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Busselton Eastern Link Project

Environmental Review Document

Prepared for
City of Busselton
by Strategen

January 2018

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Busselton Eastern Link Project

Environmental Review Document

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January 2018

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Client: City of Busselton

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	A	For client review	A Ennis, H Morgan / K Taylor	PDF	17 December 2017
Final Report	0	For submission to EPA	A Ennis, H Morgan / K Taylor	PDF	8 January 2018

Filename: CIB16605_01 R004 Rev 0 - 8 January 2018

Executive Summary

The City of Busselton (the City) has undertaken extensive work over recent years to identify an overall strategic direction for the ongoing development, management and improvement of the local road network in and around Busselton. A key outcome of this work is the identified need to develop the Eastern Link (the Proposal) as an alternative and more efficient route into Busselton to ease existing and forecast congestion on Causeway Road and Queen Street.

The Proposal is to construct a new two-lane crossing linking Causeway Road to Cammilleri Street including a new bridge over the Vasse River.

Table ES1 provides a summary of the Proposal. Table ES2 provides a description of the location and proposed extent of physical and operational elements of the existing project and the Proposal. Table ES3 provides a summary of potential impacts, proposed mitigation and outcomes for the Proposal.

Table ES1: Summary of the proposal

Proposal title	Busselton Eastern Link
Proponents name	City of Busselton.
Short description	Development of a new Eastern Link bridge in Busselton.

Element	Location	Proposed extent
Physical elements		
Clearing and disturbance for bridge and road corridor	See Figure ES1	• Clearing of up to 0.56 ha of native vegetation • Total disturbance envelope approximately 2.64 ha.
Bridge	See Figure ES1	• Two lane bridge of width 12 m and span 22 m across Lower Vasse River.

Table ES3: Summary of potential impacts, proposed mitigation and outcomes

Element	Description
Flora and vegetation	
EPA objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
Policy and guidance	Flora and vegetation surveys that have informed the planning of the Proposal have been conducted in accordance with the Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) and the Environmental Factor Guideline: Flora and Vegetation (EPA 2016).
Potential impacts	Clearing of up to 0.56 ha of native vegetation. Represents 0.01% of estimated remaining extent of Vasse vegetation complex. No threatened or priority ecological communities or flora species will be impacted.
Mitigation	Avoid: • Not applicable. Minimise: • Vegetation clearing minimised as far as is practicable. • Proposal alignment uses disused railway embankment to minimise disturbance to samphire vegetation. • Construction Environmental Management Plan (CEMP) includes clearing controls and weed management. Rehabilitate: • Re-planting and rehabilitation of vegetation equivalent to the vegetation to be cleared.
Outcomes	Residual Impact: • Not significant.

Element	Description
Terrestrial environmental quality	
EPA objective	To maintain the quality of land and soils so that environmental values are protected.
Policy and guidance	Terrestrial environmental quality investigations that have informed the planning of the Proposal have been conducted in accordance with the Technical Guidance – Terrestrial Environmental Quality (EPA 2016).
Potential impacts	Potential disturbance to acid sulfate soils (ASS) and/or monosulfidic black ooze (MBO) due to excavation, dewatering and dredging of riverine sediments. Volume of excavation estimated at 100-500 m^3 and volume of dewatering estimated at 1000-5000 m^3.
Mitigation	Avoid: • Not applicable. Minimise: • Excavation and dewatering minimised to requirements for trenching. No bulk earthworks proposed. • Road embankment to be constructed of imported fill. • ASS and Dewater Management Plan (ASSDMP) implemented during construction. • Riverine sediments tested for MBO and, if present, a MBO Management Plan (MBO) implemented during construction. Rehabilitate: • Not applicable.
Outcomes	Residual Impact: • Not significant.
Terrestrial fauna	
EPA objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Policy and guidance	Fauna survey have informed the planning of the Proposal have been conducted in accordance with the Technical Guidance – Terrestrial fauna surveys (EPA 2004) and the Environmental Factor Guideline: Terrestrial Fauna (EPA 2016).
Potential impacts	Clearing of up to 17 Peppermint trees (0.1 ha) representing habitat for Western Ringtail Possum. Vegetation does not comprise significant habitat for Black Cockatoos, with no roosting or breeding trees. Potential impacts to waterbird habitat due to water quality impacts and disturbance from vehicles and public access.
Mitigation	Avoid: • Not applicable. Minimise: • Vegetation clearing minimised as far as is practicable. • Proposal alignment uses disused railway embankment to minimise disturbance to wetlands. • Possum over-pass (rope bridge) and underpass (1 in 2 slopes vegetated with native species Sword Sedge) provided on north and south river banks. • Foreshore planting of native vegetation between new bridge and Causeway Bridge to provide connection to underpass. • Fauna crossing warning signs installed on road to warn motorists. • CEMP includes erosion, sediment and spill controls to minimise impacts to water quality during construction. • ASSDMP and MBOMP to prevent impacts to water quality from disturbance of ASS and MBO during construction. • New bridge and road will drain to biofiltration gardens to capture stormwater runoff and spills to prevent water quality impacts during operation. • Existing Butter factory weir boards, located downstream of the Proposal, will be kept in the same location, so that if a spill occurs the weir can be used to capture spills using absorbent booms/skimmer pumps, preventing spills from impacting on downstream waterbird habitat. • Shared use path provided on west side of road to minimise public/domestic animal access to wetlands to the east. • Road and bridge lighting shuttered to minimise light spill. Rehabilitate: • Peppermint trees replanted at a ratio of at least two trees for every tree cleared.
Outcomes	Residual Impact: • Not significant.

Element	Description
Hydrological processes	
EPA objective	To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.
Policy and guidance	The hydrological investigations that have informed the planning of the Proposal have been conducted in accordance with the Environmental Factor Guideline: Hydrological Processes (EPA 2016).
Potential impacts	Predicted afflux of up to 16mm during a 1 in 100 year average recurrence interval (ARI) flood event between the new bridge and Causeway Bridge, up to 10mm afflux upstream of Causeway Bridge, and zero afflux downstream of the new bridge. Predicted velocity of 0.38 m/s through the new bridge is significantly less than the 0.92 m/s predicted for the existing Causeway Bridge, and not expected to result in significant scour and erosion.
Mitigation	Avoid: • Not applicable. Minimise: • Sword Sedge planted on river banks to minimise erosion. Rehabilitate: • Not applicable.
Outcomes	Residual Impact: • Not significant.
Inland waters environmental quality	
EPA objective	To maintain the quality of groundwater and surface water so that environmental values are protected.
Policy and guidance	The inland water quality investigations that have informed the planning of the Proposal have been conducted in accordance with the Environmental Factor Guideline: Inland Waters Environmental Quality (EPA 2016).
Potential impacts	Potential impacts to water quality from construction activities including erosion and sediment, ASS and MBO, spills and discharge of dewatering effluent. Potential impacts to water quality during operations due to stormwater runoff and accidental spills (e.g. vehicle accidents), and erosion of river banks during flood events. Potential direct impacts to Carters Freshwater Mussel due to excavation of river banks/bed for abutment construction, and smothering through suspension and deposition of sediments.
Mitigation	Avoid: • Not applicable. Minimise: • CEMP includes erosion, sediment and spill controls to minimise impacts to water quality during construction. • ASSDMP and MBOMP to prevent impacts to water quality from disturbance of ASS and MBO during construction. • New bridge and road will drain to biofiltration gardens to capture stormwater runoff and spills to prevent water quality impacts during operation. • Existing Butter factory weir boards, located downstream of the Proposal, will be kept in the same location, so that if a spill occurs the weir can be used to capture spills using absorbent booms/skimmer pumps. • Sword Sedge planted on river banks to minimise erosion. • Translocation of Carters Freshwater Mussel from bridge site to upstream on Vasse River, and replacement once construction has been completed. Translocation to be subject to Regulation 17 licence under Wildlife Conservation Act 1950. Rehabilitate: • Not applicable.
Outcomes	Residual Impact: • Not significant.
Social surroundings	
EPA objective	To protect social surroundings from significant harm.
Policy and guidance	The social surroundings investigations that have informed the planning of the Proposal have been conducted in accordance with the Environmental Factor Guideline: Social Surroundings (EPA 2016).

Element	Description
Potential impacts	Potential impacts to social surroundings during construction activities including noise, vibration, dust, wastes, traffic, access and parking. State listed heritage buildings St Mary's Anglican Church and Old Butter Factor in the vicinity of the Proposal. Vibration expected to be noticeable by occupants of nearby buildings however vibration not expected to cause cosmetic or minor damage to buildings. Potential impacts to social surroundings during operation including visual impacts to foreshore, disruption to pedestrian access routes, and changed traffic patterns. Traffic levels in local roads will be well within road capacity and not expected to impact convenience of motorists or pedestrians.
Mitigation	Avoid: • Not applicable. Minimise: • Span bridge is consistent with request from Aboriginal representatives participating in ethnographic survey. • Minimising elevation and visual intrusion of bridge as far as is practicable. • Provision of shared use paths to maintain access to the west and south of the footbridge, and connecting to shared use paths on Causeway Road and Peel Terrace. • Landscaping with native vegetation replacing the vegetation to be cleared, to maintain the existing visual character of the Lower Vasse River. • CEMP includes notification of nearby residences/businesses, complaints response procedure, dust monitoring and suppression, waste management, erosion/sediment controls and spill controls. • CEMP to be reviewed by State Heritage Office, with advice incorporated into CEMP prior to construction commencing. • Construction limited to 7am to 7pm Monday to Friday, Saturdays by exception. • Construction works staged from southern bank, including road embankment construction, construction compound, and bridge deck construction/cranage. • Construction traffic and materials supply restricted to Causeway Road south of the river except for construction works that must be undertaken north of the river. Access and parking for construction vehicles will be restricted along Peel Terrace. • Construction vehicles prohibited from parks, standing or verge access along heritage listed buildings St Mary's Anglican Church and Old Butter Factory. Rehabilitate: • Not applicable.
Outcomes	Residual Impact: • Not significant.

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All appendices are in electronic form on a data CD/DVD attached inside the back cover of this report and on the disc containing the electronic version of this report.

1. Introduction

1.1 Purpose and scope

The City of Busselton (the City) has undertaken extensive work over recent years to identify an overall strategic direction for the ongoing development, management and improvement of the local road network in and around Busselton. A key outcome of this work is the identified need to develop the Eastern Link (the Proposal) as an alternative and more efficient route into Busselton to ease existing and forecast congestion on Causeway Road and Queen Street.

The Proposal is to construct a new two-lane crossing linking Causeway Road to Cammilleri Street including a new bridge over the Vasse River. The location of the Proposal is provided in Figure 1. The Development Envelope and layout of the Proposal are provided in Figure 2.

This Environmental Review has been prepared in accordance with Environmental Protection Authority (EPA) *Instructions on how to prepare an Environmental Review Document* (EPA 2016a) to support referral of the Proposal under s 38 of the *Environmental Protection Act 1986* (EP Act).

1.2 Proponent

Table 1 provides the details of the proponent.

Table 1: Proponent and key contact details

	Contact details
Name	City of Busselton
ABN	87285608991
Postal address	Locked Bag 1 Busselton WA 6280
Proponent contact (City of Busselton)	Daniell Abrahamse Manager Engineering and Facilities Services City of Busselton 9781 0379 *Daniell.Abrahamse@busselton.wa.gov.au*

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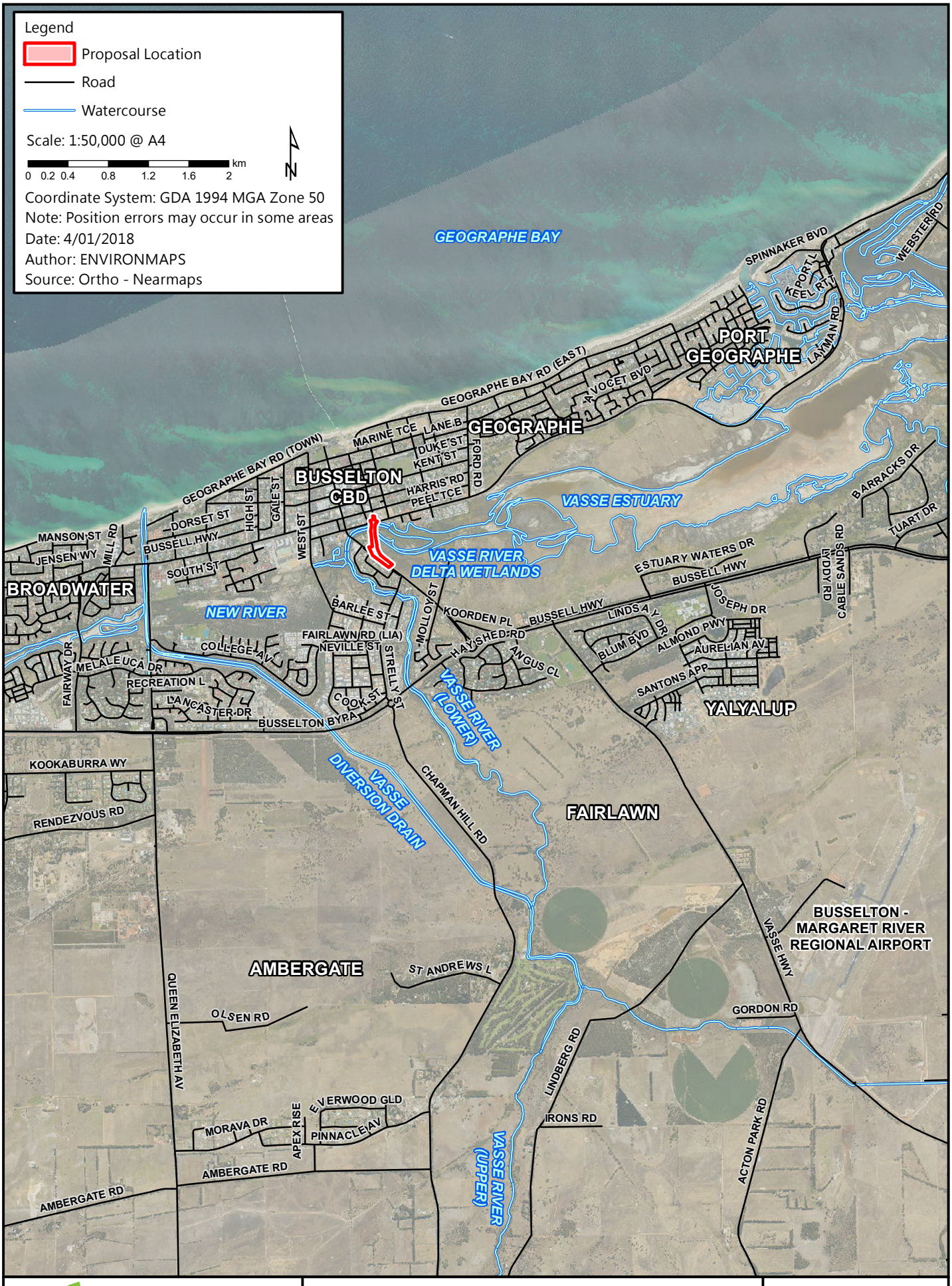

