

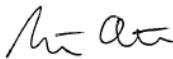


**Squibbs Road
Drainage Improvements,
Spreyton Tasmania**

FINAL

**Preliminary Documentation
(EPBC: 2017/7956)**

DOCUMENT INFORMATION

PROJECT TITLE	Sheffield Road – Road Safety and Flood Mitigation Upgrade
ORGANISATION	Devonport City Council (DCC)
PROJECT MANAGER	Mr Randell Stott, DCC
PROJECT REFERENCE	Squibbs Road – Drainage Improvements Preliminary Documentation (EPBC: 2017/7956)
REVISION STATUS	Revision 3.0
DATE:	12 August 2019
PREPARED BY: Signature:	DCC with the assistance of Van Diemen Consulting Pty Ltd  Richard Barnes
REVIEWED BY: Signature:	 Mr Randell Stott (DCC)
APPROVED BY: Signature:	 Mr Matthew Atkins (A/General Manager DCC)

Disclaimer

Whilst DCC have made every attempt to ensure the accuracy and reliability of the information and data provided, it is the responsibility of the data user to make their own decisions about the accuracy, currency, reliability and correctness of information provided. DCC, its employees, partners and agents do not accept any liability for any damaged caused by, or economic loss arising from, reliance on this information.

Declaration of accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both.

I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed 

Full name (please print) Matthew Atkins

Organisation (please print) Devonport City Council

Date 13/08/2019

CONTENTS

1. INTRODUCTION	1
1.1 SCOPE OF INFORMATION	1
1.2 DEVONPORT CITY COUNCIL	1
1.2.1 LOCATION	1
1.2.2 DEMOGRAPHICS	2
1.2.3 STRATEGIC PLAN 2009-2030	2
1.2.4 ORGANISATIONAL STRUCTURE	2
1.2.5 COMMITMENT TO THE ENVIRONMENT AND SUSTAINABILITY	3
1.3 SPECIALIST ADVICE AND ASSISTANCE	3
1.4 COMMUNITY CONSULTATION	3
2. ACTIVITY DESCRIPTION	4
2.1 PROJECT OVERVIEW	4
2.2 EXISTING DRAINAGE AT THE IMPACT SITE	4
2.3 DRAINAGE WORKS AT THE IMPACT SITE	4
2.4 CENTRAL NORTH BURROWING CRAYFISH AT THE IMPACT SITE	5
2.6 PROJECT LOCATIONS	10
2.6.1 IMPACT SITE	10
2.6.2 OFFSET SITE	10
2.7 PROJECT MANAGEMENT	11
2.7.1 DEVONPORT CITY COUNCIL	11
2.7.2 CONSTRUCTION CONTRACTOR	11
2.8 PROJECT TIMING	11
2.9 RELATIONSHIP TO OTHER ACTIONS	11
3. CONSTRUCTION AT THE IMPACT SITE	12
3.1 ESTABLISHMENT OF THE WORK AREA	12
3.3 DRAIN EXCAVATION AND BACKFILLING	13
3.4 CULVERT INSTALLATION	13
3.5 REHABILITATION	14
3.6 ROLES AND RESPONSIBILITIES FOR PLAN IMPLEMENTATION	14
3.6.1 PROPONENT	14
3.6.2 DCC SUPERINTENDENT	14
3.6.3 STAFF AND CONTRACTORS	15
4. EXISTING ENVIRONMENT AT IMPACT SITE	16
4.1 LAND USE AND TENURE	16
4.2 GEOLOGY AND SOILS	16
4.3 SURFACE WATER	16
4.4 VEGETATION	16
4.5 THREATENED FLORA SPECIES	16
4.6 THREATENED FAUNA SPECIES	16
4.7 WEEDS	16
5. RELEVANT PLANNING ASPECTS	17
5.1 LOCAL GOVERNMENT	17
5.2 STATE GOVERNMENT	17

5.2.1	LAND USE PLANNING AND APPROVALS ACT 1993.....	17
5.2.2	THREATENED SPECIES PROTECTION ACT 1995.....	17
5.3	COMMONWEALTH GOVERNMENT	17
5.3.1	ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 ...	17
6.	POTENTIAL EFFECTS ON MATTERS OF NES	19
6.1	SURVEYS.....	19
6.2	CENTRAL NORTH BURROWING CRAYFISH	19
6.2.1	BACKGROUND INFORMATION.....	19
6.2.2	SURVEY INFORMATION.....	21
6.2.3	SIGNIFICANT IMPACT ASSESSMENT	22
6.3	AVOIDANCE AND MITIGATION MEASURES FOR MNES	29
6.3.1	MEASURES FOR CNBC.....	29
6.3.2	MEASURES FOR OTHER MNES.....	29
7.	OFFSET REQUIREMENTS AND PLAN	34
7.1	OFFSET REQUIREMENT AND EPBC CALCULATOR	34
7.1.1	IF MORE OR LESS CNBC ARE TRANSLOCATED.....	34
7.1.2	CONFIDENCE	34
7.2	OFFSET LOCATION AND CHARACTERISTICS.....	34
7.2.1	LOCATION	34
7.2.2	LAND USE AND TENURE	35
7.2.3	GEOLOGY AND SOILS	35
7.2.4	SURFACE WATER.....	35
7.2.5	VEGETATION AND FLORA	35
7.2.6	FAUNA.....	35
7.2.7	WEEDS.....	35
7.3	OFFSET IMPLEMENTATION - MANAGEMENT PLAN.....	36
7.3.1	OBJECTIVES.....	36
7.3.2	OBJECTIVES.....	36
7.3.3	TERM	37
7.3.4	AREA TO WHICH MMOP APPLIES.....	37
7.3.5	RELATIONSHIP OF MMOP TO OTHER MANAGEMENT PLANS	37
7.3.6	FUNDING FOR MMOP	37
7.4	MONITORING OF TRANSLOCATION AREA	37
7.5	REMEDIAL ACTIONS AT OFFSET SITE	38
7.6	CONTINGENCY	38
7.7	REPORTING	38
7.8	REVIEW PROCESS.....	38
8.	REFERENCES	40

TABLES

Table 1: Species Identified by the EPBC Act Search Tool and an assessment of occurrence and impact at the Impact Site and Offset Site.....	23
Table 2: Potential impacts to Central North Burrowing Crayfish at the Impact and Offset Sites	30

Table 3. Impact avoidance and mitigation measures for Central North Burrowing Crayfish at the Impact and Offset Sites.....	31
--	----

FIGURES

Figure 1	Location of Squibbs Road Drainage Improvements (Impact Site)
Figure 2	Local Central North Burrowing Crayfish Records (NVA sourced data)
Figure 3	Central North Burrowing Crayfish Distribution (NVA range boundary)
Figure 4	Approximate Drainage Catchments of the Impact Site (Squibbs Road) and the Figure of Eight Catchment (Based on 5m contours and known drains)
Figure 5	Proposed Works (see also Drawing CS0055 – Attachment A) at Impact Site (Squibbs Road)
Figure 6	Detail of existing site drainage at the Impact Site (Squibbs Road)
Figure 7	<i>Engaeus</i> burrow locations in the Impact Site (Squibbs Road)
Figure 8	Detail of proposed drainage at the Impact Site (Squibbs Road)
Figure 9	Sediment management during construction at Impact Site (Squibbs Road)
Figure 10	Monitoring of Impact Site (Squibbs Road) and surrounds
Figure 11	<i>Engaeus</i> translocation area at Clayton Reserve (Offset Site)
Figure 12	Monitoring of translocation area at Clayton Reserve (Offset Site)

ATTACHMENTS

Attachment A	Engineering Drawings for Construction - Drawing CS0055
Attachment B	Environmental Management Procedures - Construction
Attachment C	EPBC Offset Calculator Sheet – Squibbs Road Drainage Improvements
Attachment D	Management, Monitoring and Offset Plan – Squibbs Road Drainage Improvements
Attachment E	Standard Operating Procedure - <i>Engaeus granulosus</i> translocation

ABBREVIATIONS / GLOSSARY

Abbreviation / Term	Definition
CEMP	Construction and Environmental Management Plan
CNBC	Central North burrowing crayfish (<i>Engaeus granulatus</i>)
DCC	Devonport City Council
DoEE	Department of Environment and Energy (Cth)
DPIPWE	Dept. of Primary Industries, Parks, Water and Environment (State)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act</i> 1999 (Cth)
Impact Site	That section of Squibbs Road defined in Figure 5
LUPAA	<i>Land Use Planning and Approvals Act</i> 1993 (State)
NES	National Environmental Significance
NVA	Natural Values Atlas (database maintained by DPIPWE)
MMOP	Management, Monitoring and Offset Management Plan
Offset Site	39 Clayton Drive, Sheffield (Title Reference 24071/361)
VDC	Van Diemen Consulting Pty Ltd
WONS	Weed of National Significance

1. INTRODUCTION

1.1 Scope of Information

This document has been prepared by the Devonport City Council (DCC) to provide additional information requested by the Department of Environment and Energy (DoEE) (EPBC Ref 2017/7956, decision dated 5 July 2017) for proposed road drainage improvements at Squibbs Road, Spreyton, Tasmania.

The DoEE determined that the project was likely to have a significant impact on a listed threatened species (sections 18 and 18A) protected under Part 5 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), being the Central North burrowing crayfish (*Engaeus granulatus*, CNBC).

Information provided in this document will be used by DoEE to assess the project under the EPBC Act by Preliminary Documentation.

This Preliminary Documentation is separated into sections which relate to the background of the action being taken, and include the following –

Section 1	Information about the applicant and information about information sources and consultation conducted by the applicant
Section 2	A description of the action being taken at the Impact Site, project management arrangements and environmental management measures to be applied to avoid, mitigate and offset relevant impacts to MNES
Section 3	Construction methods and processes at the Impact Site
Section 4	Information about the existing environment at the Impact Site
Section 5	Relevant statutory and planning matters for the project
Section 6	Potential effects to relevant MNES and avoidance and mitigation measures to impacts of relevant MNES
Section 7	Offset arrangements for the impact to CNBC at the Impact Site
Section 8	References

1.2 Devonport City Council

1.2.1 Location

The City of Devonport which is the administrative centre of the Devonport City Council sits on the banks of the Mersey River within Central North Tasmania's fertile Mersey and Forth valleys.

