeting the design standards. Results were assigned to the following categories:

- All wastewater can likely be contained on site.
- All wastewater can likely be contained on site, but some design standards may not be met.
- Wastewater can likely be partially contained on site.
- Wastewater cannot be contained on site.

For cases where wastewater can be contained on site, appropriate onsite wastewater management systems for treatment and disposal were identified based on the LCA and geotechnical constraints, occupancy (or footprint), temporality (whether the dwelling is used permanently or intermittently) and ability to meet the identified performance requirements. Likely additional information requirements to allow detailed design of the wastewater management system and to support the required regulatory process were assessed.

For cases where wastewater cannot be contained on site alternatives were identified, including consideration of cluster or other off site systems.

Potential reductions in disposal volumes brought about by the introduction of IWM measures were considered. The use of holding tanks was also considered to help buffer wastewater disposal volumes during times of high demand. Management options for onsite systems were reviewed, including the existing requirements under Certificates of Approval.

Assessing cluster systems

The potential for adjacent sites or groups of sites to enter into a shared or cluster wastewater management system was assessed. This included consideration of sites that are unable to contain wastewater on site. The approach to the assessment involved:

- Identifying sites that might be suited to a cluster system based on proximity, inability to contain wastewater on site and other factors.
- Identifying potential treatment and disposal areas for each identified cluster.
- Identifying appropriate treatment and disposal technologies for cluster systems to meet performance requirements.
- Identifying potential governance arrangements including; ownership, management and cost sharing mechanisms.
- Developing a concept design for the identified cluster systems, where appropriate.
- Identifying additional feasibility investigations required to support detailed design.
- Identifying regulatory approval process.

Assessing other offsite systems

Proposals for a sewerage scheme covering Wye River and Separation Creek have been previously assessed, but were found to involve significant geotechnical risks. Therefore, we assessed other offsite treatment and disposal solutions. Our approach to the assessment was to:

- Identify potential treatment and disposal options excluding the option to build a new sewerage treatment plant.
- Identify potential governance arrangements including; ownership, management and cost sharing mechanisms.
- Develop a concept design where appropriate.
- Identify additional feasibility investigations required to support detailed design.
- Identify regulatory approval process.

Estimation of capital and operational costs of options

Capital and operational cost estimates were prepared for the options considered to concept design. This included onsite systems for sites where wastewater can be contained within the property, alternatives for sites where wastewater cannot be contained and any cluster or other offsite systems that are developed to concept design in our assessment.

Option selection

Based on the outcomes of the options assessment and cost estimation, the results for our recommended options were tabulated in a basic multi criteria decision analysis. This can then form the basis of a consultation process to support the selection of a preferred option. A high level assessment of the ability of each option to be extended to the non-fire affected properties has also been included.

We recognise that additional site specific investigations, including soil classification, may be required to support the implementation of onsite systems and to ensure that the regulatory requirements (including Victorian Land Capability Assessment Framework, Code of Practice, AS/NZS 1547:2012) are met. Therefore, cluster, offsite and other systems identified as the preferred option have only been developed to a concept stage as part of this assessment. Additional work is required, including field investigations, to support preliminary and detailed design.

3.5. Limitations

The sites were difficult to access as the bushfires had left a number of large burnt trees, partially collapsed structures, fragmented fibre sheeting (possibly containing asbestos), loose corrugated metal, fallen trees, downed electricity lines and numerous trip hazards. DELWP provided Coffey with safety assessments of the fire affected sites. Many of the sites were designated as ‘unsafe to enter’. Most of the sites considered ‘accessible’ were still rated as ‘high risk’ to enter. Access was therefore restricted for some sites within the study area. Assessments were typically undertaken from vantage points on the road or in the driveway and where greater access was possible, the building debris often blocked off significant parts of the sites in question.

4. Overview of wastewater management

4.1. Wastewater management principles

Wastewater management refers to the combined processes for the collection, reuse, conveyance, treatment and disposal or recycling of wastewater. The major objective of wastewater treatment is to remove or reduce the concentration of contaminants and pathogens in wastewater that may pose a human health or environmental risk before the effluent is discharged back to the environment or recycled. This can be achieved through a range of treatment options, depending on the effluent quality required, how it will be disposed or recycled, and the scale of the wastewater management system.

