Flora and Fauna Management Plan

NSW Long Term Train Support Facility Depot Relocation

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Document Approval/ Sign Off

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1 Introduction

1.1 Purpose of this document

The Construction Flora and Fauna Management Plan (CFFMP) supplements the Project Construction Environmental Management Plan (CEMP) for the construction phase of the NSW Long Term Train Support Facility (TSF) Depot Relocation (the Project).

The CFFMP addresses relevant Minister's Conditions of Approval (MCoA), specifically Condition E63(b) of State Significant Infrastructure MP07_0171 Modification 2 as issued by the NSW Department of Planning, Industry and Environment (DPI&E). Information and mitigation measures is based on the following assessments:

- Ecological Investigations (Ecological, November 2012);
- Ecological Investigations (Ecological, June 2013);
- Ecological Assessment (Jacobs, 23 May 2019); and
- Section 5.25 Modification to SSI 6090: Hexham Long Term Train Support Facility-Ancillary Depot ang Wagon Storage (Ethos Urban 8 April 2022)
- Hexham Long Term Train Support Facility BDAR Waiver Request (21 September 2021, Jacobs)

This CFFMP aims to provide best practice methods and initiatives to detail how any adverse construction impacts on the flora and fauna of the site will be minimised and managed. In essence this report provides:

- Identification of sensitive ecological areas including Endangered Ecological Communities (EECs) and habitat for threatened species;
- Mitigation measures for flora and fauna protection and management; and
- Weed management strategies.

1.2 Conditions of Consent

The production of this FFMP specifically relates to the MCoA contained in Table 1.1 and 1.2 below.

Table 1.1 Requirements of the Flora and Fauna Management Plan

MCoA	Task	Reference
E63(b)	A **Construction Flora and Fauna Management Plan** to detail how construction impacts on ecology will be minimised, managed and monitored. The Plan shall be developed in consultation with the EESG and the Water Group and shall include, but not necessarily be limited to:	Section 1.3
(i)	details of pre-construction surveys required to verify the construction boundaries/footprint of the SSI based on detailed design and to confirm the vegetation to be cleared as part of the SSI (including threatened flora and fauna species, endangered ecological communities, riparian vegetation and tree hollows);	Table 7
(ii)	details on the location (including plans) of all native vegetation communities, threatened flora and fauna species and their habitat, and endangered ecological communities to be impacted by the SSI;	Attachment A
(iii)	details of mitigation measures to be implemented during construction to minimise impacts on native fauna and vegetation (particularly threatened species and endangered ecological communities and their habitats), including measures to be implemented in those areas that will not be cleared. Measures shall include, but not necessarily be limited to, the mitigation measures set out in this infrastructure approval, delineation of sensitive areas, a protocol for the removal and relocation of fauna during clearing, fauna rescue procedure, appropriate topsoil management, erosion and sediment control, and construction worker education;	Table 7

MCoA	Task	Reference
(iv)	a procedure for dealing with unexpected finds of threatened species and endangered ecological communities and their habitat identified during construction, including stopping works and notification to the EESG and the Department, determination of appropriate mitigation measures in consultation with the EESG (including relevant re-location measures), and updating of biodiversity offset requirements consistent with condition C4;	Table 7
(v)	procedures for clearing blockages in waterways resulting from construction of the SSI;	Table 7
(vi)	weed management measures focusing on early identification of invasive weeds and effective management controls;	Section 4.0 Table 4.1
(vii)	proposed revegetation and rehabilitation measures, including identification of flora species and sources, completion criteria and measures for the management and maintenance of rehabilitated/ revegetated areas;	Table 7
(ix)	mechanisms for the monitoring, review and amendment of this plan.	Section 5.0

Table 1.2 Relevant Minister's Conditions of Approval - Biodiversity

MCoA	Task	Reference
C5	The Proponent shall ensure that groundwater dependent ecosystems outside the project footprint are not adversely affected by the design, construction and operation of the SSI.	Table 7
C17	All temporary and permanent watercourse crossings shall be designed in consultation with the NoW, and with the DPI (Aquaculture and Fisheries) where the crossing has the potential to impact on fish passage. Where feasible and reasonable, the crossings shall be consistent with the NoW's *Guidelines for Controlled Activities* and *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries, 2004) and *Policy for and Guidelines for Design and Construction of Bridges, Roads, Causeways, Culverts and Similar Structures* (NSW Fisheries, 1999).	Table 7
E3	Marking of EEC and threatened species' habitat.	Table 7 Attachment B – Pre-clearing checklist
E4	Revegetation of disturbed areas.	Table 7 Attachment C – Recommended revegetation species.
E6 and E7	Pre-clearing surveys, tree hollows and nest boxes.	Table 7 Attachment B – Pre-clearing checklist Attachment D – Hollow inspection check list.

MCoA	Task	Reference
E8 and E9	Green and Gold Bell Frog management.	Table 7 Attachment E – *Litoria aurea* (Green and Gold Bell Frog Management Plan Attachment F – Hygiene Protocol
E10	Unexpected finds of threatened flora and fauna.	Table 7
E11	Implement measures to reduce impacts to site flora and fauna and habitats.	Table 7 Attachment B – Pre-clearing checklist Attachment D – Hollow inspection check list
E34	Riparian rehabilitation	Table 7
E35	Construction activities undertaken in and around watercourses	Table 7

1.3 Consultation with State Agencies

Consultation with agencies during the preparation of the original TSF CFFMP was undertaken at a number of stages. Consultation was undertaken with the Hunter catchment Management Authority, the Office of Environment and Heritage, Office of Water and NSW Fisheries.

Due to the CFFMP undergoing only minor revisions to permit construction of the Project consultation with regulatory agencies was not required as confirmed by the Department of Planning, Industry and Environment. Approval of this document may be made by the Environmental Representative without the need for further consultation.

2 Project Location and Context

The TSF site has a total area of 255ha and is located at Hexham, NSW approximately 16km north-west of the Newcastle Central Business District.

The Site shares borders with the Main Northern Railway and Pacific Highway to the east and the New England Highway to the north. To the south and west rural properties and the Hexham Swamp Nature Reserve are adjacent. The Site is located within a predominantly industrial setting, with only a small number of residential dwellings within the local vicinity.

The Site's history as a coal handling facility has resulted in the southern portion of the site containing an abandoned rail loop corridor and coal washery reject (CWR). CWR is retained within vegetated stockpiles however it is also present extensively in sub surface deposits. Remediation completed during the construction of the Site infrastructure has resulted in excavated CWR and neutralised Acid Sulphate Soil being stockpiled in the southern portion of the site

Brancourts Manufacturing and Processing Pty Ltd are currently licensed to use a portion of the site for a waste water treatment plant and effluent irrigation area under Environmental Protection Licence (EPL) 816. Effluent is irrigated over the above mentioned CWR stockpiles.

The vegetation on the site contains remnant, albeit highly disturbed, swamp oak forest, salt marsh and freshwater wetland as well as artificial freshwater wetlands (i.e. drains and ponds) and open pasture. Much of the site is currently subject to pasture improvement and cattle grazing.

In 2015 construction of the TSF was completed consisting of site infrastructure, associated civil works and remediation of site contamination.

The projects regional context is shown in Figure 2.1 below.

2.1 Project Description

The Hunter Valley Coal business is experiencing a sustained reduction in coal haulage volumes. The key regional priority is to consolidate and simplify the footprint and operating complexity of the Aurizon business while continuing to support the transportation of coal throughout the Hunter region. The Project will achieve this by the following:

- Construction of the following elements:
    - A warehouse for the storage of rail maintenance equipment.
    - A depot for office staff and train crew.
    - Ancillary staff and visitor car park connected to the private roadway (existing main access road).
- Rail wagon storage area located on the western portion of the western portion
- Ancillary infrastructure (hardstand, water management, landscaping, lighting etc)
- Utilities connection.

Figure 2.1 Regional Context

2.2 Indicative Construction Activities Schedule

The project is expected to be completed over a nominal duration of 6 months from approval. The indicative schedule of construction activities is summarised in **Table 2.1**.

Table 2.1 Indicative Construction Stages and Scheduling

Construction Phase	Activity	Indicative Schedule
Mobilisation	• Tarro interchange dilapidation survey • Delineation of sensitive areas • Site establishment	November 2022
Civil Earthworks	• Clear and grub • Strip topsoil	November 2022 to December 2023

Construction Phase	Activity	Indicative Schedule
	• Bulk earthworks • Civil stormwater and services reticulation	
Construction	• Construction: • Stage 1 - Depot • Stage 2 - Warehouse of depot • Stage 3 – Carpark • Stage 4 – Heavy vehicle loading area • Stage 5a and 5b – Eastern carpark	December 2022 – August 2023
Demobilisation	• Site clean-up and demobilisation	May 2023

2.3

2.3 Site Flora and Fauna

The TSF site contains four biometric vegetation communities which have been identified, described and mapped as part of the biodiversity field surveys, with three communities corresponding to respective EECs. Vegetation condition varied across the study area. Swamp Oak Swamp Forest had considerable variation in quality due to past disturbance, with some areas being in moderate condition, areas of rehabilitation that contained Swamp Oak (*Casuarina glauca*) and other areas consisting of a predominantly native understorey only and a cleared canopy (Derived Grassland). Areas of Swamp Oak Swamp Forest that comprised rehabilitation were not considered to reflect the description of Swamp Oak Floodplain Forest EEC due to modifications/introduced soil and floristic composition.

One vegetation area currently mapped as SEPP 14 Wetland No. 833 is present in the central eastern portion of the site and is comprised of a degraded remnant of Swamp Oak Swamp Forest. This area has been subject to clearing, grazing and waste water irrigation purposes for several decades and is considered to be in poor condition.

The proposed Project footprint is located within land which has been highly modified from its natural state by a long history associated with coal stockpiling, loading and unloading. Most of the site has had substantial landform modification, with the addition of a significant quantity of coal tailings to raise the level of the ground above the surrounding floodplain wetlands. The dominant native groundcover species is *Cynodon dactylon* (Common Couch), a grass which is common across the broader site in both disturbed and undisturbed areas. *Cynodon dactylon* is not indigenous to the Hunter region but is now widespread across most of NSW and is likely to have established from turf grass.

The only areas within the Project footprint that contain a different assemblage of native species are several constructed swale drains. These drains are presumably designed to move water across the site during periods of high rainfall and are predominately dry throughout the year. During periods of rainfall and inundation, seed and sediment has been deposited in the drains and there are a variety of native wetlands species established in the drains, including *Phragmites australis* (Common Reed), *Typha orientalis* (Bulrush), *Persicaria lapathifolia* (Pale Knotweed), *Persicaria decipiens* (Slender knotweed) and *Alternanthera denticulata* (Lesser Joyweed).

While originally the area is likely to have been part of a wetland, the drains are located within the centre of a long-disturbed spoil fill area that has been raised up above the level of the surrounding wetland. Vegetation already mapped as freshwater wetland outside of the site is lower-lying and closer to natural occurrences of this vegetation community. Given the purpose of the drains is to manage stormwater and their elevation on unnatural substrate has placed the drains above natural floodplain levels, they are not naturally occurring wetlands and are not considered to adequately meet the criteria for the freshwater wetlands EEC.

All remnant native vegetation on the site (excluding the rehabilitation plantings of Swamp Oak Swamp Forest) is considered to meet the definition of Groundwater Dependence Ecosystems as described in NSW

State Groundwater Dependent Ecosystem Policy (DLWC 2002) due to the likely interaction of the vegetation with shallow water table and periodic inundation of floodwater.

Ecological communities adjacent to the Project project area is show in Figure 2.2 below.

Figure 2.2 Construction footprint and ecological communities

2.3.1 Floristics

A total of 268 flora species have been recorded from the vegetation communities of the TSF, including 182 native species and 86 introduced species. No threatened flora species were recorded within the Project study area

2.3.2 Fauna

Biodiversity surveys conducted during the TSF environmental assessment revealed a total of 168 fauna species utilising the TSF site, including nine amphibians, 128 avian species, 25 mammal species and six reptile species. A total of nine threatened and migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Threatened Species Conservation Act 1995* (TSC Act) that have been recorded in the study area as part of the biodiversity studies.

No threatened fauna species were recorded within the Project study area

2.3.3 Biodiversity Values

The biodiversity values present within the greater TSF area, including threatened biodiversity (EECs, threatened species and migratory species) recorded or considered likely occurrences are detailed in. No EECs threatened or migratory species have been identified within the Project footprint.

Biodiversity values specific to the Project is detailed in the Hexham Long Term Train Support Facility BDAR Waiver Request (21 September 2021, Jacobs).

Table 2.2 TSF Threatened Biodiversity

Scientific Name	Common Name	TSC Act	EPBC Act	Likelihood of Occurrence
—	*Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.*	EEC	—	Recorded
—	*Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*	EEC	—	Recorded
—	*Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions*	EEC	—	Recorded
Zannichellia palustris	—	E	—	Potential
Litoria aurea	Green and Golden Bell Frog	E	V	Potential
Hieraaetus morphnoides	Little Eagle	V	—	Recorded onsite
Anseranas semipalmata	Magpie Goose	V	M	Recorded onsite
Botaurus poiciloptilus	Australasian Bittern	V	—	Recorded onsite
Ephippiorhynchus asiaticus	Black-necked Stork	E	—	Some marginal potential
Irediparra gallinacea	Comb-crested Jacana	V	—	Potential
Ixobrychus flavicollis	Black Bittern	V	—	Potential
Rostratula australis (a.k.a. R. benghalensis)	Painted Snipe (Australian subspecies)	E	V	Potential
Tyto capensis	Grass Owl	V	—	Recorded onsite
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Potential
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	—	Recorded onsite
Miniopterus australis	Little Bent-wing Bat	V	—	Recorded onsite
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	—	Recorded onsite
Mormopterus	East Coast Freetail Bat	V	—	Recorded onsite

Scientific Name	Common Name	TSC Act	EPBC Act	Likelihood of Occurrence
norfolkensis				
Myotis adversus	Large-footed Myotis	V	—	Recorded onsite
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V	Recorded onsite
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	—	Potential
Scoteanax rueppellii	Greater Broad-nosed Bat	V	—	Recorded onsite
Apus pacificus	Fork-tailed Swift	—	M	Potential
Haliaeetus leucogaster	White-bellied Sea-Eagle	—	M	Recorded onsite
Hirundapus caudacutus	White-throated Needletail	—	M	Potential
Ardea alba	Great Egret	—	M	Potential
Ardea ibis	Cattle Egret	—	M	Potential

Table 2.3 Turning Angle project area biodiversity values

Biodiversity value	Meaning	Relevant (✓ or N/A)	Explain and document potential impacts including additional impacts prescribed under the BC Regulation Attach additional supporting documentation where appropriate
Vegetation abundance - 1.4(b) *Biodiversity Conservation Regulation 2017* (BC Regulation)	Occurrence and abundance of vegetation at a particular site	N/A	There is some native vegetation (according to the definition of native vegetation provided in the LLS Act) that has naturally established in the development site, namely *Cynodon dactylon* (Common Couch), and a few individuals of *Juncus usitatus* (Common Rush) and *Eleocharis acutus*. However, this native vegetation cannot be assigned to a PCT as identified in the DPIE BioNet Vegetation Classification. As such, the vegetation cannot be allocated to vegetation zones. The habitat types in the development site and study area are best described as miscellaneous ecosystems as identified by the DPIE, specifically: Highly disturbed areas with no or limited native vegetation. Vegetation abundance (as it would apply to a PCT) would not be impacted by removal of vegetation within the development site.
Vegetation integrity 1.5(2)(a) BC Act	Degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near-natural state	N/A	As the native vegetation cannot be assigned to a native PCT, it is not possible to assess vegetation integrity against benchmark scores by undertaking an assessment of the composition, structure or function of the vegetation according to the field methods outlined in Section 5.3 of the BAM. A vegetation integrity score cannot be determined in accordance with Section 5.4 of the BAM as there are no PCTs that will be impacted by this proposal. There would be no loss of vegetation composition, structure, or function (as assessed in accordance with the BAM) as a result of this proposal.
Habitat suitability 1.5(2)(b) BC Act	Degree to which the habitat needs of threatened species are present at a particular site	N/A	The exotic dominated vegetation in the development site does not provide any suitable habitat for threatened species.
Threatened species abundance 1.4(a) BC Regulation	Occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site	N/A	No targeted threatened species surveys have been undertaken as part of this assessment and no high-quality threatened species habitats have been identified on the proposed development site. This proposal is unlikely to have an appreciable impact on threatened species abundance.
Habitat connectivity 1.4(c) BC Regulation	Degree to which a particular site connects different areas of habitat of threatened	✓	The development site is surrounded by highly modified land where natural habitats have been cleared. There is no obvious physical habitat connectivity associated with the development site.