1.2.2 Demographics

The City of Devonport provides services to over 26,000 residents and functions as a north-west Tasmanian regional service centre for a large rural and semi-rural hinterland. This region includes the Councils of Latrobe, Kentish and Central Coast, in addition to Devonport.

Additional information on the community profile of DCC can be accessed at <http://www.devonport.tas.gov.au/Council/Our-City/Our-Vision>

1.2.3 Strategic Plan 2009-2030

DCC have developed a Strategic Plan for 2009-2030 to help focus and guide town planning, residential and commercial development, recreational activities, parks and infrastructure within the municipality.

The Vision of **Devonport's Strategic Plan 2009-2030** is -

“Devonport will be a thriving and welcoming regional City living lightly by river and sea

1. Strong, thriving and welcoming regional City - Devonport is a regional leader with a strong economy. It is a great place to live, work and play.
2. Valuing the past, caring for the present, embracing the future - We have been shaped by a rich cultural heritage and enthusiastically embrace present challenges and future opportunities.
3. Engaging with the world - We have an outward focus and send quality products and experiences to the world. We welcome all peoples to share our beautiful City and all it offers.
4. Living lightly by river and sea - We live lightly on our valued natural environment of clean rivers, waterways, beaches; rich agricultural land and coastal landscapes so future generations can also enjoy this special place.”

Of greatest relevance to this project is Goal 1 of the Strategic Plan:

Living lightly on our environment

Through the integration of sustainable practices, we will ensure Devonport's viability socially, economically and environmentally, preserving our natural geography and landscapes for future generations. Planned and sustainable management of energy, air, water and waste will assist in the delivery of a healthy environment.

1.2.4 Organisational Structure

Devonport City Council is a body corporate with perpetual succession and a common seal.

The Council is comprised of twelve Aldermen, each elected for a term of four years.

DCC is administered by a dedicated management team, comprising of three Portfolios. The three respective Portfolios are the General Manager's Portfolio; the Technical and Finance Portfolio; and the Customers and Community Portfolio. The leadership team oversee the efficient operation of Council. The General Manager has the ultimate responsibility for the effective management of Council's budget, its daily operations and implementation of Alderman's decisions.

1.2.5 Commitment to the environment and Sustainability

The proposed action will be conducted in accordance with the DCC *Environment Strategy* (see <http://www.devonport.tas.gov.au/Council/Publications-Plans-Reports/Council-Plans-Strategies>).

1.3 Specialist Advice and Assistance

Specialist advice and expertise has been sought in the preparation of this document and associated documents, which is consistent with the operational procedures of Council.

Specifically, information and advice has been sought from Van Diemen Consulting Pty Ltd on the environmental impact assessment process for the action – including the survey/assessment of the site for threatened species, communities and associated natural values, the application for permits from relevant authorities and the management of the action to mitigate impact to MNES.

1.4 Community Consultation

The drainage improvements are being made to provide for a safe road surface and associated drainage for the community of Squibbs Road and surrounds. The road as it exists now is unstable and may fail in the near future.

Local residents have been kept informed of the project and are supportive of the project being completed.

2. ACTIVITY DESCRIPTION

2.1 Project Overview

DCC proposes to make drainage improvements to a section of Squibbs Road in the locality of Spreyton (Figures 1 to 4) to improve road safety and mitigate flood risk in the area.

The *Squibbs Road Drainage Improvements* project will substantially improve the safety of road users, pedestrians and residents in this area of Spreyton. As the road is a geographically fixed entity there are no alternatives to the proposed action.

The capital cost of the road upgrade program is being met by the Devonport City Council.

Project Title: Squibbs Road – Drainage Improvements, Spreyton

Proponent: Devonport City Council (DCC) (ABN 47 611 446 016)

Customer Service Centre

137 Rooke Street, Devonport TAS 7310

2.2 Existing Drainage at the Impact Site

The Work Area (Figure 5) at the Impact Site has a drainage channel on the western side of its length – the channel follows Squibbs Road.

The drainage channel is scoured and, in many locations, eroded to bedrock. The channel is so deep in some sections that the road surface has been under-cut and is now at risk of collapsing into the drain. The depth of the drain is also unsafe if any driver was to leave the road and enter it – a situation that is possible given the narrow width of the road.

There is an existing culvert near a topographic low point that directs water from the western side of the road (uphill) to the eastern side of the road (downhill) as shown in Figure 6. Further northwards along Squibbs Road there is another existing culvert.

The Work Area at the Impact Site is approximately 0.11 hectares in size.

Plate 1 contains images that show the condition of the existing roadside drain and some of the damage that flooding has caused to the drain and associated road surface.

2.3 Drainage works at the Impact Site

The Works will not cause a change in water flow rate or direction along Squibbs Road and surrounds.

The Works will formalise the scoured drain alongside Squibbs Road and improve the slope and form of the embankment to improve drainage alongside the road formation to protect the road surface and sub-surface. Squibbs Road will also be slightly widened to improve the safety of road users which requires the drain to be moved slightly to the west as shown in the Technical Drawings (Attachment A).

The Works includes the installation of two new culverts (see Figure 7), one near a major inflow into the drain and the other will be for the outflow of the drain where it flows into a much larger drainage network. The culvert to be constructed at the lower (southern) end of the drain under Squibbs Road will be positioned such that it does not excessively drain water away from those areas which support burrowing crayfish outside the Work Area.

2.4 Central North Burrowing Crayfish at the Impact Site

The Central North burrowing crayfish (*Engaeus granulatus*, CNBC) is the only Matter of National Environmental Significance (MNES) present at the Impact Site.

The CNBC is endemic to the central north region of Tasmania (Figure 2). The range of the species has been expanded over the past 10 years as additional survey work has located new sub-populations (see Figure 3 for the known geographic range for the species) – the species may extend into the Tamar graben and towards Ulverstone, but this is yet to be verified with positive identifications of the species. Its stronghold is the Devonport – Spreyton – Latrobe region.

The CNBC is known to occupy various habitat types within its geographic range including seeps, tea-tree swamps, wet forest areas, wetlands and stream banks in relatively undisturbed habitats and roadside and agricultural drain networks. There are many recorded locations of the species in roadside drains, wet areas within pastures and in the yards of residential properties.

Figure 7 shows the observed burrowing crayfish locations within and near the Work Area at the Impact Site. The type of burrows present, and their general form are shown in Plate 2.

The greatest density of burrows occurs at the lowest topographic location in the landscape where there is a major drainage point for the road and nearby pastures. Burrows were also observed on the eastern side of Squibbs Road (outside Works Area) where there is a large and deep drain which continues southwards towards the junction of Squibbs and Bishops Roads.

Approximately 90 burrows occur in the Work Area – assuming half of the burrows are occupied by a crayfish (a reasonable proposition and is consistent with the approach adopted and approved for EPBC 2011/6095), there are about 45 CNBC animals potentially impacted upon by the works.

2.5 Project Objectives for Matters of National Environmental Significance

The objectives of the project in relation to the relevant MNES are to –

1. maximise the number of Central North burrowing crayfish successfully translocated from the Impact Site to the Translocation Area at the Offset Site; and to
2. minimise the impact to Central North burrowing crayfish external to the Work Area at the Impact Site.

The document *Management, Monitoring and Offset Plan – Squibbs Road Drainage Improvements* (MMOP) describes the management measures to avoid, correct and/or improve situations that may threaten or potentially threaten the successful outcomes of the project.

The MMOP includes an Operating Procedure (see also Attachment E of this document) to guide the CNBC salvage and translocation process.

The successes recorded for the translocation of CNBC to the Clayton Reserve (established under a plan '39 Clayton Drive, Spreyton – Offset Management Plan' that was prepared and approved for the project 'PIPING OF OPEN DRAIN AND TRANSLOCATION OF BURROWING CRAYFISH AT SHEFFIELD ROAD, DEVONPORT TASMANIA (EPBC REF: 2011/6095) from Sheffield Road demonstrates, in our view, the successful ability of DCC to plan, implement and report on actions which involves matters of NES. It also demonstrates

the ability of the CNBC to be translocated, if done correctly, to other locations where the animals and their future offspring can persist and thrive in the environment. Hence, the loss of CNBC animals that may occur during the works at the Impact Site is likely to be very low and those that are lost will be replaced by improving habitat at the Translocation Area in the Offset Site – causing a net effect of negligible impact (an impact that does not qualify as a ‘significant’ one under the criteria).

Plate 1. Squibbs Road existing drainage channels and culverts



Squibbs Road looking southwards from its corner that leads uphill towards Kelcey Tier. The existing drain (arrow) can be seen on the topside of the roadline.



Squibbs Road looking northwards from its corner which leads uphill towards Kelcey Tier. Water flows into the drainage channel are by surface flows and water directed to it by a culvert underneath the road surface. The blue dashed line shows the approximate location of the under-road culvert.



The drainage channel alongside Squibbs Road is scoured.



The area where water enters the under-road culvert is dominated by gravels and other sediments transported by flood waters.

Plate 2. Central North burrowing crayfish burrows/chimneys along Squibbs Road



Burrows of CNBC were observed in a few locations in the drain alongside Squibbs Road. There were very few burrows located in the northern section of it due to the lack of sediments/clay for the species to excavate within. It appears that flooding has eroded the clay base of the drainage channel such that burrows have been destroyed.



The northern section of the Work Area is a topographic high-point on Squibbs Road, with the low-point of the Work Area being at the southern end (arrow) where there is a large drainage channel on the eastern side of the road.



The pasture in the low point of the landscape supports numerous large chimneys (arrows) indicative of the CNBC.

2.6 Project Locations

There are two areas associated with the drainage improvements for a section of Squibbs Road at Spreyton in Central North Tasmania:

1. **Impact Site** - the Road Reserve and surrounds at Squibbs Road as delineated in Attachment A and Figure 5; and
2. **Offset Site** - 39 Clayton Drive, Spreyton (Title Reference 24071/361).

The Impact and Offset Sites relative to each other in the landscape are shown in Figure 3.

2.6.1 Impact Site

The Impact Site is the location where the action will take place, that is, the location of Squibbs Road where drainage improvements will be conducted. This area is delineated in Attachment A and shown in Figure 5. Access is directly from Squibbs Road.