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Proposal Location

Figure 1

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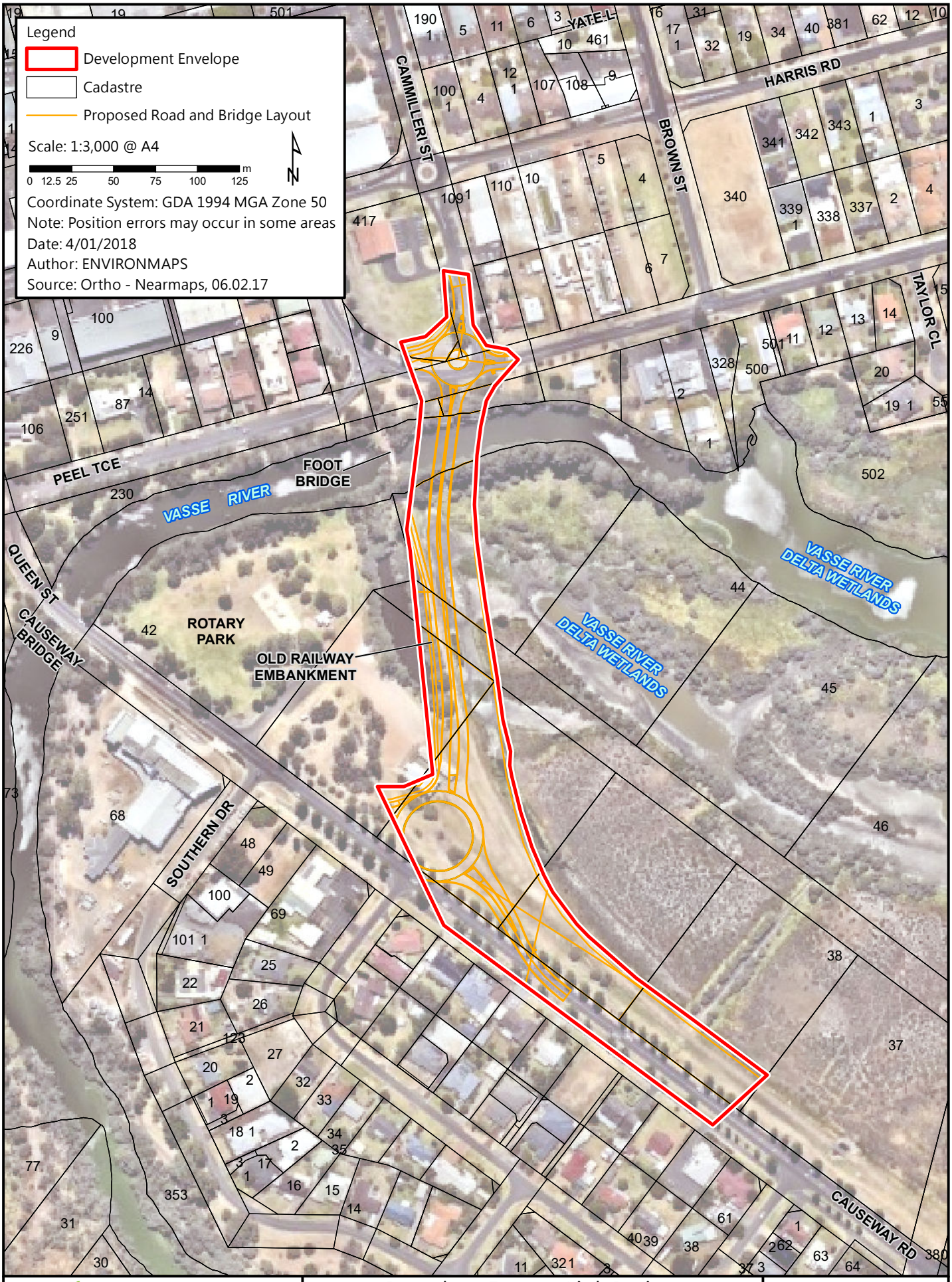

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Busselton Eastern Link Project
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Proposal Development Envelope and Layout

Figure 2

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1.3 Environmental impact assessment process

In accordance with s 2.3.1 of the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016*, this Environmental Review aims to provide sufficient information for the EPA to decide whether to assess the Proposal. This includes sufficient information and level of detail on:

- the Proposal
- potential impacts
- mitigation measures
- environmental outcomes
- stakeholder consultation.

The Environmental Review refers to technical studies and a Construction Environmental Management Plan (CEMP) contained in the appendices. The Proponent, via Strategen, have consulted with government agencies, key stakeholders and the community to obtain feedback for input into the design and construction of the Proposal.

The Proponent, via Strategen, has consulted with the Australian Government Department of Environment and Energy (DEE). The Proposal will be referred to the Australian Government under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.4 Other approvals and regulation

Table 2 provides a summary of the key environmental approval and regulations relevant to the Proposal.

Table 2: Other approvals and regulation

State and Local Government approvals			
Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.			No
If this proposal has been referred by a decision-making authority, what approval(s) are required from you?			N/A
Proposal activities	**Land tenure/access**	**Type of approval**	**Legislation regulating the activity**
Clearing of native vegetation	Crown land, freehold held by City	Part V clearing permit if not assessed under Part IV of EP Act	EP Act – *Part V*
		Assessment of impacts on Matters of National Environmental Significance and approval if determined to be a controlled action	EPBC Act
Translocation of mussels	N/A	Regulation 17 Licence to take fauna for scientific purposes	*Wildlife Conservation Act 1950* (WC Act) and *Wildlife Conservation Regulations 1970*
	N/A	Exemption from recreational bag limits	*Fish Resources Management Act 1994*

2. Proposal

2.1 Background

The Busselton Strategic Network Corridors program has been developed based on extensive work over recent years to identify the strategic direction for ongoing development, management and improvement of the road network in and around Busselton. This strategic direction is critical to managing current and future traffic flows and supporting the town's growth as a key tourism hub in the South West region.

The program involves a number of upgraded or newly constructed bridge crossings over the Vasse River, New River and Vasse Estuary, as presented in Figure 3. The City of Busselton are proceeding with approvals for Item 1 Eastern Link (the Proposal) as the short-term priority for traffic management, with construction proposed to proceed in 2018. Other items are proposed in the timeframe of a few years to several years, with approvals sought for each item in a staged manner as required.

2.2 Justification

The justification for the Proposal is presented in detail in the Engineering and Works Services Report of the City of Busselton Council minutes dated 8 June 2016 (see Appendix 1) with a summary provided below.

The Busselton-Vasse urban area is experiencing rapid and consistent population and economic growth, which is expected to continue for the foreseeable future. Local growth combined with broader regional growth will result in increased traffic through, into, out of and within the Busselton-Vasse urban area, especially in and around the Busselton City Centre. Awareness of these issues prompted the City to commence the Busselton Traffic Study, which comprised a process of investigation including several reports and workshops informed by traffic modelling.

The Busselton Traffic Study acknowledged the State Government's plans for progressive, significant upgrades to the regional Main Roads network, but considered that population and economic growth would place increased pressure on key local roads including the town's gateway entrance at Causeway Road Bridge and the intersections with Peel Terrace, Queen Street and Albert Street. These intersections are currently subject to significant congestion, particularly at times of peak tourism inflow such as Friday afternoons through much of the summer and prior to long weekends and major events throughout the rest of the year.

The congestion of these intersections is due primarily to residents and tourists driving into Busselton from Causeway Road and then wishing to turn west to access the majority of the town's accommodation that lies west of the Central Business District (CBD). At peak times, a minority of motorists wish to enter the CBD itself or access the Busselton foreshore north of the CBD. The traffic flow bound for the west is expected to grow in dominance, as the majority of population growth in the town will be to the west of the CBD.

For the above reason, the City considered that the previously proposed crossing at Ford Road east of Causeway Road bridge would be unlikely to effectively divert traffic from the impacted intersections, as it would deliver traffic to and from the eastern side of the CBD. Accordingly, the City considered a program of road upgrades in the vicinity and west of Causeway Road as the priority for the short and medium term.

Figure 3: Busselton Strategic Network Corridors - Overview

The Eastern Link was proposed as part of the short-term priority upgrades (Initiative 2, see Appendix 1) as it would provide:

- the most attractive alternative to Causeway Bridge for traffic to and from east of the CBD to access almost any destination other than the CBD itself or some locations west of the CBD
- the most attractive and intuitive route for traffic to and from large car parks located along Camilleri Street, as well as the Busselton foreshore
- visibility of congestion on Causeway Bridge, enabling motorists to select an alternative route while still on Causeway Road
- other benefits associated with development of business activity and investment east of the CBD, which would balance the moving focus of the CBD to the west.

Traffic modelling of the Eastern Link was subsequently undertaken and demonstrated an effective diversion of traffic away from the Causeway Road, Queen Street and Albert Street intersections. The results are presented in the assessment of Social Surroundings in Section 4.7 of this document. The Proposal in of itself is not considered a long-term solution and will require other road upgrades to further divert, convey and distribute the growing traffic into the town. These other road upgrades will be developed in a staged manner as and when funding becomes available, at which time the associated environmental approvals will be sought.

Further to the Busselton Traffic Study recommendations, the Council elected to prioritise investigation and design into the priority short-term road upgrades, including the Proposal. In September 2017, the City secured partial funding for the Proposal under the Australian Government's Bridges Renewal Program, with the balance to be funded by the City.

2.3 Description of Proposal

2.3.1 Key Proposal Characteristics

Key Proposal characteristics are presented in Table 3.

Table 3: Key Proposal Characteristics

Proposal title	Busselton Eastern Link
Proponents name	City of Busselton.
Short description	Development of a new Eastern Link bridge in Busselton.

Element	Location	Proposed extent
Physical elements		
Clearing and disturbance for bridge and road corridor	See Figure 2	• Clearing of up to 0.56 ha of native vegetation • Total disturbance envelope approximately 2.64 ha.
Bridge	See Figure 2	• Two lane bridge of width 12 m and span 22 m across Lower Vasse River.

2.3.2 Proposal design

The Proposal will involve development of a new two-lane road and bridge connecting Causeway Road in the south to Peel Terrace / Cammilleri Street in the north. Draft design drawings are presented in Appendix 2.

The new road will be approximately 240 m in length and connect to new roundabouts on Causeway Road and Peel Terrace / Cammilleri Street. The new road will run along a disused railway embankment for part of its length, to minimise disturbance to wetlands east of the embankment. The road will drain to the south, away from the river and into bio-filtration gardens. The bio-filtration gardens will treat stormwater runoff prior to discharging into the wetland west of the new road, which is disconnected from the river and the wetlands east of the road. The road will have a new dual use path on its western side, to minimise public access to wetlands east of the road. The dual use path will connect to an existing footbridge over the Lower Vasse River and a new dual use path to be established along Peel Terrace.

The new bridge will be developed over the Lower Vasse River and comprise a 22 m long (between abutments), 12 m wide deck. The bridge will comprise a single span without piers, to minimise impacts to Aboriginal cultural values. The banks beneath the bridge abutments will be planted with Sword Sedge (*Lepidosperma gladiatum*) to encourage fauna passage and provide erosion protection. The bridge will have vehicle / cycle barriers on either side. The bridge will have barrier kerbs and drain northwards away from the river and into new bio-filtration gardens developed adjacent to the new roundabout on Peel Terrace.

Lighting on the bridge and road will be shuttered to direct light onto the road and bridge deck and minimise light spill onto adjacent wetlands and river.

An example of a similar span bridge is provided in Plate 1.

Plate 1: Example of a span bridge

2.3.3 Proposal construction

The Proposal will be constructed over a period of 12 to 18 months and involve the following key activities:

- establish construction compound adjacent to Scout and Girl Guide halls near Rotary Park
- construct road embankment south of the river using imported fill material
- remove soft silt and mud from river banks and bed and construct temporary platforms into the river
- drive pre-cast concrete piles into the river banks then construct reinforced concrete abutments on top of the piles
- construct temporary hard stand near the river's southern bank to provide crane access
- lay large steel girders between abutments using a crane on the river's southern bank
- construct reinforced concrete bridge deck on top of steel girders, and concrete slabs on north and south approaches
- construct asphalt pavements, vehicle / cyclist barriers, kerbing, stormwater drainage and bio-filtration gardens
- install lighting and electrical services
- provide landscaping and erosion protection, including fauna under-passage and planting of Peppermint (*Agonis flexuosa*) trees
- remove temporary hard stand, construction platforms and construction compound.

Construction vehicle access will use Causeway Road as much as possible and minimise use of Causeway Bridge and Peel Terrace. Construction will be limited to between 7:00am to 7:00pm Monday to Friday, with construction on Saturdays by exception and limited to between 7:00am to 7:00pm. No construction works will be undertaken on Sundays or public holidays.

2.4 Local and regional context

The Proposal is located within Busselton in the South West Region of Western Australia. Figure 4 presents the local context of the Proposal. The Proposal lies over the Lower Vasse River and adjacent to the western fringe of the Vasse River Delta Wetlands that form the geomorphic interface between the river and the Vasse Estuary downstream.

The Proposal is located in the Busselton urban area and is surrounded by residential and commercial properties to the north and south-west, with City of Busselton administration offices located approximately 160 m to the west. The main Busselton central business district (CBD) is located approximately 250 m north-west of the Proposal.

Recreational areas in the vicinity of the Proposal include the Lower Vasse River foreshore utilised as Public Open Space; comprising Arthur and Norah Breeden Park on the north bank and Rotary Park on the south bank. The two parks are connected by footpaths that connect with the Causeway Bridge and footbridge, which form part of the Vasse River Trail section of the City of Busselton Wetland Walks and Trails.

