BLIGH TANNER

Great Ocean Road Coastal Trail – Stormwater Management Considerations

Department of Environment, Land, Water and Planning (DELWP) c/- World Trail

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JOB NUMBER	2021.0354		
PROJECT ENGINEER	Riley de Jong		
CLIENT	Department of Environment, Land, Water and Planning (DELWP) c/- World Trail		
CLIENT CONTACT	Will Rayner		
VERSION	**AUTHOR**	**REVIEW**	**DATE**
DRAFT	Lysani Pallay, Riley de Jong	A Hoban	05/10/2022
P1	Riley de Jong	A Hoban CPEng	16/11/2022

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Bligh Tanner Pty Ltd
ABN 32 061 537 666
blightanner@blightanner.com.au
blightanner.com.au

Brisbane
Level 9, 269 Wickham Street
PO Box 612
Fortitude Valley
Qld 4006 Australia
T +61 7 3251 8555
F +61 7 3251 8599

Sydney
Level 32, 101 Miller Street
North Sydney
NSW 2060 Australia
T +61 2 8019 7221

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GLOSSARY

TERM	DEFINITION
AEP	Annual Exceedance Probability (expressed as a percentage).
Afflux	A change in flood water level or extents.
Braiding	Formation of several informal trails caused by walkers avoiding an obstacle or wet area on a trail. Trail braiding is easily formed in water-logged areas or areas of sensitive ground-cover vegetation. Braided trails may easily become localised areas of ponding.
CPESC	Certified Practitioner in Erosion and Sediment Control.
Ephemeral	A creek or drainage path which may be expected to see rapid rise in water level for a short duration before receding to dry or low-flow conditions during or following rainfall events.
ESCP	Erosion and Sediment Control Plan.
Grade reversal	Trail feature which acts as a localised sag in the trail to create small catchments and direct run-off to an outfall location.
Level spreader	A stormwater structure constructed from earth, rock armour or timber which distributes run-off at an outfall over a wide area to reduce velocities and avoid concentration of flows to downstream areas.
LSIO	Land Subject to Inundation.

1. INTRODUCTION

1.1 Project Background

The Great Ocean Road Coastal Trail is a proposed 90 km walking trail from Fairhaven to Skenes Creek, Victoria (Figure 1). The proposed trail alignment is predominantly located within the Great Otway National Park, as well as sections through existing settlements and land adjacent to the coastline/Great Ocean Road corridor.

Figure 1 Proposed Great Ocean Road Coastal Trail (excerpt from Master Plan)

The Trail falls within the Corangamite Catchment Management Authority (Thompsons and Otway Coast sub-catchment area) and crosses the following major waterway catchments as well as numerous ephemeral and lower-order streams (Figure 2):

+ Moggs Creek
+ Erskine River
+ St Georges River
+ Cumberland River
+ Grey River
+ Wye River
+ Kennett River
+ Smythes Creek
+ Wild Dog Creek
+ Skenes Creek

Figure 2: Major waterways - Otway Coast and Thompson sub-catchment areas (Corangamite Management Authority)

A number of places along the Trail are mapped as land subject to inundation in the Surf Coast Council and Colac-Otway Shire planning scheme mapping. **Error! Reference source not found.** to Figure 7 show the land subject to inundation overlay along affected areas of the Trail (Vic Plan).

Where the trail is located within the mapped LSIO areas, the trail is located within existing developed areas.