2.6.2 Offset Site

The Offset Site is located at 39 Clayton Drive, Spreyton (Figure 11; Title Reference 24071/361). Access is via Clayton Drive (northern access to land).

The area of specific relevance to this project is the Translocation Area shown in Figure 11. It is this area that will be the focus of the project to create/improve habitat for CNBC and to translocate salvaged CNBC from the Impact Site to this area.

The document *Management, Monitoring and Offset Plan – Squibbs Road Drainage Improvements* (MMOP) has been prepared to provide management measures to avoid, correct and/or improve situations which may threaten or potentially threaten the successful outcomes of the translocation aspect of the project. The MMOP includes an Operating Procedure (see also Attachment E of this document) to guide the CNBC salvage and translocation process.

The remainder of Clayton Reserve will continue to be managed under the existing management plan – ‘39 Clayton Drive, Spreyton – Offset Management Plan’ that was prepared and approved for the project ‘PIPING OF OPEN DRAIN AND TRANSLOCATION OF BURROWING CRAYFISH AT SHEFFIELD ROAD, DEVONPORT TASMANIA (EPBC REF: 2011/6095)’.

2.7 Project Management

2.7.1 Devonport City Council

The DCC is responsible for:

- the implementation and management of the project in accordance with the Preliminary Documentation and associated plans and strategies;
- all monitoring and reporting associated with the project; and
- ensuring that all the conditions of the approval are met.

The Squibbs Road Drainage Improvements project will be managed by a Project Superintendent with input from other DCC staff and suitably qualified external contractors.

2.7.2 Construction Contractor

A Contractor will be appointed for the Works through a Tender process.

The Contractor will be made aware of the requirements of the project and specifically those that relate to EPBC2017-7956.

Permit conditions and associated work measures to protect, salvage and translocate CNBC from the Impact Site to the Offset Site will be required to be inserted into the Environmental Management System of the Contractor. Proof of this will be required by DCC as part of its assessment and awarding of the contract of works.

2.8 Project Timing

Works are scheduled for spring 2019 to minimise the risk of construction occurring in wet soil conditions.

The Works should be completed within three months from their commencement and no staging is proposed.

2.9 Relationship to other Actions

The Squibbs Road Drainage Improvements project is not related to any other Action.

There are no subdivisions, applications for the conversion of land to residential use or any other roadworks in the immediate vicinity of the Impact Site.

3. CONSTRUCTION AT THE IMPACT SITE

3.1 Establishment of the Work Area

The Work Area is required to accommodate construction activities, materials storage and soil stockpiles (see Attachment A). Temporary fences or marking tape (blue) will be used to identify retained trees, existing cables, pipes and drains that are not to be disturbed during construction.

The exclusion zone depicted in Figure 9 will be marked in the field by a suitably qualified ecologist using easily identified tape and markers. The location of the exclusion areas will be included within the induction process prior to any earthworks occurring.

Sediment traps comprised of straw bales and/or silt netting will be erected on relevant drains (See Figure 9) to provide an effective sediment control barrier in the event of sediment release into the drainage network.

3.2 Environmental Management Procedures (EMPs)

Environmental management procedures will be implemented at the Impact Site as specific construction procedures.

The EMPs (Attachment B) are as listed below –

- **EMP 1:** Disturbance to Terrestrial and Aquatic Flora and Fauna
- **EMP 2:** Working near waterways and drains
- **EMP 3:** Erosion, Sedimentation and Surface Run-off
- **EMP 4:** Aboriginal Artefacts – Unanticipated Discovery Plan
- **EMP 5:** Weed and Pathogen Control

To enable the EMP's to be implemented effectively, particularly in areas where threatened fauna may be present, a suitably qualified person (Environmental Officer or similar) will be present on site during the excavation of the drains. This person or their suitably qualified delegate will also be responsible for the recovery and translocation of CNBC from the Impact Site to the Offset Site in accordance with the Operating Procedure (Attachment E).

The handling of CNBC will be undertaken by an appropriately trained person with the necessary permits to 'take' protected wildlife as per the MMOP.

The EMPs include measures to achieve the following:

- the topsoil will be appropriately reinstated when the trench is backfilled, with excess removed from the site for use at a suitable DCC operated landfill;
- sediment control equipment will be installed to minimise any suspension of sediment and prevent unacceptable contamination to waterways or drainages;
- materials handling and storage will be restricted to DCC - Contractor agreed lay-down areas;

- all products and chemicals classified as dangerous or hazardous will be handled, labelled, stored and disposed of in accordance with Dangerous Goods regulations;
- if shallow groundwater is intersected, appropriate control methods will be used to ensure that environmental disturbance is minimised and that any intersected water is prevented from directly entering drains or waterways, and
- the contractor will adhere to wash down requirements as specified in *'Keeping It Clean – A Tasmanian Field Hygiene Manual to prevent the spread of freshwater pests and pathogens'* to control the spread of weeds and pathogens within the site and to minimise the risk of introducing new species to the site.

3.3 Drain Excavation and Backfilling

Heavy machinery such as an excavator will be used to remove topsoil, excavate the drains and backfill trenches once pipes and materials (rock, gravel, geotextile fabric etc.) have been installed. Trucks will be used to transport gravel and rock products from stockpiles to the Work Area.

Soil and erosive materials will –

- a. not be stored within 10 m of a drain inlet, culvert or watercourse.
- b. Not be stored in the exclusion zone shown in Figure 9.

Excess excavated soil and rock not needed to backfill and contour the roadside verge for revegetation will be removed from the Work Area and disposed of at a suitable DCC operated landfill.

3.4 Culvert Installation

There are two existing culverts in the Work Area that go underneath Squibbs Road (Figure 6). The northern culvert flows under Squibbs Road and directs water from a series of residential driveways into the drain on the western side of Squibbs Road. This culvert will be extended at its southern extent to connect to the new pipework being installed in the drain.

The southern culvert directs water from a wet soak/drainage line into the open drain on the eastern side of Squibbs Road.

Environmental management objectives for the installation of culverts are as follows:

- minimise the release of sediment or suspended solids during culvert removal;
- minimise the release of sediment or suspended solids during culvert installation;
- minimise disturbance and erosion of the watercourse bed and banks;
- avoid significant disruptions to water flow; and
- minimise impacts on aquatic and water dependant species downstream of the site.

The Contractor is responsible for implementing site management actions to meet the objectives of the Environmental Management Procedures (see Attachment B) and any conditions applied through other statutory approvals.

Permit conditions and associated work measures to protect, salvage and translocate CNBC from the Impact Site to the Offset Site will be required to be inserted into the Environmental Management System of the Contractor. Proof of this will be required by DCC as part of its assessment and awarding of the contract of works.

A field supervisory regime will be in place whereby the DCC Project Superintendent will 'sign off' on the works completed by the Contractor. The ultimate responsibility for the correct and timely implementation of the conditions associated with the approval of this activity lie with the DCC.

3.5 Rehabilitation

Clean-up and restoration will be undertaken progressively during construction in the Work Area and with a final clean-up at project completion.

As drain works progress the Contractor will include removal of construction material and waste, and re-establishment of retaining walls, amenity plantings and grass (lawn grass). Replacement and grading of the topsoil layer will follow drain closure.

Fences, gates, driveways and other infrastructure disturbed by the construction activities will be reinstated.

Erosion control measures to minimise run-off and sedimentation of completed works prior to seeding or replanting with pasture species will be determined on a case by case basis. Higher risk areas identified as a result of specialist advice and detailed engineering design will have specific erosion control measures implemented applicable to the site. This may include sediment netting, straw barriers and geo-textile materials. All measures applied will remain in use until the DCC Project Superintendent deems them to be no longer necessary.

The monitoring of both (i) rehabilitation of the Impact Site and (ii) the colonisation of CNBC back into the Work Area is described in the *Management, Monitoring and Offset Plan – Squibbs Road Drainage Improvements*.

3.6 Roles and responsibilities for plan implementation

3.6.1 Proponent

The Devonport City Council (DCC) is responsible for:

- Ensuring that the DCC Superintendent is briefed on the requirements of the MMOP and its importance to the overall success of plan implementation;
- Ensuring that the MMOP is complied with, through regular assessments of the site and liaison with the DCC Superintendent;
- Ensuring that any variations to the MMOP are developed and provided to the DoEE and the Policy and Conservation Assessment Branch (DPIPWE) for approval prior to their implementation; and
- Ensuring that the legislative requirements to implement the MMOP have been met and are kept current, such as permits.

3.6.2 DCC Superintendent

The DCC Superintendent is responsible for:

- Ensuring that this Plan is complied with, implemented and reviewed from time to time as required;
- Ensuring appropriate reporting to the DCC or their representative on the implementation of this Plan. This will include any breaches and how they were recorded and addressed;
- Ensuring that reporting requirements and assessments of project success are initiated and completed on time;
- Ensuring that all staff working at the site are aware of the locations of underground and overhead services (maps and diagrams to be provided during induction) that may pose a safety risk to them in carrying out their assigned tasks; and
- Coordinating the training of staff and contractors in techniques for MMOP implementation.

3.6.3 Staff and Contractors

All staff and contractors that work within the site will be inducted and advised of the natural values within the site. They will also be inducted and advised of management requirements within the site to protect and enhance those natural values, including actions that are unacceptable (eg dumping of rubbish).

Staff and contractors are responsible for:

- Applying the management measures in the site for which they have received training; and
- Reporting to the DCC Superintendent any breaches of the MMOP as soon as practical, including provision of written details of the breach, and any measures that were taken to reduce the likelihood of any environmental harm.

4. EXISTING ENVIRONMENT AT IMPACT SITE

4.1 Land Use and Tenure

The DCC is the owner of the land upon which the action is to occur (it is a *local highway* within the meaning of the *Local Government (Highways) Act 1982*).

4.2 Geology and soils

The site is comprised of Permian mudstone bedrock with a shallow overlaying silty loam. Areas associated with the main channel of the creekline are deeply incised and have a muddy base. Permian mudstone derived soils are generally infertile and susceptible to erosion due to their paucity of clay content. No sites of geoconservation significance are known to occur at the site.

4.3 Surface Water

The Impact Site is within the Figure of Eight catchment which flows into the Mersey River estuary. Existing drainage within the site is shown in Figures 4 and 6.