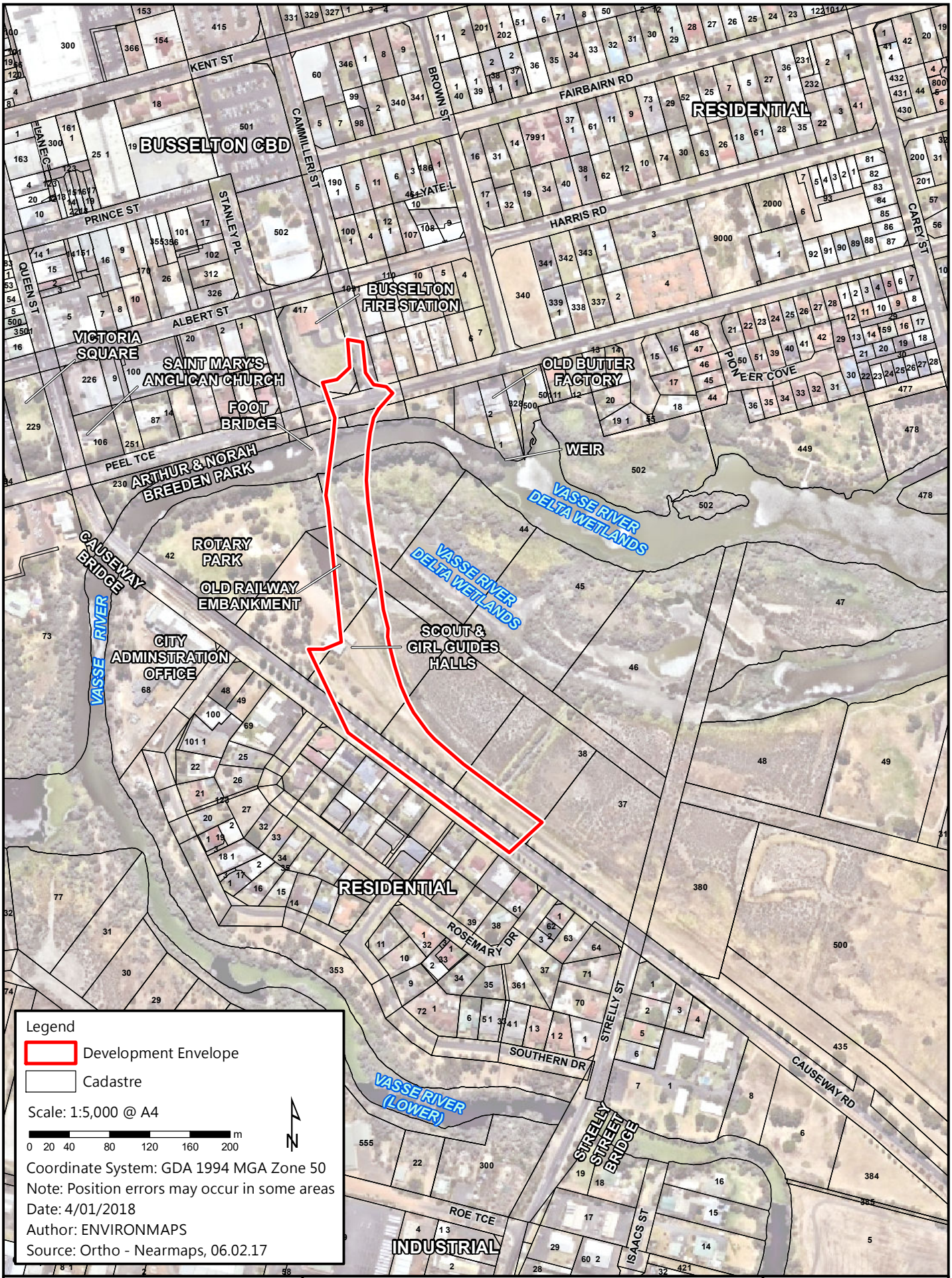
Busselton forms part of the Core Habitat for the Western Ringtail Possum (*Pseudocheirus occidentalis*) as defined by the Australian Government, with land to the south comprising Primary Corridors. The Proposal lies across and in the vicinity of stands of Peppermint trees (*Agonis flexuosa*) which comprise habitat and a corridor for the species.

The hydrology of the Lower Vasse River and Vasse River Delta Wetlands is artificially controlled. Upstream flows into the Lower Vasse River flows managed through the Vasse Diversion Drain penstock, which diverts nutrient rich first flush and flood flows away from the river. A weir near the Old Butter Factory downstream of the Proposal retains water in the river during the summer and autumn period. The Lower Vasse River has been dredged in the past and now intersects groundwater during the summer and autumn. Water quality in the river is poor, with high nutrient levels and annual Blue-Green Algal blooms.

The Vasse River Delta Wetlands are expected to have been subject to tidal / salt water inundation in the past, as evidenced by the presence of samphire, however since 1908 tidal / salt water flows have been restricted by the Vasse Estuary surge barrier downstream. Although the surge barrier is opened to allow salt water flows into the Vasse Estuary during summer, the estuary water levels are maintained below the elevation of the Vasse River Delta Wetlands and so the wetlands dry out the summer and autumn.

Key environmental and heritage features close to the Proposal include (see Figure 4):

- Vasse-Wonnerup Wetlands Ramsar site approximately 1 km to the east, a significant habitat for waterbirds including migratory birds
- Unclassified Nature Reserve (R 49385) and A Class Nature Reserve (R 50017) approximately 540 m and 840 m respectively to the east, within the Vasse River Delta Wetlands
- Unclassified Nature Reserve (R 48837) approximately 640m to the west
- Vasse River and New River, of which portions are mapped as a conservation category wetland and listed in the *Directory of Important Wetlands of Australia*
- State heritage site St Mary's Anglican church, graveyard and hall (Place number 18163, 18162 and 402) approximately 120 m to the west
- State heritage site Old Butter Factory (Place number 3568) approximately 125 m to the east
- New River registered Aboriginal mythological heritage site (Id 16807) approximately 350 m to the southwest.



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Proposal Context

Figure 4

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3. Stakeholder engagement

3.1 Key stakeholders

The following stakeholders have been identified as key stakeholders in regard to the Proposal:

- Department of Biodiversity, Conservation and Attractions (DBCA)
- Department of Water and Environmental Regulation (DWER)
- Federal Department of Environment and Energy (DEE)
- Busselton Chamber of Commerce and Industry
- Geographe Catchment Council
- South West Aboriginal Land and Sea Council
- St Mary's Anglican Church
- Busselton Historical Society
- State Heritage Office
- Fostering and Assistance for Wildlife Needing Aid (FAWNA)
- Possum Centre Busselton Inc
- Busselton-Dunsborough Environment Centre
- Busselton and Districts Residents' Association Inc
- Busselton Volunteer Fire & Rescue Service.

3.2 Stakeholder engagement process

Government agencies have been engaged individually to provide feedback on key components of the Proposal relevant to their role. This has included individual meetings, phone discussions and emails as outlined in Section 3.3.

Non-government organisations (NGOs) and community stakeholders have been engaged through a two-stage process. Non-government organisations and nearby property owners/occupiers (see mapped area in Appendix 3) were contacted via letter drop and invited to briefing and feedback sessions held at the City of Busselton's offices on 28 and 30 November 2017. The stakeholders invited were as follows (see letters in Appendix 3):

- Busselton Chamber of Commerce and Industry
- Geographe Catchment Council
- St Mary's Anglican Church
- Busselton Historical Society
- FAWNA
- Possum Centre Busselton Inc
- Busselton-Dunsborough Environment Centre
- Busselton and Districts Residents' Association Inc
- Busselton Volunteer Fire & Rescue Service.

In addition to targeting NGOs and nearby properties, a public advertisement was made in the Busselton-Dunsborough Times on 15 November 2017 (see Appendix 3) and the City of Busselton Facebook page inviting members of the public to a briefing and feedback session held at the City of Busselton's offices on 5 December 2017.

A slide show was presented during the three briefing and feedback sessions and factsheets available for all participants (see Appendix 3). Participants were encouraged to provide written submissions to the City and advised that the Proposal was to be referred to the EPA and Commonwealth DEE and that submissions could be made when the referrals were advertised by those agencies.

3.3 Stakeholder consultation

Table 4 presents an overview of the stakeholder consultation for the Proposal.

Table 4: Stakeholder consultation

Stakeholder	Date	Topic/issue raised	Proponent response/outcome
DBCA	Meeting on 13 October 2017	• Peppermint trees along river a corridor for Western Ringtail Possum due to trees remaining in good condition over summer/autumn. • Recommend fauna underpass with 1:2 slopes and thick planting with Sword Sedge. • Provide pedestrian access west of road or else provide fencing if along east of road. • Provide stormwater treatment and spill capture to prevent water quality impacts. • Consider higher elevation deck to allow waterbirds to fly beneath. • Waterbird use of river and wetlands likely to be opportunistic. • Waterbird breeding and resident habitat expected downstream of Butter Factory weir. • Require translocation proposal and Regulation 17 for mussel translocation. • Samphire a potential threatened ecological community. • Rehabilitation of samphire has been successful and takes 3 years of weed/grass control using mechanical and chemical means. • Provide copies of flora, fauna and mussel survey reports.	• DBCA recommendations on fauna underpass, pedestrian access and stormwater treatment/spill capture incorporated into Proposal design. • Bridge deck height designed to convey flood flows and connect with adjacent road network in Peel Terrace and Cammilleri Street. • Waterbird habitat of river and wetlands assessed in Section 4.4. • Draft translocation proposal prepared and issued to DBCA for review (Appendix 10). • Status of samphire as not comprising a threatened ecological community established in Detailed Flora and Vegetation Survey (see Section 4.2 and Appendix 5). • Rehabilitation of samphire proposed as mitigation for clearing (see Section 4.2). • Copies of flora and fauna survey (see Appendix 4) and mussel baseline assessment (see Appendix 9) provided to DBCA for review. Reports updated for DBCA comments received on 6 November 2017.
DWER	Emails from DWER on 3 October, 22 and 23 November 2017	• Proposal does not require a bed and banks permit as it located in an unproclaimed Surface Water Area and does not involve taking, diverting or storing of water. • Feedback provided on Preliminary Waterways Assessment (WSP 2017), which does not affect hydraulic modelling findings for the Proposal relating to hydrological processes as presented in Section 4.5. • Advice provided on sampling and management of monosulfidic black ooze (MBO). • DWER supports use of bio-filtration gardens for stormwater treatment and spill capture.	• Advice on bed and banks permit noted. • Feedback to be incorporated into revised Preliminary Waterways Assessment. Does not affect findings for the Proposal relating to hydrological processes. • DWER advice incorporated into approach for sampling and management of MBO if present in the bridge construction footprint. • Support for proposed stormwater/spill capture noted.
DEE	Meeting on 27 September 2017	• Sensitivity of Western Ringtail Possum habitat. • Ensure consistency with Recovery Plan in February 2017.	• Survey of WRP habitat undertaken (see Appendix 4) and potential impacts and mitigation presented in Section 4.4.
SWALSC	Presentation to South West Boojarah Working Party on 24 May 2017	• SWALSC recommended eight Aboriginal consultants (plus one reserve) for participation in ethnographic survey.	• Recommended Aboriginal consultants engaged during ethnographic survey (see Appendix 11).

Stakeholder	Date	Topic/issue raised	Proponent response/outcome
State Heritage Office	Proposal referred to State Heritage Office 20 November 2017 Response letter received 13 December 2017	• Requested a copy of Construction Environmental Management Plan (CEMP) for review and advice prior to works commencing.	• A copy of the CEMP will be issued to the State Heritage Office for review and advice prior to construction commencing.
Key stakeholders • Nearby property owners/occupiers • St Marys Anglican Church • Busselton-Dunsborough Environment Centre • Possum Centre Busselton • Possum Working Group • Geographe Catchment Council • Busselton Museum/ Busselton Historical Society • Busselton Volunteer Fire and Rescue	Briefing and feedback sessions 14 recorded attendees on 28 November 7 recorded attendees on 30 November	• Question why Ford Road ecology is more important than Eastern Link. • Impacts to amenity / human interaction with environment. • Sensitivity of Western Ringtail Possum and clearing of habitat. • Preference for a possum bridge rather than fauna underpass, and recommendation for more than two trees replacement for each tree cleared. • Tourism developed to the detriment of locals. • Preference for Ford Road upgrade rather than Eastern Link. • Impacts on local roads - safety and amenity. • 1 in 100 year flooding event – will bridges be under water? • Access by visitors to Old Butter Factory museum during construction. • Lack of community input into options selection. Proposal presented as a *fait accompli*. • No spill response materials kept in Busselton fire station for use in waterways (e.g. floating booms).	• Explained presence of Ramsar wetland of international importance adjacent to Ford Road, with high value waterbird habitats either side of the road. Explained that waterbird habitats about Eastern Link are lower in value. • Explained impacts to amenity to be considered in EPA referral under social surroundings factor. Pedestrian linkages in the area to be maintained through new shared use path on west of road connecting to footbridge and new path on Peel Terrace. • Welcome feedback from the community and will investigate bridges; plans informed by discussions with DBCA. • City is growing and the current road network requires upgrading for all road users. • Explained Ford Road was rejected by Minister for Environment and may not be re-referred to the EPA without substantial re-design and additional data. Ford Road adjacent to Ramsar wetland. City intends to pursue Ford Road in the future but more work is required to refer it to the EPA. • Traffic modelling explained. Local roads will be at most one third of their capacity by 2036. Eastern Link will improve distribution of traffic in Busselton and reduce congestion on Causeway Road and Queen Street. If the bridge is moved it will shift traffic to other roads. • 1 in 100 year flood event won't overtop bridges and won't break the banks of the Vasse River adjacent to Proposal. Proposal will cause negligible increase in afflux. • Construction works will be staged and traffic management provided to ensure that visitors can continue to access the Old Butter Factory museum during construction. • Explained that all road upgrades in Strategic Network Corridors project need to be implemented, they are not options. Ford Road and duplication of Causeway Bridge, West Street and Fairway Drive are complimentary rather than alternatives to Eastern Link and ultimately required to address traffic in the town. • City requested written submissions by 15 December 2017. • Proponent will purchase floating booms and provide to Busselton fire station for use in event of spill on Lower Vasse River.

Stakeholder	Date	Topic/issue raised	Proponent response/outcome
Members of the public (including Busselton Chamber of Commerce)	Briefing and feedback session 64 recorded attendees on 5 December 2017	• Preference for Ford Road upgrade. • Ford Road was given the green light and should have gone ahead. • Consult with local waterbird expert Dr Jim Lane (DBCA). Consider Molloy Street alternative to Ford Road. • Lack of community input into options selection. Proposal presented as a *fait accompli*. • Environmental damage to parkland and amenity. • Ratepayers want total cost of proposal. • Can Commonwealth funding obtained for Eastern Link be used elsewhere? • Queries regarding various road impacts (suggestions also made). Have heavy vehicles been considered? • Girl Guides (near Rotary Park) have no place to go. Ensure adequate relocation before construction commences. • Impacts on Old Butter Factory museum access and visitor numbers due to new roundabout on Peel Terrace. Can the roundabout be moved.	• Explained presence of Ramsar wetland of international importance adjacent to Ford Road, with high value waterbird habitats either side of the road. Explained that waterbird habitats about Eastern Link are lower in value. • Explained Ford Road was rejected by Minister for Environment on the recommendation of the Appeals Committee and may not be re-referred to the EPA without substantial re-design and additional data. Ford Road adjacent to Ramsar wetland. City intends to pursue Ford Road in the future but more work is required to refer it to the EPA. • Dr Jim Lane consulted regarding Molloy Street extension and advised it was high value waterbird habitat and a road crossing is not desirable. Molloy Street extension would cross over A class conservation reserve. • Explained that all road upgrades in Strategic Network Corridors project need to be implemented, they are not options. Ford Road and duplication of Causeway Bridge, West Street and Fairway Drive are complimentary rather than alternatives to Eastern Link and ultimately required to address traffic in the town. • All areas to be cleared will be replaced by replanting and rehabilitation works to improve the river foreshore and wetlands in the vicinity. • Project cost is estimated at $3.8m plus relocation of services, drainage and land acquisition. • Commonwealth funding must be used specifically for the Eastern Link. • Traffic modelling explained – end result is local roads will be at one-third capacity by 2036. Heavy vehicle traffic has been considered in the traffic modelling and design. • Girl Guide Hall relocation will be provided by City of Busselton ahead of any demolition or construction works commencing. • Roundabout location can be re-considered. City invited representatives of Old Butter Factory museum to further discussion. • City requested written submissions by 15 December 2017.

