

Weed and Pathogen
Management Plan
Warrell Creek to Nambucca Heads
Upgrade of the Pacific Highway



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Weed and Pathogen Management Plan Warrell Creek to Nambucca Heads Upgrade of the Pacific Highway

Prepared for: Acciona and Ferrovial Joint Venture/
Roads and Maritime Services
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Introduction

1.1 Project Overview and Background to the Plan

The Pacific Highway Upgrade Program is a joint commitment by the Australian and New South Wales (NSW) governments to improve the standard and safety of the Pacific Highway between Hexham and the Queensland border.

The Warrell Creek to Urunga (WC2U) project forms part of the Pacific Highway Upgrade Program and comprises approximately 42 kilometres of dual carriageway road that would bypass the towns of Warrell Creek, Macksville, Nambucca Heads and Urunga on the Mid North Coast of NSW. The Project has been divided into two stages with Stage 1 consisting of the approximate 22.5 kilometre stretch from Nambucca Heads to Urunga (NH2U) and Stage 2 consisting of the remaining approximate 19.5 kilometres of dual carriageway between Warrell Creek and Nambucca Heads (WC2NH). This Weed Management Plan relates to Stage 2 (WC2NH) which is referred to throughout this report as 'the Project' (refer to **Illustration 1.1**).

The Acciona and Ferrovial Joint Venture (AFJV) has been awarded the contract to design and construct the WC2NH upgrade.

As part of the WC2NH project, effective and ongoing weed and pathogen control measures are to be identified and implemented to prevent the spread of weeds and soil-borne pathogens. Project requirements for weed and pathogen management on the project are provided in the following documents and summarised in **Table 1.1**:

- Ministers Conditions of Approval (MCoA).
- RMS Specifications: D&C G36 Environmental Protection – *Version for Pacific Highway Upgrade-Warrell Creek to Nambucca Heads (RMS, 2013)*.
- RMS Specifications: D&C G40 Clearing and Grubbing – *Version for Pacific Highway Upgrade-Warrell Creek to Nambucca Heads (RMS, 2013)*.

Table 1.1 RMS Specifications for Weed and Pathogen Control on the WC2NH Project

<i>Reference</i>	<i>Section</i>	<i>Requirement</i>
Minister's CoA	B31 (b)(v-part there of)	<i>As part of the Construction Environment Management Plan for the project required under condition B30 of this approval, the Proponent shall prepare and implement the following subplan(s)...including (b) a Construction Flora and Fauna Management Plan to detail how construction impacts on ecology will be minimised and managed... including details of general work practices to minimise the potential for damage to native vegetation (particularly EECs) not proposed to be cleared as part of the project and native fauna during construction, including (but not necessary limited to)...appropriate topsoil management, construction worker education, weed management, erosion and sediment control and progressive re-vegetation...</i>
D&C Specification G36	4.11 (d)	<i>The Contractor must include procedures in the Construction Environment Management Plan (CEMP), Flora and Fauna Management Sub-plan (FFMP) for controlling the introduction and spreading of weeds caused by the Work Under the deed, including the arrangements for monitoring.</i>
	4.11.1	<i>Where weeds are present, consult relevant Authorities, and be guided by best practice removal and control techniques and any management procedures that may have been developed for particular noxious weeds.</i>