Biodiversity value	Meaning	Relevant (✓ or N/A)	Explain and document potential impacts including additional impacts prescribed under the BC Regulation Attach additional supporting documentation where appropriate
	species to facilitate the movement of those species across their range		However, functional connectivity exists for flying animals such as birds and bats that use the airspace above the development sites to move between habitats. This proposal is considered unlikely to have a detrimental effect on habitat connectivity for these species.
Threatened species movement 1.4(d) BC Regulation	Degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle	✓	The site is unlikely to contribute to the movement of threatened species, apart from flying species, such as Fork-tailed Swift, White-throated Needletail, Eastern Osprey, White-bellied Sea-Eagle, Square-tailed Kite, Wedge-tailed Shearwater, Sharp-tailed Sandpiper, Red-necked Stint, Latham's Snipe, Common Greenshank and Marsh Sandpiper. These species are powerful flyers capable of covering large distances between habitat patches. Their movement would not be impeded as to affect their lifecycles.
Flight path integrity 1.4(e) BC Regulation	Degree to which the flight paths of protected animals over a particular site are free from interference	✓	The proposed development site is located between sections of the Hunter Wetlands National Park (Hexham Swamp Nature Reserve), which is known to contain habitat and species sightings for threatened and migratory birds. It is possible that these migratory bird species will fly over the proposed development sites on occasion, however, considering the current disturbance on the sites, and what is proposed for development, this proposal is unlikely to increase the current barrier to flights paths and no new barriers will be introduced.
Water sustainability 1.4(f) BC Regulation	Degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site	N/A	No threatened species or threatened ecological communities have been identified on the development site that is being sustained by water quality, water bodies and hydrological processes.

2.3.4 Significant Vegetation Communities

The TSF site contains areas of SEPP14 wetlands and EEC although none are present within the Project footprint. As indicated in Section 2.3, four native vegetation communities, representing three EEC types are present within and adjacent to the TSF site.

All of the vegetation communities shown in Figure 2.2 are considered potential Green and Golden Bell Frog Habitat. Remaining cleared areas are considered marginal habitat that may be used for occasional foraging movement. All areas of significant vegetation (EECs, SEPP 14 areas and GGBF habitat) are to be protected during construction.

2.3.5 Hollow Bearing Trees

The TSF site contains a total of 682 trees bearing potential habitat hollows were identified and mapped and the size class of hollows were recorded (refer Figure 2.3). The majority of hollows were generally small and over 90% of the hollow bearing trees were *Casuarina glauca* (EcoBiological 2008). These are all located within the former northern offset area.

With the exception of the remnant Swamp Oak Forest retained in the former northern offset area, the vast majority of the TSF site contains few mature trees, although some tall shrubs and trees are evident in the southern and eastern portions of the site. These trees are generally within regeneration areas, of a young age and are often of poor quality, but still have the potential to provide some small hollow habitat value.

No trees are within the footprint of the proposed Project and as such no clearance of hollow bearing trees is proposed as part of this project.

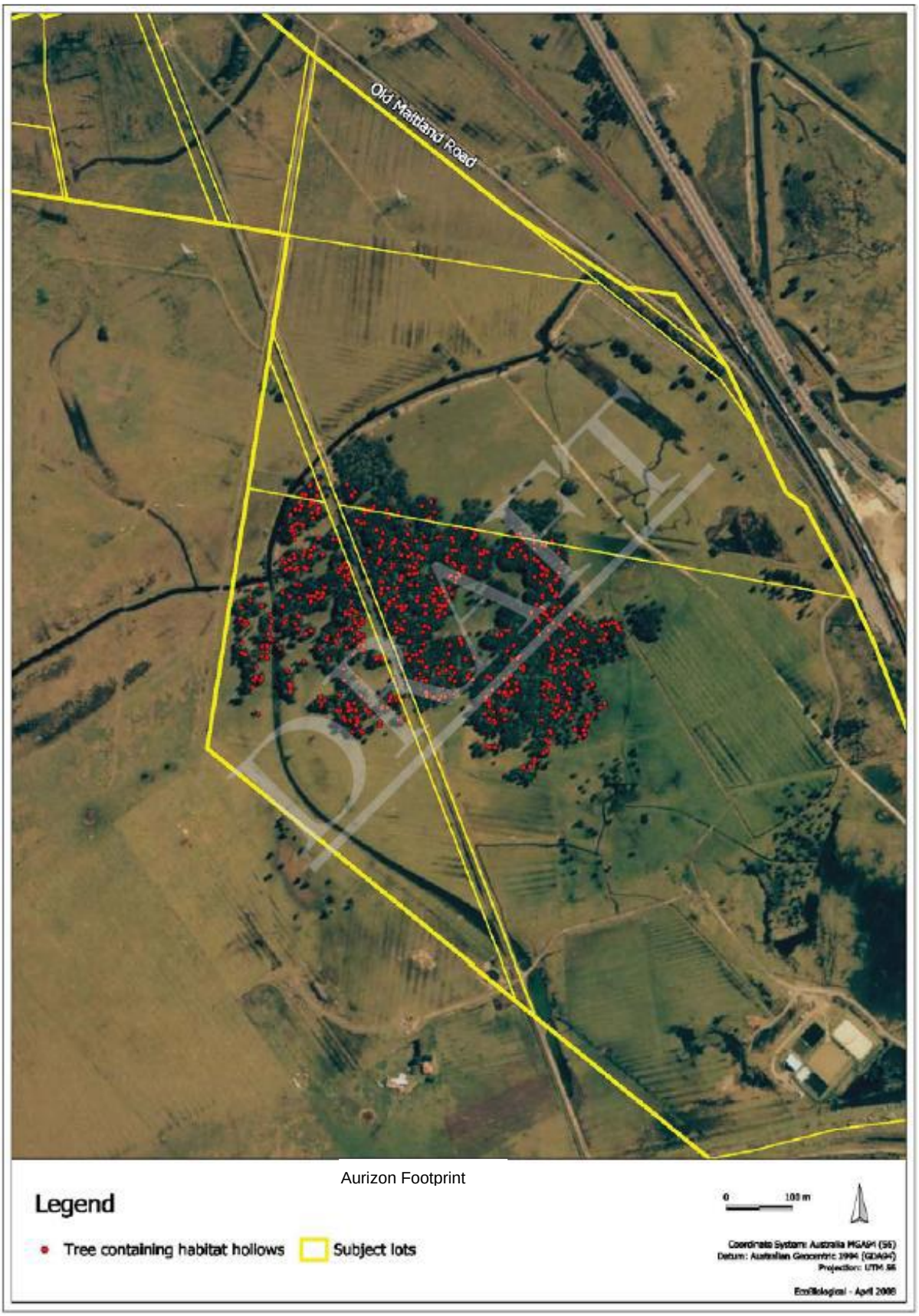


Figure 2.3 Location of hollow bearing trees in the Study Area

2.4 Revegetation

Where practicable, rehabilitation will be carried out in some of the areas that are to be cleared to restore or create native vegetation community environments. Revegetation efforts will only utilise locally indigenous flora species. Any native tubestock or propagules (e.g. seed) will be locally sourced for provenance issues – ideally within a 10km radius of the study area.

Suitable species for revegetation purposes are presented in **Attachment C** and are divided into vegetation community specific species to provide for the best results. Additionally, another category has been provided specifically for local native species that are suitable for landscaping purposes. It is assumed that areas to be targeted for general landscaping will be elevated from the surrounding low-lying areas and as such will require native species that are not dependent on or restricted to wet area habitats. Species detail will need to be selected to reflect the location.

2.5 General responsibilities

General responsibilities for the implementation of the CFFMP are included in Table 6 below.

Table 4 - Responsibilities

Position	General Responsibility
All staff and contractors	• Report incidences of damage to mitigation measures such as fencing and nest boxes. • Report sightings of Green and Golden Bell Frog and any other threatened or injured fauna species.
Restoration Ecologist	• Undertake restoration of native vegetation following temporary disturbance.
Ecology Specialist	• Be available to assist as required where specialist ecological knowledge is required.
Contractor's Environmental Officer	• Provide site inductions to contractors • Undertake inspections of mitigation measures • Provide advice to the Senior Adviser Environment on improvements to mitigation measures where measures are inadequate to achieve their objective.
Senior Adviser Environment	• Provide recommendations to the Site Manager on improvements to mitigation measures to minimise impacts to ecological values.
Site Manager	• Order the rectification of failed mitigation measures and adapt mitigation measures in consultation with the Senior Adviser Environment as required.

3 Ecological Controls

Table 7 below details the specific ecological (flora and fauna) control issues and measures to mitigate, reduce and ameliorate impacts on species and sensitive environments (e.g. EECs). The strategies are based on the recommendations of the ecological assessments and MCoA.

The information provided will provide detail on all stages of the development including:

- Ecological induction;
- Pre-clearing tasks;
- Pre-clearing surveys;
- Vegetation clearance;
- Actions for threatened species discovery; and
- Reporting and post-clearing actions.

Table 7 Environmental Control Measures for CFFMP

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
Task	**Training and Induction**			
1	Ensure that all staff working (civil contractors and sub-contractors) on the TSF project under-take a site-specific environmental induction. The induction must include: • Reference to the CEMP and an overview of its content and applicability; • Sensitivity of EEC wetland / swamp areas, including saltmarsh; and the preventative measures in place to avoid impact such as fencing. Contractors are to be advised that costs associated with incursions requiring rehabilitation may be borne by the contractor. • Site environmental procedures (vegetation management, marking of habitat trees, sediment and erosion control, protective fencing, limits of clearing, noxious weeds – includes photographs and description details of all noxious weeds, EECs and threatened species); • Need for tool-box talk at the start of each day to discuss avoidance of impacts to EECs. • What to do in case of discovery of threatened species (e.g. Green & Gold Bell Frog) or injured fauna; • Key contacts in case of environmental emergency e.g. Native Animal Trust Fund - Ph: 0148 628 483. Inductions are to be provided by the Contractors Environmental Officer.	Contractor	Prior to any new staff or contractors entering the site.	
	Pre-construction / clearing			
2	Accurately and clearly mark out the limits of clearing and trees/vegetation to be retained as well as all stockpile and compound areas as required – on plans and in the field.	Contractor	Prior to commencement of works.	

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
3	Identify trees and significant vegetation (EECs, Offset areas, retained SEPP 14 wetlands) close to work areas which are at risk during construction and install protective fencing (temporary fluoro orange 'para-web' fencing or similar) to reduce risk of damage during the construction phases of the development (this is particularly important during spring and summer when migratory birds and waders use such habitats). Tree protection and significant vegetation areas are to be clearly marked as "No Go Areas" on plans and the fencing (Figure 2.4 and **Attachment B**). Signs indicating significant vegetation and habitat "No Go Areas" are to be located at intervals of no greater than 30m and are to be placed in clear view of site workers. The following actions are prohibited from the protected areas: • Vehicle parking; • Liquid or refuse disposal; • Machinery repairs and/or refuelling; • Construction site office or shed; • Combustion of any material; • Stockpiling of soil, rubble or debris; • Storage and mixing of chemicals or materials; • Any filling or excavation including trenchline, topsoil skimming and/or surface excavation, unless otherwise approved by the relevant authority; and • Unauthorised pesticide, herbicide or chemical applications. These protected areas are to include both the north and south offset sites and any remaining sections of SEPP 14 Wetland or EEC vegetation beyond the construction footprint (**Attachment B**).	Contractor	Prior to commencement of works	

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
4	As the fauna and flora surveys conducted as part of the Hexham Long Term Train Support Facility BDAR Waiver Request (21 September 2021, Jacobs) confirmed that the proposed project area as being heavily disturbed and devoid of any habitat features and/or threatened fauna and flora no additional preclearance survey will be undertaken prior to the commencement of works. If threatened fauna is identified during construction an Ecological specialist will be engaged to advise on suitable management measures and conduct additional surveys of vegetation within the actual Project works area to be carried out (**Attachment B**) as required. •	Senior Adviser Environment	Immediately upon being triggered	
5	Structures to replace hollows shall be erected in accordance with a Nest Box Plan as required and installed a minimum of two weeks prior to clearing works commencement. • Nest boxes of similar type are to be provided on a one to one basis for any natural hollow removed by development; • All nest boxes are to be erected prior to any clearing occurring on the development site (i.e. Common Brush-tail Possum, birds (such as Eastern Rosella) and micro-chiropteran boxes). Nest boxes are to be installed in areas of remnant vegetation where trees are present primarily the northern offset area of Swap Oak Swamp Forest (EEC); • Nest boxes constructed utilising specific dimensions for the target species are to be of durable materials (e.g. natural marine ply, native hardwood, etc.) and fixed to recipient tree with stainless steel screws or wire; • Ecologist to identify suitable location to erect nest boxes within areas beyond the TSF construction limits; • Ecologist(s) to install nest boxes.	Senior Adviser Environment to engage Ecology Specialist when required	2 weeks prior to clearing of any hollow-bearing trees.	

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
6	Stag Watching (if suitable hollows are identified in Project development footprint): • Undertake pre-clearing surveys in the days/nights prior to removal of hollow-bearing trees (HBT) using qualified ecologists – this should be carried out over two evenings the week preceding the proposed clearing; • Dusk stag watches of hollow-bearing trees (dusk or pre-dawn) may need to be done on the days/nights prior to the clearing phases. Searches will primarily be in regard to microchipteran bats, birds and nocturnal fauna species such as possums; • Mark trees/nests that have been surveyed with spray paint; • Any features subject to fauna activity are to be marked appropriately in the field, with a GPS, photos of the hollows are to be taken, the hollow position recorded (i.e. position, height and aspect) to inform nest box placement in the retained areas; • Any species detected will have the number of individuals recorded; • If roosts, dens or dormitories are identified during pre-clearing surveys, the active feature is to be retained in-situ until it is vacated. Clearing of the remaining vegetation could encourage dispersal of fauna from the active feature.	Senior Adviser Environment to engage Ecology Specialist	1 week prior to clearing hollow-bearing trees	
7	Fauna at risk of injury are to be relocated to suitable habitat a safe distance from the proposed works by a qualified ecologist. This will include (where opportunistically encountered during pre-clearing works) species such as small reptiles (e.g. Blue Tongue Lizard).	Senior Adviser Environment to engage Ecology Specialist	As required – whenever fauna are at risk.	
9	Undertake monitoring in accordance with the FFMP as required/triggered.	Senior Adviser Environment	Where triggered	
	During Construction / Clearing			

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
10	**Clearing Supervision Protocol:** • An Ecological Specialist must be present during clearing of all habitat features. • Where required, prior to commencement of works the Ecological Specialist and Contractors Environmental Officer is to discuss the methods of clearing with the plant operators to ensure the following procedures are followed. • All tree clearing will be undertaken in a two-stage process whereby non-habitat tree and vegetation is removed first, then 48 hours later all habitat trees are carefully felled in the presence of a suitably qualified and experienced ecologist; • Clearing is to start from the inside towards the outer edge – towards the areas to be conserved; • Where non-treed wetland areas are to be cleared, "walk overs" by ecologists during the clearing works are to be carried out at the start of each day to inspect and remove native fauna (e.g. Green & Gold Bell Frogs). This must be done while working cooperatively with the machine operators; • Suitable equipment for capturing and storing injured fauna must be on hand during clearing; • The ecologist is to inspect each hollow bearing tree or dormitory for activity prior to removal using binoculars where necessary; • Active roosts, dens or dormitories are to be re-surveyed following agitation to confirm absence of fauna prior to clearing; • Habitat trees will be felled gently through use of excavators rather than chainsaws (by skilled operators), hollows are to be inspected on the ground for injured fauna, and hollow-bearing trees are to be left for 24 hours on the ground giving any fauna trapped in the trees an opportunity to escape; • Hollows are to be inspected to check for fauna after the 24 hours. Any injured fauna are to be taken to the local vet clinic or wildlife carer (Native Animal Trust Fund). Non-injured fauna will be recorded (sex, condition) and relocated to the offset area(s). Fauna rescue personnel will be available to assist with injured fauna;	Contractors Environmental Officer in conjunction with Ecology Specialist	Two days prior to clearing and then each day during clearing of trees. Walk-overs for GGBF are to occur prior to clearing in wetland areas each day.	