4. Environmental principles and factors

4.1 Principles

The EP Act identifies a series of principles for environmental management. The environmental principles are the highest level goals that a proposal must meet in order to be found environmentally acceptable by the EPA. The City of Busselton has considered these principles in relation to the development and implementation of the Proposal. Table 5 outlines how the principles relate to the Proposal.

Table 5: EP Act principles

Principle	Consideration
Precautionary principle Where there are threats of serious irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: 1. careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and 2. an assessment of the risk-weighted consequences of various options.	The City has used existing environmental data during design and has supplemented it with additional studies including ecological and heritage surveys, acid sulfate soil investigation and hydraulic modelling. Consultation has been undertaken with relevant government agencies to identify potential environmental impacts and appropriate management for the Proposal. Comprehensive environmental mitigation is proposed for all identified potential impacts from the Proposal, and incorporated into the design and the Construction Environmental Management Plan.
Intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Proposal can be development without significant impacts on the health, diversity or productivity of the environment.
Conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integration should be a fundamental consideration.	Survey work has been used to identify and confirm the range and condition of the environmental factors within and surrounding the Proposal Development Envelope. The Proposal will not substantially reduce the extent of any vegetation type or habitat within the Busselton area. The findings indicate that with appropriate design, construction management and revegetation that no likely significant biodiversity or ecological impacts will result from the Proposal at local or regional scales.
Improved valuation, pricing and incentive mechanisms 1. Environmental factors should be included in the valuation of assets and services. 2. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. 3. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which benefit and/or minimise costs to develop their own solutions and responses to environmental problems.	Environmental constraint avoidance and management costs have been considered in the design of the Proposal.
Waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	Waste will be minimised by adopting the hierarchy of waste controls; avoid, minimise, reuse, recycle and safe disposal.

4.2 Key environmental factor 1 – Flora and vegetation

4.2.1 EPA objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016) identifies the following objective for flora and vegetation:

- To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

4.2.2 EPA policy and guidelines

Flora and vegetation surveys that have informed planning for the Proposal have been conducted in accordance with the Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) and the Environmental Factor Guideline: Flora and Vegetation (EPA 2016).

4.2.3 Receiving environment

Vegetation

Native vegetation in the Proposal footprint has been mapped as the Vasse vegetation complex by Heddle *et al* 1980 as updated by Webb *et al* 2016 (referred to as the Swan Coastal Plain dataset), which reflects the extent of Pre-European coastal saltmarsh and Melaleuca woodland south of Vasse River. Vegetation on the northern and southern Vasse River foreshore has been modified and now includes planted 'parkland cleared' Peppermint trees (*Agonis flexuosa*), Flooded Gum (*Eucalyptus rudis*) and Melaleuca species.

Table 6 presents the estimated pre-European and current extent of the Vasse vegetation complex. The total native vegetation (planted and remnant) within the Development Envelope represents approximately 0.01% of the current extent of the Vasse vegetation complex.

Table 6: Extent of Vasse vegetation complex

Vegetation complex (Swan Coastal Plain dataset)	Description	Pre-European extent (ha)	Current extent (ha)	% Remaining of pre-European extent
Vasse Complex	Mixture of the closed scrub of Melaleuca sp. fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca* sp. and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri). Will include areas dominated by *Tecticornia* and *Sarcocornia* sp. (Samphire) near Mandurah and south of the Capel River.	15 692	4924	31.4

The Proposal Development Envelope and surrounds have been subject to Reconnaissance and Detailed Level Flora and Vegetation Surveys. A Reconnaissance Level Survey was undertaken by Ecosystem Solutions in August 2017 (see Appendix 3) and a Detailed Level Survey undertaken by Strategen in November 2017 (see Appendix 5). The Detailed Level Survey refined and superseded the Reconnaissance Level Survey, including:

- definition of Vegetation Types (VTs) and condition
- survey for spring flowering species, including threatened flora
- definition of mature Peppermint trees

  determining the potential presence of Subtropical and Temperate Coastal Saltmarsh Threatened Ecological Community (TEC).

The Detailed Survey identified four VTs within the Development Envelope as presented in Table 7 and Figure 5, with vegetation condition presented in Table 8 and Figure 6. As shown, there is approximately 0.56 ha of native vegetation within the 2.64 ha Development Envelope. Of the 0.56 ha of native vegetation, 0.10 ha is Completely Degraded and the remaining 0.46 ha is Degraded, Good and Very Good.

Table 7: Vegetation Types surveyed in Development Envelope

Vegetation Type	Description	Area (ha) within Development Envelope	Percentage of Development Envelope
VT1	*Agonis flexuosa* low woodland over **Cynodon dactylon* grassland (managed)	0.10	3.7%
VT2	*Eucalyptus rudis*, *Eucalyptus cornuta* and **Eucalyptus grandis* mid woodland over *Melaleuca rhaphiophylla* and *Agonis flexuosa* low open woodland over *Callistemon* sp. Low open shrubland over **Cenchrus clandestinus* and *Bolboschoenus caldwellii* low grassland/sedgeland	0.08	2.9%
VT3	*Melaleuca rhaphiophylla*, *Melaleuca teretifolia* and *Melaleuca preissii* low open forest over *Melaleuca viminea* mid shrubland over **Cynodon dactylon* and **Cenchrus clandestinus* low grassland	0.08	3.0%
VT4	*Salicornia quinquefolia*, *Tecticornia indica subsp. bidens* and *Salicornia blackiana* low samphire shrubland	0.11	4.2%
VT4 (d) (degraded)	**Carex divisa* mid closed sedgeland over **Stenotaphrum secundatum* low open grassland	0.19	7.4%
CL	Cleared or manicured grassland	1.73	65.6%
OW	Open Water	0.35	13.3%

* introduced species

Table 8: Vegetation condition surveyed in Development Envelope

Vegetation Condition	Area (ha) within Development Envelope	Percentage of Development Envelope
Very Good	0.04	1.34
Good	0.23	8.71
Degraded	0.19	7.39
Completely Degraded	1.83	69.28
Open Water	0.35	13.28
Total	**2.64**	**100**

VT1 and VT2 within the Development Envelope comprise vegetation predominantly planted in the 1990s and 2003/04, as well as mature Peppermint trees within VT1 that existed prior to the planting. VT3 comprises predominantly vegetation planted in the wetland area west of the railway embankment. VT4 and VT4(d) comprise remnant samphire to the east of the railway embankment with varying degrees of invasion by introduced grasses.

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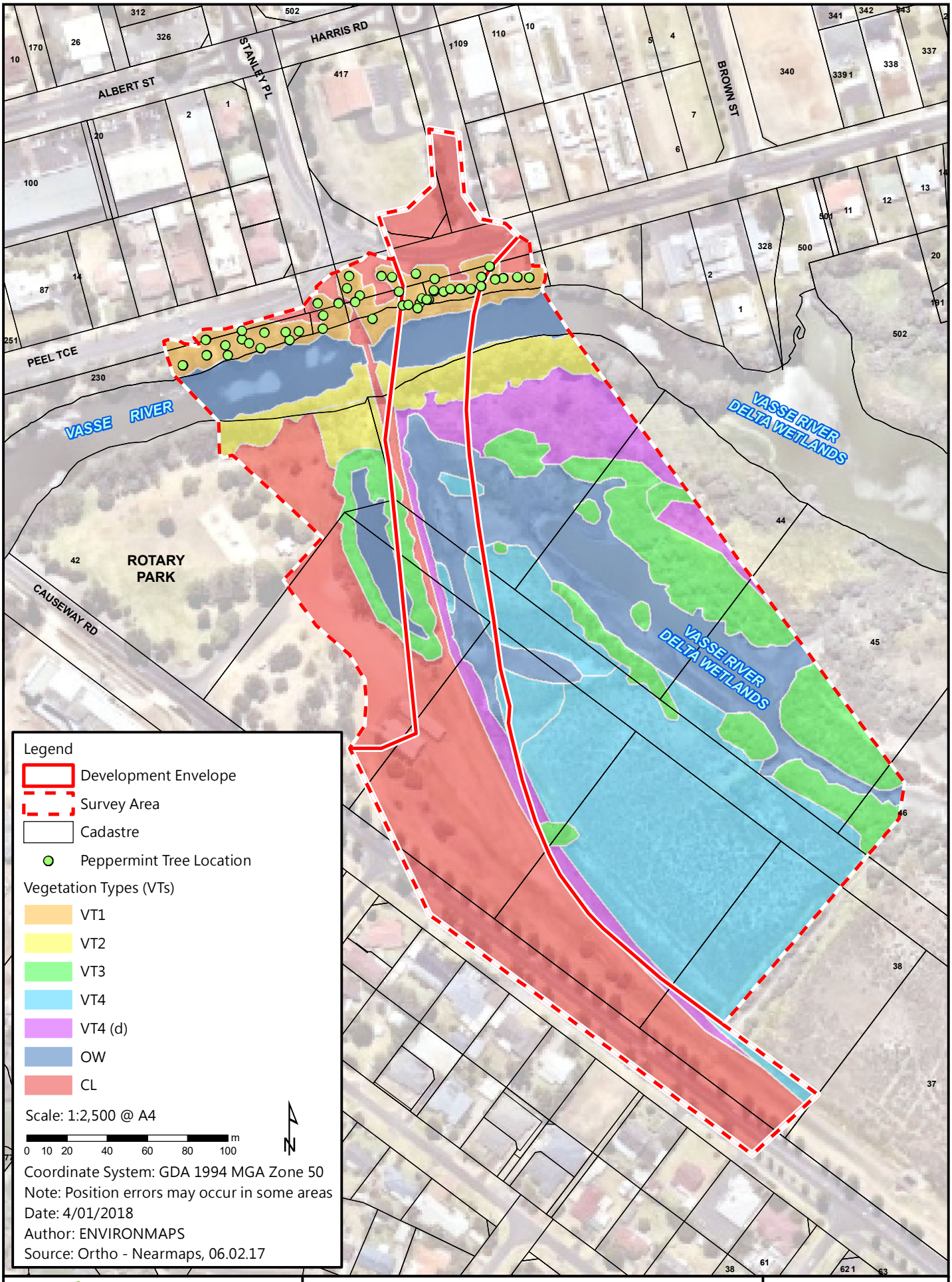

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Busselton Eastern Link Project
Environmental Review

Vegetation Types

Figure 5

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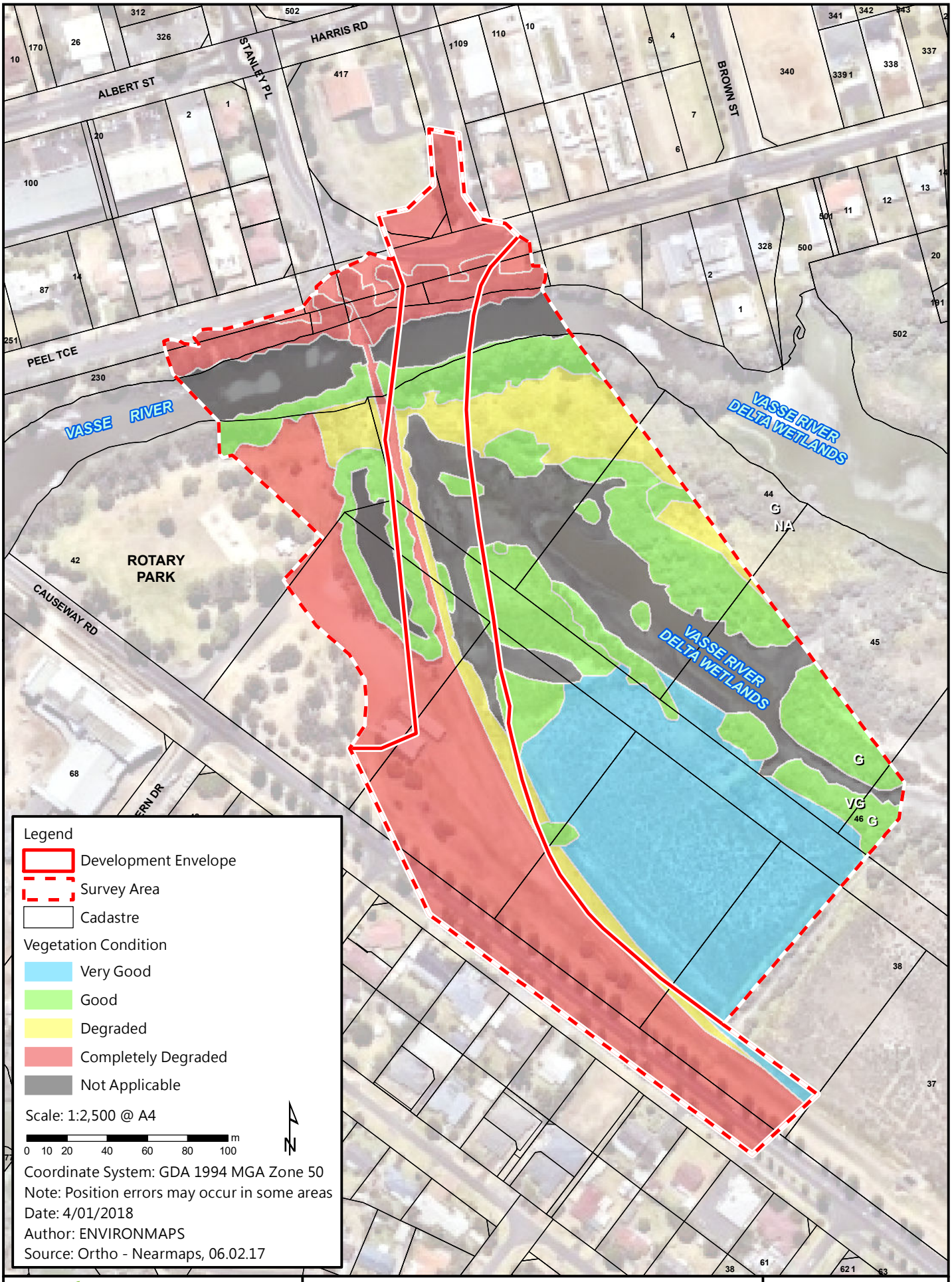

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Busselton Eastern Link Project
Environmental Review

Vegetation Condition

Figure 6

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Threatened ecological communities

The Reconnaissance Level Survey (Ecosystem Solutions 2017) identified one TEC as potentially occurring within the Development Envelope, namely the Subtropical and Temperate Coastal Saltmarsh which is listed as Priority 3 under the WC Act and Vulnerable under the EPBC Act. This was based on floristic and structural similarities to the samphire vegetation (VT4).