Figure 3 Land subject to inundation overlay – Erskine River near Lorne

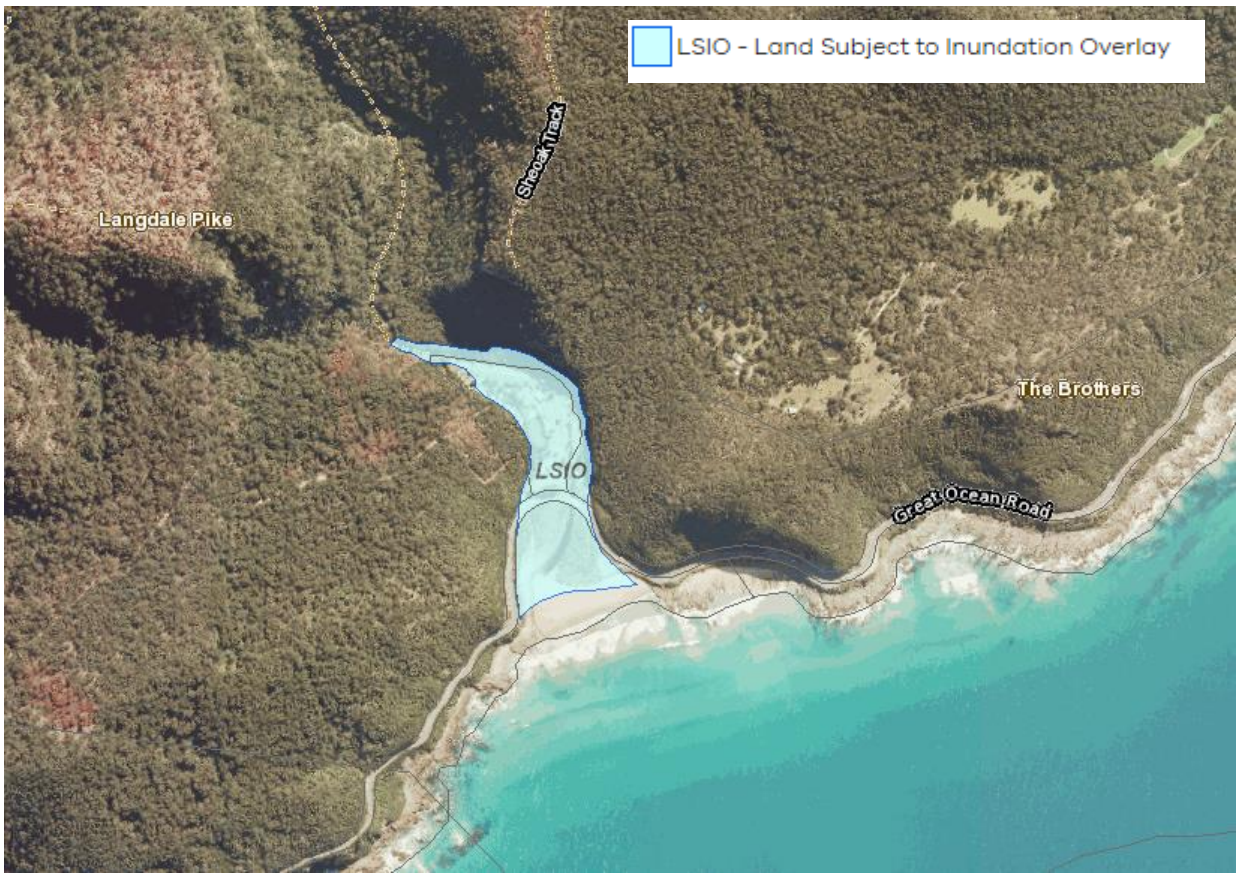

Figure 5 Land subject to inundation overlay – Cumberland River Beach

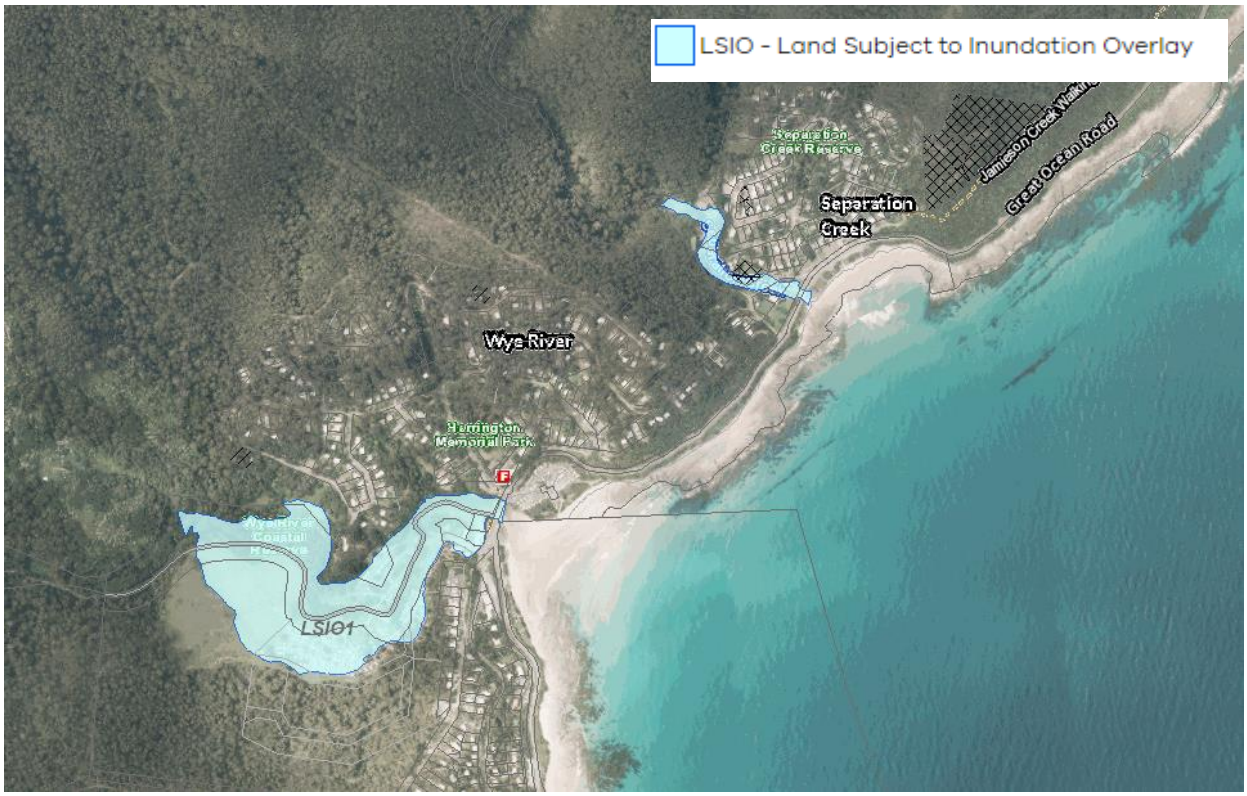

Figure 4: Land subject to inundation overlay - Wye River

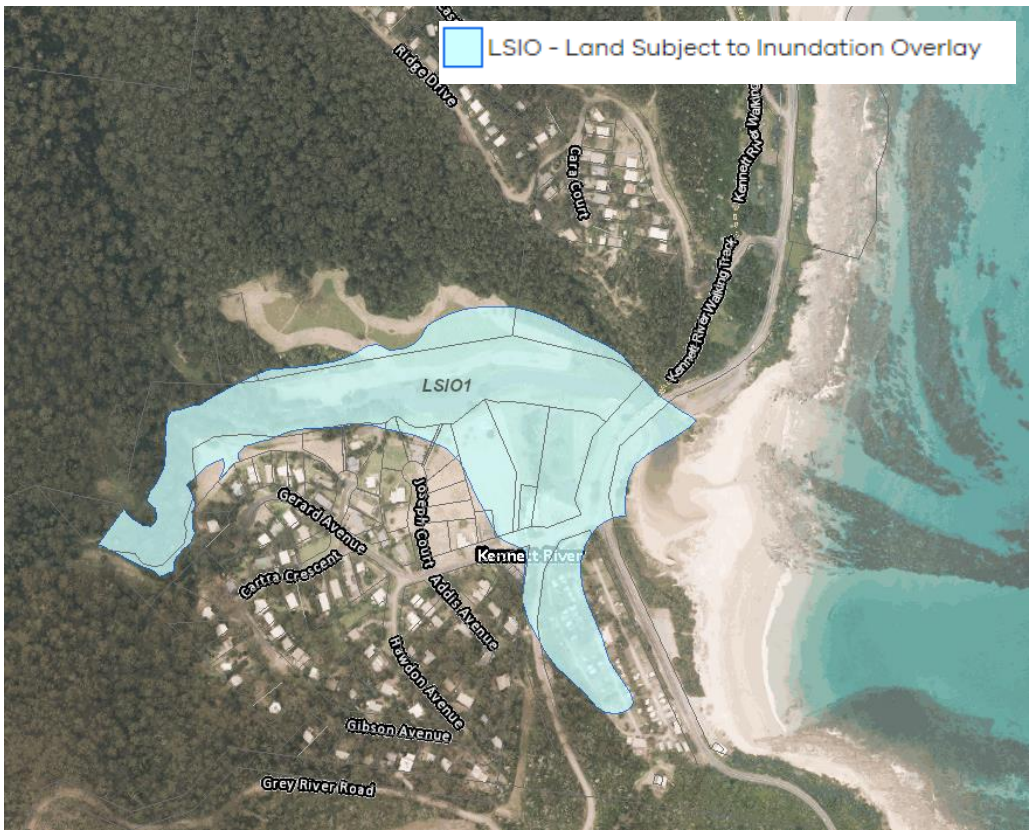

Figure 6: Land subject to inundation - Kennett River

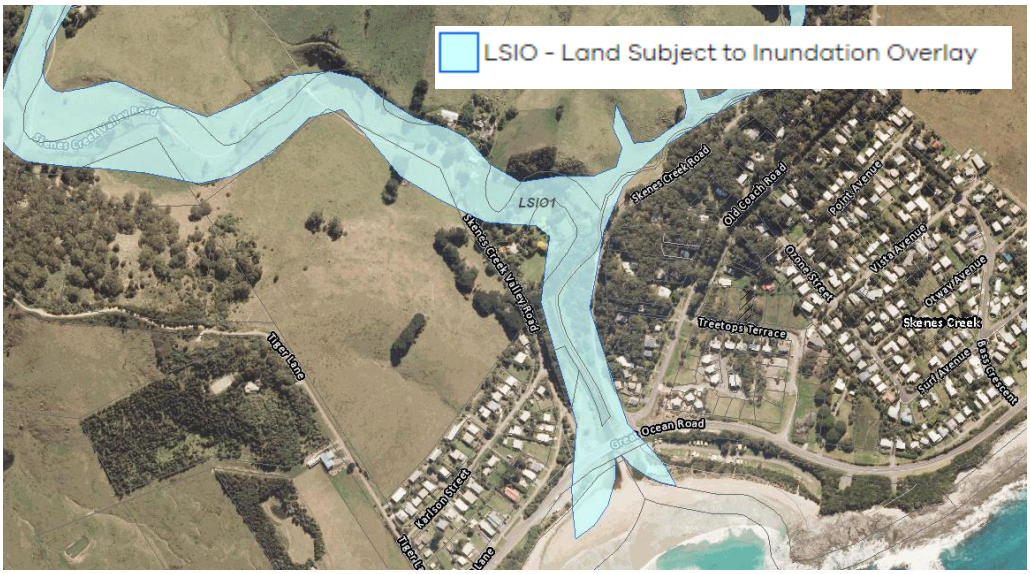

Figure 7: Land subject to inundation - Skenes Creek

1.2 Report Scope

As the project is currently in a masterplan stage, it is not possible to undertake detailed assessment of potential stormwater/flooding impacts associated with the works. The intention of this report is to identify potential impacts and best-practice management strategies to appropriately manage these impacts to guide future detailed design and construction stages.

If required, detailed site-based stormwater management plans, flood risk/impact assessments and construction environmental management plans should be undertaken as part of subsequent design stages.

2. STORMWATER MANAGEMENT

2.1 Potential Stormwater Impacts

The proposed project has the following potential impacts on stormwater, requiring management through design, construction, and on-going operation:

+ Increases in impervious area and associated increase in run-off associated with construction of built infrastructure in previously undeveloped locations for carparks, trailheads and lookouts.
+ Diversion, concentration or ponding of run-off and associated erosion due to construction of new walking trails.
+ Flood impacts associated with the construction of bridges and other infrastructure within waterways and flood plains.
+ Impacts to riparian corridor ecosystems and receiving environment water quality due to in-stream construction works for river crossings.
+ Some areas of the trail/proposed trail infrastructure are subject to the Land Subject to Inundation Overlay and may be at risk of storm tide inundation or coastal erosion.