4.4 Vegetation

The Impact Site is located within a peri-urban setting with a mosaic of agricultural land (improved pasture, orchards and crops), housing developments, hardwood plantations and remnant wet and dry native vegetation.

Native vegetation (absent from the Impact Site) in the surrounding area is generally limited to small areas (<1 hectare) on public land (such as State Forest) or remnants in paddocks, along waterways or within swampy areas that have remained uncleared and unimproved.

Most remnants are in poor condition with high numbers of exotic understorey species. Understorey species generally comprise pasture grasses, exotic herbs and woody environmental weeds including gorse, mirror bush, blackberry, Spanish Heath, blue periwinkle and horehound.

4.5 Threatened Flora Species

No plant species listed on the Tasmanian *Threatened Species Protection Act 1995* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* have been recorded within the Impact Site.

4.6 Threatened Fauna Species

The conservation significant fauna species in the Impact Site is the Central North burrowing crayfish which relies on habitats with prolonged wet areas and elevated groundwater levels during dry times.

4.7 Weeds

One species listed as a Declared Weed on the *Weed Management Act 1999* occurs at the Impact Site; blackberry (*Rubus fruticosus*).

5. RELEVANT PLANNING ASPECTS

5.1 Local Government

The Works at the Impact Site will require a permit to be issued by the DCC under the *Local Government (Highways) Act 1982* to authorise works in the road reservation associated with a local highway.

5.2 State Government

5.2.1 Land Use Planning and Approvals Act 1993

Provisions in LUPAA allow Local Government to regulate land use and development through planning schemes and the planning permit system.

The road upgrade and ancillary works at both the Impact and Offset sites are exempt from the Scheme and do not require any Development Applications or Planning Permits/approval.

5.2.2 Threatened Species Protection Act 1995

Under section 51 of the *Threatened Species Act 1995* it is an offence to knowingly take, destroy, injure, trade, keep or disturb listed flora or fauna without a permit. Threatened species gain this status because their abundance, range or habitat has been reduced or threatening processes are occurring that are likely to result in population reduction.

A permit issued by DPI/PWE to 'take' *Engaeus granulatus* will be needed to conduct works at both the Impact and Offset Sites because CNBC will be taken/handled.

5.3 Commonwealth Government

5.3.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's central piece of environmental legislation. The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. These are defined in the EPBC Act as matters of NES (National Environmental Significance).

The eight matters of NES to which the EPBC Act applies are:

- world heritage sites;
- national heritage places;
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed);
- nationally threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park, and
- nuclear actions.

The Squibbs Road Drainage Improvements project was referred under the EPBC Act in 2017. On 5 July 2017 DoEE determined that the project required assessment and approval under the Act by Preliminary Documentation because it appeared that the proposed action is

likely to have a significant impact on the following matters protected by the EPBC Act: Listed threatened species and communities (sections 18 & 18A).

The DoEE determined that the project was likely to have a significant impact on a listed threatened species (sections 18 and 18A) protected under Part 5 of the EPBC Act, being the Central North burrowing crayfish (*Engaeus granulatus*, CNBC).

6. POTENTIAL EFFECTS ON MATTERS OF NES

An assessment of the likelihood of impact from project actions to species identified by the DoEE search tool results is documented in Table 1.

Although the species listed in Table 1 were identified using the search tool the assessment of likelihood of impact was based on site surveys of the Impact and Offset Sites by qualified ecologists (Van Diemen Consulting) as well as existing knowledge and documented information about those species (eg existing known recorded locations stored within the NVA) in the region.

6.1 Surveys

The Impact Site is within a residential – agricultural landscape that lacks trees (and any form of native vegetation) in the Work Area. Plates 1 and 2 contain pictures of the landforms and vegetation present – it is agricultural land dominated by pasture herbs, grasses and pin rush. On that basis there was very little to survey for ecological values apart from the presence of *Engaeus* which was noted within the Impact Site by the occurrence of burrows. Burrows were counted and are spatially shown in Figure 7. The *Engaeus* species was not confirmed as CNBC because sampling is destructive – a conservative approach is to assume that it is CNBC and then confirm this once animals are excavated during earthworks.

Terrestrial mammals, such as the Tasmanian devil, spotted-tailed quoll and eastern barred bandicoot are all known to occur within the region.

6.2 Central North Burrowing Crayfish

6.2.1 Background Information

Central North burrowing crayfish (*Engaeus granulatus*) is a burrowing crayfish species that occupies seeps, tea-tree swamps, wet forest areas, wetlands and stream banks in relatively undisturbed habitats through to roadside and agricultural drain networks.

Several studies have been carried out on *Engaeus* species, covering geographic distribution, habitat partitioning and preferences, burrow structure, food, and other general ecology (Suter and Richardson 1977, Richardson and Swain 1980, Horwitz *et al.* 1985a, b, Horwitz 1986, Richardson and Horwitz 1987, Nelson 2003 cited on EPBC Act Webpage).

Nelson (<http://www.disjunctnaturalists.com/articles1/crayfish.htm>) notes:

‘Devonport may once have been a significant habitat area for the species, because it very likely had many springs, streams and tea tree swamps. These were drained and cleared as the town grew and eventually became a city. The springs and streams have been diverted into storm drains that empty into the Don and Mersey Rivers. Latrobe also appears to have been a population centre for the crayfish, as there are a number of small remnant areas where they still occur, even within the town. The Kings Creek which still flows above ground through the town into the Mersey River could more properly be called ‘Kings Drain’ these days. This creek which arises within the Latrobe Municipality is reputed to be the most polluted creek in the Mersey River catchment.’

More information on this species can be found at http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=78959

Habitat Preferences

The species is often found in more clayey soils with deeper burrows than other *Engaeus* species. Burrows can be complex and extensive and may often be the product of several generations of crayfish activity (DPIWE, 1999). The species is only rarely seen above ground or in standing water and their burrows exhibit characteristic chimneys of pelleted soil (DPIWE, 1999).

Population Estimates

Nelson (2003 cited on EPBC Act Webpage) indicated that this species was confined to seven geographically isolated areas, with a minimum of 5 km separating each area. However, more recent surveys and assessments by Richardson *et al.* (2008) located 35 new populations of the species, extending its known range from 343 km² to 515 km². Richardson *et al.* (2008) note that its likely area of occupancy remains below 1 km² but estimated the overall population from 392,200 to 74,400 individuals.

Feeding

The Central North Burrowing Crayfish is believed to eat rotting wood, detritus, root material and, occasionally, animal material (Doran 1999).

Movement Patterns

The dispersal of the Central North Burrowing Crayfish through waterways may be limited, leading to restricted ranges and a high degree of local speciation (Doran 1999).

Burrow formation

Most *Engaeus* species are characterised by their ability to burrow, often to considerable depths, and specimens are only rarely seen above ground or in standing water. Burrows can be quite simple and shallow, or complex and extensive; while crayfish may not be communal *per se* (Horwitz *et al.* 1985b), a burrow can often be the product of several generations of crayfish activity (EPBC Act Webpage).

Crayfish burrows can be classified according to their location and hydrologic character (Horwitz and Richardson 1986). Type 1a and type 1b burrows are found respectively in or connected to permanent waters such as streams or lakes, and this provides their source of water. Type 2 burrows are found connected to the water-table and receive their water from both groundwater and surface runoff, while type 3 burrows are independent of the water-table and derive their water from runoff only. Type 3 burrows are only found in Australia and are only known to be constructed by *Engaeus* species (Horwitz and Richardson 1986).

Life Cycle

The Central North Burrowing Crayfish mates in mid to late spring (Horwitz 1990). Eggs and larvae are incubated in late spring and early summer with juveniles hatching in mid to late summer and released from the burrow when water levels are high. During the breeding season females carry large orange eggs and recently hatched young under their tail (Nelson 2003 cited on EPBC Act Webpage). The generation length of the Central North Burrowing Crayfish is approximately three years (EPBC Act Webpage).

Translocation and Habitat Creation

The translocation of Central North Burrowing Crayfish has been previously conducted however the success or otherwise of the translocation efforts have not been determined (Nelson <http://www.disjunctnaturalists.com/articles1/crayfish.htm>; Richardson *et al.* 2008).

Nelson (<http://www.disjunctnaturalists.com/articles1/crayfish.htm>) notes that for the Miandetta wetlands recreation project (located at Miandetta, north-west of Spreyton) that –

‘The Landcare group has now diverted the flood waters of Kings Creek back onto the original flood plain to be captured by the new dam wall to create a wetland. It is hoped that by planting out the diversion area, especially with *Melaleuca ericifolia*, that much of the pollution of the creek can be remediated through the plants grabbing many of the pollutants as nutrients. Since Kings Creek flows through Latrobe's industrial area, the Council has been advised by the state government that they will also need to monitor the water quality of the creek and enforce pollution control measures.’

In terms of a monitoring program for determining the response of the crayfish to more saturation and the planting of suitable vegetation, areas are soon to be pegged out and burrows counted so that the burrow numbers can be monitored.

The Miandetta Park site and the new Kings Creek wetlands are experiments in habitat restoration with the intention of gaining an understanding as to whether or not habitat improvements can benefit the crayfish by increasing their numbers. Both involve saturating more ground area, and planting out with suitable plants. What we learn from these experiments will hopefully be transferred to further habitat works.

For translocation, Nelson (<http://www.disjunctnaturalists.com/articles1/crayfish.htm>) notes –

‘The ongoing monitoring and assessments of success or otherwise of the efforts could prove difficult, given a species which lives below ground, and for which we have no known way of accurately measuring the crayfish numbers that doesn't involve massive disturbance – thus defeating our purpose. Therefore, burrow activity (counting burrows before and after) must be used as a monitoring device. Where it can be determined that a cluster of burrow openings to the surface all appear to link to the same burrow, these will be counted as one burrow. It is accepted that counting burrow numbers is a crude monitoring device, but it should be able to show trends over the longer term.’

6.2.2 Survey Information

The DoEE SPRAT recommends the survey methods developed during a workshop in June 2010 for presence/absence surveys (Tasmanian Burrowing Crayfish Workshop 2010). Where it is not possible to conduct surveys in this manner, failure to detect burrowing crayfish should not be considered indicative of their absence.