<i>Reference</i>	<i>Section</i>	<i>Requirement</i>
		<i>All staff must be made aware of noxious weeds present on the Site and the other areas affected by the Contractor's Work and requirements related to the listing under the Noxious Weeds Act 1993.</i>
D&C Specification G40	2.4.2	<i>Prior to the commencement of clearing and grubbing, prepare a Weed and Pathogen Management Plan in consultation with the Project Ecologist. The Weed and Pathogen Management Plan must adhere to best practice guidelines and be prepared and implemented in accordance with the Noxious Weeds Act 1993, and National Trust Weed Management Manual and incorporated into the Construction Flora and Fauna Management Plan.</i>
		<i>The Weed and Pathogen Management Plan must include pre-construction, construction and post construction weed control works including the weed control works to be undertaken during the Landscape Maintenance Period, to control the spread of weeds and to reduce the levels of weed infestation within the Construction Site and adjoining areas, and include measures to improve the quality of habitat in retained vegetation.</i>
		<i>The Weed and Pathogen Management Plan must include controls to prevent the introduction or spread of <i>Phytophthora cinnamomi</i> in accordance with Planning and Infrastructure's condition of approval B.31(b)(iii).</i>
		<i>The Weed and Pathogen Management Plan must include requirements for monitoring through which the success of weed control is assessed and techniques modified where necessary, including measures to improve the quality of habitat in retained vegetation. The monitoring must include regular site visits, mapping and fixed point photographs of the Construction Site and adjoining areas.</i>
		<i>The frequency and duration of weed monitoring must be specific to the Construction Site and adjoining areas with the flexibility to respond to changes in the environment. As a minimum, undertake weed inspections on a monthly basis for the first six months after commencement of construction (or as necessary responding to seasonal and climatic conditions), then at least every two months for a further six months until the Date of Construction Completion.</i>
		<i>Submit a report to the Project Verifier, Environmental Representative and RMS Representative outlining the results of each monitoring inspection against the weed management objectives and activities in the Weed and Pathogen Management Plan.</i>
		<i>The Contractor must consult with the relevant local Weeds Authority Officer on the presence of any noxious weed in areas to be cleared and to ascertain if any special precautions are required. Should the presence of noxious weeds be confirmed, the Contractor must mark out their location and then treat them in accordance with the Weed and Pathogen Management Plan.</i>
		2.4.3
		<i>Site specific vehicle movement plans must to be prepared for each worksite that contains a noxious weed infestation/ or native/ or remnant vegetation that could be affected by the Contractor's Work. The vehicle movement plans must include identification of vehicles, plant, equipment, turning and parking areas and any vehicle, plant and equipment hygiene measure to ensure compliance with the Noxious Weeds Act 1993.</i>

Reference	Section	Requirement
		<i>Treat and dispose of any noxious weeds in accordance with their category under the Noxious Weeds Act 1993. Any spraying of noxious weeds must comply with RMS D&C G36 clause 6.12.2 and be carried out with care to avoid damage to adjacent native vegetation and to prevent overspray entering waterways or adjacent property.</i>
		<i>Where noxious weed areas are disturbed by your construction activities, weeds and topsoil potentially containing weed propagules must be removed and disposed of in accordance with the requirements of the Local Weeds Authority.</i>
	5.1	<i>Under no circumstances must the extent of clearing and grubbing be extended or weeds or exotic species used to make up any shortfall of mulch.</i>

1.2 Purpose and Goals

This Weed and Pathogen Management Plan (WPMP) identifies how potential impacts associated with weed contamination, noxious and environmental weeds and plant pathogen spread will be managed during construction of the WC2NH project. The key objectives of this plan are to give direction to ensure the Project avoids, suppresses and controls the spread of all weeds, plant pathogens and invasive species to ensure that impacts to the environment are minimised. The specific goals of the weed and pathogen management on the project are as follows:

- Compliance with relevant legislation and project requirements.
- Identify listed noxious and significant infestations of environmental weeds growing within the project boundary and provide maps showing these areas.
- Treat and dispose of all noxious weeds in accordance with their category under the Noxious Weeds Act 1993 prior to and during clearing/ grubbing.
- No new weeds introduced to the project area.
- No increase in distribution of weeds currently existing within the project areas.
- Minimise adverse impacts to biodiversity from weed control works.
- No transfer of plant diseases or pathogens to or from the project work areas.
- Best practice weed/ pathogen hygiene protocols to be undertaken by personnel and applied to all plant/ machinery entering/ leaving site to minimise the spread of weeds and plant pathogens.
- Prevent the spread of weeds by best practice mulch and topsoil management.

The plan covers all areas within the approved WC2NH project boundary and incorporates the pre-construction, construction and post-construction (landscape maintenance period) stages of the project. The plan has been prepared based on best practice weed/ pathogen management information and the RMS Biodiversity Guidelines (2011).

1.3 Management Structures and Plan Updates

This management plan has been presented using an adaptive management approach based on firstly identifying specific goals for management, implementation of management actions followed by monitoring of the performance of these measures against the goals and identified thresholds. As a final step the monitoring would evaluate the effectiveness of the management measures using identified thresholds for performance and implementing corrective actions to improve mitigation where required. To ensure the success of this approach the management goals presented in the plan have been based on the following SMART principles:

- Specific
- Measurable
- Achievable
- Results-based
- Time-based.