2.2 Best-Practice Management Strategies – Design and Construction

The following sections provide best-practice management strategies for the main forms of infrastructure with potential to impact water quality and stormwater drainage/flooding.

2.2.1 Trail and Off-grid Campsites

+ Ensure detailed design of new trails incorporate best-practice drainage and erosion and sediment control considerations (also refer Trail Infrastructure Report for details of proposed trail design), including:
  - Trail design (including trail surface) consistent with relevant walking trail class as described in AS2156.1 *Walking Tracks Classification and signage*, Australian Walking Track Grading System and expected traffic volumes.
  - The Half Rule: Trail grade shouldn't exceed half the grade of the hill slope or side slope that the trail traverses to minimise water flowing along the trail and causing erosion.
  - 10% Average Guideline: The overall grade of the trail should be 10% or less. Steps added where sustainable trail grades are exceeded.
  - Maximum Sustainable Trail Grades: typically 15-20% depending on soil type, annual rainfall, vegetation and topography constraints and the level of difficulty for users. Steps added where sustainable trail grades are exceeded.
  - Outslope: Grading the trail with a cross slope of 5% following the general slope direction of the local terrain to avoid concentrating flows.
  - Localised grade reversals (a localised dip in the trail to redirect flow off the trail) and/or water bars or table drains to be installed to direct drainage to nominated locations where it can be discharged to stable areas of surrounding landscape.
  - Rock armouring in steep trail grades or areas of water-logged soils to stabilise trail surfaces and prevent soil erosion and compaction.

  - Waterway crossings are minimised to avoid disturbance to riparian corridors. Bridge crossings generally preferred to at-grade crossings except for ephemeral gullies or waterways not susceptible to erosion such as those comprised primarily of rock.
  - Trail alignment to minimise alignment running parallel to the waterway within 10 m of the waterway bank or as identified by the project Ecologist to limit disturbance to riparian habitat.
+ Trail drainage to direct water onto stabilised vegetation and not exposed soils or areas of dispersive soil, ideally using small 'level spreaders' at outlets to reduce runoff velocity and disperse flows over a wide as possible an area.
+ Campsite design and layout to consider local site topography and drainage patterns, including gullies, watercourses and water-logged areas to avoid redirecting, concentrating or ponding by:
  - Clearly defined pads or platforms (subject to individual site suitability) for camping, walking and communal areas
  - Wayfinding signage and warning signage to encourage travel between tent platforms via designated paths/boardwalks to prevent informal trails or braiding
  - Natural drainage infrastructure such as contour bunds or swales to convey stormwater around cleared areas
+ Maximise rainwater capture opportunities from any roofed structures for non-potable reuse and ensure appropriate scour protection around tank outlets and taps. Detailed design of campsite water supply to be undertaken as part of future stages.
+ Appropriate on-site wastewater capture and on-site treatment or off-site removal (zero-discharge system) of effluent from amenities. Regular maintenance and inspection will be required to ensure no untreated effluent is discharged to receiving waterway environment and that any on-site treatment infrastructure is appropriately functioning.
+ "Leave no Trace" principles included in trail wayfinding/educational signage and promotional material to discourage disposal of litter and human waste in the environment at campsites.
+ The following erosion and sediment controls should be complied with during construction works
  - A project specific Erosion and Sediment Control Plan (ESCP) should be prepared by a suitably qualified Certified Practitioner in Erosion and Sediment Control (CPESC) prior to construction. Priority treatments are to focus on reducing erosion. All erosion and sediment controls must be maintained in effective working order as required during the construction process to ensure dirty water is directed into sediment controls at all times.
  - Areas of construction disturbance, including temporary work areas and access routes to be minimised as much as practical. Access to work areas be via existing management/vehicle trails or new trail wherever possible.
  - Where the trail runs alongside or crossing a watercourse or drainage depression, excavated material should not be placed such that it blocks the natural drainage.
  - Rock or other armouring shall be placed in forded stream crossings, steep chutes, and waterlogged ground.
  - Specialist input into track location should be sought if unusual landforms such as hummocky ground, seepages or evidence of shallow subsurface drainage through the soil (e.g. intermittent disappearance of small water flows and minor collapse holes) occur.
  - Avoid or limit disturbance in areas of highly erodible soils or unstable slopes. Seek geotechnical advice as required.
  - Site by site assessment on the requirement for retaining walls will be required. Batters will be stabilised appropriately to reduce potential slippage and erosion. Manage on site as necessary and design to minimise the need for vertical cuts. Appropriate sediment control mechanisms will be applied where necessary to control and minimize scour and sediment transport off batters, including clean water diversions, temporary stabilisation using polymer sprays (e.g. Vital Bon Mat).
  - Sediment fences or coir logs to be installed on all grade reversal outlets.
  - Cease construction activities, particularly soil disturbance works, during wet weather periods.