4.2. Existing wastewater management

An inventory of wastewater management systems was included in the COS Wastewater Management Strategy (2002) (Table 4.1). An additional audit was conducted in 2013 as part of the preparation of the COS Domestic Wastewater Management Plan (2015) (Table 4.2).

Table 4.1 Wastewater management systems from the 2002 audit

Wastewater management systems	Wye River	Separation Creek
Treated effluent (sand filter or AWTS) with offsite disposal	25	6
Treated effluent (sand filter or AWTS) with onsite disposal	18	4
All wastewater to onsite disposal to 30m drain	30	15
All wastewater to onsite disposal to 60m drain	54	15
Other (package treatment plants, bio-loos, drop pits)	7	7
Split system with sullage off site	29	3
Split system with sullage on site	74	27
Total	**237**	**77**

Table 4.2 Wastewater management systems from the 2013 audit

Wastewater management systems	Disposal	Wye River	Separation Creek
Aerated Wastewater Treatment System	Drip irrigation	24	8
	Trenches	2	5
	Irrigation	11	4
	Sub surface irrigation	16	7
	Unknown	28	10
Composting toilet	Unknown	1	-

Table 4.2 Wastewater management systems from the 2013 audit (cont'd)

Wastewater management systems	Disposal	Wye River	Separation Creek
Sand filter	Sub surface irrigation	-	21
Septic tank	Sub surface irrigation	-	1
	Trenches	31	1
	Unknown	26	1
Worm farms	Trenches	3	-
	Unknown	3	-
Unknown	Drip irrigation	5	-
	Trenches	1	2
	Irrigation	1	2
	Unknown	18	11
Total		**170**	**73**

Between 2002 and 2013 some significant changes occurred in the types of wastewater management systems. This included the replacement of many split blackwater and greywater systems with single all-waste systems and an increase in secondary treatment at Separation Creek.

The most common cause of wastewater management system failure is hydraulic overloading due to inadequate system capacity during holiday period peak flows. This can lead to ponding and effluent runoff from around the treatment system or disposal field. Mechanical failure and leakage can also occur but are less common. Failure of absorption trenches and other high rate disposal structures can occur due to poor design and installation, and post installation damage such as infiltration by tree roots.

In addition, overloading of high rate disposal structures can lead to soil clogging and system failure due to a range of biological and chemical processes that reduce soil permeability.

4.3. Onsite disposal

Primary treatment systems such as septic tanks and absorption trenches have traditionally been the most common onsite wastewater management system at Wye River and Separation Creek. Septic tanks are anaerobic systems that provide only limited biodegradation of organic material and pathogen reduction. In some instances it is likely that many existing absorption trench systems or other land disposal structures have been overloaded potentially resulting in anaerobic conditions occurring.

Secondary treatment using aerobic microbiological processes can produce a significantly higher quality effluent than primary treatment septic tanks. These processes also have the ability to transform ammonia into nitrate. Additional treatment may also occur after land disposal due to filtration and biological processes occurring within the soil. Some treatment components may not be compatible with all disposal components or recycling options.

Advanced secondary treatment can produce a very high standard of effluent, but in some circumstances additional disinfection is also required to ensure sufficient pathogen removal.

4.4. Onsite, cluster and centralised scales

Previously wastewater treatment and disposal at Wye River and Separation Creek has been achieved using decentralised onsite systems. In some circumstances, some effluent may have been disposed of offsite due to discharge to stormwater drains or overland flow.

There is also potential to address wastewater management at the cluster scale, in which small groups of properties share a common treatment and disposal system, and on a centralised scale in which all properties in the community share a common treatment and disposal system. In a community, there may be a range of treatment and disposal scales operating to achieve optimum wastewater management. For example, the majority of properties may use onsite systems, whereas some properties, in environmentally sensitive areas, may share a common treatment and disposal cluster system.

4.5. Performance standards

The primary performance objective for wastewater management is the protection of the environment and human health so that the beneficial uses of the environment are not compromised. This can be achieved by ensuring that wastewater management systems are sustainable and meet appropriate performance standards. In Victoria, current best practise for onsite wastewater management can be considered to be:

- Wastewater treatment to secondary standard or better.
- Disposal to land onsite without offsite discharge.