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
11	**Protocol for the removal of, rescue and relocation of fauna** Cease work immediately if any previously unknown threatened f fauna species are encountered. NATF (Native Animal Trust Fund) will be notified by the Ecology Specialist if required as part of the clearing works if injured native fauna are encountered. An ecologist is to be present at all times during clearing of habitat features and on call during construction phases. Where fauna species are located and require removal from site prior to and after construction the following steps are to be carried out • Ensure animal and staff are safe. • If fauna is venomous or dangerous (e.g. snake) then allow animal to clear the area by way of observation and follow (at distance / binoculars) to ensure animal has vacated required area. If animal is in an undesirable location (e.g. building or works area) and will not remove itself, the Contractors Environmental Officer and / or the Ecology Specialist should be contacted to remove (a reptile / snake handler may be required for dangerous reptiles). • Other native fauna species requiring rescue, removal or relocation from site – staff are to contact the Contractors Environmental Officer and / or the Ecology Specialist for advice. • If any fauna (native or feral) is sick or injured a wildlife carer may be required to attend – contact via the Contractors Environmental Officer and / or the Ecology Specialist. • Captured native fauna requiring relocation are to be released in an area specified after consultation with wildlife carer, OEH staff or other specialist. • Where domestic stock (e.g. cattle, horse, domestic dog, etc.) are located on site and are suspected as being from adjacent properties, the Contractors Environmental Officer is to contact local landholders for removal. • Feral animals (cats, foxes, goats etc) are to be removed from the construction area onto adjoining land. **Note**: All actions undertaken as part of this component are to be fully documented including aspects such as, species; species numbers; location (GPS); photographs (if possible); corrective, relocation or mitigation actions carried out; details of any consultation carried out (i.e. with OEH of other specialists). Documented information is to be summarised and included in the Clearing and Annual Reports. Where a threatened species has been recorded on the site, details of its location and method of removal (if the individual is in danger) are to be reported to OEH by the Senior Adviser Environment as part of the annual Operational Compliance Report. Mitigation measures are to be reviewed to ensure the CFFMP remains appropriate for the species.	Contractors Environmental Officer with assistance from Ecology Specialist.	As required.	

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
12	As the fauna and flora surveys conducted as part of the Hexham Long Term Train Support Facility BDAR Waiver Request (21 September 2021, Jacobs) confirmed that the proposed project area as being heavily disturbed and devoid of any habitat features and/or threatened fauna and flora no additional preclearance survey will be undertaken prior to the commencement of works. In the event that endangered flora is identified subsequent to this, works are to stop in the immediate vicinity and the following actions undertaken immediately: • Project Manager and Senior Adviser Environment notified; • Isolation and demarcation of the site; • EESG and DPI&E immediately notified; and • Mitigation strategy developed as per Condition 4 of the Approval and Task 13 below.	Senior Adviser Environment	Immediately upon being triggered	
13	As per condition C4 of the Approval, Aurizon will provide the Planning Secretary with a Biodiversity Offset Package developed in consultation with the EESG and Hunter LLS within 12 months of construction commencing. This control measure is triggered only if disturbance occurs outside of the approved Project area and approved disturbance areas listed in the documents under Condition B1 of the Approval.	Senior Adviser Environment	Within 12 months of construction commencing if triggered.	
14	**Woody Debris / Mulch** Where trees require felling, retain the timber, particularly sections with hollows, as Coarse Woody Debris for enhancement of the former northern offset area. Additionally, smaller sections of cleared native vegetation are to be chipped / mulched for use in the northern offset area or any landscaped areas. This material is to be stored at a dedicated stockpile area and then transported and placed in collaboration of Bushland Regenerators / Ecology Specialist and site construction crew (if required).	Senior Adviser Environment	Within 1 week of clearing being completed.	
15	Stockpiles of topsoil shall be stored in the Temporary Topsoil Stockpile Location in windrows no higher than 2m and be maintained free of weeds. The location is shown in the CEMP Ancillary Features figure.	Contractor	On-going.	
16	**Setbacks and exclusion fencing** Limit disturbance of vegetation to the minimum necessary to construct works. Place exclusion fencing including signage every 30m that the fencing represents a 'no go' zone.	Contractor	On-going.	

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
17	Restrict equipment storage and stockpiling of resources to designated areas within cleared land.	Contractor	On-going.	
18	All hollow-bearing trees (HBT) that require felling the Hollow Inspection Checklist will be followed.	Contractor		
19	**Excavation Cells** • Where practicable all excavation cells from construction are to be covered and / or have a protective barrier (e.g. silt fencing or similar) installed to reduce the likelihood of fauna species being trapped and injured. • Contractor's Environmental Officer to inspect all excavation cells prior to work commencing each day to determine if any fauna has been trapped in the cell. If live fauna has been trapped the Contractor's Environmental Officer will contact the Ecology Specialist who will relocate the animal. If the trapped fauna is dead the Ecology Specialist shall identify the species and report to the Office of Environment and Heritage if the animal is a threatened species.	Contractor	Ongoing - During construction	
20	**Green & Gold Bell Frog (GGBF):** • If GGBF is identified by an Ecologist (or other site worker) the protocol as indicated in the Green & Gold Bell Frog Management Plan will be implemented. • Potential GGBF habitat is shown in Figure 1 of the **Attachment E**. Impacts to potential GGBF habitat outside of the construction footprint should be avoided. Where an impact has occurred, rehabilitation of the impact will be directed by the Ecology Specialist.	Senior Adviser Environment	As required.	
21	Impacts to riparian vegetation will be minimised to the greatest possible extent. Where impacts are identified NoW and DPI (Aquaculture and Fisheries) will be immediately notified.	Senior Adviser Environment	As required	

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
22	Rehabilitation of native vegetation areas impacted upon by approved project activities are to be undertaken immediately following the completion of works, where practicable. Rehabilitation measures will include stabilisation of the impacted area through revegetation and/or revetment with geotextile or other suitable material (where revegetation is not sufficient as an individual rehabilitation treatment). Where riparian areas have been impacted rehabilitation measures will be developed in consultation with NoW and DPI (Aquaculture and Fisheries). Where required seedlings replacement is to be carried out for up to three years from initial installation. Revegetation of all areas outside of pasture will be undertaken using native tubestock or seed of local provenance. Weed removal will also occur as part of the revegetation activities in accordance with this plan. All native revegetated areas are to have a 90% success rate for plantings. Implemented remediation will be reported to the ER as part of the scheduled Quarterly Report and to the DPI&E as part of the annual Operation Compliance Report.	Senior Adviser Environment	As required	
23	All exterior lighting will be directional and mounted in a manner to keep light at required locations and not escaping or reflecting unnecessarily.	Senior Adviser Environment	On-going.	
24	Erosion and sediment controls to be implemented in accordance with the Construction Soil and Water Management Plan (CSWMP) – particularly at locations near watercourses and detention basins.	Senior Adviser Environment	On-going.	

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
25	**Waterway Blockages** Inspections of works in or near waterway areas should be carried out in conjunction with sediment control inspections carried out by the Contractors Environmental Officer. • Visual inspections are to be carried out at least on a weekly basis or daily where active construction is in the vicinity of either Middle Creek or the drainage line leading off site to the south. Where blockages in waterways occur as a result of construction of the SSI (for example through failure of erosion and sediment controls), sediment shall be removed as follows: • If the sediment is causing a blockage of channels in saltmarsh, hand tools should be used as care taken to ensure the dimensions of the bed and bank are not altered. • If the sediment is causing a blockage in Middle Creek or other waterways that have stable banks and have an exotic or disturbed grassland riparian zone, machinery such as small back-hoe can be used. Care should be taken to ensure the channel bed and bank dimensions are not altered. • Removed material is to be placed in one of the approved stockpile areas unless originating from the adjacent location and directed for replacement by Contractors Environmental Officer. • Stabilise areas as necessary and reinstall any sediment control structures as necessary. • Management of blockages should be generally consistent with the *NSW Office of water Guidelines for Instream Works on Waterfront Land*	Contractor	Minimum of weekly inspections during construction. Clearing within 24 hours of blockage occurring.	
26	Control and manage potential contaminants (fuels, oils, lubricants) from construction activities by utilisation of safe working methods, as well as specific site requirements for bunding and presence of spill kits.	All contractors	On-going.	
27	Species selected for landscaping will be locally native and/or non-invasive species (**Attachment J**).	Contractor	On-going.	
28	Activities such as hydro-mulching and broadcast seeding to use 'sterile' cover crops which are non-invasive may be utilised in soil stockpiling areas, although revegetation of natural areas, must use species locally indigenous to the area.	Contractor	On-going.	
29	Weeds are to be removed and managed	Contractor	On-going	
	Monitoring – during construction			

	Ecological Control Measure	Person Responsible	Timing/ Frequency	Completed (initials/date)
30	Daily inspection of environmental controls will be reported weekly by the Contractors Environmental Officer– during periods where construction is occurring on a daily basis. Where works are sporadic, inspections by the Contractors Environmental Officer can be reduced appropriately. Inspection timing can be decided upon by the Contractors Environmental Officer in conjunction with the site manager. Inspections should be implemented as soon as practicable after storms and heavy rainfall events.	Contractor	Daily during construction phase.	
31	All environmental records including monitoring and complaints records shall be kept for a period of 4 years and produced to an authorised EPA officer on demand.	Senior Adviser Environment	On-going.	
	Reporting and Non-conformance			
32	Non-conformance report will be completed in accordance with the CEMP.	Senior Adviser Environment	See CEMP	
33	All reporting in regard to the outcomes of CFFMP processes (such as: pre-clearance and clearance surveys; clearing of vegetation; a register of habitat trees, hollows and active nests; rescued / relocated fauna species; corrective actions or necessary changes to procedures) will need to be compiled and documented on a regular and on-going basis by the Contractors Environmental Officer and Ecology Specialist. All information recorded is to be summarised and incorporated into the Annual Report.	Contractor	On-going basis (weekly as a minimum)	
34	Submit reports to OEH outlining environmental performance and compliance with the MCoA.	Senior Adviser Environment	Timeframes in the CEMP	

4 Weed Management

4.1 Background

The TSF area contains a total of 86 introduced species, five of which are declared as noxious weeds in the Newcastle Local Government Area (LGA) and five are regarded as Weeds of National Significance (WoNS) (refer Table 8).

It is essential that all landowners and occupiers must control noxious weeds according to the control category specified in the *Noxious Weeds Act 1993*. It is also desirable from an ecological perspective that all environmental weeds (particularly weeds regarded as Weeds of National Significance (WoNS) or highly invasive species) are also controlled and managed on site. Weed control is of particular importance due to the close proximity of natural areas of significance, such as Hexham Swamp within Hunter Wetlands National Park.

The information provided in 8 provides weed prioritisation in regard to the weed species present at the TSF site and provides detail in regard to control.

General comments in regard to weed control are outlined as below.

- Noxious, WoNS and highly invasive environmental weed species (ranked as very high or high) need to be controlled and managed on site. Upon removal these weeds may be best retained and disposed of on-site and buried either under fill, as part of the construction process, or can be disposed of by burying elsewhere on site. Alternatively weeds may be disposed of at a dedicated waste disposal facility;
- All significant weeds need to be effectively managed to prevent spreading into significant vegetation e.g. SEPP 14 wetland, EECs and the adjacent section of Hunter Wetland National Park;
- Various weed control techniques will be required and likely combinations to effectively control some species such as physical/mechanical removal by hand (i.e. cut and paint) for small clumps, larger clumps may need to be sprayed with herbicide;
- Chemical control (herbicide treatment) across the site will need to done delicately due to the location of the site in and adjacent to significant wetland areas. Environmentally sensitive herbicide such as Round up Biactive® should be utilized;
- Common and less invasive weed species biomass may be retained, broken down (i.e. via a mulching and seed sterilisation process (solar)) on site and reused for rehabilitation / revegetation purposes in pasture restoration areas;
- All weed control and management is to be carried out by suitably experienced and qualified contractors (e.g. Bushland Regenerators) who are able to identify weed species and chose the management technique to carry out any necessary control; and
- Information, including photographs of all noxious weeds and WoNS will be provided to staff during the training and induction phase of site staff prior to the commencement of construction.

4.2 Noxious Weeds

The Contractor must submit a written Noxious Weed Management Plan for the following species to Newcastle City Council's Noxious Weeds Officer for approval one to two weeks prior to proposed removal.

Class 3 Noxious Weeds - Regionally Controlled Weeds

Class Characteristics – Class 3 noxious weeds are plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.

Control Objectives – The control objectives for weed control Class 3 is to reduce the area and the impact of those plants in parts of NSW.

Control Measure – The plant must be fully and continuously suppressed and destroyed.

Class 4 Noxious Weeds - Locally Controlled Weeds

Class Characteristics – Class 4 noxious weeds are plants that threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.

Control Objectives – The control objectives for weed control Class 4 is to minimise the negative impact of those plants on the economy, community or environment of NSW.

Control Measure – The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority

Class 5 Noxious Weeds - Restricted Plants

Class Characteristics – Class 5 noxious weeds are plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

Control Objectives – The control objectives for weed control Class 5 is to prevent the introduction of those plants into NSW, the spread of those plants within NSW or from NSW to another jurisdiction.

Control Measure – The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with and as such must not be sold or purchased and must not be moved from the land.

All weed control activities will be completed by suitably qualified staff and/or contractors.

Table 8 Weeds management priorities and techniques

Scientific Name	Common Name	Noxious Weed Classification	Frequency	Priority Ranking	Management / Comments
Alternanthera philoxeroides	Alligator Weed	Class 3 Noxious Weed – Regionally Controlled (WoNS)	Moderate	Very High	This species is widely dispersed across the site, but generally occurs in dense aggregations. Physical control (deep manual digging) is required with some initial chemical control (herbicide treatment) for use in environmentally sensitive areas (e.g. Round up Biactive) to kill above-ground plant growth as per best management practices provided in the Alligator Weed Control Manual (DPI 2009). As a fair proportion of the TSF and adjacent areas are of pasture, there is potentially some success of reducing the spread of the species in damp to wet grassy meadow areas by grazing cattle / horses. Must be controlled in areas in the near vicinity (~5 m) of significant vegetation (e.g. SEPP 14 wetland, EECs, offset areas). All cleared topsoil containing this species is not to be reused as topsoil, but may be used as fill or disposed of correctly at a licensed waste management facility.
Ageratina adenophora	Crofton Weed	Class 4 Noxious Weed (locally Controlled)	Low	High	The species is not widely dispersed and is restricted to some small clumps / stands in the south eastern disturbed section of the TSF. The application of a registered herbicide for use in environmentally sensitive areas (e.g. Round up Biactive), as per label instructions is recommended. Physical/mechanical removal of small clumps and outliers (including the root system) by hand is a suitable alternative method. The plant must be prevented from growing within 5 metres of a property boundary or watercourses, addition it must be controlled or managed within or near areas of retained significant vegetation (e.g. SEPP 14 wetland, EECs, offset areas).
Bryophyllum delagoense	Mother of millions	Class 4 Noxious Weed (locally Controlled)	Low	High	Present as scattered clumps in highly modified and disturbed areas in the southern portion of the site. The application of a registered herbicide for use in environmentally sensitive areas (e.g. Round up Biactive), as per label instructions. Physical/mechanical removal provides best results - by hand for small clumps and isolated individuals and bagging and disposal; or by machinery (removing the topsoil) and then disposal as part of fill to be used on site or disposed of correctly at a licensed waste management facility. The plant must be prevented from growing within 5 metres of a property boundary and in the vicinity of areas of significant remnant native vegetation (e.g. SEPP 14 wetland, EECs, offset areas).