The Detailed Level Survey (Strategen 2017) assessed VT4 and VT4(d) against the key diagnostic characteristics and excluding factors for the Coastal Saltmarsh TEC. The Detailed Level Survey concluded that the Development Envelope and its surrounds are not expected to contain the TEC due to:

- VT4(d) containing more than 50% weeds, being highly infested with introduced grasses
- VT4 and VT4(d) lying over land and adjacent to wetlands that do not experience tidal / salt water influence.

Flora

No threatened or priority flora species listed under Commonwealth or WA legislation were observed in the Development Envelope during the field surveys for the Reconnaissance or Detailed Flora and Vegetation Surveys, which included field survey in spring.

4.2.4 Potential impacts

The Proposal will result in clearing of native vegetation within the Development Envelope to enable construction of the new road and bridge.

Construction activities have potential to impact on adjacent native vegetation through uncontrolled access and spread of weeds.

4.2.5 Assessment of impacts

Vegetation

The Proposal will result in clearing of approximately 0.56 ha of native vegetation, comprising 0.27 ha in Good or Very Good condition and 0.29 ha in Degraded or Completely Degraded Condition. Approximately 60% of the native vegetation to be cleared (most of which is samphire VT4 and VT4[d]) is expected to be remnant vegetation of the Vasse vegetation complex. The remaining 40% of native vegetation to be cleared was planted in the 1990s and 2003/04 and is not remnant vegetation of the Vasse vegetation complex.

The Proposal is not expected to impact on any TECs or PECs listed under Commonwealth or WA legislation.

Flora

The Proposal is not expected to impact on any threatened or priority flora species listed under Commonwealth or WA legislation.

4.2.6 Mitigation

Impacts to vegetation will be mitigated through the following:

- minimising the extent of native vegetation clearing as far as is practicable
- re-planting of 0.26 ha of riparian/Melaleuca vegetation equivalent to VT1, VT2 and/or VT3 along the Lower Vasse River or Vasse River Delta Wetlands
- rehabilitation of 0.30 ha of VT4 in the Vasse River Delta Wetlands to remove invasive grasses and promote re-establishment of samphire vegetation
- vegetation clearing and weed management controls in the CEMP (see Appendix 7).

4.2.7 Predicted outcome

The Proposal will require clearing of a small area of native vegetation (0.01% of the current extent of the Vasse vegetation complex), approximately 40% is planted (non-remnant) vegetation and approximately half in a Degraded to Completely Degraded condition. No TECs, PECs or threatened or priority flora species are expected to be impacted by the Proposal. The Proposal will implement mitigation measures to replant and rehabilitate similar vegetation types as will be cleared, and prevent uncontrolled impacts to vegetation adjacent to the Development Envelope.

Based on the scale and nature of impacts and the mitigation to be implemented, the Proposal will not have a significant impact on flora and vegetation, and biological diversity and ecological integrity will be maintained.

Accordingly, it is expected that the EPA objective for flora and vegetation will be met.

4.3 Key environmental factor 2 - Terrestrial Environmental Quality

4.3.1 EPA objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016) identifies the following objective for terrestrial environmental quality:

- To maintain the quality of land and soils so that environmental values are protected.

4.3.2 EPA policy and guidelines

Investigations that have informed the planning of the Proposal have been conducted in accordance with the Technical Guidance – Terrestrial Environmental Quality (EPA 2016).

4.3.3 Receiving environment

Geology and soils overview

The Proposal lies at the boundary of two geological units. The land south of the Vasse River comprises silty estuarine deposits of the Vasse land system and land north of the river comprises calcareous Safety Bay Sands of the Quindalup Dune land system (Belford 1987). The estuarine deposits west of the Proposal have been infilled with imported material, including Rotary Park and the land bounded by Causeway Road and Southern Drive (Belford 1987).

Soils within the Development Envelope are influenced by the geology and imported material in the area. The new road south of the river is expected to lie over:

- disused railway embankment and land adjacent to Causeway Road comprising imported fill
- wetland areas to the east of the railway embankment underlain by silts described as brownish grey, partly calcareous, soft, with some fine sand and shell debris in places, and minor clay content (Belford 1987).

Soils north of the river are expected to comprise calcareous sand described as white, medium grained, rounded quartz and shell debris, well sorted, of aeolian origin (Belford 1987).

Land in the vicinity of the Proposal is mapped as being at High to Moderate risk of acid sulfate soil (ASS) occurring within 3 m of natural soil surface, reflecting the estuarine / riverine nature of the soils. There is also potential for monosulfidic black ooze (MBO) to be present within the sediments of the Vasse River (P. Hanly [DBCA] 2017, pers. comm. 13 October). MBO is an organic ooze enriched by iron monosulfides. Disturbance of ASS or MBO through excavation, dewatering and/or dredging works has potential to impact on soil and water quality.

Acid Sulfate Soils

An ASS investigation was undertaken by Strategen in July 2017 to determine the nature and extent of the ASS risk posed by soils in the area. The ASS Investigation Report provided in Appendix 6 and a summary is provided below.

Two soil bores were drilled within the Development Envelope to a depth of depth of 6 metres below ground level (mbgl). One bore was drilled on the northern bank and one bore on the southern bank, as these are locations where excavation and dewatering was more likely to occur. The soil bore on the northern bank of the river was converted to a groundwater bore. The new road south of the bridge will be constructed with imported fill with no excavation proposed, therefore no soil bores were drilled over the road area.

The bore logs and observations during drilling indicate the following local soil profiles adjacent to the Vasse River:

- soil profiles consist predominantly of sand, varying from black to grey to red and brown to yellow
- southern bore soil profile consisted of 0.5 m of gravelly sand over clayey sand to 1.5 mbgl and then sand to 5 m, with a layer of clay present between 2.5 and 3.2 mbgl
- northern soil profile consisted of sand, with the exception of a layer of gravelly sand from 0.5 to 1.5 mbgl and gravely sandy clay becoming sandy clay below 4.2 mbgl.

Field measurements indicated no actual (i.e. oxidised) ASS as present in the soil profile, with field soil samples recording a pH_F above 4 pH units. The average pH_F of samples tested was 8.0 pH units with pH varying between 7.4 and 8.8 (i.e. alkaline soils). However, all of the soil samples showed a difference between pH_F and pH_{FOX} greater than 1.0 pH unit, indicating potential (i.e. un-oxidised) ASS are present throughout the soil profiles.

Laboratory analysis using the SPOCAS method indicated a net acidity of 0.04%S to 1.3%S. The highest sample (1.3%S) was subject to verification using Chromium Reducible Sulphate method (SCr), which indicated a lower value of 0.95% S. Liming rates have been set for the soils based on SCr values, at 82 kg/tonne (Strategen 2017, Appendix 6).

Two soil samples were analysed for heavy metals, indicating that all analytes were below environmental investigation levels (EIL) for Public Open Space and below health investigation levels (HIL) for Residential land uses.

Groundwater was encountered within 1 m of the surface. Laboratory analysis of groundwater samples indicated acidity of 12 mg/L $CaCO_3$ and alkalinity of 340 mg/L $CaCO_3$. The sulfate to chloride ratio was less than 0.5, with values between 0.055 and 0.11. These results indicate well buffered waters with a very high alkalinity, with have adequate buffering to maintain an acceptable pH level in the future. The laboratory analysis of groundwater samples showed no exceedance of DWER ASS criteria.

4.3.4 Potential impacts

Acid Sulfate Soils

The Proposal will result in excavation of river bank/bed sediments, excavation of soils north of the river, and potential for dewatering of soils north of the river, which may potentially oxidise ASS and (in the case of river sediments) MBO.

The new road south of the bridge will be constructed on fill materials associated with the disused railway embankment and made ground adjacent to Causeway Road, as well as imported fill for the new road embankment. The road will be serviced with underground piped stormwater drains and electrical services, which are expected to have a depth of up to 2 m below the road surface and lie within fill materials rather than the underlying estuarine sediments. Accordingly, construction of the new road south of the bridge is not expected to result in excavation or dewatering of potential ASS.

The river banks/bed will be excavated to remove soft riverine sediments and imported fill placed on each bank to form construction platforms to enable construction of bridge abutments. The riverine sediment material removed for the construction platforms may comprise potential ASS and potentially MBO. The area and depth of excavation works on the river banks/bed and the presence of ASS/MBO in the material to be removed remain to be determined.

The new bridge abutments will be laid on pre-cast concrete piles driven into the ground using a pile-driver. Concrete abutments will be laid on the piles with the brick deck laid on the abutments. Installation of the piles, abutments and bridge deck are not expected to require excavation or dewatering.

The new road and roundabout north of the bridge will be serviced with underground piped stormwater and electrical services that are expected to have a depth of up to 2 m below the road surface. Trenches for infrastructure, as well as light pole footings, will require excavation and potentially dewatering as groundwater depths have been recorded within 1 mbgl. Based on the scale of activities it is estimated that excavation volumes will range from 100 to 500 m^3 and dewatering rates at approximately 2 L/s and volumes ranging from 1000 to 5000 m^3 over the construction period. The small scale of dewatering for construction exempts the Proposal from the requirement for a groundwater abstraction licence under the *Rights in Irrigation and Water Act 1914*.

4.3.5 Assessment of impacts

Excavation and/or dewatering for infrastructure trenches and light pole footings north of the river has potential to oxidise excavated or in-situ potential ASS. In addition, excavation of soft riverine sediments for construction platforms has potential to oxidise potential ASS or MBO.

Oxidation of ASS may result in lowering of pH of groundwater, although laboratory analysis suggests that local groundwater is well buffered should oxidation occur. The buffering of groundwater is expected due to the calcareous geology of the Safety Bay Sand. In the event of a lowering of groundwater pH there is potential for heavy metals to be released from soils and be mobilised into groundwater and flow into the Lower Vasse River. Accordingly, mitigation is required to prevent impacts to Terrestrial Environmental Quality (see Section 4.3.6).

Oxidation of MBO in riverine sediments has potential to result in rapid deoxygenation and acidification of the water column and release of heavy metals (Ward et al 2010). Acidification of the water column, release of heavy metals and deoxygenation has potential to impact on the aquatic fauna of the Lower Vasse River, including native fish species and the threatened Carters Freshwater Mussel (see Section 4.6). Accordingly, mitigation is required to prevent potential impacts to Inland Waters Environmental Quality.

The potential impacts, while requiring mitigation, are not considered large or abnormal in relation to disturbance of ASS and MBO associated with infrastructure construction.

4.3.6 Mitigation

Acid Sulfate Soils

ASS investigations indicate that majority of natural soils encountered during the investigation are potentially ASS and should be treated in accordance with DWER guidance. As such the following management actions will be implemented:

1. An ASS and Dewatering Management Plan (ASSDMP) will be developed and submitted to DWER for review and approval prior to excavation and dewatering commencing.
2. Because of the presence of ASS and the environmentally sensitive location of the works, the ASSDMP will recommend the use of lime dosing of excavated soils.
3. Local groundwater appears to be well buffered. The need for treatment of any dewatering effluent will be addressed as part of the ASSDMP depending on the volume and intended discharge methods for dewatering effluent.

Monosulfidic Black Ooze

Riverine sediments to be removed for abutment construction will be subject to sampling and management in accordance with DWER advice (K. Seewraj [DWER] 2017, pers. comm. 23 November) as follows:

- sampling of sediments over the proposed footprint and depth of construction platforms
- laboratory analysis of samples to determine MBO characteristics
- assessment of hazard posed by MBO characteristics and proposed volume/method of removal
- preparation of MBO Management Plan (MBOMP) to address the hazard, incorporating advice from DWER and guidance from the Commonwealth Department of Agriculture and Water Resources
- MBOMP to be submitted to DWER for review and approval prior to disturbance of riverine sediments.

It is noted that the Commonwealth Department of Agriculture and Water Resources is intending to release a package of guidance on MBO management (K. Seewraj [DWER] 2017, pers. comm. 23 November). The MBO sampling and MBOMP will incorporate this guidance should it become available prior to construction commencing.

4.3.7 Predicted outcome

Based on the small scale of excavation and dewatering, the well buffered local groundwater, and the proposed mitigation measures, the Proposal is not expected to result significant impacts to the quality of land and soils. According, it is expected that the EPA objective for terrestrial environmental quality will be met.

4.4 Key environmental factor 3 - Terrestrial Fauna

4.4.1 EPA objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016) identifies the following objective for terrestrial fauna:

- To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

4.4.2 EPA policy and guidelines

The fauna survey that has informed the planning of the Proposal has been conducted in accordance with the Technical Guidance – Terrestrial fauna surveys (EPA 2004) and the Environmental Factor Guideline: Terrestrial Fauna (EPA 2016).

4.4.3 Receiving environment

A Reconnaissance Level Fauna Survey was undertaken by Ecosystem Solutions in August 2017 (see Appendix 3) to identify fauna of conservation significance, including threatened and priority species or migratory species listed and protected under Commonwealth and Western Australian legislation.

The Reconnaissance Level Survey included a desktop assessment, which identified potential conservation significant fauna as the Western Ringtail Possum (WRP) (*Pseudocheirus occidentalis)*, endangered Black Cockatoo species, and migratory waterbirds. The Survey included field surveys for these species including:

- day time visual inspection of the Development Envelope and adjoining areas for signs of fauna (e.g. scats, diggings, dreys, nests, burrows, feeding signs)
- hollow bearing trees suitable for Black Cockatoos
- direct observations of terrestrial vertebrate fauna and signs
- 20 minute bird survey including observation and recording of waterbirds

- two non-consecutive, night time spotlight surveys
- two pre-dawn and two dusk surveys to determine Black Cockatoo activity.

The results of the field survey are presented in Figure 7. Apart from WRP observations, the field surveys within the Development Envelope did not record any threatened, priority or migratory terrestrial vertebrate fauna species listed under Commonwealth or State legislation.

Western Ringtail Possum

The day time survey identified four areas of WRP scats and one drey observed within Vegetation Type 1 ('parkland cleared' Peppermint woodland) on the northern side of the river (Figure 7) The Peppermint trees in this area are mature and have potential gaps or hollows in their lees which would provide WRP habitat.