4.5.1. Effluent quality standards

The minimum standards for effluent quality in Victoria for onsite systems are specified in the Code (Table 4.3). Standards are including for 5-day biological oxygen demand (BOD_5), total suspended solids and E. coli. These parameters are considered a general guide to effluent quality and do not relate to specific human health or environmental risks. There are no standards for salinity, sodium or other wastewater constituents.

Table 4.3 Effluent quality standards

		BOD_5 (mg/L)	TSS (mg/L)	E. coli (cfu/100mL)	Nutrient removal	Salinity/ sodium
Typical values for primary treated effluent	No specific effluent standard. Primary treated effluent can only be disposed to land via below-ground application techniques. Values in the following columns are typical for primary treated effluent.	(100 to 250)	(20 to 140)	(1000's to 1,000,000s)	Minor nutrient removal through retention of sludge	No
Secondary effluent standard	Secondary treated effluent can only be disposed to land via below-ground application techniques. Where there is a risk of pathogen contamination the Council Delegated Officer may require disinfection of the secondary treated effluent to achieve <10 cfu/100 mL. Nutrient and salinity concentrations may still limit the sustainability of secondary treated effluent land disposal.	<20	<30	<10 when disinfected	Little additional nutrient removal beyond primary treatment	No
Advanced secondary effluent standard	Advanced secondary treated greywater effluent may be disposed to land via surface irrigation and be used for indoor recycling (toilet flushing and washing machine). Nutrient and salinity concentrations may still limit the sustainability of secondary treated effluent land disposal.	<10	<10	<10	Little additional nutrient removal beyond primary treatment	No
Secondary effluent standard with nutrient reduction	As per the secondary effluent standard but incorporates additional processes to reduce nutrient concentrations.	<20	<30	<10 when disinfected	Yes	No

4.5.2. Effluent quality standards for recycled water

In addition to the guidance provided in the Code for suitability of treated effluent for recycling, the Guidelines for Environmental Management – Use of Reclaimed Water (EPA Publication 464.2) provides standards on effluent quality and recycling options. These classes primarily apply to larger commercial and industrial wastewater management systems, however, as household water recycling

from an all-waste wastewater management system is not considered by the Code they may provide a de facto standard in these situations.

The Department of Human Services is responsible for ensuring that Class A recycling schemes do not pose a risk to public health and their endorsement of a scheme is required prior to submission to EPA Victoria for sign-off.

4.5.3. Surface water discharge

The SEPP requires that the water quality of any discharge to surface water (post mixing) meets the water quality objectives set out in Table 4.4 of this report or that it is of a higher quality than the existing quality of the receiving water body.

Table 4.4 SEPP water quality objectives

Parameter	Forests B – Otway Ranges (freshwater)	Estuaries and inlets	Open coast
Total phosphorous (mg/L)	≤ 0.025	≤ 0.030	≤ 0.025
Total nitrogen (mg/L)	≤ 0.350	≤ 0.300	≤ 0.300
Ammonia (mg/L)	< 0.32 (freshwater)	< 0.50 (estuarine)	<0.50
Dissolved oxygen (% saturation)	90-110	80-110	90-110
Turbidity (NTU)	≤ 5	≤ R75 (75th percentile of reference)	≤ R75 (75th percentile of reference)
pH	6.4 – 7.7	-	-
Electrical conductivity (mg/L)	≤ 500	-	-
E. coli (cfu/100 mL) median	≤ 150 (primary contact) ≤ 1,000 (secondary contact)	-	-
Enterococci (cfu/100 mL)	-	≤ 35 (primary contact) ≤ 230 (secondary contact)	≤ 35 (primary contact) ≤ 230 (secondary contact)

4.6. Previous assessments for wastewater management

Previous assessments have considered a wide range of options that encompass most of the possible options for wastewater management at Wye River and Separation Creek. The human health and environmental risk modelling undertaken by SKM and Ecos Environmental (2014) and the COS DWMP suggest that onsite systems are likely to be a sustainable wastewater management solution for properties that are able to contain wastewater on site.