Surveys should:

- maximise the chance of detecting the species;
- determine the context of the site within the broader landscape;
- account for uncertainty and error (such as false presences and absences); and

- be conducted by a suitably qualified person with experience in burrowing crayfish surveys, or in consultation with burrowing crayfish experts.

The first step in surveying for burrowing crayfish is a visual search to locate burrows within suitable habitat. Presence of burrows in suitable habitat indicates the presence of burrowing crayfish. The recommended minimum search effort is one hour per hectare (Tasmanian Burrowing Crayfish Workshop 2010).

In areas where only one burrowing crayfish species is known to occur there, the presence of crayfish burrows confirms the presence of that species. However, in some areas, more than one crayfish species may be present (that is, the species occur together). The Impact and Offset Sites occur in an area of overlapping distributions of *Engaeus granulatus* with non-threatened species. Burrow excavation surveys cause disturbance to habitat (and the possible death to the animal being excavated) and should be avoided during the planning of a project - the identification of the *Engaeus* species present can be made during earthworks.

6.2.3 Significant Impact Assessment

Significant impact criteria have been developed by the Department of Environment and Energy (DoEE) to assist in determining whether the impacts of a proposed action (excluding those that are not a 'continuing use' or 'prior authorisation' exemption) on matters with EPBC Act status are likely to be significant impacts.

A significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

A conservative assessment process was applied to identify potential impacts from the road upgrade and implementation of avoidance, mitigation and offset measures to reduce residual impacts to negligible levels.

Table 1: Species Identified by the EPBC Act Search Tool and an assessment of occurrence and impact at the Impact Site and Offset Site

Species	Status (EPBC) ¹	Type of Presence	Likelihood of Occurrence in the Impact Site	Assessment of impact at Impact Site	Likelihood of Occurrence in the Offset Site	Assessment of impact at Offset Site
Birds						
<i>Apus pacificus</i> fork-tailed swift	MMB	Species or species habitat may occur in area.	Low likelihood of occurrence, no habitat present, species may fly through the area when in transit between areas of habitat.	Nil likelihood of any impact.	Low likelihood of occurrence, foraging habitat present, species may fly through area in transit.	Nil likelihood of any impact.
<i>Ardea alba</i> great egret	MMB, MWS	Species or species habitat may occur in area.	Very low likelihood of occurrence, no habitat present.	Nil likelihood of any impact.	Very low likelihood of occurrence. Species may utilise the dams at the southern end of the site for foraging.	Very low likelihood of any impact as the dams at the southern end of the site will not be affected by proposed offset strategy.
<i>Ardea ibis</i> cattle egret	MMB, MWS	Species or species habitat may occur in area.	Very low likelihood of occurrence.	Nil likelihood of any impact.	Very low likelihood of occurrence. Species may utilise the dams at the southern end of the site for foraging.	Very low likelihood of any impact as the dams at the southern end of the site will not be affected by proposed offset strategy.
<i>Aquila audax fleayi</i> wedge-tailed eagle	EN	Breeding likely to occur in area. Species or species habitat may occur in area.	Very low likelihood of occurrence. No nests occur within 2kms of the Impact Site.	Nil likelihood of any impact.	Very low likelihood of occurrence. No nests occur within 2kms of the Impact Site.	Nil likelihood of any impact.
<i>Ceyx azureus diemensis</i> azure kingfisher	EN	Species or species habitat known to occur within area.	Nil likelihood of occurrence, no habitat present.	Nil likelihood of any impact.	Nil likelihood of occurrence, no habitat present.	Nil likelihood of any impact.
<i>Gallinago hardwicki</i> Latham's snipe	MWS	Species or species habitat may occur within area.	Very low likelihood of occurrence, no habitat present.	Nil likelihood of any impact.	Very low likelihood of occurrence, may occasionally use the dams at the southern end of the site to forage.	Nil likelihood of any impact as the dams at the southern end of the site will not be affected by the proposed offset strategy.

Species	Status (EPBC) ¹	Type of Presence	Likelihood of Occurrence in the Impact Site	Assessment of impact at Impact Site	Likelihood of Occurrence in the Offset Site	Assessment of impact at Offset Site
<i>Haliaeetus leucogaster</i> white-bellied sea eagle	MTS	Species or species habitat likely to occur within area.	Very low likelihood of occurrence. No nests occur within 2kms of the Impact Site.	Nil likelihood of any impact.	Very low likelihood of occurrence. No nests occur within 2kms of the Impact Site.	Nil likelihood of any impact.
<i>Hirundapus caudacutus</i> white-throated needletail	V	Species or species habitat may occur within area.	Low likelihood of occurrence, no habitat present, species may fly through the area when in transit between areas of habitat.	Nil likelihood of any impact.	Low likelihood of occurrence, no habitat present, species may fly through the area when in transit between areas of habitat.	Nil likelihood of any impact.
<i>Lathamus discolor</i> swift parrot	EN	Species or species habitat may occur within area; breeding likely to occur within area.	Moderate likelihood of occurrence, site is within the migratory path of species and a nesting colony has been recorded on the north-west side of Kelcey Tier (north-west of the site). Garden trees and shrubs may be opportunistically used as a foraging resource, although their value to the species are negligible compared to other foraging resources in the area (eg <i>Eucalyptus ovata</i>).	Nil likelihood of impact as foraging trees (garden planted trees such as <i>Corymbia ficifolia</i>) are absent.	High likelihood of occurrence, site is within the migratory path of species and a nesting colony has been recorded on the north-west side of Kelcey Tier (north-west of the site). <i>Eucalyptus ovata</i> trees (of variable size; 5-22m tall) are present along the watercourse in the site. No trees with suitably sized hollows for nesting are present.	Nil likelihood of impact as <i>Eucalyptus ovata</i> trees will not be removed by the project.
<i>Sternula nereis nereis</i> fairy tern	VU	Species or species habitat may occur within area.	Nil likelihood of occurrence, no foraging or nesting habitat present.	Nil likelihood of any impact.	Nil likelihood of occurrence, no foraging or nesting habitat present.	Nil likelihood of any impact.
<i>Myiagra cyanoleuca</i> satin flycatcher	MTS	Breeding likely to occur within area.	Low likelihood of occurrence, no habitat present, species may fly through the area when in transit between	Nil likelihood of any impact.	Low likelihood of occurrence, no habitat present, species may fly through the area when in transit between	Nil likelihood of any impact.

Species	Status (EPBC) ¹	Type of Presence	Likelihood of Occurrence in the Impact Site	Assessment of impact at Impact Site	Likelihood of Occurrence in the Offset Site	Assessment of impact at Offset Site
			areas of habitat.		areas of habitat.	
<i>Tyto novaehollandiae castanops</i> masked owl (Tasmanian)	VU	Species or species habitat known to occur within area.	Very low likelihood of occurrence, species may fly through the area when in transit between areas of habitat.	Nil likelihood of any impact.	Moderate likelihood of occurrence, foraging and roosting habitat present only. Species may fly through the area when in transit between areas of habitat.	Nil likelihood of any impact.
Mammals						
<i>Dasyurus maculatus maculatus</i> spotted-tail quoll	VU	Species or species habitat likely to occur within area.	Very low likelihood of occurrence. Species may move through the area when in transit between areas of habitat or forage in the area. No denning habitat present.	Low likelihood of impact as the species is nocturnal, with works being conducted during daylight hours. Animals may become trapped in trenches left open overnight	Moderate likelihood of occurrence, foraging and denning habitat present along creekline at eastern side of site. Species may move through the area when in transit between areas of habitat to the north and south of the site.	Low likelihood of impact as existing remnant native trees and shrubs will not be removed by the project.
<i>Perameles gunnii gunnii</i> eastern barred bandicoot	VU	Species or species habitat likely to occur within area.	Very low likelihood of occurrence. Species may move through the area when in transit between areas of habitat or forage in the area. No nesting habitat present.	Low likelihood of impact as the species is nocturnal, with works being conducted during daylight hours.	Moderate likelihood of occurrence, foraging and nesting habitat present along creekline. Species may move through the area when in transit between areas of habitat to the north and south of the site.	Low likelihood of impact as existing remnant native trees and shrubs will not be removed by the project.
<i>Sarcophilus harrisii</i> Tasmanian devil	EN	Species or species habitat likely to occur within area.	Very low likelihood of occurrence. Species may move through the area when in transit between areas of	Low likelihood of impact as the species is nocturnal, with works being conducted during daylight hours.	Moderate likelihood of occurrence, foraging and denning habitat present along creekline at eastern side of site.	Low likelihood of impact as existing remnant native trees and shrubs will not be removed by the project.

Species	Status (EPBC) ¹	Type of Presence	Likelihood of Occurrence in the Impact Site	Assessment of impact at Impact Site	Likelihood of Occurrence in the Offset Site	Assessment of impact at Offset Site
			habitat or forage in the area. No denning habitat present.		Species may move through the area when in transit between areas of habitat to the north and south of the site.	Management measures required.
Ray-finned Fishes						
<i>Prototroctes maraena</i> Australian grayling	VU	Species or species habitat known to occur within area.	<p>Nil likelihood of occurrence in roadside drains.</p> <p>The drains in the site flow into Figure of Eight Creek which is connected to the sea but there are several in-stream dams and structures between the site and the sea which may prevent the species from migrating to the site.</p>	Low likelihood of any impact.	Low likelihood of occurrence. Creekline is connected to the sea but there are several in-stream dams and structures between the site and the sea which may prevent the species from migrating to the site.	Low likelihood of any impact.
Frogs						
<i>Litoria raniformis</i> green and gold bell frog	VU	Species or species habitat known to occur in area.	<p>Nil likelihood of occurrence in the roadside drain.</p> <p>The species may occur in dams on Figure of Eight Creek and its tributaries downstream of the site.</p>	Low likelihood of any impact.	<p>Moderate likelihood of occurrence in the dams at the southern end of the site.</p> <p>The species may occur in dams on Figure of Eight Creek and its tributaries downstream of the site.</p>	Low likelihood of any impact.
Crabs, lobsters, shrimps, woodlice						
<i>Astacopsis gouldi</i> giant freshwater crayfish	VU	Species or species habitat	Nil likelihood of occurrence in the	Low likelihood of any impact.	Moderate likelihood of occurrence in the dams	Low likelihood of any impact.