Scientific Name	Common Name	Noxious Weed Classification	Frequency	Priority Ranking	Management / Comments
Lantana camara	Lantana	Class 5 Noxious Weed - Restricted Plants (WoNS)	Low	High	Generally located as small to medium clumps in the highly modified southern portion of the study area. Physical/mechanical removal by hand (i.e. cut and paint) may be the most effective method; alternatively larger clumps may need to be sprayed with herbicide. The application of a registered herbicide for use in environmentally sensitive areas (e.g. Round up Biactive), as per label instructions. The plant must be prevented from growing within 5 metres of a property boundary or in the vicinity of areas of significant remnant native vegetation (e.g. SEPP 14 wetland, EECs, offset areas).
Rubus fruticosus sp. agg.	Blackberry complex	Class 4 Noxious Weed (locally Controlled) (WoNS)	Low	High	Scattered locations across the TSF site, although no large dense aggregations generally associated with the highly disturbed southern portion of the site. Physical/mechanical removal by hand (i.e. cut and paint) may be the most effective method; alternatively larger clumps may need to be sprayed with herbicide. Machinery may be useful in dense aggregations (e.g. tractor, backhoe, etc.). The plant must be prevented from growing within 5 metres of a property boundary or watercourse.
Araujia sericifera	Moth Vine		Low	High	Generally located as primarily isolated individuals in the highly modified southern portion of the study area, although scattered plants are present across the site. Hand removal of small plants and cut and paint (or spray) for larger individuals. Aerial seed should be removed and destroyed (by methods such as incineration, disposal at a dedicated waste management facility or buried on site as where fill is utilised). The plant must be prevented from growing within 5 metres of the boundary of areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas.
Ipomoea purpurea	Common Morning Glory		Low	High	Generally located as small to medium clumps in the highly modified southern portion of the study area, although scattered plants are present across the site. Hand removal of ground runners and cut and paint (or spray) for larger individuals. Aerial seed should be removed and destroyed or deeply buried. The plant must be prevented from growing within 5 metres of the boundary of areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas.

Scientific Name	Common Name	Noxious Weed Classification	Frequency	Priority Ranking	Management / Comments
Ricinus communis	Castor Oil Plant		Low	High	Generally located as small to medium clumps in the highly modified southern portion of the study area, although scattered clumps are present across the site. Hand removal of small plants and cut and paint (or spray) for larger individuals. Aerial seed should be removed and destroyed or deeply buried. The plant must be prevented from growing within 5 metres of the boundary of areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas.
Juncus acutus	Sharp Rush		Low / Moderate	High	Primarily located in the southern portion of the site within and adjacent to the southern offset area (this area has a particularly dense population), although some scatted individuals are dispersed across the site. This species will need to be managed, likely by a combination of hand removal of small individuals and spraying or cut and painting of larger individuals. The plant must be prevented from growing within 5 metres of a property boundary or in the vicinity of areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas.
Senecio madagascariensis	Fireweed	(WoNS)	Moderate	Moderate	This species is widely dispersed across the site in all areas containing pasture, Swamp Oak Swamp Forest, although it seldom appears to be in dense stands. Hand-pulling individual plants and using spot spraying herbicide application (e.g. Round up Biactive or similar product). Difficult species to eradicate, but some effort must go into managing the species.
Acacia saligna	Golden Wreath Wattle		Moderate	Moderate	Present as a rehabilitation / stabilisation species, across most vegetated non-pasture or wetland areas of site. Species will need specific control where reestablishment of native woodland /open forest habitats or native landscaping is to be recreated. Hand pull seedlings and cut and paint more mature individuals Control as necessary where in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Hydrocotyle bonariensis	Pennywort		Low / Moderate	Moderate	Control as necessary where in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Aster subulatus	Wild Aster		Low / Moderate	Moderate	Control as necessary where in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas

Scientific Name	Common Name	Noxious Weed Classification	Frequency	Priority Ranking	Management / Comments
Gomphocarpus fruticosus	Narrow-leaved Cotton Bush		Low / Moderate	Moderate	Control as necessary where in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Cirsium vulgare	Spear Thistle		Low	Moderate	Control as necessary where in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Cotula coronopifolia	Water Buttons		Low	Moderate	Control as necessary where in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Cinnamomum camphora	Camphor Laurel		Low	Moderate	Cut and paint or hand pull small individuals. Larger plants will need to be frilled or drilled and with the application of herbicide.
Ligustrum sinense	Small-leaved Privet		Low	Moderate	Cut and paint or hand pull small individuals. Larger plants will need to be frilled or drilled and with the application of herbicide.
Phytolacca octandra	Inkweed		Low	Moderate	Potentially invasive weed that will need to be removed and controlled, either by hand or mechanically.
Conyza sp.			Moderate	Low	General control as necessary across the TSF site, although specific treatment may be required in locations in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Sida rhombifolia	Paddy's Lucerne		Moderate	Low	
Pennisetum clandestinum	Kikuyu Grass		Moderate	Low	
Chloris gayana	Rhodes Grass		Moderate	Low	
Axonopus fissifolius	Narrow-leafed Carpet Grass		Moderate	Low	
Tagetes minuta	Stinking Roger		Low / Moderate	Low	
Verbena bonariensis	Purpletop		Moderate	Low	
Phyla nodiflora	Carpet Weed		Moderate	Low	

Scientific Name	Common Name	Noxious Weed Classification	Frequency	Priority Ranking	Management / Comments
Cyperus congestus			Low / Moderate	Low	
Rumex crispus	Curled Dock		Low / Moderate	Low	
Lolium perenne	Perennial Ryegrass		Low / Moderate	Low	
Ehrharta erecta	Panic Veldtgrass		Low / Moderate	Low	
Paspalum dilatatum	Paspalum		Low / Moderate	Low	
Anagallis arvensis	Scarlet/Blue Pimpernel		Low / Moderate	Low	General control as necessary across the TSF site, although specific treatment may be required in locations in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Solanum mauritianum	Wild Tobacco Bush		Low / Moderate	Low	
Schinus areira	Pepper Tree		Low	Low	
Erechtites valerianifolius	Brazilian Fireweed		Low	Low	
Euchiton sp.	Cudweed		Low	Low	
Hypochaeris radicata	Catsear		Low	Low	
Bidens pilosa	Cobbler's Pegs		Low	Low	
Ambrosia tenuifolia	Lacy Ragweed		Low	Low	
Ambrosia psilostachya	Perennial Ragweed		Low	Low	
Conyza albida	Tall Fleabane		Low	Low	
Conyza bonariensis	Flaxleaf Fleabane		Low	Low	

Scientific Name	Common Name	Noxious Weed Classification	Frequency	Priority Ranking	Management / Comments
Galinsoga parviflora	Potato Weed		Low	Low	
Heterotheca grandiflora	Telegraph Weed		Low	Low	
Taraxacum officinale	Dandelion		Low	Low	
Capsella bursa-pastoris	Shepherd's Purse		Low	Low	
Atriplex prostrata	-		Low	Low	Will need to be removed / controlled (physical hand removal / spot spraying with (e.g. Round up Biactive or similar)) if in the vicinity of Saltmarsh EEC areas
Euphorbia peplus	Petty Spurge		Low	Low	General control as necessary across the TSF site, although specific treatment may be required in locations in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Trifolium repens	White Clover		Low	Low	
Trifolium fragiferum	Strawberry Clover		Low	Low	
Centaurium erythraea	Common Centaury		Low	Low	General control as necessary across the TSF site, although specific treatment may be required in locations in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Romulea rosea var. *australis*	Onion Grass		Low	Low	
Lilium formosanum	Formosan Lily		Low	Low	Treatment (either hand dig or high concentration herbicide on scraped stems) will be required in locations in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas.
Cotoneaster sp.	Cotton Easter		Low	Low	General control as necessary across the TSF site, although specific treatment may be required in locations in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Malva sp.			Low	Low	
Modiola caroliniana	Red-flowered Mallow		Low	Low	
Hibiscus sp.			Low	Low	
Plantago lanceolata	Lamb's Tongues		Low	Low	
Hordeum leporinum	Barley Grass		Low	Low	

Scientific Name	Common Name	Noxious Weed Classification	Frequency	Priority Ranking	Management / Comments
Echinochloa crus-galli	Barnyard Grass		Low	Low	
Eragrostis curvula	African Lovegrass		Low	Low	
Setaria gracilis	Slender Pigeon Grass		Low	Low	
Melinis repens	Red Natal Grass		Low	Low	
Andropogon virginicus	Whisky Grass		Low	Low	
Briza maxima	Quaking Grass		Low	Low	
Holcus lanatus	Yorkshire Fog		Low	Low	
Setaria verticillata	Whorled Pigeon Grass		Low	Low	
Sporobolus africanus	Parramatta Grass		Low	Low	
Persicaria orientalis (cultivated form)	Princes Feathers		Low	Low	General control as necessary across the TSF site, although specific treatment may be required in locations in close proximity to areas of significant remnant native vegetation e.g. SEPP 14 wetland, EECs, offset areas
Portulaca sp.			Low	Low	
Portulaca pilosa			Low	Low	
Verbascum virgatum	Twiggy / Green Mullein		Low	Low	
Solanum nigrum	Black-berry Nightshade		Low	Low	
Verbena rigida	Veined Verbena		Low	Low	

5 Environmental Monitoring and Reporting

5.1 Monitoring

Inspections of sensitive areas and activities with the potential to impact on flora and fauna will occur for the duration of the project consisting of regular processes including daily visual inspections, documented weekly inspections by environmental staff and regular Environment Review Group inspections will be utilised to ensure mitigation measures and environmental controls are working effectively.

Weed management will be reported on a as part of the Post Decommissioning Compliance Report and will addressing the following:

- Summary of conditions;
- Description of weed control activities completed;
- Results of treatments; and
- Future management recommendations.

Where deficiencies in controls or systems are identified, the issue and required action will be managed as described in the CEMP and a record maintained to demonstrate timely action and close out.

As per Condition B4A of the Approval, the ecological monitoring program detailed in condition C3 is not applicable to the Project. As such the requirement to link the effectiveness of management measures to it, as required by Condition E63(b)(viii), does not apply.

5.2 Reporting

An initial Clearing Report in relation to the utilised clearing procedures will be implemented into the Post Decommissioning Compliance Report and will include (but not limited to) the following:

- Details of methods used during pre-clearing surveys and clearing operations;
- Fauna species displaced / rescued / relocated by clearing, species captured, species released and any wildlife injuries or mortalities resulting either directly or indirectly from the clearing operations;
- Location of fauna within clearing footprint (recorded with GPS) and release locations;
- Register of habitat trees, hollows and active nests;
- Results of vegetation clearing; and
- Implemented corrective actions or necessary changes to procedures.

5.3 Review and amendment of CFFMP

The Senior Adviser Environment will review this Plan and its implementation, as per MCoA E63(b) (ix), upon any material change to the approved scope of works. The purpose of the review is to ensure that the CEMP and associated sub-plans and project operating system is meeting the project's statutory requirements.

The review will consider:

- Relevance of existing FFMP strategies and protocols;
- Clients, site personnel and agency comments;
- Audit findings;

- Environmental inspection and monitoring records;
- Complaints;
- Incident reports;
- Corrective actions taken;
- Environmental non-conformance;
- Changes in organisational structure;
- Changes in construction methodology; and
- Changes in legislation and standards.

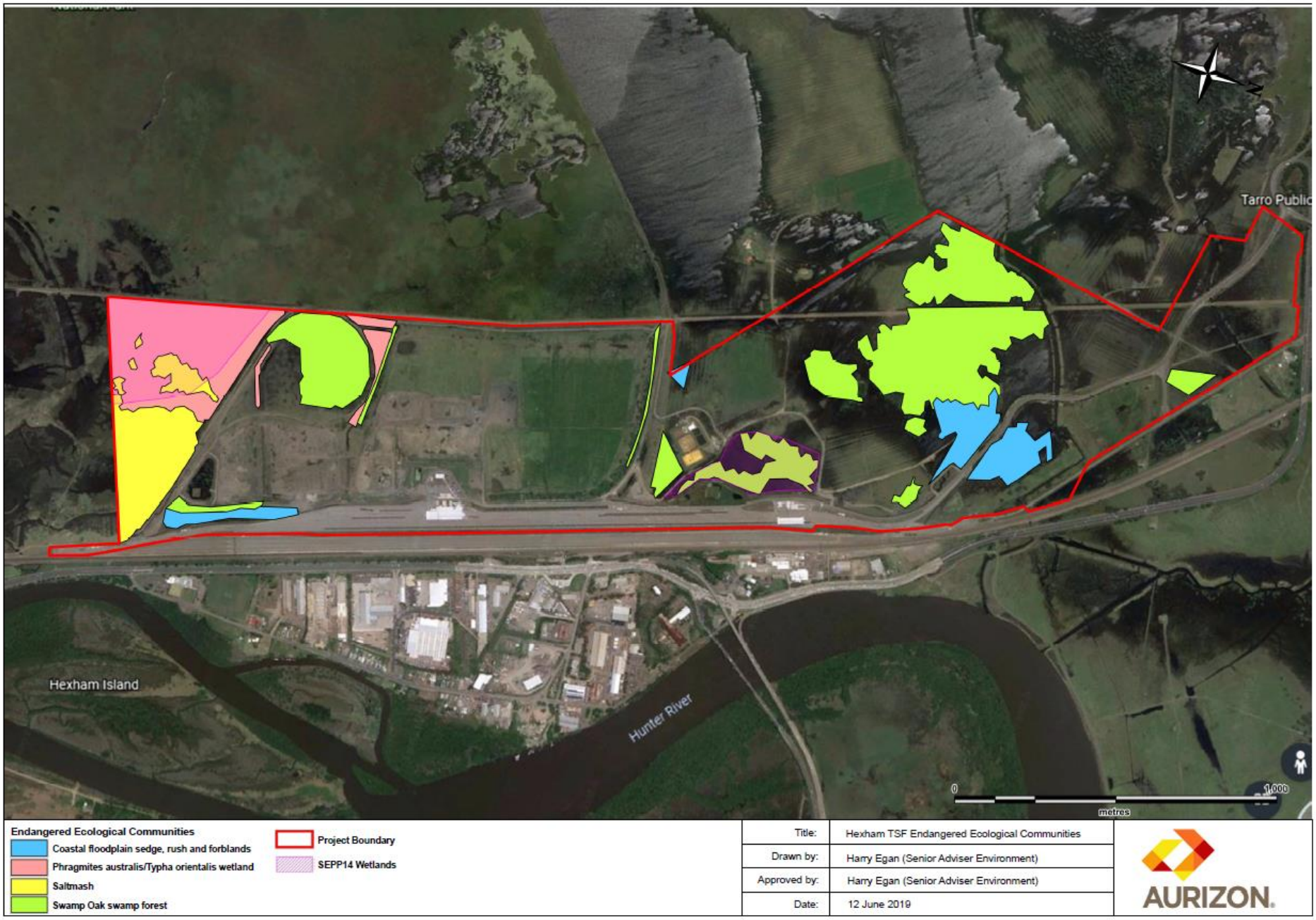
The Senior Advisor Environment or Environment Representative, if required to be engaged, has authority to approve/reject minor amendments to this CEMP. Minor amendments are changes that do not have a detrimental effect on the environment or increase the risk profile. Major changes to the CEMP and associated sub-plans will require Director-General approval.