2.2.2 Waterway crossings (ephemeral waterways using low-level bridge or rock armoured crossings)

+ Final trail alignment to be determined during future design stages at each crossing to consider the following factors to limit impacts on waterways:
  - Riparian ecological conditions – avoid areas of sensitive habitat
  - Slope stability and geotechnical conditions
  - Minimising in-stream work extents as far as possible
+ Install safety signage at approaches to waterway crossings advising of risk of flash flooding.

+ Where permanent structures are required for stream crossings, engineering designs prepared by a qualified engineer, in accordance with relevant design/loading standards (refer Trail infrastructure Report).
+ Typically, design bridge levels above 10% AEP flood levels to ensure good flood immunity, maximise resilience of the structure, and minimise impacts to flooding. Site specific studies to be undertaken to inform detailed design. Lower flood immunities may be appropriate to enhance the trail user experience, subject to a risk assessment.
+ Seasonal watercourses or drainage lines (i.e. those watercourses that only flow briefly following periods of heavy rainfall) will generally be rock armoured rather than bridged. Final rock armour design to ensure appropriate for fish or amphibian passage.
+ Rock armouring will extend for 2-3m to either side of all stream crossings, regardless of bridge or rock armoured crossing.
+ The following construction stage considerations should be employed:
  - Works near waterways should be scheduled appropriately. For example, works should be timed to coincide with periods of low flow and completed quickly. Works should be stopped if conditions are not suitable, such as during and after heavy rain.
  - Existing crossings should be used to move equipment across the waterway. If there is no crossing and the stream must be crossed, any disturbance should be minimized, and the machinery should be carefully 'walked' across the stream.
  - Take special care at creek crossings (and even minor drainage depression features) to reduce the chance of sediment/chemical input, and to minimise damage/disturbance to creek bed and banks (special advice should be sought if creek crossings cannot be installed in a manner that will not result in long-term changes to the creek bed – consider also long-term use of the track).
+ A specific Erosion and Sediment Control Plan (ESCP) should be prepared by a suitably qualified Certified Practitioner in Erosion and Sediment Control (CPESC) prior to construction for all in-stream works. Priority treatments are to focus on reducing erosion. All erosion and sediment controls must be maintained in effective working order as required during the construction process to ensure dirty water is directed into sediment controls at all times.