During the nocturnal surveys, four WRP were observed in Night 1 and three were observed in Night 2, within the areas of Vegetation Types 1 and 3 (Figure 7).

The Proposal lies over the WRP Core Habitat Area (Area 1) defined under the EPBC Act Significant Impact Guidelines (DEWHA 2009) and the Swan Coastal Plain management zone defined in the WRP Recovery Plan (Department of Parks and Wildlife 2017). Due to the contiguous canopy of the Peppermint trees and proximity to the Vasse River (which would promote good vegetation condition in summer and autumn), the vegetation of VT1 on the north bank of the Vasse River is expected to support a fauna corridor for the WRP (K. Williams [DBCA] 2017, pers. comm. 17 October). Peppermint trees along riparian areas can provide higher quality food over the critical late summer-autumn period when WRP would otherwise be forced onto a very low protein diet (Shedley and Williams 2014).

Black cockatoos

The field survey identified tree species known to provide food and potential roosting sites for black cockatoo species (e.g. Marri and Flooded Gums), however there were no signs of foraging, feeding or roosting on or nearby the trees. There were no trees identified as suitable for Black Cockatoo nesting (i.e. there were no hollows) within the Development Envelope, nor were any Black Cockatoos seen or heard during either of the dawn or dusk surveys.

The Reconnaissance Survey concluded that the Development Envelope does not comprise significant Black Cockatoo habitat (Ecosystem Solutions 2017).

Waterbirds

Desktop assessment identified eight migratory bird species as known to occur or potentially occurring in the vicinity of the Development Envelope. The Development Envelope lies on the western fringe of the Vasse River Delta Wetlands, an area of known habitat for migratory waterbirds.

The field survey did not observe any listed migratory birds on either the Lower Vasse River or the Vasse River Delta Wetlands within or adjacent to the Development Envelope. Wetlands immediately east of the Development Envelope are not subject to tidal / salt water inundation and dry out during the summer and autumn (Strategen 2017, Appendix 5), however the wetlands may potentially be used by migratory waterbirds on an occasional or opportunistic basis. DBCA database records include the Eastern Great Egret (*Ardea modesta*) and Glossy Ibis (*Plegadis falcinellus*) in the Lower Vasse River and wetlands within 500 m of the Development Envelope (Figure 7).

Higher value waterbird habitats lie to the east of the Proposal, in the Vasse River Delta Wetlands downstream of the Old Butter Factory (Figure 7) which retains water throughout the summer and autumn, as well as the Vasse Estuary further downstream. DWER release salt water from the surge barrier into the Vasse Estuary to maintain water levels in the summer, however this water is at too low an elevation to reach upstream into the wetlands adjacent to the Proposal (Strategen 2017, Appendix 5)

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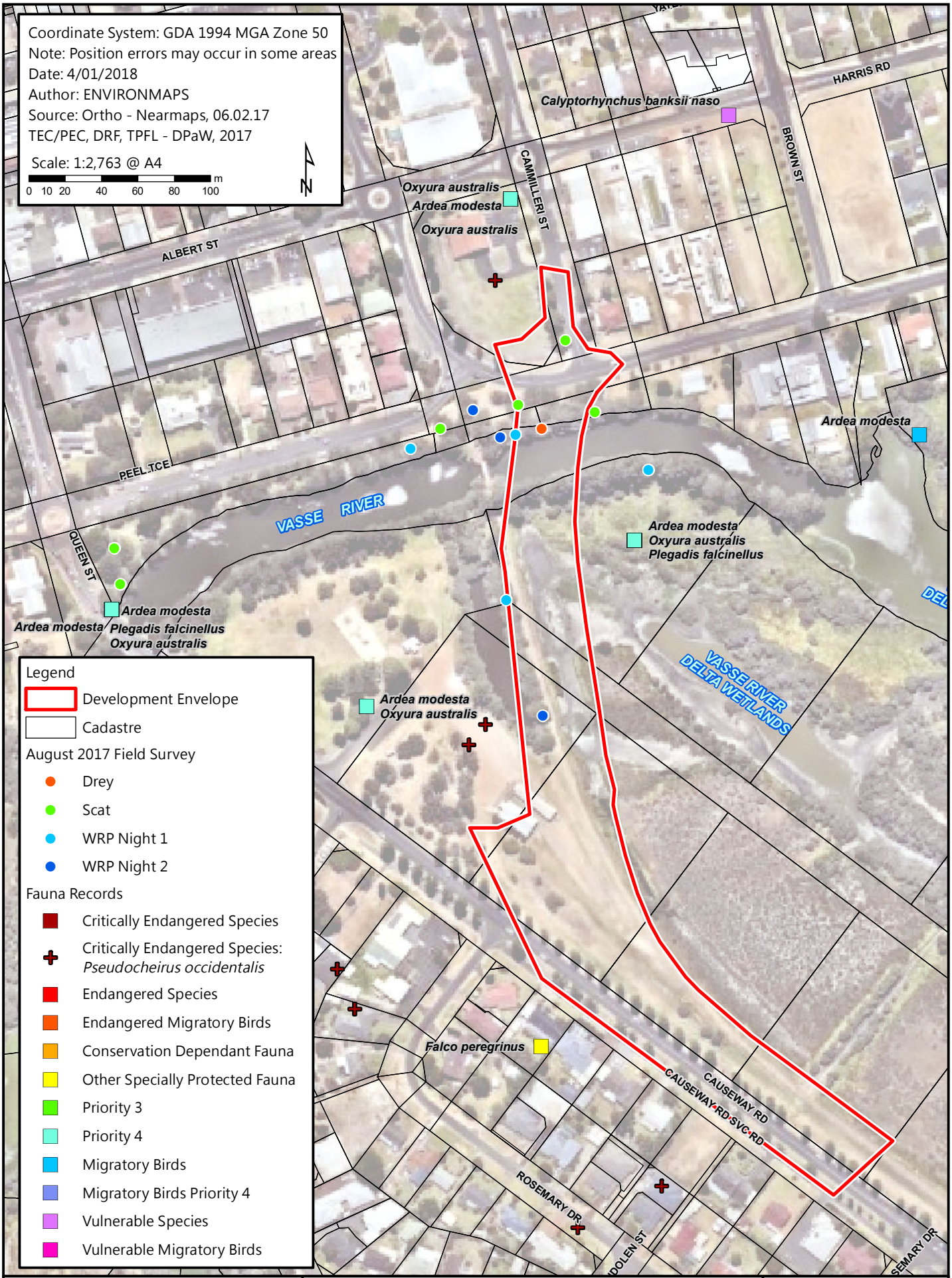

strategen ENVIRONMENTAL

Busselton Eastern Link Project
Environmental Review
Fauna Records

Figure 7

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4.4.4 Potential impacts

Western Ringtail Possum

The Proposal will result in a clearing of a total of 17 mature Peppermint trees comprising approximately 0.1 ha of canopy (VT1, see Section 4.2 and Figure 5) along the north shore of the Vasse River, which represent habitat and a corridor for WRP.

There is potential for ongoing WRP mortality due to vehicle collisions on the new road crossing the WRP habitat and corridor along the north shore of the Vasse River. Street lighting along the new road may also result in light spill affecting the night vision of individuals.

Black cockatoos

The Proposal will result in clearing of 0.08 ha of vegetation (VT2) that includes tree species that may potentially provide foraging habitat for Black Cockatoos. However, the Reconnaissance Survey indicated that the vegetation to be cleared does not comprise nesting or breeding habitat and is not considered to be significant habitat for the species.

Waterbirds

The Proposal will result in clearing of riparian and wetland vegetation and infilling of open water areas on the Lower Vasse River and the western fringe of the Vasse River Delta Wetlands, which will reduce the habitat for migratory waterbirds that may occasionally or opportunistically use these areas.

There is potential for impacts to water quality during construction or operation of the Proposal (see Section 4.6) to impact waterbird habitat, including the downstream Vasse River Delta Wetlands.

There is potential for the Proposal to result in increased public and domestic animal (pet) access in the vicinity of the Vasse River Delta Wetlands, which may result in disturbance and mortality (e.g. pet predation) of waterbirds using the wetlands.

4.4.5 Assessment of impacts

Western Ringtail Possum

Commonwealth Government (DEWHA 2009) guidance indicates that for Core Habitat (Area 1), within which the Proposal is located, there is a real chance or possibility of a significant impact on WRP for actions resulting in clearing of more than 0.5 ha in a remnant habitat patch, clearing more than 50% of a remnant habitat patch, and/or fragmentation of existing habitat linkages.

The Proposal will not result in clearing of a scale that could cause significant impacts to WRP populations, however the clearing will break the connectivity of a WRP corridor which could potentially result in fragmentation of existing WRP populations. Accordingly, mitigation is required to prevent significant impacts to WRP (see Section 4.4.6).

Black cockatoos

The Proposal will not result in a significant impact on Black Cockatoo species as the vegetation to be cleared does not comprise significant habitat for the species. The Reconnaissance Survey assessed the potential for impacts based on guidance by the Australian Government (DSEWPaC 2011) and concluded that the Proposal poses a low risk of significant impacts to Black Cockatoos (Ecosystem Solutions, Appendix 3).

Waterbirds

Without implementation of construction controls and design measures the Proposal is likely to have adverse impacts on water quality downstream, which has the potential to impact migratory waterbirds known to be utilising wetlands downstream.

The areas to be cleared and infilled are not expected to comprise significant waterbird habitat as they dry out in the summer and autumn and are expected to be used on an occasional or opportunistic basis compared to the higher value wetland habitats located downstream of the Old Butter Factory and in the Vasse Estuary.

4.4.6 Mitigation

Western Ringtail Possum

To maintain habitat connectivity, the Proposal design incorporates a possum over-pass (rope bridge) and vegetated underpass (1 in 2 slopes) on the north and south banks of the Vasse River, complimented with planting of understorey native vegetation in a strip approximately 2 m wide along the north bank of the river between the Proposal and Causeway Road. Revegetation within the underpass and northern foreshore will consist of native species Sword Sedge (*Lepidosperma gladiatum*) to encourage native fauna to use the underpass and deter predators.

To replace lost habitat trees, revegetation will be undertaken through planting of at least two Peppermint trees for every tree cleared (at least 34 Peppermint trees). The Peppermint trees will be planted preferably along, and no more than 100 m from, the Lower Vasse River and Vasse River Delta Wetlands to provide replacement habitat for the local WRP populations.

Traffic signs will be placed at the new roads north and south of the new bridge to warn motorists of potential fauna crossing, to reduce the potential for mortality of WRP crossing the new road.

Street lighting along the new road and bridge will be shuttered to reduce light spill to adjacent woodland and the underpass on the north and south banks.

A Construction Environmental Management Plan (CEMP; see Appendix 7) will be implemented, including engagement of a fauna spotter / carer during clearing operations to prevent potential impacts on animals.

Black cockatoos

Given that the Proposal will not result in a significant impact on Black Cockatoo habitat or populations no mitigation measures are proposed.

Waterbirds

The following mitigation measures are proposed to manage potential impacts on waterbirds:

- the CEMP (Appendix 7) includes spill response procedures and erosion/sediment controls (e.g. silt fences/curtains) to prevent water quality impacts on the Lower Vasse River and Vasse River Delta Wetlands
- the existing Butter factory weir boards, located downstream of the Proposal, will be kept in the same location, so that if a spill occurs the weir can be used to capture spills using absorbent booms/skimmer pumps
- ASS and (if present) MBO will be managed through implementation of approved management plans (see Section 4.3.6) to prevent water quality impacts to waterbird habitat
- the new road and bridge will drain away from the Vasse River and into biofiltration gardens that will treat and infiltrate stormwater and capture spills if these occur on the road and bridge
- the river banks below the bridge will be thickly vegetated with Sword Sedge to minimise erosion and scour
- establishment of a future shared use path on the western side of the new road, discouraging access by people and domestic animals to wetlands to the east.

4.4.7 Predicted outcome

Based on the proposed mitigation measures for WRP and waterbirds, and the lack of significant habitat for Black Cockatoos, the Proposal is not expected to cause significant impacts to biological diversity or ecological integrity.

According, it is expected that the EPA objective for terrestrial fauna will be met.

4.5 Key environmental factor 4 - Hydrological processes

4.5.1 EPA objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016) identifies the following objective for hydrological processes:

- To maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.

4.5.2 EPA policy and guidelines

The hydraulic modelling that has informed the planning of the Proposal have been conducted in accordance with the Environmental Factor Guideline: Hydrological Processes (EPA 2016).

4.5.3 Receiving environment

The Proposal lies over and adjacent to the Lower Vasse River, a key tributary of the Vasse-Wonnerup estuarine system. The Vasse-Wonnerup system is highly regulated by weirs and culverts (WSP 2017). Upstream flows into the Lower Vasse River flows managed through the Vasse Diversion Drain penstock, which diverts nutrient rich first flush and peak flood flows away from the river. The VDD penstock is located approximately 4 km to the south-east of the Proposal. A weir near the Old Butter Factory approximately 150 m downstream of the Proposal retains water in the river during the summer and autumn period.

There are a number of existing bridges and obstructions on the Lower Vasse River, including the Strelly Street Bridge, Causeway Bridge, railway footbridge and Butter Factor weir (WSP 2017).

DWER have developed hydrological and hydraulic models and undertaken comprehensive analyses for the Vasse-Wonnerup system to assess scenarios likely to improve water quality and ecological health of the estuaries. These have been documented in the draft report *Reconnecting rivers in the Vasse Geographe catchment* (DWER 2016) the final report for which has yet to be released.

The DWER hydraulic model developed for the Vasse-Wonnerup system has been adapted to model the hydraulic impact of the Proposal on peak water levels and velocities during flood events in the Lower Vasse River (WSP 2017, see Appendix 8).

4.5.4 Potential impacts

The Proposal has potential to cause an increase in water levels (afflux) and flow velocities in the Lower Vasse River due to constriction and/or obstruction of flood flows through the new bridge structure. The increased water levels have potential to increase flood risk upstream of the Proposal, while increased flow velocities have potential to cause scour and erosion on the river banks.

The Proposal will involve a small scale of excavation (up to 2 mbgl and 500 m^3 total volume) and dewatering (approximately 2 L/s and up to 5000 m^3 total volume) during construction, which will temporarily lower groundwater levels in the vicinity of construction works.

4.5.5 Assessment of impacts

Hydraulic modelling was undertaken to predict the effect of the Proposal on peak water levels and velocities during the 1 in 100 year average recurrence interval (ARI) flood event (WSP 2017, see Appendix 8).

The hydraulic modelling indicates that the Proposal would result in an afflux during the 1 in 100 year ARI event of up to 16 mm between Causeway Bridge and the Proposal, up to 10 mm upstream of Causeway Bridge, and 0 mm downstream of the Proposal. These levels of afflux are negligible and within the error range of the hydraulic model. Accordingly, the Proposal is not expected to cause significant flood impacts either upstream or downstream of the new bridge.