Where there has been a significant incident or failure of the CEMP and CFFMP to protect flora and fauna the CFFMP is to be reviewed as soon as practicable and changes recommended to ensure the failure will not occur again. Where the recommended changes are relatively minor, they are to be submitted to the Senior Advisor Environment or Environmental Representative (if engaged) for approval and provided to the DPE for information. Where changes are significant, the recommendations are to be submitted to the DPE for their approval.

References

- ADW Johnson (2013) *Environmental Assessment, NSW Train Support Facility*, 16 November 2012, Project No. 37417.
- Department of Primary Industries (DPI) NSW (2009) Pest Weed Management – Species Information http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles
- Department of Primary Industries (DPI) NSW (2009) Noxious Weed Declarations http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed
- Department of Water and Energy (DWE) NSW (2008) *Guidelines for Controlled Activities Watercourse Crossings.*
- Ecobiological (2008) Draft Ecological Assessment for Proposed Train Support Facility, Maitland Rd, Hexham, NSW
- ECOHUB (2009) Draft Ecological Assessment for Aurizon – Proposed Industrial subdivision, train support facility and intermodal development.
- Ecological (2013) *Aurizon – Train Support Facility, Hexham Ecological Investigations*, Report Ref: 10NEWECO-0017, 10 April 2013.
- JBA (2013) *Preferred Project Report and Response to Submissions Project Application MP07_0171, Maitland Road, Hexham, PPR NSW Train Support Facility*, June 2013, Ref: 12599.
- Ecological Assessment (Jacobs, 23 May 2019).
- Section 5.25 Modification to SSI 6090: Hexham Long Term Train Support Facility-Ancillary Depot ang Wagon Storage (Ethos Urban 8 April 2022)
- Hexham Long Term Train Support Facility BDAR Waiver Request (21 September 2021, Jacobs)

ATTACHMENT A – ECOLOGICAL COMMUNITIES


Tarro Public
Hexham Island
Hunter River
0
1,000
metres
Endangered Ecological Communities
Coastal floodplain sedge, rush and forblands
Phragmites australis/Typha orientalis wetland
Saltmash
Swamp Oak swamp forest
Project Boundary
SEPP14 Wetlands
Title: Hexham TSF Endangered Ecological Communities
Drawn by: Harry Egan (Senior Adviser Environment)
Approved by: Harry Egan (Senior Adviser Environment)
Date: 12 June 2019

ATTACHMENT B – PRE-CLEARING CHECKLIST

Pre-clearing checklist

Project:		**Date inspected:**			
Project Area:		**Chainage area envelope:**			
Subcontractor:		**List of machinery used:**			
Date start:		**Construction Stage / Activity:**			
Date finish:		**Compliance**			
#	**Control Measure**	**Yes**	**No**	**NA**	**Comments**
1	Has the limit of clearing (including stockpile and compound areas) been clearly delineated by survey?				
2	Has detailed boundary survey of all retained native vegetation communities (SEPP 14 and EEC) using a differential GPS been carried out?				
3	All trees / vegetation to be retained identified and “No-Go” Areas fenced off? Is “No-Go” signage at the minimum recommended 30m intervals?				
4	Have habitat trees / nests been identified and appropriately marked?				
5	Has the boundary of the outer edge of the north and south dedicated offset areas been permanently delineated using fencing, posts, bollards or similar as well as signage?				
6	Have required nest boxes been installed?				
7	Are there any hollow bearing trees to be cleared?				
8	Has the ecologist cleared tree(s) for removal?				
9	Specific targeted surveys required? (e.g. GGBF, stag-watching, call playback, Anabat)				
10	Specific targeted surveys undertaken? (e.g. GGBF, stag-watching, call playback, Anabat)				
	Detail how surveys were carried out including results.				

#	Control Measure	Compliance			
		Yes	No	NA	Comments
11	Are any animals present? (If *Yes*, relocation required?)				
12	Are any active nests present? (If *Yes*, relocation required?)				
13	Any unexpected threatened species observed? If so, provide detail in regard to: species type, number, measures taken, consultation (if required)				
14	Are erosion and sediment controls in place?				
15	Are vehicle/equipment access routes minimised and delineated?				
16	Is the green waste storage area identified and delineated in an existing cleared area?				
17	Have all personnel involved been "toolboxed" on the sensitive "No-Go" area locations and ecological management measures?				
18	Are the proposed works covered by an existing Approval?				
Brief description of sensitive areas / sites or threatened species within clearing zone:					
Additional Comments:					

APPROVALS

Inspection completed by Ecological Specialist: Date:

Ecologist Signature Required

Approval by Environmental Co-ordinator / Manager: Date:

EC / EM Signature Required

ATTACHMENT C – REVEGETATION SPECIES LIST

LTTSF (Hexham) Recommended revegetation species

The following table provides an indication of the native species suitable for revegetation purposes at the TSF site

* General Landscaping – it is assumed that areas to be targeted for general landscaping will be elevated from the surrounding low-lying areas and as such will require native species that are not dependent on or restricted to wet area habitats. Species detail will need to be selected to reflect the location.

Family	Scientific Name	Common Name	Swamp Sclerophyll Forest	Swamp Oak Swamp Forest	Saltmarsh	Freshwater Wetland	General Landscaping*
Acanthaceae	*Brunoniella australis*	Blue Trumpet					
Adiantaceae	*Pellaea falcata*	Sickle Fern					
Adiantaceae	*Cheilanthes sieberi*						
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair					X
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach			X		
Alismataceae	*Alisma plantago-aquatica*	Water Plantain				X	
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed					
Apiaceae	*Apium prostratum*	Sea Celery			X		
Apiaceae	*Centella asiatica*	Pennywort	X	X			X
Apiaceae	*Actinotus minor*	Lesser Flannel Flower					X
Apiaceae	*Hydrocotyle peduncularis*		X	X			
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort	X	X			
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax					X
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine	X				X
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell					X
Casuarinaceae	*Casuarina glauca*	Swamp Oak	X	X			X
Casuarinaceae	*Allocasuarina littoralis*	Black Sheoak					X
Chenopodiaceae	*Sarcocornia quinqueflora*				X		

Family	Scientific Name	Common Name	Swamp Sclerophyll Forest	Swamp Oak Swamp Forest	Saltmarsh	Freshwater Wetland	General Landscaping*
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	X				
Chenopodiaceae	*Einadia trigonos*	Fishweed	X				
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	X	X			X
Cunoniaceae	*Ceratopetalum gummiferum*	Christmas Bush					X
Cyperaceae	*Bolboschoenus caldwellii*					X	
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	X				
Cyperaceae	*Eleocharis minuta*					X	
Cyperaceae	*Baumea articulata*	Jointed Twig-rush	X			X	
Cyperaceae	*Baumea rubiginosa*		X			X	
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge	X			X	
Cyperaceae	*Lepidosperma laterale*						
Cyperaceae	*Schoenoplectus mucronatus*					X	
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern	X				X
Dicksoniaceae	*Calochlaena dubia*	Common Ground Fern	X				
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower					X
Ericaceae	*Epacris pulchella*						X
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart	X	X			X
Fabaceae (Faboideae)	*Gompholobium latifolium*	Golden Glory Pea					X
Fabaceae (Faboideae)	*Pultenaea paleacea*						X
Fabaceae (Faboideae)	*Bossiaea obcordata*	Spiny Bossiaea					X
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	X				X
Fabaceae (Faboideae)	*Glycine microphylla*		X				X

Family	Scientific Name	Common Name	Swamp Sclerophyll Forest	Swamp Oak Swamp Forest	Saltmarsh	Freshwater Wetland	General Landscaping*
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle	X				X
Fabaceae (Mimosoideae)	*Acacia suaveolens*	Sweet Wattle					X
Fabaceae (Mimosoideae)	*Acacia terminalis*	Sunshine Wattle					X
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses					X
Haloragaceae	*Gonocarpus teucrioides*	Raspwort					X
Haloragaceae	*Gonocarpus micranthus* subsp. *micranthus*		X				X
Iridaceae	*Patersonia sericea* var. *sericea*						X
Juncaceae	*Juncus kraussii*	Sea Rush		X	X		
Juncaceae	*Juncus subsecundus*			X		X	
Juncaceae	*Juncus continuus*			X		X	
Juncaceae	*Juncus planifolius*			X		X	
Juncaceae	*Juncus prismatocarpus*			X		X	
Juncaginaceae	*Triglochin striatum*	Streaked Arrowgrass				X	
Juncaginaceae	*Triglochin microtuberosum*					X	
Lobeliaceae	*Pratia purpurascens*	Whiteroot	X	X			X
Lomandraceae	*Lomandra glauca* subsp. *glauca*						X
Lomandraceae	*Lomandra obliqua*						X
Lomandraceae	*Lomandra confertifolia* subsp. *rubiginosa*						X
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*						X
Lomandraceae	*Lomandra longifolia* var. *longifolia*		X				X

Family	Scientific Name	Common Name	Swamp Sclerophyll Forest	Swamp Oak Swamp Forest	Saltmarsh	Freshwater Wetland	General Landscaping*
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark	X				
Myrtaceae	*Corymbia maculata*	Spotted Gum					X
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	X				X
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark	X	X		X	X
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree	X				X
Myrtaceae	*Eucalyptus acmenoides*						X
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	X	X			X
Myrtaceae	*Angophora costata*	Sydney Red/Rusty Gum					X
Myrtaceae	*Melaleuca armillaris*	Bracelet Honey-myrtle	X			X	X
Myrtaceae	*Kunzea ambigua*	Tick Bush					X
Myrtaceae	*Melaleuca hypericifolia*	Hillock bush					X
Myrtaceae	*Callistemon citrinus*	Crimson Bottlebrush	X				X
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany					X
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush	X				X
Myrtaceae	*Melaleuca decora*		X				X
Myrtaceae	*Melaleuca nodosa*	Ball Honeymyrtle					X
Myrtaceae	*Melaleuca sieberi*		X				X
Myrtaceae	*Melaleuca thymifolia*		X				X
Myrtaceae	*Corymbia gummifera*	Red Bloodwood					X
Myrtaceae	*Syncarpia glomulifera*	Turpentine					X
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*						X
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree					X
Phormiaceae	*Dianella caerulea* var. *caerulea*		X	X			X
Pittosporaceae	*Billardiera scandens*	Appleberry	X				X

Family	Scientific Name	Common Name	Swamp Sclerophyll Forest	Swamp Oak Swamp Forest	Saltmarsh	Freshwater Wetland	General Landscaping*
Poaceae	*Phragmites australis*	Common Reed		X	X	X	
Poaceae	*Paspalum vaginatum*	Salt-water Couch		X	X		
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass					X
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass					X
Poaceae	*Isachne globosa*	Swamp Millet	X			X	
Poaceae	*Poa labillardieri*	Tussock					X
Poaceae	*Entolasia stricta*	Wiry Panic	X				
Poaceae	*Themeda australis*	Kangaroo Grass					X
Poaceae	*Microlaena stipoides* var. *stipoides*		X				X
Poaceae	*Austrostipa pubescens*		X				X
Polygonaceae	*Persicaria decipiens*	Spotted Knotweed	X			X	
Polygonaceae	*Persicaria lapathifolia*	Pale Knotweed	X			X	
Polygonaceae	*Persicaria hydropiper*	Water Pepper	X			X	
Proteaceae	*Banksia integrifolia* subsp. *integrifolia*	Coastal Banksia					X
Proteaceae	*Grevillea sericea*						X
Proteaceae	*Hakea dactyloides*	Finger Hakea, Broad-leaved Hakea					X
Proteaceae	*Lambertia formosa*	Mountain Devil					X
Proteaceae	*Lomatia silaifolia*	Crinkle Bush					X
Proteaceae	*Petrophile pulchella*	Conesticks					X
Proteaceae	*Banksia oblongifolia*	Fern-leaved Banksia					X
Proteaceae	*Banksia serrata*	Old-man Banksia					X
Proteaceae	*Isopogon anethifolius*						X
Proteaceae	*Banksia spinulosa* var. *collina*						X
Ranunculaceae	*Ranunculus inundatus*	River Buttercup	X			X	
Ranunculaceae	*Clematis glycinoides*	Headache Vine					X
Restionaceae	*Lepyrodia scariosa*		X	X		X	
Rubiaceae	*Opercularia varia*	Variable Stinkweed	X				

Family	Scientific Name	Common Name	Swamp Sclerophyll Forest	Swamp Oak Swamp Forest	Saltmarsh	Freshwater Wetland	General Landscaping*
Rubiaceae	*Pomax umbellata*						X
Rutaceae	*Zieria smithii*	Sandfly Zieria					X
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo					X
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush					X
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsaparilla	X				X
Sterculiaceae	*Lasiopetalum ferrugineum* var. *ferrugineum*						X
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*						X
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi				X	
Violaceae	*Viola hederacea*		X	X			X
Vitaceae	*Cissus antarctica*	Water Vine	X				X

ATTACHMENT D – HOLLOW BEARING TREE INSPECTION SHEET

Hollow Inspection Checklist

Project:			**Date:**
Location/Chainage:			
Ecologist:		**Tree Number:**	
Size of entrance (small/medium/large)*		Fauna species inhabiting hollow (if present)	
Size of hollow (small/medium/large)*		Fauna species most likely to utilise hollow	
Height of hollow from ground		Is there an animal in the hollow? What type?	
Tree species		Is it injured or juvenile?	
Where/when was it released/rescued?			
Are there any other hollows on same tree? (use a separate checklist)			
Description and location of replacement hollow	Material/brand:	GPS: Height mounted on tree:	Tree species:

*Key hollow size: small <8cm, medium 8-20cm and large >20cm

ATTACHMENT E – GREEN AND GOLDEN BELL FROG PLAN

LTTSF (Hexham)

Green and Golden Bell Frog Plan

1 Introduction

The following information is provided and is to be utilised if a Green and Gold Bell Frog (*Litoria aurea*) is located or suspected to be within the construction clearing zone for the TSF by construction staff. The strategies indicated in this document must be adhered by all construction staff.

Unless otherwise referenced, the management actions described were adopted from the Newcastle Coal Infrastructure Group (NCIG 2013) Green and Golden Bell Frog Management Plan, and the NCIG Kooragang Island Coal Export Terminal – Seasonal Ecological investigations – Green and Golden Bell Frog Survey report prepared by Connell Hatch in 2006.

2 Delineation of disturbance areas

In accordance with the project Flora and Fauna Management Plan, sensitive environmental areas including potential Green and Golden Bell Frog habitat areas adjoining the construction area are to be clearly marked to prevent accidental damage during construction and operation. All areas of native vegetation except for saltmarsh are considered potential GGBF habitat. The cleared areas and saltmarsh may provide for occasional foraging and movement. **Figure 1** in this Green and Gold Bell Frog plan shows GGBF habitat for protection.

If Green and Golden Bell Frog are recorded on the site an ecologist will advise on the location and need for additional fencing that prevents access by frogs onto the construction zone.

3 Contractor induction and training

In accordance with the Flora and Fauna Management Plan, all Aurizon personnel and contractors will undergo environmental induction training carried out by the Contractors Environmental Officer before commencing work on-site. Information addressed during this training would include:

- Green and Golden Bell Frog profile and identification.
- Identification of potential Green and Golden Bell Frog habitat areas within and adjacent to the construction footprint. Project personnel would be prohibited from entering Green and Golden Bell Frog habitat areas located outside the defined construction or operational areas.
- The correct procedures (as described in section 5 of this GGBF Management Plan) to follow in the event that Green and Golden Bell Frogs are found on site.

4 Pre-clearance surveys

Pre-clearance surveys would include targeted active searches of potential Green and Golden Bell frog habitat located within project disturbance areas. Pre-clearance surveys would be undertaken by a suitably qualified and licensed ecologist prior to construction each day, and would comply with the NSW Department of Primary Industries and Animal Research wildlife survey guidelines for amphibians.

The pre-clearance surveys (and if applicable relocation activities) would be conducted to minimise disruption to breeding activities and the need to relocate tadpoles or metamorphlings, where practicable (NCIG 2013). As a general precaution clearing would be kept to the minimum required, to minimise disturbance to frog habitats.