Species	Status (EPBC) ¹	Type of Presence	Likelihood of Occurrence in the Impact Site	Assessment of impact at Impact Site	Likelihood of Occurrence in the Offset Site	Assessment of impact at Offset Site
		may occur in area.	roadside drain. The species may occur in dams on Figure of Eight Creek and its tributaries downstream of the site.		at the southern end of the site, but less so for the main creekline in the site. The species may occur in dams on Figure of Eight Creek and its tributaries downstream of the site.	
<i>Engaeus granulatus</i> Central North burrowing crayfish	EN	Species or species habitat known occur in area.	Known occurrence in the site – an estimated 45 animals occur in the direct impact zone of the activity.	Known significant impact to the species by the proposed activity. Habitat within the roadside drains in the Impact Site will be completely removed by the activity. The species occurs in Figure of Eight Creek and its tributaries into which water from Squibbs Road flow. Management measures required.	Known occurrence in the main creekline and associated side drains that are fed by springs and small watercourses.	Soil contouring and habitat creation/improvement at the site will not impact on any CNBC. Sediment released into the creekline that flows into Figure of Eight Creek during site works may impact on the species and its habitat <i>immediately</i> downstream. Management measures required.
Sharks						
<i>Lamna nasus</i> mackerel shark	MMS	Species or species habitat likely to occur in area.	Marine species, known to occur in Bass Strait and surrounding waters. Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact.	Marine species, known to occur in Bass Strait and surrounding waters. Nil likelihood of occurrence in site as no habitat present	Nil likelihood of any impact.
Plants						
<i>Caladenia caudata</i> tailed-spider orchid	VU	Species or species habitat likely to occur	Species is known to occur in larger stands of	Nil likelihood of any impact, no habitat present.	Species is known to occur in larger stands	Nil likelihood of any impact, no habitat present.

Species	Status (EPBC) ¹	Type of Presence	Likelihood of Occurrence in the Impact Site	Assessment of impact at Impact Site	Likelihood of Occurrence in the Offset Site	Assessment of impact at Offset Site
		in area.	dry forests near the Townships of Port Sorell, Hawley and Railton. Nil likelihood of occurrence in site as no habitat present.		of dry forests near the Townships of Port Sorell, Hawley and Railton. Nil likelihood of occurrence in site as no habitat present.	
<i>Glycine latrobeana</i> purple clover	VU	Species or species habitat likely to occur in area.	Grows in grassy woodlands and grasslands mainly on soils derived from dolerite or basalt. Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact, no habitat present.	Grows in grassy woodlands and grasslands mainly on soils derived from dolerite or basalt. Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact, no habitat present.
<i>Pterostylis atriola</i> snug greenhood	EN	Species or species habitat may occur in area.	Has been recorded in dry sclerophyll forest, typically with an open understorey (e.g. shrubby <i>Eucalyptus obliqua</i> forest, shrubby/heathy <i>Eucalyptus amygdalina</i> forest). Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact, no habitat present.	Has been recorded in dry sclerophyll forest, typically with an open understorey (e.g. shrubby <i>Eucalyptus obliqua</i> forest, shrubby/heathy <i>Eucalyptus amygdalina</i> forest). Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact, no habitat present.
<i>Prasophyllum apoxychilum</i> tapered leek orchid	EN	Species or species habitat may occur in area.	Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact, no habitat present.	Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact, no habitat present.
<i>Thelymitra jonesii</i> sky-blue sun orchid	EN	Species or species habitat may occur in area.	Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact, no habitat present.	Nil likelihood of occurrence in site as no habitat present.	Nil likelihood of any impact, no habitat present.

¹Key: EN – Listed as Endangered, VU – Listed as Vulnerable; MMB – Listed as migratory marine bird species; MMS – Listed migratory marine species; MTS – Listed as a migratory terrestrial species; MWS – Listed as migratory wetland species.

6.3 Avoidance and Mitigation Measures for MNES

6.3.1 Measures for CNBC

Central North Burrowing Crayfish is a robust species that frequently occurs in modified landscapes such as the site (road verge and drain) in Squibbs Road.

Table 3 identifies the potential impacts to CNBC at both the Impact and Offset Sites.

The mechanism to ensure impacts to CNBC are avoided and mitigated at the Impact Site is the Environmental Management Procedures (EMP's) while the mechanism at the Offset Site is the *Management, Monitoring and Offset Plan - Squibbs Road Drainage Improvements* (MMOP).

The MMOP has been prepared in accordance with the 'Environmental Management Plan Guidelines, Commonwealth of Australia 2014' issued by DoEE.

The translocation of CNBC from the Impact Site to the Offset Site described in the *Management, Monitoring and Offset Plan - Squibbs Road Drainage Improvements* (MMOP) is in accordance with the *EPBC Act Policy Statement on the Translocation of Listed Threatened Species*.

The methodology for the translocation of CNBC to the Translocation Area Offset Site is addressed in the Standard Operating Procedure - *Engaeus granulatus* translocation (Attachment E).

6.3.2 Measures for other MNES

Environmental management procedures will be implemented at the Impact and Offset Sites.

After the application of the measures outline in the EMPs the potential impacts to NES Values (refer to Table 3 of this document), except for Central North Burrowing Crayfish, are reduced to negligible levels.

The EMPs (Attachment B) are as listed below –

- **EMP 1:** Disturbance to Terrestrial and Aquatic Flora and Fauna
- **EMP 2:** Working near waterways and drains
- **EMP 3:** Erosion, Sedimentation and Surface Run-off
- **EMP 4:** Aboriginal Artefacts – Unanticipated Discovery Plan
- **EMP 5:** Weed and Pathogen Control

To enable the EMP's to be implemented effectively, particularly in areas where threatened fauna may be present, a suitably qualified person (Environmental Officer or similar) will be present on site during the excavation of the drains. This person or their suitably qualified delegate will also be responsible for the recovery and translocation of CNBC from the Impact Site to the Offset Site in accordance with the Operating Procedure (Attachment E).

Table 2: Potential impacts to Central North Burrowing Crayfish at the Impact and Offset Sites

		Central North burrowing crayfish
Potential Impact		
Impact Site (Squibbs Road)		
The release of sediment during drain excavation and culvert installation process may enter downstream drains, dams and waterways		✓
Spillage of chemicals, fuels or other toxic substances into the landscape used in the drain and culvert installation process may flow into downstream drains, dams and waterways		✓
Offset Site (Translocation Area at the Clayton Reserve)		
The release of sediment during initial construction works at the site and/or may enter downstream drains, dams and waterways		✓
The release of sediment during ongoing management works at the site may enter downstream drains, dams and waterways		✓
Spillage of chemicals, fuels or other toxic substances into the landscape used in the initial construction works at the site may flow into downstream drains, dams and waterways		✓
Spillage of chemicals, fuels or other toxic substances into the landscape used in ongoing management works at the site may flow into downstream drains, dams and waterways		✓
Introduction of pathogens to the site during initial construction works and ongoing management works at the site		✓

Table 3. Impact avoidance and mitigation measures for Central North Burrowing Crayfish at the Impact and Offset Sites

Phase	Potential Impact	Avoidance Measures	Mitigation Measures	Method of application for measure and monitoring mechanism
Construction at Impact Site	The release of sediment during drain excavation and culvert installation may enter downstream drains, dams and waterways.	<ul style="list-style-type: none"> ▪ 'No go' areas such as the drain network south of the site and the drain to the west of Squibbs Road will be clearly marked with a fence constructed from steel posts (with safety caps installed) and orange fencing as exclusion areas for all machinery, equipment and personnel. ▪ Backfill grading will ensure topsoil is appropriately separated and stockpiled for reinstatement and rehabilitation to avoid erosion. ▪ Construction activities likely to result in sediment run-off into drains and waterways will not be carried out during wet weather. 	<ul style="list-style-type: none"> ▪ Sediment control equipment (applicable to the soil texture) will be installed to minimise any suspension of sediment and prevent contamination to any waterways or drainages. ▪ If construction intersects groundwater, then appropriate control methods will be implemented to ensure environmental disturbance is minimised and that any intersected water is prevented from directly entering drains or waterways. 	EMP's
	Spillage of chemicals, fuels or other toxic substances into the landscape used in the drain and culvert installation process may flow into downstream drains, dams and waterways.	<ul style="list-style-type: none"> ▪ All efforts shall be made to ensure that no pollutants, including liquids and solids, enter the watercourses, waterways, drainages or stormwater drainage systems. For example, vehicles, plant and equipment are not to be washed so that waste water enters the waterways or drainage system. ▪ No refuelling of equipment, machines or vehicles is to occur at least 50 m away from a watercourse/drain. 	<ul style="list-style-type: none"> ▪ Bunding will be installed around storage areas for fuels and oils to prevent the spillage of fuels, oils or other hazardous substances into the water. ▪ Wastes are not to be deposited into, hosed down or swept into the drainage systems. ▪ A spill kit will be maintained on site near the source of fuel/oil and other chemicals. Multiple spill kits may be needed when there are multiple sources of fuel, oil or other chemicals needed for the construction process. 	EMP's
Construction at Offset Site	The release of sediment during initial construction	<ul style="list-style-type: none"> ▪ 'No go' areas such as the main tributary in the site will be clearly marked with a fence constructed from steel posts (with safety 	<ul style="list-style-type: none"> ▪ Sediment control equipment (applicable to the soil texture) will be installed to minimise any suspension of sediment and prevent 	MMOP