The hydraulic modelling indicates that the Proposal would result in a peak velocity of 0.38 m/s through the new bridge and 0.95 m/s through the Causeway Bridge during a 1 in 100 year ARI event. By comparison, the existing Causeway Bridge is predicted to experience a peak velocity of 0.92 m/s during a 1 in 100 year ARI event. The Proposal is thus expected to cause a small increase in the peak velocity through the Causeway Bridge and a lower velocity through the new bridge, which is due to the new bridge having a larger span (22 m) compared to the Causeway Bridge (5.4 m) and thus producing less constriction of river flows. The Proposal is therefore not expected to significantly increase flow velocities in the river.

The risk of scour and erosion on the new bridge is expected to be low, due to the wide span and lower velocities compared to the Causeway Bridge, as well as the planting of Sword Sedge along the banks to promote fauna passage (see Section 4.4).

The Proposal will involve a small scale of excavation and dewatering during construction, which is not expected to cause a significant impact to the groundwater regime of the area. The small scale of dewatering for construction exempts the Proposal from the requirement for a groundwater abstraction licence under the *Rights in Irrigation and Water Act 1914*.

4.5.6 Mitigation

The Proposal is not expected to cause significant changes to peak river levels or velocities during flood events, nor significant impacts to the groundwater regime, and no mitigation measures are proposed.

4.5.7 Predicted outcome

The Proposal will maintain the hydrological regime of the Lower Vasse River and the local groundwater aquifers and therefore not have a significant impact on hydrological processes. According, it is expected that the EPA objective for hydrological processes will be met.

4.6 Key environmental factor 6 – Inland waters environmental quality

4.6.1 EPA objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016) identifies the following objective for inland water environmental quality:

- To maintain the quality of groundwater and surface water so that environmental values are protected.

4.6.2 EPA policy and guidelines

The inland water quality investigations that have informed the planning of the Proposal have been conducted in accordance with the Environmental Factor Guideline: Inland Waters Environmental Quality (EPA 2016).

4.6.3 Receiving environment

For the purposes of EIA, the EPA defines the factor Inland Waters Environmental Quality as:

> *The chemical, physical, biological and aesthetic characteristics of inland waters.*

Accordingly, this section addresses water quality, aquatic ecology and aesthetics of the Lower Vasse River and Vasse River Delta Wetlands that lie over and adjacent to the Proposal.

Lower Vasse River and Vasse River Delta Wetlands

Flows in the Lower Vasse River are artificially controlled through the Vasse Diversion Drain penstock upstream, and the weir downstream near the Old Butter Factory.

The penstock and weir are operated by the City of Busselton to control water quality and water levels in the Lower Vasse River (G. Simpson, [City of Busselton] 2017, pers. comm. 6 September). The penstock is closed for approximately two weeks a year in May/June to divert the nutrient rich first flush into the Vasse Diversion Drain (VDD), which discharges directly into Geographe Bay approximately 2.2 km to the west of the Proposal. The penstock is also closed during large flood events when the Lower Vasse River levels are high, to prevent flooding in Busselton town. The VDD diverts much of the runoff from the Upper Vasse River and Sabina Rivers away from the Lower Vasse River and into Geographe Bay.

The weir boards near the Old Butter Factory are installed in November and remain in place until early May, to impound water during the summer and autumn. The weir boards are removed in May to release river flows and urban runoff during the winter and spring, preventing flooding and allowing flushing of nutrient rich water and sediment.

The Lower Vasse River has been dredged approximately 40 to 50 years ago and now intersects groundwater during the summer and autumn (G. Simpson, [City of Busselton] 2017, pers. comm. 6 September). Due to the controlled flows and altered bathymetry the Lower Vasse River functions hydrologically more like a lake than a natural river system.

A large volume of flocculent sediment has accumulated in the river bed and these stores release additional nutrients to the river system during summer (GoWA 2010). The river has experienced regular blooms of toxic phytoplankton in summer for many years: common species are *Microcystis* and *Anabaena* (Paice 2005). Summer conditions promote algal growth because the water in the river is warm and still. Seasonal odour arising from the decomposition of algae has long been a problem in the river. Loss of amenity has also occurred due to restrictions in recreational contact when toxic species of phytoplankton are present. Such occurrences have disrupted traditional festival activities in the town that involved the river (GoWA 2010).

The Lower Vasse River has been identified as exceeding criteria for both phosphorous and nitrogen and contributing a disproportionately large share of the nutrient load to the Vasse-Wonnerup Wetlands given its small catchment size (GoWA 2010).

The City of Busselton is coordinating implementation of projects to improve water quality and long-term management of the Lower Vasse River, including nutrient reduction trials and upgrading of urban stormwater and drains. Options considered include dredging nutrient rich sediments and infilling to raise the river bed to its natural level to create ephemeral water conditions or a series of pools during summer and autumn rather than the current extended lake-like condition (G. Simpson, [City of Busselton] 2017, pers. comm. 6 September).

The Vasse River Delta Wetlands are immediately downstream of the Lower Vasse River and form the geomorphic interface with the Vasse Estuary. The Vasse River Delta Wetlands are expected to have been subject to tidal / salt water inundation in the past, as evidenced by the presence of samphire, however since 1908 tidal / salt water flows have been restricted by the Vasse Estuary surge barrier downstream. Although the surge barrier is opened to allow salt water flows into the Vasse Estuary during summer, the estuary water levels are maintained below the elevation of the Vasse River Delta Wetlands and so the fringing wetlands dry out the summer and autumn. The main water body of the wetlands that lies between the Butter Factor weir and Ford Road retains water through the summer and autumn and is a known habitat for waterbirds.

Geomorphic wetland mapping for the Swan Coastal Plain indicates that the northern portion (approximately 20%) of the Development Envelope adjacent to the Lower Vasse River lies over a conservation category wetland and the remainder of the Development Envelope lies over a multiple use wetland.

Vasse-Wonnerup wetlands

The Proposal is approximately 1 km upstream and west of the Vasse-Wonnerup wetlands Ramsar site. The Vasse-Wonnerup system is an extensive, shallow, nutrient-enriched wetland system of highly varied salinities and hydroperiods (i.e. flooded in winter, with large areas drying out in summer). The system is fringed by samphire and rushes with some melaleuca woodlands on higher ground.

The wetlands are of national and international importance and are justified as a Ramsar wetland on the basis that they meet two of the nine criteria:

- Criterion 5: More than 33,000 waterbirds have been counted at the Vasse-Wonnerup System. Waterbird data indicate that more than 20,000 waterbirds use the Ramsar site each year suggesting that the wetland regularly supports 20,000 waterfowl. This includes species such as Red-necked Avocets, Banded and Black-winged Stilts, Wood Sandpiper, Sharp-tailed Sandpiper, Long-toed Stint, Curlew Sandpiper and Common Greenshank
- Criterion 6: At least 1% of the Australian population of Black-winged Stilt and at least 1% of the world population of Red-necked Avocet use the Vasse-Wonnerup System most years.

The wetland system is highly modified with diversion of flow from several of the rivers, surge gates at the exits of both estuaries and high nutrient runoff from the catchment. Despite their high ecological values, the wetlands are characterised by poor water quality in the summer months resulting in reduced visual amenity and increased risk of algal blooms, noxious odours and fish deaths.

Aquatic fauna

The Lower Vasse River was surveyed in 2003 and 2004 to determine the distribution and abundance of fish (Morgan and Beatty 2004). Sampling upstream and downstream of the Proposal recorded common fish species, including native freshwater western pygmy perch (*Edelia vittata*) and nightfish (*Bostockia porosa*), and estuarine Swan River goby (*Pseudogobius olorum*) and western hardyhead (*Leptatherina wallacei*). No threatened fish species were recorded during the surveys. The surveys identified the Lower Vasse River to be heavy infested with introduced mosquitofish (*Gambusia holbrooki*) and goldfish (*Carassius auratus*) which have become established due to the heavily altered riverine habitat and flow regime (Morgan and Beatty 2004).

Survey in 2008 identified the presence of Carter's Freshwater Mussel (*Westralunio carteri*) in the Lower Vasse River (Lymbery et al 2008). The species was recently listed as Vulnerable under the WC Act. Accordingly, a baseline assessment of the species was undertaken at the Proposal bridge site (Beatty et al 2017, see Appendix 9). The assessment identified the mussel as being present at the new bridge site and at reference sites located upstream and downstream. Mussel density was greater at the new bridge site than reference sites, possibly due to a preference for occupying habitats adjacent to bridges (e.g. the nearby footbridge). The assessment concluded that the population in the Lower Vasse River is self-maintaining and the Proposal bridge site contributes significantly to the viability of the population by providing preferred habitat.

4.6.4 Potential impacts

The Proposal may result in potential impacts to water quality within the Lower Vasse River and the Vasse River Delta Wetlands and Vasse Estuary downstream of the Development Envelope. Potential impacts may occur due to construction activities and operations.

Construction activities may potentially impact water quality through:

- soil erosion and sediment from terrestrial areas
- excavation and suspension of riverine sediments increasing turbidity, release of nutrients and oxidation of MBO (if present)
- accidental spills of fuels or chemicals
- excavation and dewatering of ASS
- discharge of dewatering effluent.

Operation of the new bridge and road may potentially impact water quality through contaminated stormwater runoff and accidental spills of fuel, oil or chemicals (e.g. following vehicle accidents). The Proposal has potential to cause increased flow velocities in the Lower Vasse River due to constriction and/or obstruction of flood flows through the new bridge structure. The increased flow velocities have potential to cause scour and erosion on the river banks which may affect local habitat values and aesthetics.

Impacts to water quality may include reduced dissolved oxygen levels, increased turbidity, algal blooms, production of toxic metal sulphides, and increase heavy metal concentrations. The reduced water quality has potential to impact on the health of aquatic fauna of the Lower Vasse River, including native fish species and Carter's Freshwater Mussel, as well as the high value habitats for waterbirds within the Vasse River Delta Wetlands and Vasse Estuary downstream of the Proposal. Water quality and aquatic fauna impacts over the Lower Vasse River have potential to impact on the river and foreshore aesthetics and amenity.

Excavation of the river banks/bed for construction of abutments has potential to directly impact Carter's Freshwater Mussel living in the riverine sediments to be removed, as well as smothering of mussels in adjacent areas through suspension and deposition of sediments.

4.6.5 Assessment of impacts

The Proposal lies over the Upper Vasse River, which has aesthetic and amenity values as well as supporting a population of the threatened species Carters Freshwater Mussel. The Proposal also lies upstream of high value waterbird habitats within the Vasse River Delta Wetlands and Vasse Estuary. Water quality impacts have potential to impact on the values of these wetlands as well as causing direct impacts to Carters Freshwater Mussel during excavation of riverine sediments.

Based on the environmental values of the area, mitigation is required to prevent potential impacts to threatened species and waterbird habitat (see Section 4.6.6).

The risk of scour and erosion on the new bridge is expected to be low, due to the wide span and lower velocities compared to the Causeway Bridge, as well as the planting of Sword Sedge along the banks to promote fauna passage (see Section 4.4).

4.6.6 Mitigation

Water quality

The following mitigation measures to manage potential impacts on water quality are proposed:

- the CEMP (Appendix 7) includes spill response procedures and erosion/sediment controls to prevent water quality impacts on the Lower Vasse River, downstream wetlands and groundwater
- the existing Butter factory weir boards, located downstream of the Proposal, will be kept in the same location, so that if a spill occurs the weir can be used to capture spills using absorbent booms/skimmer pumps
- ASS and (if present) MBO will be managed through implementation of approved management plans (see Section 4.3.6) to prevent water quality impacts to the Lower Vasse River, downstream wetlands and groundwater
- the new road and bridge will drain away from the Vasse River and into biofiltration gardens that will treat and infiltrate stormwater and capture spills if these occur on the road and bridge
- the river banks below the bridge will be thickly vegetated with Sword Sedge to minimise erosion and scour.

The new bridge and road will be provided with barrier kerbs on either side. In the unlikely event of a major spill of fuel, oil or chemicals occurring on the bridge or road (e.g. following a vehicle accident) the barrier kerbs will contain the spill on the bridge deck or road pavement where it can be contained and cleaned up. Should spill volumes be great enough to exceed immediate spill response capability, the spills will enter side entry pits that discharge via underground pipes into biofiltration gardens. The biofiltration gardens will have capacity to retain spill volumes before overflowing into the river or wetlands. Should spills enter the stormwater system and biofiltration gardens the system/gardens will be pumped out and cleaned to remove the spill materials. The contaminated soil and vegetation will then be removed from the affected bio-filtration garden/s and the bio-filtration garden's reinstated with clean soil and new vegetation to maintain their primary function of stormwater treatment.

Carters Freshwater Mussel

Previous studies, including those for maintenance work on the Helena River pipehead dam (Klunzinger et al 2011) and the Serpentine River pipehead dam (Klunzinger et al 2012), have shown that mussels can be successfully translocated from impact sites and returned following disturbance.

Prior to any disturbance of the river banks or bed, an intensive translocation program of the mussels will be undertaken to mitigate the likelihood of impacts. A translocation site will be selected upstream where known suitable habitat exists and at sufficient distance to avoid any adverse conditions that may arise form construction works, such as elevated turbidity. The Upper Vasse River, in the vicinity of the junction with the Vasse Diversion Drain, would provide a suitable site for translocation as it supports a large, viable population of mussels and protection from public access (Beatty et al 2017, see Appendix 9).

Mussels will be maintained in cages within the translocation site, with weekly monitoring. Following completion of the Proposal construction phase, similar numbers of mussels will be relocated to the sites they were collected to avoid density dependent impacts on the population and ensure the ecosystem services provided by the species are maintained on the impact site. Prior to relocation, the water quality of the Proposal bridge site will be monitored to ensure that conditions are suitable prior to the mussels being released.

Translocation of the mussel will require a Regulation 17 Licence under the WC Act and Wildlife Conservation Regulations 1970 (administered by DBCA), as well approval for exemption from recreational bag limits under the *Fish Resources Management Act 1994* (administered by Department of Primary Industries and Regional Development). A draft translocation proposal to support the Regulation 17 Licence application has been prepared (see Appendix 10), outlining procedures, success criteria, monitoring and ethics.

4.6.7 Predicted outcome

Based on the proposed mitigation measures for water quality in the Upper Vasse River and downstream wetlands, and the proposed translocation of Carters Freshwater Mussel during construction, the Proposal is not expected to cause significant impacts to the quality of groundwater and surface water.

According, it is expected that the EPA objective for inland waters environmental quality will be met.

4.7 Key environmental factor 7 – Social surroundings

4.7.1 EPA objective

The EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2016) identifies the following objective for social surroundings:

- To protect social surroundings from significant harm.