Habitat resources typically associated with the lifecycle components of the Green and Golden Bell Frog (e.g. ponded areas and rocks, logs, tussock forming vegetation and other cover) would be searched during a diurnal visual inspection (NCIG 2013).

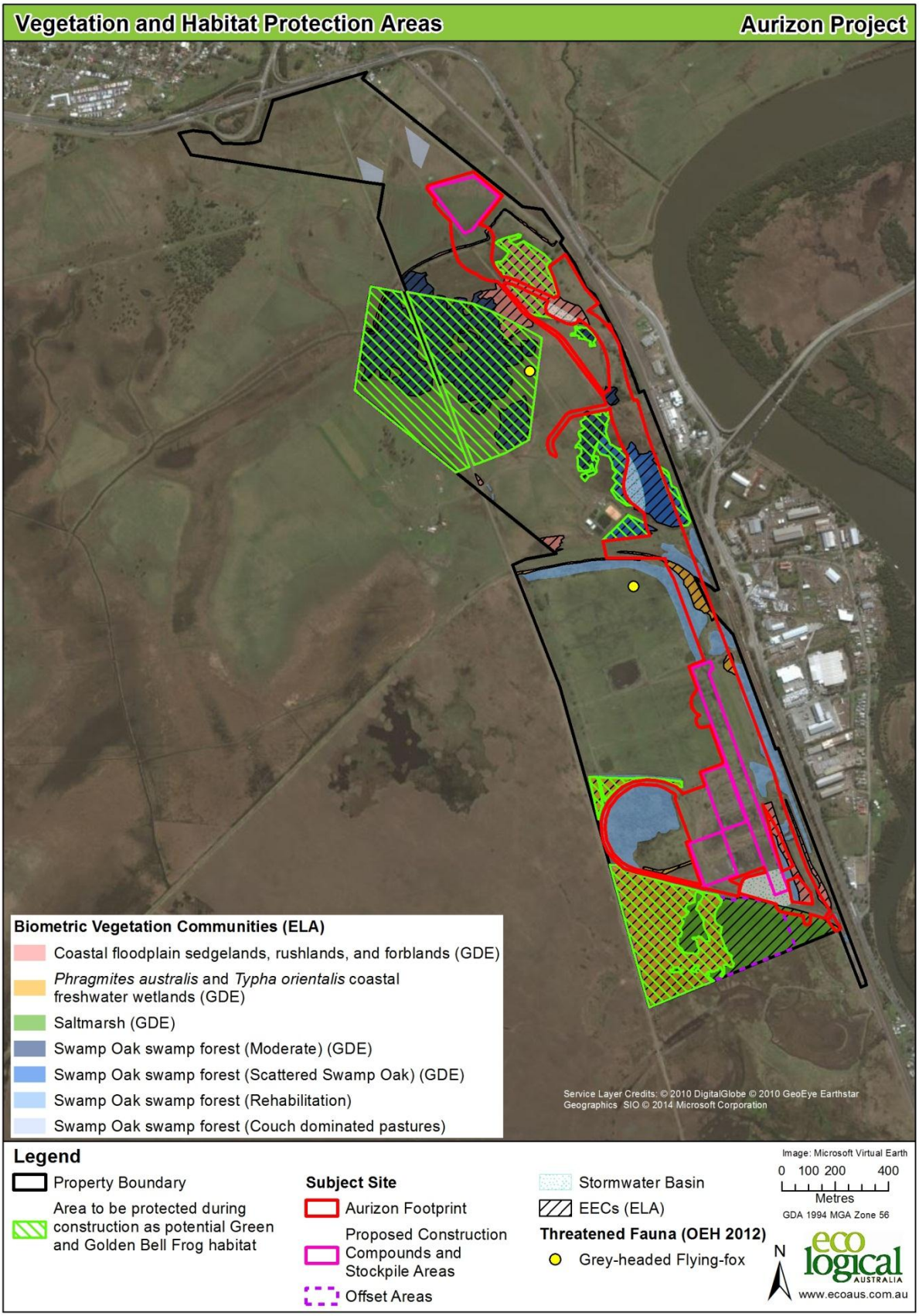


Figure 1 Green and Gold Bell frog habitat for protection

Following the diurnal habitat searches, a nocturnal search will be conducted to assess nocturnal usage (i.e. breeding/calling) in the habitat area. The nocturnal habitat searches shall be based on DEC (2009) Field Survey Methodology and is to include:

- Searching of habitat features which were searched during the day;
- Spotlighting; and/or
- Call playback.

In the event that any Green and Golden Bell Frogs are observed during the diurnal or nocturnal searches for the pre-clearance surveys, frogs would be relocated to adjacent habitat prior to the commencement of construction works and OEH notified immediately.

In the event that GGBF are found on the site a targeted GGBF survey will be undertaken in accordance with DEC (2004) Threatened Species Survey and Assessment Guidelines.

5 Frog relocation procedure

5.1 Relocation during pre-clearance surveys

In the event a Green and Golden Bell Frog is identified within the project disturbance areas during pre-clearance surveys, the following relocation procedure would be initiated:

1. The ecologist undertaking the pre-clearance survey would capture the frog. The use of clean gloves and / or freezer bags (or similar) should be utilised to capture the frogs to reduce the incidence of transfer of potentially toxic elements to frogs. New gloves or freezer bags should be utilised for each individual caught to reduce the potential for transfer of disease between individuals (as per the DECC 2008 Hygiene Protocol for the Control of Disease in Frogs). The bag is to be rinsed out with clean water. Bad should be inflated and knotted at the top.
2. If the frog appears to be healthy a release location would be determined by the ecologist, and the frog would be released into the relocation area. If GGBF are found in the northern half of the site, the ecologist will determine a suitable relocation area preferably in the northern offset area shown in Figure 2.2. The release area should be within 30m of standing freshwater if possible and in a cool and sheltered location. If the GGBF is found in the southern part of the site, the frog should be released into the southern offset area in the freshwater-dominated environment (i.e., not in the saltmarsh). The ecologist will however need to determine the best location given the activities being undertaken and the weather conditions on the day. Any frog to be relocated would be held in a cool, dark, moist place until nightfall (NCIG 2013). If the frog appears to be sick, or is dead, the procedures outlined in the section below would be followed.

Details of Green and Golden Bell Frog relocations (e.g. lifecycle stage and sex of individual, location where found and location of release) conducted during pre-clearance surveys would be recorded and reported to the NSW Office of Environment and Heritage as part of the project environmental management reporting.

5.2 Relocation at other times

In the event a Green and Golden Bell Frog is observed within the project site outside pre-clearance surveys (e.g. within an area already disturbed), the following relocation procedure would be initiated:

1. Works within the vicinity of the identified frog would cease temporarily.

2. The observer would notify the contractors Environmental Manager of the frog's location. The Contractor's Environmental Manager would then determine whether the frog would be likely to be harmed by works
3. If the frog would likely be harmed by the works, the Project Manager would temporarily suspend works to allow an ecologist to capture it. In handling the frog, the ecologist would adhere to the DECC (2008) guidelines for handling a frog in the field, as described in the Hygiene Protocol for the Control of Disease in Frogs (**Appendix A**) which can be found at: http://www.environment.nsw.gov.au/resources/nature/hyprfrog.pdf
4. If the frog appears to be healthy a release location would be determined the ecologist, and the frog would be released into the relocation area. Any frog to be relocated would be held in a cool, dark, moist place until nightfall, separate from any other frogs or animals captured. Containers such as an esky with no are appropriate but should be stored in cool environments and not in warm environments such as a car. If the frog appears to be sick, or is dead, the procedures outlined in Section 6 would be followed.
5. Details of the Green and Golden Bell Frog relocation (e.g. lifecycle stage and sex of individual, location where found and location of release) conducted would be recorded and reported to the NSW Office of Environment and Heritage as part of the project environmental management reporting (NCIG 2013).

5.3 Procedures for handling sick or dead frogs

Table 1 details the range of symptoms that may be exhibited by sick or dying frogs, while **Table 2** provides diagnostic behaviour tests which can be used to determine if a frog is sick (e.g. infected with chytrid fungus) (NCIG 2013).

Table 1: Symptoms of sick and dying frogs (Source: DECC 2008)

Appearance	Behaviour
• Darker or blotchy upper (dorsal) surface • Reddish/pink-tinged lower (ventral) surface and/or legs and/or webbing or toes • Swollen hind limbs • Very thin or emaciated • Skin lesions (sores, lumps) • Infected eyes • Obvious asymmetric appearance	• Lethargic limb movements, especially hind limbs • Abnormal behaviour (e.g. a nocturnal burrowing frog sitting in the open during the day and making no vigorous attempt to escape when approached) • Little or no movement when touched

Table 2: Diagnostic behaviour tests (Source: DECC 2008)

Sick frogs will fail one or more of the following tests:		
Test	**Healthy**	**Sick**
Gently touch with finger	Frog will blink	Frog will not blink
Turn frog on its back	Frog will flip over	Frog remain on its back
Hold frog gently by its mouth	Frog will use its forelimbs to try to remove grip	No response from frog

In the event a Green and Golden Bell Frog appears sick, or is dead, the following procedure would be followed (DECC 2008):

- Disposable gloves would be worn when handling any frog (i.e. healthy, sick or dead);
- To prevent cross-contamination, new gloves and a clean plastic bag would be used for each frog specimen;
- Sick frogs likely to survive transportation would be placed into either a moistened cloth bag with some damp leaf litter or into a partially inflated plastic bag with damp leaf litter. All frogs would be kept separate during transportation. These would be delivered to the appropriate frog carer for rehabilitation. Containers would be kept cool and labelled with the date, location and species of frog (if known);
- Dead frogs would be kept cool and delivered as soon as possible to the appropriate recipient for testing. A list of potential sick and dead frog recipients has been provided in Appendix A. The closest recipient is:

  Michael Mahoney

  School of Biological Sciences

  University of Newcastle

  CALLAGHAN NSW 2308

  Phone: 02 4921 6014

Details of sick or dead Green and Golden Bell Frogs found at the project would be recorded and reported to the NSW Office of Environment and Heritage.

6 Implementation of additional mitigation measures

If GGBF are found on the site, the Ecology Specialist is to advise on the need for additional mitigation measures specific to this species and the environment in which it was recorded. For example, fencing which prevents the movement of GGBF onto construction or operational areas may be temporarily or permanently erected if this measure will avoid fatalities of the GGBF but not prevent the species accessing important habitat resources.

Once mitigation measures are developed, specific GGBF monitoring will be designed to determine the effectiveness of the mitigation measures.

If GGBF are recorded on the site, annual monitoring of the population will be undertaken in accordance with DEC (2004) Threatened Species Survey Guidelines, with results reported in the annual Ecological Monitoring Report required under the Ecological Monitoring Program.

7 Species Identification

The Green and Golden Bell Frog is a relatively large, stout frog ranging in size from 45 – 100 mm (DEC 2005). Most individuals are a vivid pea-green splotched with a metallic brassy brown or gold, with a cream to white stripe extending from behind the eye almost to the groin (**Plate 1**). Variations in the amount of gold markings on the back occur, with some individuals

being almost entirely green, while in others the golden markings may dominate (DEC 2005). Tadpoles are relatively large (65 – 100 mm), with deep bodies, long tails, and a long tail fin that extends almost half-way along the body (**Plate 2**).

Plate 1: Adult Green and Golden Bell Frog (source: NCIG 2013)

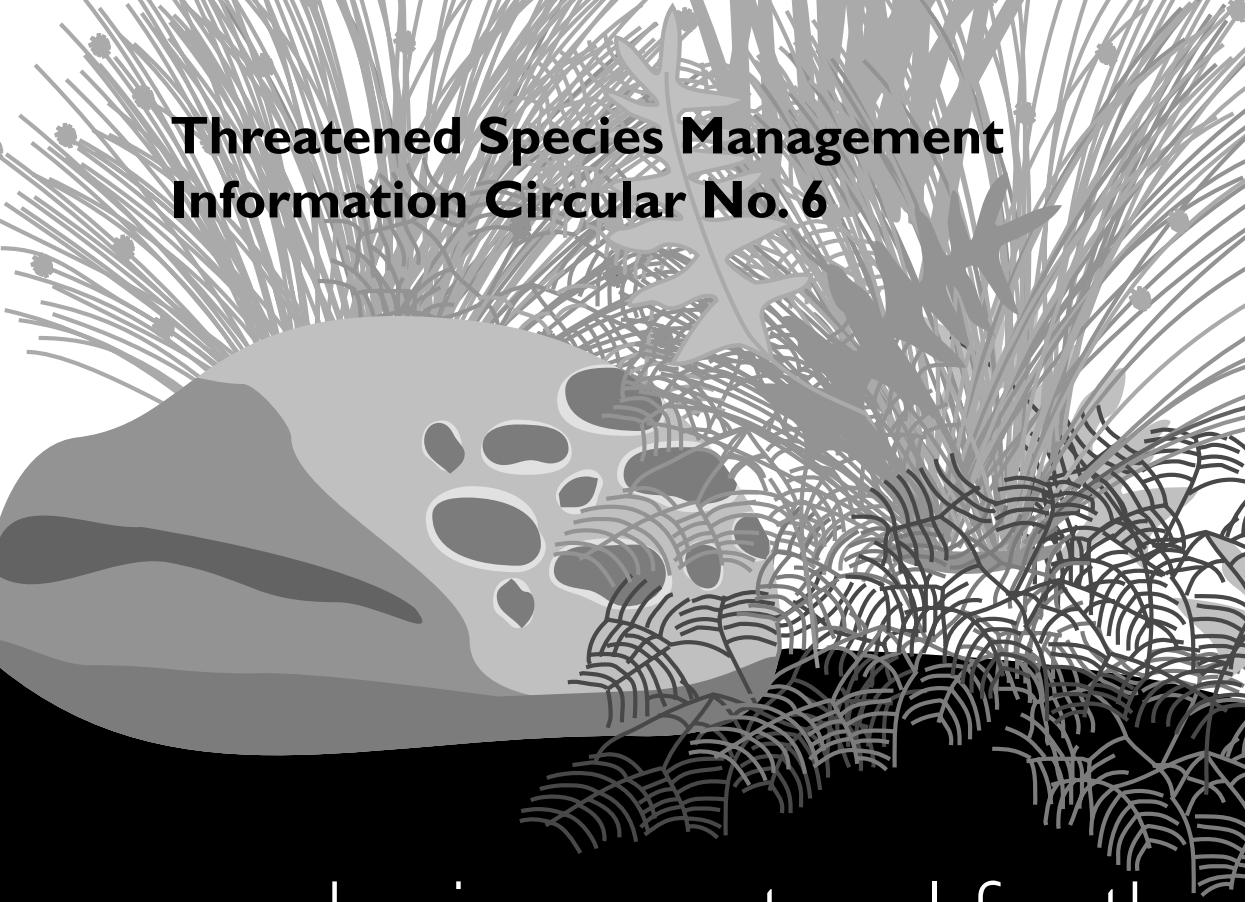
Plate 2: Green and Golden Bell Frog tadpole (source: NCIG 2013)

Breeding predominantly occurs during spring and summer, with males calling between September and January. However, some males will call outside of this period during favourable conditions (NPWS 2003). Eggs are laid amongst aquatic vegetation, and typically hatch within three days of being laid. Metamorphosis can take from two to eleven months (Daly 1995), however, six weeks appears to be an average duration for the field. The adults are highly mobile, with strong colonising and dispersal capabilities (NPWS 2003). Often breeding and over-wintering sites are considerable distances apart.

The species utilises different habitats for breeding, foraging and over-wintering. Breeding habitat includes human-made or natural permanent and ephemeral sites. Examples are quarries, brickpits, mining sites, sewage treatment ponds, bunded or otherwise 'retained' areas, detention basins, drains, scrapes, depressions and farm dams along with coastal or floodplain wetland features such as swamps, ponded areas of intermittent creeklines, lagoons, billabongs and dune swales (NPWS 2003). Foraging habitat requirements include tall, dense grassy vegetation and tussock-forming vegetation. Over-wintering sites provide protection during the cooler months when individuals enter a period of quiescence and become torpid. Such sites include the bases of dense vegetation beneath tussocks, beneath rocks, timber, within logs or beneath ground debris including human refuse such as sheet iron. Over-wintering sites may be adjacent to the breeding sites but may also be some distance away (NPWS 2003).