2.2.3 Suspension Bridges/Major Waterway crossings

+ Where permanent structures are required for stream crossings, engineering designs prepared by a qualified engineer, in accordance with relevant design/loading standards (refer Trail infrastructure Report).
+ Design bridge levels above 1% AEP flood levels to ensure good flood immunity, maximise resilience of the structure, and minimise impacts to flooding.
+ The following construction stage considerations should be employed:
  - Works near waterways should be scheduled appropriately. For example, works should be timed to coincide with periods of low flow and completed quickly. Works should be stopped if conditions are not suitable, such as during and after heavy rain. Rainfall and water level should be monitored at all times during construction of crossings.
  - Existing crossings should be used to move equipment across the waterway. If there is no crossing and the stream must be crossed, any disturbance should be minimized, and the machinery should be carefully 'walked' across the stream.
  - Take special care at creek crossings (and even minor drainage depression features) to reduce the chance of sediment/chemical input, and to minimise damage/disturbance to creek bed and banks (special advice should be sought if creek crossings cannot be installed in a manner that will not result in long-term changes to the creek bed – consider also long-term use of the track).
+ A specific Erosion and Sediment Control Plan (ESCP) should be prepared by a suitably qualified Certified Practitioner in Erosion and Sediment Control (CPESC) prior to construction for all in-stream works. Priority treatments are to focus on reducing erosion. All erosion and sediment controls must be maintained in effective working order as required during the construction process to ensure dirty water is directed into sediment controls at all times.

2.2.4 Proposed culvert crossings

It is proposed to reuse several existing culverts under the Great Ocean Road as walking track crossing points to reduce conflict with the Great Ocean Road and reduce new bridge/crossing infrastructure requirements. Several of these crossings are currently used as informal beach access points. Reuse of existing culverts as walking trail crossings are subject to further engagement and approval by relevant authorities/asset owners (including VicRoads, Surf Coast Council and Colac-Otway Council).

- Specific engineering design based on flood investigations to ensure than any culvert crossing designs retains existing hydraulic capacity of culvert and that design appropriately considers hazard, afflux (changes to flood levels) on adjoining properties/road reserve.
- Install flood height indicators at entry to culvert crossing and warning signage advising of flash flooding risk and alternative crossing routes if culvert is inundated by flooding or tidal inundation.
- Any works to culvert base to ensure that appropriate fish passage and fauna passage is retained, including locally roughening surface and ensuring a low-flow channel is retained.
- A specific Erosion and Sediment Control Plan (ESCP) should be prepared by a suitably qualified Certified Practitioner in Erosion and Sediment Control (CPESC) prior to construction for all in-stream works. Priority treatments are to focus on reducing erosion. All erosion and sediment controls must be maintained in effective working order as required during the construction process to ensure dirty water is directed into sediment controls at all times.
- Works near waterways should be scheduled appropriately. For example, works should be timed to coincide with periods of low flow and completed quickly. Works should be stopped if conditions are not suitable, such as during and after heavy rain.

Figure 8: Example of existing culvert proposed to be incorporated into trail design to facilitate road crossings under Great Ocean Road.

2.2.5 Trail Infrastructure (Carparks, trailheads)

- Design grading of carparks and hardstand surfaces and associated stormwater drainage infrastructure to ensure no concentration of run-off and reduce potential for scour.
- Water sensitive urban design (WSUD) elements to be incorporated into the design of carparks and to provide water quality improvements of run-off. Treat run-off from hardstand areas to ensure pollutant loads meet local and state requirements. These may include permeable pavements, raingardens/bioretention or vegetated swales.
- Layout to consider flood, coastal hazard risk and avoid locating infrastructure within areas subject to inundation where possible or ensuring that the design of infrastructure is resilient to expected flood inundation. Detailed site flood investigations should be undertaken as part of future design stages to assist in locating infrastructure and informing infrastructure design requirements.
- Design to include permeable pavements, where possible, to minimise run-off volumes.
- Maximise rainwater collection opportunities from rooves where possible for non-potable reuse. Detailed design of campsite water supply to be undertaken as part of future stages.

- Appropriate on-site wastewater capture and on-site treatment or off-site removal (zero-discharge system) of effluent from amenities. Regular maintenance and inspection will be required to ensure no untreated effluent is discharged to receiving waterway environment and that any on-site treatment infrastructure is appropriately functioning.
- “Leave no Trace” principles included in wayfinding/educational signage and promotional material to discourage disposal of litter and human waste in the environment at trailheads/campsites. Consider on-going maintenance requirements for removal of litter from carparks/trailheads.
- A site-specific Erosion and Sediment Control Plan (ESCP) should be prepared by a suitably qualified Certified Practitioner in Erosion and Sediment Control (CPESC) prior to construction for all trailhead/carpark works. Priority treatments are to focus on reducing erosion. All erosion and sediment controls must be maintained in effective working order as required during the construction process to ensure dirty water is directed into sediment controls at all times.