4.7.2 EPA policy and guidelines

The social surroundings investigations that have informed the planning of the Proposal have been conducted in accordance with the Environmental Factor Guideline: Social Surroundings (EPA 2016).

4.7.3 Receiving environment

Social Surroundings include aesthetic, cultural, economic and social surroundings of humans that could affect or be affected by physical or biological surroundings.

Aesthetic, economic and social

As presented in Section 2.4 and Figure 4, the Proposal is located Proposal is located in the Busselton urban area and is surrounded by residential and commercial properties to the north and south-west, with City of Busselton administration offices located approximately 160 m to the west. The main Busselton central business district (CBD) is located approximately 250 m north-west of the Proposal.

Recreational areas in the vicinity of the Proposal include the Lower Vasse River foreshore utilised as Public Open Space; comprising Arthur and Norah Breeden Park on the north bank and Rotary Park on the south bank. Rotary Park includes a children's playground, river viewing platform and grassed areas; the foreshore planted with native vegetation. Arthur and Norah Breeden Park includes a footpath, stands of Peppermint trees over grassed areas; with an open parkland style foreshore. The two parks and nearby wetland and riverine areas were planted with native vegetation in the 1990s and 2003/04, including within the Proposal Development Envelope.

The two parks are connected by footpaths that connect with the Causeway Bridge and footbridge, which form part of the Vasse River Trail section of the City of Busselton Wetland Walks and Trails (Figure 8). The Vasse River Trail connects to the Vasse River Delta Wetlands Trail to the east, New River Trail to the west, and trails to the south along the Lower Vasse River upstream of the Causeway Bridge.

Figure 8: Busselton Wetland Walks

Source: City of Busselton

Cultural heritage

An Aboriginal Heritage Survey was undertaken by Brad Goode & Associates in July 2017 (see Appendix 11). The survey included ethnographic and archaeological surveys and concluded that there were no Aboriginal heritage sites (registered or otherwise) over the Lower Vasse River in the vicinity of the Proposal. The New River registered Aboriginal heritage site (Id 16807) lies upstream and approximately 350 m to the southwest of the Proposal.

During the ethnographic survey, Aboriginal representatives requested that (Brad Goode & Associates 2017):

- a span bridge design be utilised as it is defined to be the most culturally appropriate
- cultural monitors be present during the works which will impact upon the river in order to mitigate any spiritual disturbances arising as a result of the works.

There are two state heritage sites in the vicinity of the Proposal, both of which are protected under the *Heritage of Western Australia Act 1990* (see Figure 4):

- St Mary's Anglican church, graveyard and hall (Place number 18163, 18162 and 402) approximately 120 m to the west
- Old Butter Factory (Place number 3568) approximately 125 m to the east.

4.7.4 Potential impacts

Aesthetic, economic and social

The Proposal construction activities may cause potential impacts on aesthetic, economic and social values due to:

- dust emissions and deposition
- noise and vibration from machinery
- construction waste such as litter and debris
- construction vehicle traffic including heavy vehicles supplying materials
- impacts to water quality and aquatic fauna (see Section 4.6)
- restricted access to Rotary Park due to construction works and temporary laydown area
- restricted access to portions of river foreshore during construction
- reduced parking at Rotary Park due to construction vehicles.

Sources of vibration will include pile driving (for bridge construction), vibratory rollers (for pavement construction) and heavy vehicle movements. No rock breaking or bulldozer ripping is required for the construction, which will occur over soft ground. Vibration has potential to disturb occupants and contents of buildings (e.g. rattling, shaking or movements) and result in cosmetic or structural damage to buildings.

The Proposal may cause ongoing potential impacts on aesthetic, economic and social values due to:

- creation of a new bridge across the Lower Vasse River foreshore and associated visual amenity impacts and disruption to existing pedestrian access routes along the river
- noise and traffic from vehicles using the new road and bridge
- changes in traffic patterns within Busselton.

Heritage

The Proposal is not expected to impact on any Aboriginal heritage sites protected under the *Aboriginal Heritage Act 1972*.

Potential impacts on St Mary's Anglican church and Busselton Butter Factory State heritage sites from Proposal construction activities include:

- dust deposition
- vibration causing cosmetic or structural damage to buildings
- parking of vehicles alongside or within the heritage sites
- construction waste such as litter and debris.

4.7.5 Assessment of impacts

Construction activities

Construction activities will extend over a period of 12-18 months and occur from 7:00 am to 7:00pm Monday to Friday. There is thus potential for impacts to aesthetic, economic and social values to occur over an extended period, including nuisance from dust, noise, traffic and parking.

The severity and frequency of impacts to social surroundings north of the river (e.g. along Peel Terrace) will be significantly reduced through locating the construction compound off Causeway Road and Rotary Park and constructing the bridge deck from the southern bank. This will reduce construction emissions north of the river and construction traffic using the Causeway Bridge and Peel Terrace. However, some construction activities and traffic will be required north of the river to construct the northern bridge abutments, new road and roundabout on Peel Terrace.

Due to the proximity of the construction site to residential and commercial areas and the recreational usage of the Lower Vasse River, mitigation is required to minimise the nuisance and inconvenience to residents, businesses and visitors during the construction period.

Vibration

Approximate vibration levels for construction equipment are presented in Table 9 (Department for Transport, Energy and Infrastructure [DTEI] 2007).

Table 9: Approximate vibration levels for construction equipment

Equipment	Approximate vibration levels
Vibratory rollers	Up to1.5 mm/s at distances of 25 m
Pile driving	1-3 mm/s at distances of 25-50m depending on soil conditions and pile driver energy
Heavy vehicles over irregular surfaces	0.1-2 mm/s at distances of 10-20 m

Vibration levels of 1 mm/s or more are noticeable, with 6 mm/s or more being strongly noticeable (DTEI 2007). Vibration levels exceeding 15-20 mm/s may result in cosmetic damage to un-reinforced or light framed buildings, with minor damage possible at vibration levels exceeding 30-40 mm/s (British Standard 7385-2:1993).

The closest buildings to the Development Envelope lie along Peel Terrace and Cammilleri Street. These buildings will lie within 15-50 m of vibratory rolling for construction of road pavements, and within 60-70 m of pile driving for abutment construction on the north bank of the river. State heritage listed buildings lie within 120 m of the construction area.

Based on the vibration levels presented in Table 9, the construction activities are expected to result in noticeable vibration levels for occupants of the closest buildings. Vibration levels in nearby buildings are expected to be well below the level at which cosmetic or minor damage could occur to buildings. Vibration is not expected to cause cosmetic or minor damage to State heritage listed buildings.

Aesthetics during operations

The Proposal will create a second bridge across the Lower Vasse River foreshore, on the eastern side of the footbridge which does not have formal footpath access at present and is expected to be subject to a lower level of pedestrian access than the foreshore area west and south of the footbridge. The Proposal will maintain pedestrian access to the west and south of the footbridge, with a shared use path on the western side of the new road which will connect to shared use paths along Causeway Road and Peel Terrace (see design drawings in Appendix 2).

The Proposal bridge design is a conventional, low rise span bridge of similar visual character as the existing Causeway Bridge. The elevation of the bridge deck has been limited to reduce visual impacts and elevation/earthworks of the adjacent Peel Terrace roundabout, while balancing the need to convey peak flood flows (see Section 4.5) and enable Main Roads personnel to undertake periodic safety inspections and load rating of the bridge as required to fulfil their statutory obligations.

The Proposal will be landscaped to maintain the existing visual character of the Lower Vasse River, including planting with Peppermint trees to retain habitat for Western Ringtail Possum (see Section 4.4) and planting native vegetation types (e.g. Flooded Gum and Paperbark woodland) equivalent to those being cleared (see Section 4.2)

Operational traffic

Traffic modelling has been undertaken to determine the changes to traffic flows predicted to occur upon development of the Proposal. The results of the traffic modelling are presented as vehicles per hour Table 10 and as a percentage of road capacity in Table 11. As shown in the tables, the Proposal will significantly reduce the forecast traffic flows in Causeway Road and Peel Terrace by diverting approximately one third of the traffic crossing Causeway Bridge onto the new bridge.

The Proposal will result in increased traffic in local streets to the north of the new bridge, particularly Cammilleri Street and Harris Road. However, traffic levels will well below the local roads' capacity and fall within the 1100 vehicle per hour threshold at which pedestrian crossing is affected (Department of Planning and Western Australian Planning Commission 2015). Accordingly, the Proposal is not expected to cause significant impacts to economic or social values associated with local road use.

4.7.6 Mitigation

The span bridge design is in accordance with the request from Aboriginal representatives participating in the ethnographic survey.

The CEMP (see Appendix 7) includes the following mitigation measures:

- notification of residents and business of construction activities and complaints phoneline
- complaints response process to ensure prompt response to all concerns and complaints throughout construction
- construction limited to between 7am and 7pm Monday to Friday, and Saturdays by exception
- dust monitoring and suppression (where necessary) with water sprays to prevent dust deposition on nearby buildings and grounds
- minimising access and parking for construction vehicles along Peel Terrace
- prohibiting construction vehicle parking, standing or verge access alongside the Old Butter Factory or St Mary's Church
- construction traffic and materials supply will be restricted to Causeway Road south of the river except for construction works that must be undertaken north of the river
- waste management, including litter control and use of designated bins for construction waste. Waste storage will be temporary and located in the laydown area adjacent to the Scout Hall
- spill response procedures and erosion/sediment controls to prevent water quality impacts on the Lower Vasse River.

A copy of the CEMP will be provided to the State Heritage Office for review (see Section 3.3) and the advice of the office will be incorporated into the final CEMP prior to construction works commencing.

Aesthetics during operations

Mitigation measures include:

- minimising elevation and visual intrusion of bridge as far as is practicable
- provision of shared use paths to maintain access to the west and south of the footbridge, and connecting to shared use paths on Causeway Road and Peel Terrace
- landscaping with native vegetation replacing the vegetation to be cleared, to maintain the existing visual character of the Lower Vasse River.

Operational traffic

No significant impacts are expected to social surroundings due to operational traffic and no mitigation measures are proposed.

4.7.7 Predicted outcome

Based on the low vibration levels expected at nearby buildings, an absence of Aboriginal heritage sites, the predicted range of traffic flows, and the proposed mitigation measures, the Proposal is not expected to cause significant impacts to aesthetic, cultural, economic and social values in Busselton.

According, it is expected that the EPA objective for social surroundings will be met.

Table 10: Forecast traffic flows (vehicles per hour)

	Nominal 2-way capacity	2016 – without Proposal		2016 – with Proposal		2026 – without Proposal		2026 – with Proposal		2036 – with Proposal	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Peel Terrace (Ford Rd end)	2,400	490	480	490	480	570	540	570	540	730	750
Peel Terrace (Queen St end)	2,400	670	620	70	200	680	850	300	370	390	450
Causeway Road (Queen St to Albert St)	2,800	790	1060	540	760	930	1190	830	1140	1130	1500
Albert Street (Queen St to Stanley St)	2,400	530	670	390	440	540	750	450	540	620	690
Causeway Road (Peel Tce to Southern Dr)	2,800	1290	1490	660	940	1490	1920	990	1350	1310	1740
Cammilleri Street	1,600	140	120	500	390	200	180	600	500	670	610
Brown Street	1,600	130	120	130	120	220	220	220	220	250	250
Harris Road	1,600	220	210	320	280	310	330	420	450	400	540
Stanley Place	1,600	280	210	130	230	170	150	190	350	210	380
Marine Terrace	1,600	140	140	140	120	160	170	90	130	190	250
Ford Road	1,600	170	110	80	90	200	130	90	80	230	180
Fairbairn Road	1,600	100	70	230	140	120	80	270	200	140	110
Kent Street	1,600	90	140	100	150	110	170	140	170	130	250
Adelaide Street	1,600	190	220	190	220	220	260	240	290	260	380
Causeway Road (Queen Street to Albert Street)	1,600	90	80	140	80	150	110	150	110	170	130

Table 11: Forecast traffic flows (percentage of capacity

Road	Existing		Existing + scheme		2026 (no scheme)		2026 + scheme		2036 + scheme*	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Peel Terrace (Ford Rd end)	20%	20%	20%	20%	24%	22%	24%	22%	30%	31%
Peel Terrace (Queen St end)	28%	26%	3%	8%	28%	35%	13%	15%	16%	19%
Causeway Road (Queen St to Albert St)	28%	38%	19%	27%	33%	43%	30%	41%	40%	54%
Albert Street (Queen St to Stanley St)	22%	28%	16%	18%	22%	31%	19%	23%	26%	29%
Causeway Road (Peel Tce to Southern Dr)	46%	53%	24%	33%	53%	69%	35%	48%	47%	62%
Cammilleri Street	9%	7%	31%	24%	13%	11%	37%	31%	42%	38%
Brown Street	8%	7%	8%	7%	14%	14%	14%	14%	15%	16%
Harris Road	14%	13%	20%	18%	19%	21%	26%	28%	25%	34%
Stanley Place	18%	13%	8%	14%	10%	10%	12%	22%	13%	23%
Marine Terrace	9%	9%	9%	7%	10%	11%	6%	8%	12%	15%
Ford Road	11%	7%	5%	6%	12%	8%	6%	5%	14%	11%
Fairbairn Road	7%	4%	14%	9%	8%	5%	17%	12%	9%	7%
Kent Street	6%	9%	6%	10%	7%	11%	8%	10%	8%	15%
Adelaide Street	12%	14%	12%	14%	14%	17%	15%	18%	16%	24%
Carey Street	6%	5%	9%	5%	9%	7%	10%	7%	10%	8%

Key

Percentage of road capacity
0-20%
21-40%
41-60%
61-80%
81-100%

5. Other environmental factors or matters

No other environmental factors established by the EPA for the purposes of environmental impact assessment were considered significant for the Proposal, as presented in Table 12.

Table 12: Assessment of other environmental factors

Environmental factor	Significance of impact
Benthic Communities and Habitat	The Proposal is not located adjacent to coastal areas. Impacts to riverine water quality are not expected to be significant.
Coastal Processes	The Proposal is not located adjacent to coastal areas. Impacts to riverine water quality are not expected to be significant.
Marine Environmental Quality	The Proposal is not located adjacent to marine areas. Impacts to riverine water quality are not expected to be significant.
Marine Fauna	The Proposal is not located adjacent to marine areas. Impacts to riverine water quality are not expected to be significant.
Landforms	The Proposal will involve a small scale of earthworks and will not result in significant impacts to landforms.
Subterranean Fauna	The Proposal will involve a small scale of excavation or groundwater drawdown that is not expected to cause significant impacts to subterranean fauna.
Air Quality	The Proposal will result in minor air emissions during construction which will be managed through a CEMP, and will not result in increased vehicle emissions in Busselton.
Human Health	The Proposal will not result in significant impacts to human health.

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