ATTACHMENT F – HYGIENE PROTOCOL FOR FROGS

Threatened Species Management Information Circular No. 6



hygiene protocol for the control of disease in frogs

April 2008

Department of **Environment & Climate Change** NSW

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hygiene protocol for the control of disease in frogs

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1 introduction

This information circular outlines measures to:

- Prevent or reduce disease causing pathogens being transferred within and between wild populations of frogs.
- Ensure captive frogs are not infected prior to release.
- Deal safely with unintentionally transported frogs.
- Assist with the proper identification and management of sick and dead frogs in the wild.

1.1 Who should read this document?

This protocol is intended for use by all researchers, wildlife consultants, fauna surveyors and students undertaking frog field-work. In addition, the protocol should be read by Department of Environment and Climate Change (DECC) personnel, frog keepers, wildlife rescue and carer organisations, herpetological/frog interest groups/ societies, fauna park/zoo operators/workers and other individuals who regularly deal with or are likely to encounter frogs.

This protocol outlines the expectations of the DECC regarding precautionary procedures to be employed when working with frog populations. The intention is to promote implementation of hygiene procedures by all individuals working with frogs. New licences and licence renewals will be conditional upon incorporation of the protocol. The DECC recognises that some variation from the protocol may be appropriate for particular research and frog handling activities. Such variation proposals should accompany any licence application or renewal to the DECC.

1.2 Background

1.2.1 Amphibian Chytrid Fungus

The apparent decline of frogs, including extinctions of species and local populations, has attracted increased international and national concern. Many potential causes for frog declines have been proposed (eg see Pechmann et al., 1991; Ferrero and Bergin, 1993; Pechmann and Wilbur, 1994; Pounds and Crump, 1994; Pounds et al., 1997). However, the patterns of decline at many locations suggest that epidemic disease maybe the cause (Richards et al., 1993; Laurance et al., 1996; Alford and Richards, 1997). Recent research has implicated a water-borne fungal pathogen *Batrachochytrium dendrobatidis* as the likely specific causative agent in many of these declines both in Australia and elsewhere (Berger et al., 1998; 1999). This agent is commonly known as the amphibian or frog chytrid fungus and is responsible for the disease Chytridiomycosis (Berger et al., 1999).

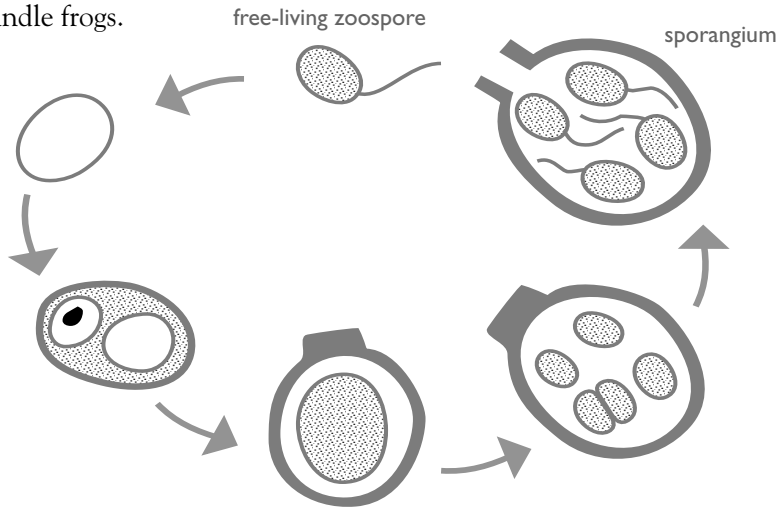
B. dendrobatidis is a form of fungus belonging to the phylum Chytridiomycota. Most species within this phylum occur as free-living saprophytic fungi in water and soil and have been found in almost every type of environment including deserts, artic tundra and rainforest and are considered important primary biodegraders (Powell 1993). *B. dendrobatidis* is a unique parasitic form of Chytridiomycete fungi, in that it invades the skin of amphibians, including tadpoles, often causing sporadic deaths with up to 100% mortality in some populations. Chytridiomycosis has been detected in over 40 species of native amphibian in Australia (Mahony and Workman 2000). However, it is not currently known whether the fungus is endemic or exotic to Australia.

The infective stage of *B. dendrobatidis* is the zoospore and transmission requires water (Berger et al.,1999). Zoospores released from an infected amphibian can potentially infect other amphibians in the same water. More research is needed on the dynamics of infection in the wild. *B. dendrobatidis* is known to be susceptible to seasonal temperature changes, dehydration, salinity, water pH, light, nutrition and dissolved oxygen (Berger et al., 1999).

1.3 Objectives

The objectives of the hygiene protocol are to:

- Recommend best-practice procedures for DECC personnel, researchers, consultants and other frog enthusiasts or individuals who handle frogs.
- Suggest workable strategies for those regularly working in the field with frogs or conducting fieldwork activities in wetlands and other aquatic environments where there is the potential for spreading pathogens such as the frog chytrid fungus.
- Provide background information and guidance to people who provide advice or supervise frog related activities.
- Provide standard licence conditions for workers engaged in frog related activities.
- Inform Animal Care and Ethics Committees (ACEC) for their consideration when granting research approvals.



Life cycle of frog chytrid fungus from infective free-living zoospore stage to sporangium (adapted from L. Berger).

2 site hygiene management

A checklist of risk management procedures and recommended standard hygiene kit is provided in Appendix 1. Please note Footnote 1 on page 4.

Individuals studying frogs often travel and collect samples of frogs from multiple sites. Some frog populations can be particularly sensitive to the introduction of infectious pathogens such as the frog chytrid fungus. Also, the arrangement of populations in the landscape may make frogs particularly vulnerable to transmission of infectious pathogens. Therefore, it is important that frog workers recognise the boundaries between sites and undertake measures which reduce the likelihood of spreading infection.

Where critically endangered species or populations of particular risk are known to occur, this protocol should be applied over very short distances ie a single site may need to be subdivided and treated as separate sites.

When planning to survey multiple sites, always start at a site where frog chytrid fungus is not known to be present before entering other infected areas.

2.1 Defining a site

Defining the boundary of a site maybe problematic. In some places, the boundary between sites will be obvious but in others, less so. Undertaking work at a number of sites or conducting routine monitoring at a series of sites within walking distance creates obvious difficulties with boundary definitions. It is likely that defining the boundary between sites will differ among localities. It may be that a natural or constructed feature forms a logical indicator of a site boundary eg a road/track, a large body of water such as a river or the sea, a marked habitat change or a catchment boundary.

As a guiding principle, each individual waterbody should be considered a separate site.

When working along a river or stream or around a wetland or a series of interconnecting ponds it is reasonable, in most instances, to treat such examples as a single site for the purposes of this protocol. Such a case would occur in areas where frogs are known to have free interchange between ponds.

Where a stream consists of a series of distinctive tributaries or sub-catchments or where there is an obvious break or division then they should be treated as separate sites, particularly if there is no known interchange of frogs between sites.

2.2 On-site hygiene

When travelling from site to site it is recommended that the following hygiene precautions be undertaken to minimise the transfer of disease from footwear, equipment and/or vehicles.

Footwear

Footwear must be thoroughly cleaned and disinfected at the commencement of fieldwork and between each sampling site.

This can be achieved by initially scraping boots clear of mud and standing the soles in a disinfecting solution. The remainder of the boot should be rinsed or sprayed with a disinfecting solution that contains *benzalkonium chloride* as the active ingredient. Disinfecting solutions should be prevented from entering any water bodies.

Rubber boots such as 'gum boots' or 'Wellingtons' are recommended because of the ease with which they can be cleaned and disinfected.

Several changes of footwear bagged between sites might be a practical alternative to cleaning.

Equipment

Equipment such as nets, balances, callipers, bags, scalpels, headlamps, torches, wetsuits and waders etc that are used at one site must be cleaned and disinfected before re-use at another site.

Disposable items should be used where possible. Non-disposable equipment should be used only once during a particular field exercise and disinfected later or disinfected at the site between uses using procedures outlined in 2.4 below.

Vehicles

Where necessary, vehicle tyres should be sprayed/flushed with a disinfecting solution in high-risk areas.

Transmission of disease from vehicles is unlikely to be a problem. However, if a vehicle is used to traverse a known frog site, which could result in mud and water being transferred to other bodies of water or frog sites, then wheels and tyres should undergo cleaning and disinfection. This should be carried out at a safe distance from water bodies, so that the disinfecting solution can infiltrate soil rather than run-off into a nearby water body.

Spraying with 'toilet duck' (active ingredient *benzalkonium chloride*) is recommended to disinfect car wheels and tyres.

Cleaning of footwear before getting back into the car will prevent the transfer of pathogens from/to vehicle floor and control pedals.

2.3 Handling of frogs in the field

The spread of pathogenic organisms, such as the frog chytrid fungus, may occur as a result of handling frogs.

Frogs should only be handled when necessary.

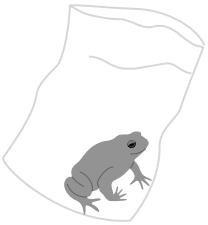
Where handling of frogs is necessary the risk of pathogen transfer should be minimised as follows:

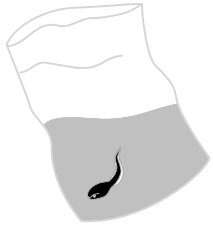
- Hands should be either cleaned and disinfected between samples or a new pair of disposable gloves used for each sample[1]. This may be achieved by commencing with a work area that has a dish containing a disinfecting solution and paper towels.
- A 'one bag – one frog' approach to frog handling should be used especially where several people are working together with one person processing frogs and others doing the collecting. Bags should not be reused.
- A 'one bag – one sample' approach to tadpole sampling should be used. Bags should not be reused.

Researchers who use toe clipping or Passive Integrated Transponder (PIT) tagging are likely to increase the risk of transmitting disease between frogs due to the possibility of directly introducing pathogens into the frogs' system. This can be minimised by using:

- Disposable sterile instruments
- Instruments disinfected previously and used once
- Instruments disinfected in between each frog

Disinfecting solutions containing *benzalkonium chloride* are readily available from local supermarkets. Some brands include Toilet Duck, Sanpic, New Clenz and Pine Clean.





[1] As a principle, this protocol assumes that not all frogs in an infected pond will be contaminated by the frog chytrid fungus. The infective load of a body of water may not be high enough to cause cross contamination of individual frogs in the same pond. Therefore care should be taken to use separate gloves and bags and clean hands for each sample, to avoid transmission of high infective loads between individuals.

Open wounds from toe clipping and PIT tagging should be sealed with a cyanoacrylate compound such as *Vetbond*© to reduce the likelihood of entry of pathogens. The DECC ACEC further recommends the application of topical anaesthetic *Xylocaine*© cream and *Betadine*© disinfectant (1% solution) before and after any surgical procedure. This should then be followed by the wound sealant.

All used disinfecting solutions, gloves and other disposable items should be stored in a sharps or other waste container and disposed or sterilised appropriately at the completion of fieldwork. Disinfecting solutions must not come into contact with frogs or be permitted to contaminate any water bodies

2.4 Disinfection Methods

Disinfecting agents for hands and equipment must be effective against bacteria and both the vegetative and spore stages of fungi. The following agents are recommended:

- Chloramine and Chlorhexidine based products such as *Halamid*©, *Halasept*© or *Hexifoam*© are effective against both bacteria and fungi. These products are suitable for use on hands, footwear, instruments and other equipment. The manufacturers instructions should be followed when preparing these solutions.
- Bleach and alcohol (ethanol or methanol), diluted to appropriate concentrations can be effective against bacteria and fungi. However, these substances may be less practical because of their corrosive and hazardous nature.

  When using methanol either:

  - immerse in 70% methanol for 30 minutes or
  - dip in 100% methanol then flame for 10 seconds or boil in water for 10 minutes

Fresh bleach (5% concentration) may be also effective against other frog pathogens such as Rana Virus.

Some equipment not easily disinfected in these ways can be effectively cleaned using medical standard 70% isopropyl alcohol wipes – *Isowipes*©.

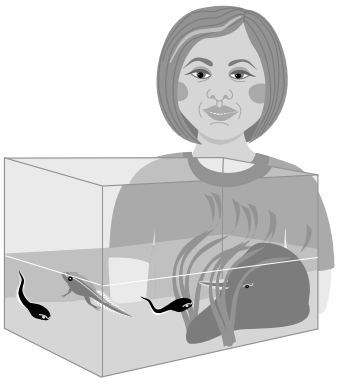
3 captive frog hygiene management

3.1 Housing frogs and tadpoles

Frogs and tadpoles should only be removed from a site when absolutely necessary.

When it is necessary for frogs or tadpoles to be collected and held for a period of time, the following measures should be undertaken:

- Animals obtained at different sites should be kept isolated from each other and from other captive animals.
- Aquaria set up to hold frogs should not share water, equipment or any filtration system. Splashes of water from adjacent enclosures or drops of water on nets may transfer pathogens between enclosures.
- Prior to housing frogs or tadpoles, ensure that tanks, aquaria and any associated equipment are disinfected.
- Tanks and equipment should be cleaned, disinfected and dried immediately after frogs/tadpoles are removed.



Careful maintenance of your enclosures will ensure a safe and hygienic environment for captive frogs and tadpoles.

When contemplating a release of captive bred tadpoles for conservation purposes a Translocation Proposal should be submitted to the DECC and pathological screening for disease should be undertaken (see also DECC Translocation Policy). Tadpoles can be tested by randomly removing 10 individuals at 6 weeks and again at 2 weeks before anticipated release. Testing could be undertaken by the pathology section at Taronga Zoo, Newcastle University, CSIRO Australian Animal Health Laboratories at Geelong and James Cook University at Townsville. Such an arrangement would need to be negotiated by contacting one of these institutions well before the anticipated release date. (see Appendix 2 for contact details)

DECC have licenced NSW Schools to allow students and/or teachers to remove tadpoles for classroom life cycle studies. They are authorised to remove individuals from only one location, each school also requires endorsement from Department of Education and Training Animal Care and Ethics Committee and comply with this protocol.

Tadpoles collected for these purposes are to be obtained from the local area of the school and are not to be obtained from DECC Reserves. As soon as tadpoles have transformed, froglets must be returned to the exact point of capture. Tadpoles from different locations are not to be mixed.

Antifungal cleansing treatments to clear tadpoles of the frog chytrid fungus are currently being trialed. In the future, such a treatment may be an added procedure required prior to froglet releases.

Detailed information on safely maintaining frogs in captivity is provided in Voigt (2001).

3.2 Tadpole treatment

In most instances:

Release to the wild of tadpoles held or bred in captivity should be avoided.

3.3 Frog treatment

The rigour with which frogs must be treated to ensure pathogens are not introduced to native populations means that any proposal for the removal of adult frogs (particularly threatened species) from wild populations should be given careful consideration.

When it is essential for frogs to be removed from the wild, the following should apply.

Individuals to be released should be quarantined for a period of 2 months and monitored for any signs of illness or disease.

Frogs must not be released if any evidence of illness or infection is detected. If illness is suspected, further advice must be sought from a designated frog recipient (Appendix 2) as soon as possible to determine the nature of the problem. Chytridiomycosis can be diagnosed in live frogs by microscopical examination of preserved toe clips or from shedding skin samples. Research is still in progress on the development of a simple technique for the detection of Chytridiomycosis and a treatment for infected frogs.