There has been limited previous assessments of cluster systems. Previous assessments of sewerage schemes suggest that they may be feasible, however these would be costly and potentially contribute to land stability risk. The human health and environmental risk modelling also suggests that a sewerage scheme may provide no additional human health or environmental benefit over improvements to onsite systems.

A summary of previous wastewater management reports for Wye River and Separation Creek is provided in Table 4.5.

Table 4.5 Summary of previous wastewater management reports

Report	Date	Description
Report on Preliminary Effluent and Groundwater Schemes for Wye River and Separation Creek Job No.265, July 1988. Report prepared for the Shire of Otway, Fisher Stewart Pty Ltd, Consulting Engineers and Surveyors	1988	Recommended that Wye River and Separation Creek needed a community sewerage scheme and groundwater collection system to reduce risks associated with onsite wastewater management and land stability.
Issues Paper Wastewater Management Wye River and Separation Creek, Colac Otway Shire	May 2002	Through the option selection and public consultation process a range of onsite and offsite systems were selected for further investigation, but a preferred option was not selected.
Wye River, Separation Creek, Kennett River Concept Design – Options development – Draft concept design report, Hyder Consulting	February 2007	Hyder Consulting was engaged by Colac Otway to identify innovative wastewater management options and to develop a concept design for the preferred option. Preferred options identified required some form of centralised wastewater management. Management options were considered in consultation with Colac Otway Shire, the Department of Sustainability and Environment (DSE) and Barwon Water.
Barwon Water Wye River and Separation Creek Sewerage Scheme Options, Revision H, SKM	March 2011	Barwon Water was required to develop a business case to implement the preferred option (Option 6a) from the Hyder Consulting Draft Concept Design Report (2007). SKM were engaged to undertake functional design for the option. Investigations required to develop the concept design determined that due to geotechnical conditions in the area the concept design referred by DSE was not feasible. Barwon Water therefore undertook preliminary investigations into potential alternative options. These are assessed in the SKM report. The report made no recommendations regarding a preferred option, but did state that in light of the high costs associated with all of the assessed options consideration should be given to reassessing the suitability of onsite systems.
Wye River and Separation Creek, Quantitative Microbial Risk Assessment and Ecological Risk Assessment, VW07110, SKM & Ecos Environmental	September 2014	Barwon Water on behalf of the working group setup to review the options for reducing public health and environmental risks commissioned SKM and Ecos Environmental to undertake a Quantitative Microbial Risk Assessment (QMRA) and Environmental Risk Assessment (ERA) of wastewater treatment and management options. The objectives of the study were to better understand risks to public health and the environment by quantifying the current level (base case) of risk to public health and the environment and measuring the value of mitigation options by the reduction in risk each offers. The QMRA and ERA modelling considered the existing base case as well as four mitigation options, including:

Table 4.5 Summary of previous wastewater management reports (cont'd)

Report	Date	Description
Wye River and Separation Creek, Quantitative Microbial Risk Assessment and Ecological Risk Assessment, VW07110, SKM & Ecos Environmental (cont'd)		MSc01 – Improve management of septic tanks (reduce rate of failure of onsite treatment and disposal systems from 50% (base case) to 0%. This would involve upgrading approximately 70% of existing systems to meet relevant standards and ensuring that each system was appropriately maintained. MSc02 – Centralised treatment of all properties that discharge to the estuaries. This would involve the inclusions of approximately 50% of all residential and commercial discharges in Wye River and approximately 80% of the properties in Separation Creek connected to a centralised treatment system. MSc03 – Remove cattle from the Wye River catchment. MSc04 – Remove ducks from the Wye River catchment. These conclusions and recommendations revealed that effective and sustainable wastewater management can likely be achieved with onsite systems if surface ponding and overland flow of effluent can be prevented.
Colac Otway Shire Domestic Wastewater Management Plan Operational Plan and Technical Document, Whitehead and Associates	November 2015	The DWMP states that previous studies have found that it is not technically feasible to introduce a community sewerage scheme due to the heavily vegetated steep slopes and landslip potential. In this regard it can be taken that the DWMP supports the continued use of onsite systems in the Wye River and Separation Creek area and based on the sensitivity analysis and constraint mapping that sustainable onsite wastewater management could be achieved if carefully designed, specialised, advanced treatment and land applications systems were used to overcome the constraints.