Phase	Potential Impact	Avoidance Measures	Mitigation Measures	Method of application for measure and monitoring mechanism
	works at the site may enter downstream drains, dams and waterways	<p>caps installed) and orange fencing as exclusion areas for all machinery, equipment and personnel;</p> <ul style="list-style-type: none"> ▪ <i>Engaeus</i> burrows in areas adjacent will be identified in the field by a suitably qualified person and flagged using steel droppers marked with bright coloured paint (and a safety cap). 	<p>contamination to any waterways or drainages.</p> <ul style="list-style-type: none"> ▪ If construction intersects groundwater, then appropriate control methods will be implemented to ensure environmental disturbance is minimised and that any intersected water is prevented from directly entering drains or waterways. 	
	Spillage of chemicals, fuels or other toxic substances into the landscape used in the initial construction works at the site may flow into downstream drains, dams and waterways.	<ul style="list-style-type: none"> ▪ All efforts will be made to ensure that no pollutants, including liquids and solids, enter the watercourses, waterways, drainages or stormwater drainage systems. 	<ul style="list-style-type: none"> ▪ Bunding will be installed around storage areas for fuels and oils to prevent the spillage of fuels, oils or other hazardous substances into the water. ▪ Wastes will not to be deposited into, hosed down or swept into the drainage systems. ▪ No refuelling of equipment, machines or vehicles is to occur at least 50m away from a watercourse/drain. ▪ A spill kit will be maintained on site near the source of fuel/oil and other chemicals. Multiple spill kits may be needed when there are multiple sources of fuel, oil or other chemicals needed for the construction process. 	MMOP
Maintenance at Offset Site	The release of sediment during maintenance works may enter downstream drains, dams and waterways.	<ul style="list-style-type: none"> ▪ Maintenance work likely to result in sediment run-off into drains and waterways will not be carried out during wet weather. 	<ul style="list-style-type: none"> ▪ Sediment control equipment (applicable to the soil texture) will be installed to minimise any suspension of sediment and prevent contamination to any waterways or drainages (as per special operation prescriptions). ▪ If maintenance work intersects shallow groundwater, then appropriate control 	MMOP

Phase	Potential Impact	Avoidance Measures	Mitigation Measures	Method of application for measure and monitoring mechanism
			methods will be implemented to ensure environmental disturbance is minimised and that any intersected water is prevented from entering drains or waterways.	
	Spillage of chemicals, fuels or other toxic substances into the landscape used in maintenance works may flow into downstream drains, dams and waterways.	<ul style="list-style-type: none"> All efforts will be made to ensure that no pollutants, including liquids and solids, enter the watercourses, waterways, drainages or stormwater drainage systems. 	<ul style="list-style-type: none"> Bunding will be installed around storage areas for fuels and oils to prevent the spillage of fuels, oils or other hazardous substances into the water. Where possible, fuels and oils should not be stored on site. Wastes will not to be deposited into, hosed down or swept into the drainage systems. No refuelling of equipment, machines or vehicles is to occur at least 50m away from a watercourse/drain. A spill kit will be maintained on site near the source of fuel/oil and other chemicals. Multiple spill kits may be needed when there are multiple sources of fuel, oil or other chemicals needed for the construction process. 	MMOP and DCC Annual Works Program

* DCC Annual Works Program – the works program of DCC is reviewed annually as part of normal Council operations. This process identifies on-ground actions for sites managed by Council and allocates the necessary funds and personnel to conduct those works.

7. OFFSET REQUIREMENTS AND PLAN

7.1 Offset Requirement and EPBC Calculator

The estimated loss to CNBC at the Impact Site is 45 animals based on the presence of 90 burrows in the Work Area. The basis for this quantum of offset is the result of the figures inserted into the EPBC Offset Calculator shown in Attachment C.

The starting value is 0 for CNBC at the Translocation Area (Figure 11) because there is no CNBC in that location because it's currently not suitable habitat for the species.

The EPBC calculator, when using a 10-year term, requires 58 animals to be successfully translocated and/or established (by colonisation of created habitat) at the Translocation Area in the Offset Site. Using the same method of burrow occupation rate, this means 116 burrows need to be present **and** exhibit some signs of use by *Engaeus*.

7.1.1 If more or less CNBC are translocated

If more than 45 CNBC are excavated at the Impact Site Work Area and translocated to the Offset Site, then that number of animals (eg. 58, 62, 51) will be used and the EPBC calculator updated to reflect the new number of animals needing to be offset.

Euthanised animals will be included in the revised number of animals.

To be conservative, if the number of animals excavated and translocated or euthanised is less than 45 then 45 will still be used (ie 45 CNBC is a minimum that need to be offset).

7.1.2 Confidence

A 90% certainty of successful translocation/recruitment of CNBC to the Translocation Area in the Offset Site has been applied in the EPBC Calculator.

The successes recorded for the translocation of CNBC to the Clayton Reserve (established under a plan '39 Clayton Drive, Spreyton – Offset Management Plan' that was prepared and approved for the project 'PIPING OF OPEN DRAIN AND TRANSLOCATION OF BURROWING CRAYFISH AT SHEFFIELD ROAD, DEVONPORT TASMANIA (EPBC REF: 2011/6095) from Sheffield Road demonstrates, in our view, the successful ability of DCC to plan, implement and report on actions which involves matters of NES.

The results contained within the annual monitoring reports for EPBC REF: 2011/6095 demonstrates the ability of the CNBC to be translocated, if done correctly, to other locations where the animals and their future offspring can persist and thrive in the environment. Hence, the loss of CNBC animals at the Impact Site will be offset by improving habitat at the Translocation Area in the Offset Site – causing a net effect of negligible impact (an impact that does not qualify as a 'significant' one under the criteria).

7.2 Offset Location and Characteristics

7.2.1 Location

The MMOP applies to the Translocation Area defined in Figure 11 which is in Clayton Reserve – located at 39 Clayton Drive, Spreyton (Title Reference 24071/361).

7.2.2 Land Use and Tenure

The land is owned and managed by the DCC for conservation (primarily to protect and enhance habitat for the CNBC and other listed species known to occur in the area) and local community recreational activities such as non-mechanised bike riding and walking.

7.2.3 Geology and soils

The Offset Site is comprised of Permian mudstone bedrock with a shallow overlaying silty loam. Areas associated with the main channel of the creekline are deeply incised and have a muddy base. Permian mudstone derived soils are generally infertile and susceptible to erosion due to a paucity of clay content. No sites of geoconservation significance are known to occur at the site.

7.2.4 Surface water

The Offset Site is within the East Ellice Hill sub-catchment of the Figure of Eight catchment which flows into the Mersey River estuary. The site is characterised by side soaks fed by springs which produce slow flowing wet areas in the site.

7.2.5 Vegetation and Flora

Since DCC has owned the land there have been numerous trees, shrubs, sedges and grasses planted along the riparian zone of Figure of Eight Creek as part of the implementation of the existing management plan for the Clayton Reserve - '39 Clayton Drive, Spreyton – Offset Management Plan' that was prepared and approved for the project 'PIPING OF OPEN DRAIN AND TRANSLOCATION OF BURROWING CRAYFISH AT SHEFFIELD ROAD, DEVONPORT TASMANIA (EPBC REF: 2011/6095).

The area surrounding the Offset Site is peri-urban with a mosaic of agricultural land (improved pasture, orchards and crops), housing developments and remnant native vegetation (wet and dry forests).

7.2.6 Fauna

The main conservation significant fauna species in the area is the Central North burrowing crayfish which relies on wet areas and elevated groundwater levels during dry times (DPIW 2008).

The Translocation Area in the existing Clayton Reserve (Figure 11) does not currently support *Engaeus granulatus* as it is not suitable habitat for the species – the MMOP seeks to modify drainage in the Translocation Area to create habitat suitable for the CNBC.

The Offset Site occurs within the known geographic range for the swift parrot (*Lathamus discolor*) although no nesting habitat exists within the area and foraging resources are scarce. Foraging resources include remnant *Eucalyptus ovata* trees scattered along the main watercourse in association with non-hollow bearing *E. viminalis* and *E. obliqua* trees.

Terrestrial mammals, such as the Tasmanian devil, spotted-tailed quoll and eastern barred bandicoot are all known to occur within the region.

7.2.7 Weeds

One species classified as a Weed of National Significance occurs within the Offset Site; *Rubus fruticosus* (blackberry). Blackberry is listed as Declared Weed on the Tasmanian *Weed Management Act 1999*.

7.3 Offset Implementation - Management Plan

7.3.1 Objectives

The *Management, Monitoring and Offset Plan – Squibbs Road Drainage Improvements* (Attachment D) contains the management measures to avoid, correct or improve any situations which may threaten or potentially threaten the successful outcomes of the project.

The objectives of the MMOP are to;

- Create new habitat for Central North burrowing crayfish within the Offset Site to increase the carrying capacity of the Clayton Reserve to compensate for the loss of Central North burrowing crayfish at the Impact Site;
- Translocate Central North burrowing crayfish to the Translocation Area in the Offset Site from the Impact Site to increase the overall number of Central North burrowing crayfish in the Clayton Reserve;
- Manage non-native areas of the site for fuel reduction purposes and passive recreational activities without impacting on the natural values in the Offset Site; and
- Provide a 'nature conservation' educational resource for community groups, land managers, school groups, visitors and the broader community.

7.3.2 Objectives

Habitat Creation and Improvement

The existing CNBC habitat and burrows adjacent to the Translocation Area will be protected from vegetation removal and earthworks using temporary fencing and star pickets.

The Translocation Area currently has no CNBC present, but it is an area that contributes to the natural habitat present in the Clayton Reserve – provides vegetation cover to prevent erosion of sediment into Figure of Eight Creek etc.

The '39 Clayton Drive, Spreyton – Offset Management Plan' contained a set of criteria against which the success of that offset project would be assessed. The criteria for CNBC recolonisation/survival was met in the first 2 years of monitoring and only part of the reserve was used to create CNBC habitat.

Clayton Reserve still contains large areas of land not used to create CNBC habitat for EPBC REF: 2011/6095. This extra land for the most part is not suitable for CNBC nor any other *Engaeus* species because it is ephemerally dry, rocky and/or generally unsuitable – some of this currently unsuitable land is what will be used to create more CNBC habitat in the Clayton Reserve.

The Translocation Area will be partially excavated, and water impounded to slow water infiltration and passage long enough for the ground to become damp for an extended period of time. This approach was applied for EPBC REF: 2011/6095 where shallow excavations were made using an excavator and the excavated soil used to create a small bund that both directs and detains water to keep the soil and sub-soil moist.

Native flora species will also be planted (eg *Carex appressa*, *Gahnia grandis*) in the Translocation Area to provide some shade to the soil surface.

Translocation of CNBC

To maximise the speed and rate of colonisation of the Translocation Area as many CNBC as possible will be translocated from the Impact Site using the methodology provided in Standard Operating Procedure - *Engaeus granulatus* translocation (Attachment E).