3. PLANNING CONSIDERATIONS

The following have been identified as potentially relevant to the project in relation to stormwater management. This may not be an exhaustive list of requirements, these should be determined as the design develops. Further details on the proposed approvals strategy and relevant planning triggers are addressed in the Planning and Design Report prepared by Biosis (2022).

Table 1 Potentially relevant planning triggers and recommendations for future design/implementation stages

Relevant Planning Trigger	Requirements	Recommended Actions for Project Implementation
Planning and Environment Act 1987	A permit is likely to be required for buildings and works under the Land Subject To Inundation Overlay (LSIO) under both the Surf Coast and Colac Otway Planning Schemes (refer to planning report for the location of the LSIO along the GORCT's alignment). An application must be referred to the relevant floodplain management authority as a recommending referral authority, unless (in the opinion of the responsible authority) the proposal satisfies requirements or conditions previously agreed in writing between the responsible authority and the floodplain management authority. Under the LSIO there are a number of decision guidelines which will be considered by the responsible authority when assessing the GORCT's planning application. For example: + The effect of the development on redirecting or obstructing floodwater, stormwater or drainage water and the effect of the development on reducing flood storage and increasing flood levels and flow velocities. + Whether the proposed use or development could be located on flood-free land or land with a lesser flood hazard outside this overlay. + Alternative design or flood proofing responses.	Necessary approvals to be obtained prior to works where relevant, including associated design/investigations.
Water Act 1989	The GORCT traverses a number of designated waterways. Works which will occur within the beds and along the banks of these designated waterways will require consent from Corangamite Catchment Management Authority (CMA).	It is recommended that consultation with Corangamite CMA occurs during the design stages of the GORCT.

Relevant Planning Trigger	Requirements	Recommended Actions for Project Implementation
Marine and Coastal Act 2018	Under Section 65 of the *Marine and Coastal Act 2018* a person must obtain consent to use or develop, or undertake works on, marine and coastal Crown land without a consent. Marine and coastal land is defined as: *Crown land between the outer limit of Victorian coastal waters and 200 metres inland of the high-water mark of the sea including:* *Crown land (whether or not covered by water) to a depth of 200 metres below the surface of that land;* *Any water covering the land referred to in paragraph (a) from time to time.* *In addition to the above, marine and coastal Crown land includes Crown land (whether or not covered by water) and any water covering that land to a depth of 200 metres below the surface of that land and that is:* *More than 200 metres inland of the high-water mark of the sea; and* *Reserved under the Crown Land (Reserves) Act 1978 for the purposes of the protection of the coastline.* It is noted that a planning application can also be used as an application for consent under the *Marine and Coastal Act 2018.* Following lodgement of a planning permit, the application will be forwarded to DELWP for consideration.	Necessary approvals to be obtained prior to works where relevant, including associated design/investigations.
Environment Protection Act 2017 & Environment Reference Standard	DELWP is responsible for ensuring no impacts to surface water quality occur resulting in changes that exceed background levels and/or the water quality objectives for the following surface water segments specified under the Environment Reference Standard: + Central Foothills and Coastal Plains + Uplands B	It is recommended that a Construction Environmental Management Plan (CEMP) is prepared which outlines any mitigation measures to avoid possible impacts to surface or groundwaters. CEMP to include detailed ESCP's prepared by suitably qualified CPESC.

Bligh Tanner Pty Ltd
ABN 32 061 537 666
blightanner@blightanner.com.au
blightanner.com.au

Brisbane
Level 9, 269 Wickham Street
PO Box 612
Fortitude Valley Qld 4006
Australia
T +61 7 3251 8555
F +61 7 3251 8599

Sydney
Level 32, 101 Miller Street
North Sydney
NSW 2060 Australia
T +61 2 8019 7221