Current methods which may be used include:

- A technique for the treatment of potentially infected frogs is to place the frogs individually in a 1mg/L benzalkonium chloride solution for 1 hour on days 1, 3, 5, 9, 11 and 13 of the treatment period. Frogs are then isolated/quarantined for two months. This and other possible treatments are documented in Berger and Speare (1998)
- *Betadine*© and *Bactone*© treatments have also been used on adult frogs with some success (M. Mahony, Newcastle University pers. comm.)
- *Itraconazole*© is an expensive drug which has been used successfully (Lee Berger CSIRO Australian Animal Health Laboratory pers. comm.). Information on this method is available on the Website http://www.jcu.edu.au/school/PHTM/frogs/adms/attach6.pdf.

Frogs undergoing treatment should be housed individually and kept separate from non-infected individuals.

3.4 Displaced frogs

Displaced frogs are those native frog species and introduced Cane Toads (Bufo marinus) which have been unintentionally transported around the country with fresh produce, transported produce and landscaping supplies. Procedures to be undertaken when encountering introduced/displaced native frog species (as well as Cane Toads) are as follows.

3.4.1 Banana box frogs

'Banana Box' frog is the term used to describe several native frog species (usually Litoria gracilenta, L. infrafrenata, L. bicolor and L. caerulea) commonly transported in fruit and vegetable shipments and landscaping supplies. In the past, well meaning individuals have attempted to return these frogs to their place of origin but this is usually impossible to do accurately. There is risk of spread of disease if these frogs are transferred from place to place.

It is strongly recommended that:

Displaced Banana Box frogs should be treated as if they are infected and should not to be freighted anywhere for release to the wild unless specifically approved by DECC.

When encountering a displaced frog:

- Contact a licensed wildlife carer organisation to collect the animal. The frog should then undergo a quarantine period of 2 months along with an approved disinfection treatment.
- Post-quarantine, the frog (if one of the species identified above) may be transferred to a licensed frog keeper. All other species require the permission from DECC Wildlife Licensing and Management Unit (WLMU) prior to transfer. Licensed carer groups are to record and receipt frogs obtained and disposed of in this way.
- Licensed Frog Keepers are to list these frogs in their annual licence returns to DECC.

Frogs held by licensed frog keepers are not to be released to the wild except with specific DECC approval.

Displaced frogs may be made available to recognised institutions for research projects, display purposes or perhaps offered to the Australian Museum as scientific specimens once approval has been provided by the DECC WLMU.

Frogs are often unintentionally transported with fresh produce and landscaping supplies. They are collectively known as 'banana box' or displaced frogs.

3.4.2 Cane toads

Cane toads are known carriers of the Frog chytrid fungus and should not be knowingly transported or released to the wild.

If a cane toad is discovered outside of its normal range, it should be humanely euthanased in accordance with the recommended NSW Animal Welfare Advisory Council procedure (see Appendix 3). Care should be taken to avoid euthanasia of native species due to mistaken identity.

3.4.3 Local frog species

Frogs encountered on roads, around dwellings and gardens or in swimming pools should not be considered as displaced frogs.

Frogs encountered in these situations should be assisted off roads, away from dwellings, or out of swimming pools preferably to the nearest area of vegetation or suitable habitat.

Incidences of frogs spawning or tadpoles appearing in swimming pools should be referred to a wildlife carer/rescue organisation for assistance (see Appendix 4).

Contact the Frogwatch Helpline if you are unsure whether a frog is a local species or displaced.

An NPWS information brochure titled 'Cane Toads in NSW' provides further information on cane toads and assistance with identification of some of the commonly misidentified native species. This information is also available on the DECC website.

4 sick or dead frogs

Unless an obvious cause of illness or death is evident (eg predation or road mortality): Sick or dead frogs encountered in the wild should be collected and disposed of in accordance with the procedures described in section 4.2 below.

4.1 Symptoms of sick and dying frogs

Sick and dying frogs exhibit a range of symptoms characteristic of chytrid infection. Symptoms may be expressed in the external appearance or behaviour of the animal. A summary of these symptoms are described below. More detailed information can be found in Berger et al., (1999) or at the James Cook University Amphibian Disease website at: http://www/jcu.edu.au/school/phtm/PHTM/frogs/ampdis.htm.

Appearance (one or more symptoms)

- darker or blotchy upper (dorsal) surface
- reddish/pink-tinged lower (ventral) surface and/or legs and/or webbing or toes
- swollen hind limbs
- very thin or emaciated
- skin lesions (sores, lumps)
- infected eyes
- obvious asymmetric appearance

Behaviour (one or more symptoms)

- lethargic limb movements, especially hind limbs
- abnormal behaviour (eg a nocturnal, burrowing or arboreal frog sitting in the open during the day and making no vigorous attempt to escape when approached)
- little or no movement when touched

Great barred frog (*Mixophyes fasciolatus*) with severe Chytrid infection — note lethargic attitude and sloughing skin. Photo: L. Berger

Diagnostic behaviour tests

Sick frogs will fail one or more of the following tests:

test	healthy	sick
Gently touch with finger	Frog will blink	Frog will not blink above the eye
Turn frog on its back	Frog will flip back over	Frog will remain on its back
Hold frog gently by its mouth	Frog will use its forelimbs to try to remove grip	No response from frog

4.2 What to do with sick or dead frogs

A procedure for the preparation and transport of a sick or dead frog is given below[2]. Adherence to this procedure will ensure the animal is maintained in a suitable condition for pathological examination and assist the DECC and researchers to determine the extent of the disease and the number of species affected.

- Disposable gloves should be worn when handling sick or dead frogs. Avoid handling food and touching your mouth or eyes as this could transfer pathogens and toxic skin secretions from some frog species.
- New gloves and a clean plastic bag should be used for each frog specimen to prevent cross-contamination. When gloves are unavailable, use an implement to transfer the frog to a container rather than using bare hands.
- If the frog is dead, keep the specimen cool and preserve as soon as possible (as frogs decompose quickly after death making examination difficult). Specimens can be fixed/preserved in 70% ethanol or 10% buffered formalin.

Cut open the belly and place the frog in about 10 times its own volume of preservative. Alternatively, specimens can be frozen (although this makes tissues unsuitable for some tests). If numerous frogs are collected, some should be preserved and some should be frozen. Portions of a dead frog can be sent for analysis eg a preserved foot, leg or a portion of abdominal skin.

- The container should be labelled showing at least the species, date and location. A standardised collection form is provided in Appendix 5.
- If the frog is alive but unlikely to survive transportation (death appears imminent), euthanase the frog (see Appendix 3) and place the specimen in a freezer. Once frozen, the specimen is ready for shipment to the address provided below.
- If the frog is alive and likely to survive transportation, place the frog into either a moistened cloth bag with some damp leaf litter or into a plastic bag with damp leaf litter and partially inflated before sealing. Remember to keep all frogs separated during transportation.
- Preserved samples can be sent in jars or wrapped in wet cloth, sealed in bags and placed inside a padded box.
- Send frozen samples in an esky with dry ice (available from BOC/CIG Gas outlets).
- Place live or frozen specimens into a small styrafoam esky (available from K-Mart/Big W for approximately $2.50).
- Seal esky with packaging tape and address to one of the laboratories listed in Appendix 4.
- Send the package by courier.

Further information on sick and dying frogs is available on the Amphibian Disease Home Page at http://www.jcu.edu.au/dept/PHTM/frogs/ampidis.htm — in particular refer to *'What to do with dead or ill frogs'*.

[2] The measures described below are standard procedures and may vary slightly depending on the distance and time required to reach the intended recipient. Contact the intended recipient of the sick or dead frog prior to sending to confirm the appropriate procedure.

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appendix 1

hygiene protocol checklist and field kit

The following checklist and field kit are designed to assist with minimising the risk of transferring pathogens between frogs.

Have you considered the following questions before handling frogs in the field:

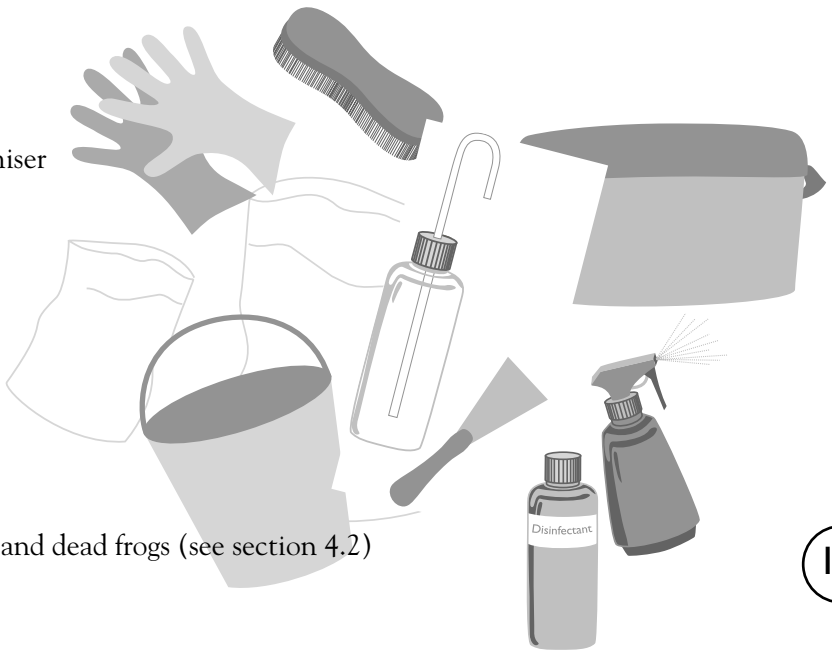
- Has your proposed field trip been sufficiently well planned to consider hygiene issues?
- Have you taken into account boundaries between sites (particularly where endangered species or populations at risk are known to occur)?
- Have footwear disinfection procedures been considered and a strategy adopted?
- Have you planned the equipment you will be using and developed a disinfection strategy?
- Are you are planning to visit sites where vehicle disinfection will be needed (consider both vehicle wheels/tyres and control pedals) and if so, do you have a plan to deal with vehicle disinfection?
- Have handling procedures been planned to minimise the risk of frog to frog pathogen transmission?
- Do you have a planned disinfection procedure to deal with equipment, apparel and direct contact with frogs?

If you answered NO to any of these questions please re-read the relevant section of the DECC Hygiene Protocol for the Control of Disease in Frogs and apply a suitable strategy.

Field hygiene kit

When planning to survey frogs in the field a portable field hygiene kit should be assembled to assist with implementing this protocol. Recommended contents of a field hygiene kit would include:

- Small styrofoam eski
- Disposable gloves
- Disinfectant spray bottle (atomiser spray) and/or wash bottle
- Disinfecting solutions
- Wash bottle
- Scraper or scrubbing brush
- Small bucket
- Plastic bags large and small
- Container for waste disposal
- Materials for dealing with sick and dead frogs (see section 4.2)



appendix 2

designated sick and dead frog recipients

Always contact the relevant specialist prior to sending a sick or dead frog. In some cases, only wild frogs will be assessed for disease. Analysis may also attract a small fee per sample.

Contact one of the following specialists to arrange receipt and analyse sick and dead frogs. Make contact prior to dispatching package:

Karrie Rose
Australian Registry if Wildlife Health
Taronga Conservation Society, Australia
PO Box 20
MOSMAN NSW 2088

Phone: 02 9978 4749
Fax: 02 9978 4516
Krose@zoo.nsw.gov.au

Diana Mendez or
Rick Speare
School of Public Health,
Tropical Medicine and
Rehabilitation Sciences
James Cook University
Douglas Campus
TOWNSVILLE QLD 4811

Phone: 07 4796 1735
Fax: 07 4796 1767
Diana.Mendez@jcu.edu.au
Richard.Speare@jcu.edu.au

Michael Mahony
School of Biological Sciences
University of Newcastle
CALLAGHAN NSW 2308

Phone: 02 4921 6014
Fax: 02 4921 6923
bimjm@cc.newcastle.edu.au

For information on frog keeping licences and approvals to move some species of displaced frog contact:

Co-ordinator, Wildlife Licensing
Wildlife Licensing and Management Unit
DECC
PO Box 1967
Hurstville NSW 1481
Ph 02 9585 6481
Fax 02 9585 6401
wildlife.licensing@environment.nsw.gov.au

For information on the possible identity of displaced frogs contact:

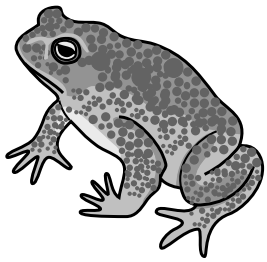
Frog and Tadpole Society (FATS)
Frogwatch Helpline

Ph: 0419 249 728

appendix 3

NSW Animal Welfare Advisory Council methodology

The NSW Animal Welfare Advisory Council procedure for humanely euthanasing cane toads or terminally ill frogs is stated as follows:



- Using gloves, or some other implement, place cane toad or terminally ill frog into a plastic bag.
- Cool in the refrigerator to 4°C.
- Crush cranium with a swift blow using a blunt instrument.

Note: Before killing any frog presumed to be a cane toad, ensure that it has been correctly identified and if outside the normal range for cane toads in NSW (north coast) that local DECC regional office is informed.

appendix 4

licensed wildlife carer and rescue organisations

Following is a list of wildlife rehabilitation groups licensed by Department of Environment and Climate Change (NSW):

Northern NSW

Australian Seabird Rescue
For Australian Wildlife Needing Aid (FAWNA)
Friends of the Koala
Friends of Waterways (Gunnedah)
Great Lakes Wildlife Rescue
Koala Preservation Society of NSW
Northern Rivers Wildlife Carers
Northern Tablelands Wildlife Carers
Tweed Valley Wildlife Carers
Seaworld Australia
WIRES branches in Northern NSW

Southern NSW

Looking After Our Kosciuszko Orphans (LAOKO)
Native Animal Network Association
Native Animal Rescue Group
Wildcare Queanbeyan
WIRES branches in Southern NSW

Sydney, Hunter and Illawarra

Hunter Koala Preservation Society
Ku-ring-gai Bat Colony Committee
Kangaroo Protection Co-operative
Native Animal Trust Fund
Organisation for the Rescue and Research of Cetaceans (ORRCA)
Sydney Metropolitan Wildlife Services
Wildlife Aid
Wildlife Animal Rescue and Care (Wildlife ARC)
Waterfall Springs Wildlife Park
Oceanworld
Wildlife Care Centre, John Moroney Correctional Centre
Koalas in Care
WIRES branches around Sydney, Hunter and Illawarra

Western NSW

Rescue and Rehabilitation of Australian Native Animals (RRANA)
RSPCA Australian Capital Territory Inc.
Wildlife Carers Network (Central West)
WIRES branches in Western NSW
Cudgegong Wildlife Carers

[4] Note: some of these organisations may not care for frogs.

appendix 5 — sick or dead frog collection form

Sender details:

name: address: postcode:

phone: (w) (h) fax: email:

Collector details: (where different to sender)

name: address: postcode:

phone: (w) (h) fax: email:

Specimen details:

record no: no. of specimens: species name: date collected: day/month/year

time collected: sex: male/female status at time of collection: healthy(H)/ sick(S)/ dead(D) date sent: day/month/year

location: map grid reference: (easting) (northing)

reason for collection:

Batch details for multiple species collection:

species	no.	locality	(AMG)	date	sex	status (H/S/D)

habitat type: eg creek, swamp, forest vegetation type: eg rainforest, sedgeland micro habitat: eg creek bank, under log, amongst emergent vegetation, on ground in the open

unusual behaviour of sick frogs: eg lethargic, convulsions, sitting in the open during the day, showing little or no movement when touched.

dead frogs appearance: eg thin, reddening of skin on belly and/or toes, red spots, sore, lumps or discolouration on skin

deformed frogs: eg limb(s) missing, abnormal shape or length dead/sick tadpoles: eg numbers/behaviour

unusual appearance of egg masses: eg grey or white eggs recent use of agricultural chemicals in area: eg pesticides, herbicides, fertilisers

other potential causes of sickness/mortality/comments/additional information:

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

General inquiries: PO Box A290 South Sydney 1232
Phone: 9995 5000 or 1300 361967
Fax: 02 9995 5999 **Web site:** www.environment.nsw.gov.au

Department of **Environment & Climate Change** NSW