Translocated CNBC will be monitored for 12 months based on burrow excavation activities over that period and survivorship rates calculated. Other monitoring will be conducted per Tables 2 and 3 in the MMOP

7.3.3 Term

The MMOP will operate for 10 years from the date of approval by DoEE.

7.3.4 Area to which MMOP applies

The MMOP only applies to the Translocation Area in Clayton Reserve which is spatially defined in Figure 11.

7.3.5 Relationship of MMOP to other Management Plans

The MMOP only applies to the Translocation Area within the Clayton Reservice, depicted in Figure 11. The remainder of the Clayton Reserve will be managed under the existing management plan - '39 Clayton Drive, Spreyton – Offset Management Plan' which was prepared and approved for the project 'PIPING OF OPEN DRAIN AND TRANSLOCATION OF BURROWING CRAYFISH AT SHEFFIELD ROAD, DEVONPORT TASMANIA (EPBC REF: 2011/6095).

7.3.6 Funding for MMOP

The funds required to implement the MMOP, site monitoring and conducting ongoing maintenance will be provided by the DCC.

7.4 Monitoring of Translocation Area

The MMOP contains details how monitoring of the Translocation Area will occur and project completion criteria.

The same method used to estimate the number of CNBC at the Impact Site will be applied at the Offset Site; the number of burrows will be counted, and number of animals estimated based on a 50% occupation rate of the total number of burrows. This approach makes the assessment of impact and offset directly comparable in terms of number of estimated animals present. Hence, at least 116 burrows will need to be recorded in the Translocation Area to meet a satisfactory offset level.

A suitably qualified ecologist will conduct the assessment of burrow number and density in the Translocation Area in the Offset Site.

Assessments will also be made of plant survivorship and erosion control. Photopoints will be identified to record empirical and visual data against which the management actions conducted at the Offset Site can be assessed in terms of achieving project goals.

DCC is responsible for the management and implementation of the MMOP and complying with all reporting requirements to the DoEE and the Policy and Conservation Assessment Branch in DPIWE.

7.5 Remedial Actions at Offset Site

Remedial works may be needed at the site in the short-term to ensure that an optimal level of water flow and soakage is occurring in areas of created habitat.

A suitably qualified ecologist will provide advice on what areas of the site represent habitat that has been created by the project and offer advice on any remedial works that may be required (eg additional plantings, improved sediment control measures, further movement of soil to improve water soakage into or through the site).

7.6 Contingency

The project is very likely to achieve the desired outcome because the project includes the proven success with the translocation of CNBC from one site to another (eg 'PIPING OF OPEN DRAIN AND TRANSLOCATION OF BURROWING CRAYFISH AT SHEFFIELD ROAD, DEVONPORT TASMANIA (EPBC REF: 2011/6095)) and habitat creation/improvement works that enable CNBC to move into an area that was previously not suitable habitat.

The contiguous nature of habitat across, into and out of the Offset Site for CNBC has no doubt provided many opportunities for CNBC to move into the created and improved habitat areas. The survival rate and additional burrows required to meet the offset requirements for EPBC REF: 2011/6095 was met in 2 years after the translocation took place from the Sheffield Road works site.

On this basis the contingency measures for the project are the monitoring of the site and necessary adjustments to the management regime at the Offset Site to increase the probability of an increase in the number of animals at the site. This may include the use of additional side drains in the Offset Site to create additional areas of habitat to increase the overall amount of habitat created for the CNBC to colonise or the establishment of a new Offset Site within which habitat can be created to establish and/or expand a CNBC colony. DCC have access to other land assets that may be used for this purpose.

In the very unlikely event that the outcomes of the project are not fully achieved a review will be conducted detailing how the project was undertaken (eg what occurred, what went wrong, what worked well, what did the monitoring data show) and to explore opportunities to increase the success of translocation and habitat creation for future projects. The review will include representatives from DCC, DoEE and PCAB (DPIPWE) with input from suitably qualified persons.

7.7 Reporting

Reports on the progress and results of the implementation of the MMOP will be made to DoEE and the Policy and Conservation Assessment Branch within DPIPWE every 6 months from the commencement of the project for 2 years (4 reporting periods) then annually for the next 8 years (8 reporting periods) within the overall project report.

7.8 Review Process

The objectives, responsibilities and management actions in the MMOP will be reviewed as new information becomes available. The MMOP is intended to be flexible to allow changes to be made to the focus of management actions, especially with respect to weed management, remedial works that may be required after heavy rainfall events and the rehabilitation of native vegetation areas.

A review of the MMOP will be conducted each year in conjunction with the Annual Report prepared by DCC (part of reporting on its normal Council operations and activities).

Reviewed versions of the MMOP will be provided to DoEE and the Policy and Conservation Assessment Branch of DPIPWE for assessment and approval before any actions.

8. REFERENCES

- DSEWPaC (2011). Draft referral guidelines for four threatened Tasmanian burrowing crayfish: Burnie burrowing crayfish (vulnerable), Central north burrowing crayfish (endangered), Mount Arthur burrowing crayfish (vulnerable) Scottsdale burrowing crayfish (endangered). Canberra, Australia.
(<http://www.environment.gov.au/epbc/publications/pubs/referral-guidelines-for-tasmanian-burrowing-crayfish.doc>)
- DEWHA (2010a). *Sarcophilus harrisii* in Species Profile and Threats Database, Department of the Environment, Water, Heritage and the Arts, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed Fri, 4 Jun 2010 14:12:39 +1000.
- Doran, N. (1999). *Burrowing Crayfish (Engaeus) Group Recovery Plan 2001-2005*. [Online]. Tasmania: Parks and Wildlife Service, Department of Primary Industries, Water and Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/recovery/burrowing-crayfish/index.html>.
- DPIWWE (2010). Distribution of *Phytophthora cinnamomi* in Native Tasmanian Vegetation. Available from <http://www.dpiw.tas.gov.au/inter.nsf/WebPages/EGIL-53Y7W3?open>. Accessed 24 June 2010.
- DPIW (2008). Tasmanian Geoconservation Database v6.0. Accessed at <http://www.thelist.tas.gov.au/listmap/listmapstart.jsp>
- DPIWE (1999). Burrowing Crayfish (*Engaeus*) Recovery Plan 2001-2005. Department of Primary Industry, Water and the Environment Parks and Wildlife Service, Threatened Species Unit, November 1999.
- Horwitz, P.H., A.M.M. Richardson and A. Boulton (1985a). The burrow habit of two sympatric species of land crayfish, *Engaeus urostrictus* and *E. tuberculatus* (Decapoda: Parastacidae). *Victoria Naturalist* **102**: 188-197.
- Horwitz, P.H.J., A.M.M. Richardson and P.M. Cramp (1985b). Aspects of the life history of the burrowing crayfish, *Engaeus leptorhynchus*, at Rattrays Marsh, North East Tasmania. *Tasmanian Naturalist* **82**: 1-5.
- Horwitz, P. (1988b). Sea-level fluctuations and the distributions of some freshwater crayfishes of the genus *Engaeus* (Decapoda; Parastacidae) in the Bass Strait Area. *Australian Journal of Marine and Freshwater Research* **39**: 497-502.
- Horwitz, P. (1990). A taxonomic revision of species in the freshwater crayfish genus *Engaeus* Erichson (Decapoda: Parastacidae). *Invertebrate Taxonomy*. **4**:427-614.
- Horwitz, P. (1991). *The conservation biology of Engaeus spinicaudatus, a threatened crayfish from north-eastern Tasmania*. Report to the Australian National Parks and Wildlife Service, Canberra.
- Nelson, J. (2003). *Unpublished Report to the Burrowing Crayfish Recovery Team on Engaeus granulatus survey work as of July 2003*. Threatened Species Unit, Tasmanian Department of Primary Industries, Water and Environment.
- Richardson, A.M.M. and Horwitz, P.H.J. (1987). Habitat partitioning by Australian burrowing crayfish. In *Freshwater Crayfish Volume VII. Papers from the Seventh International Symposium of Astacology* (International Association of Astacology). pp. 91-97.
- Richardson, A.M.M. and Swain, R. (1980). Habitat requirements and distribution of *Engaeus cisternarius* and three subspecies of *Parastacoides tasmanicus* (Decapoda:

- Parastacidae), burrowing crayfish from an area of south-western Tasmania. *Australian Journal of Marine and Freshwater Research* **31**: 475-484.
- Richardson, A., Hopgood-Douglas, S., Munks, S. Doran, N. and Peters, D. (2008). Predicting the distribution of a threatened freshwater Burrowing Crayfish: *Engaeus granulatus* in Central Northern Tasmania. *Freshwater Crayfish* 16:43-46.
- Rounsevell, D.E., R.J. Taylor, and G.J. Hocking (1991). Distribution records of native terrestrial mammals in Tasmania. *Wildlife Research*. 18:699-717.
- Rudman, T. (2005). *Interim Phytophthora cinnamomi Management Guidelines*. Nature Conservation Report 05/7, Biodiversity Conservation Branch, Department of Primary Industries, Water and Environment, Hobart.
- Suter, P. J. and Richardson, A. M. M. (1977). The biology of two species of *Engaeus* (Decapoda: Parastacidae) in Tasmania III: habitat, food, associated fauna and distribution. *Australian Journal of Marine and Freshwater Research* **28**: 95-103.
- Tasmanian Crayfish Workshop (2010). *Proceedings of the Tasmanian Crayfish Workshop, 28-29 June 2010*. Devonport, Tasmania.

ATTACHMENTS

- Attachment A Engineering Drawings for Construction - Drawing CS0055
- Attachment B Environmental Management Procedures - Construction
- Attachment C EPBC Offset Calculator Sheet – Squibbs Road Drainage Improvements
- Attachment D Management, Monitoring and Offset Plan – Squibbs Road Drainage Improvements
- Attachment E Standard Operating Procedure - *Engaeus granulatus* translocation

Attachment A Engineering Drawings for Construction - Drawing CS0055

Attachment B Environmental Management Procedures - Construction

Attachment C EPBC Offset Calculator Sheet – Squibbs Road Drainage Improvements

Attachment D Management, Monitoring and Offset Plan – Squibbs Road Drainage Improvements

Attachment E Standard Operating Procedure - *Engaeus granulatus* translocation