The WPMP has been prepared in consultation with RMS, the Environment Protection Authority (EPA) and Nambucca Shire Council (Weeds Officer). General responsibilities for environmental management would be outlined in the project specific Construction Environment Management Plan (CEMP), the Flora and Fauna Management Plan (FFMP), and the project specific Soil and Water Management Plan (SWMP). These management plans would be prepared prior to the commencement of construction. AFJV is responsible for implementing the measures in this WPMP and this would include the engagement of suitably qualified specialists to undertake weed control and monitoring activities where necessary.

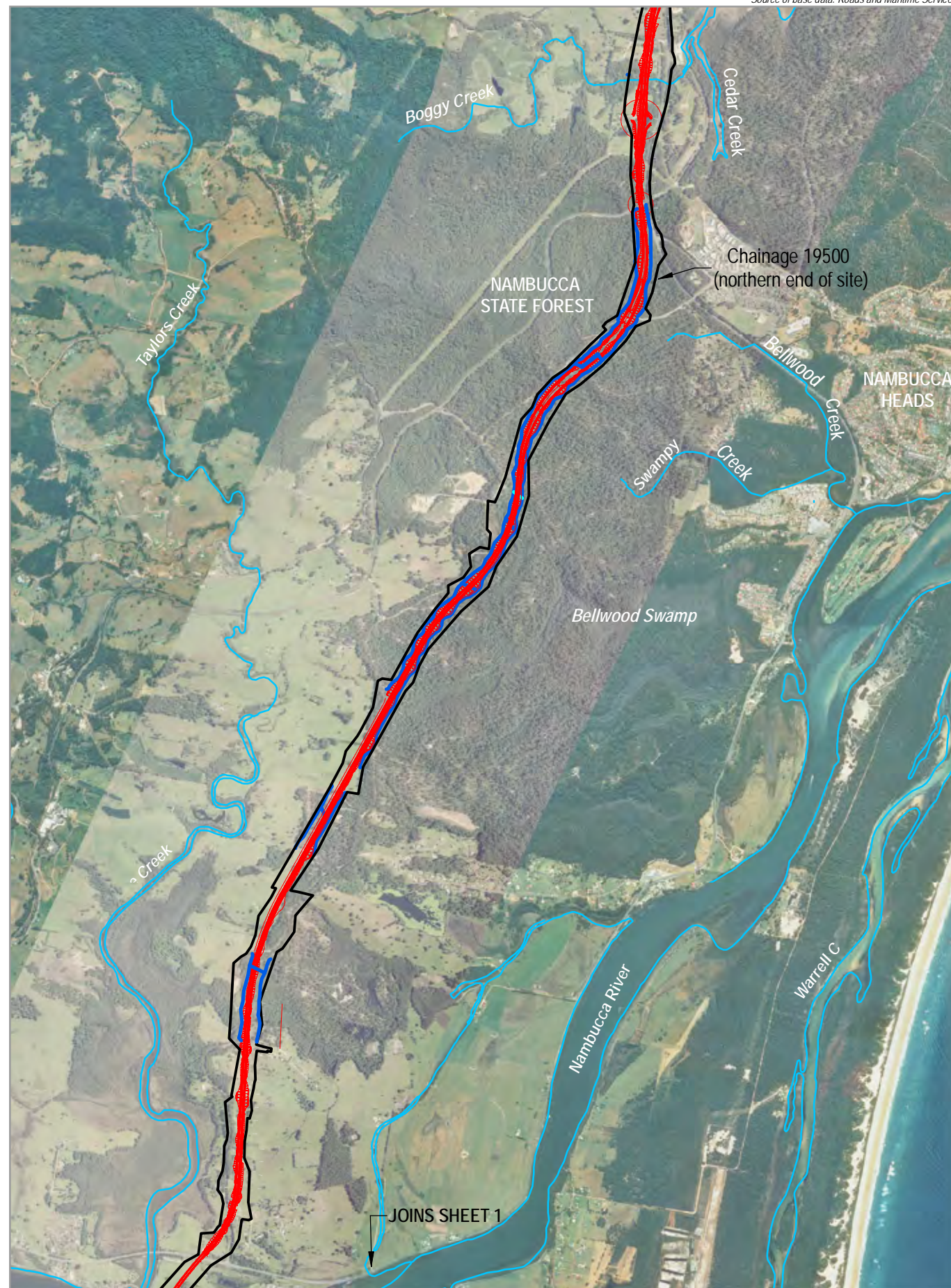
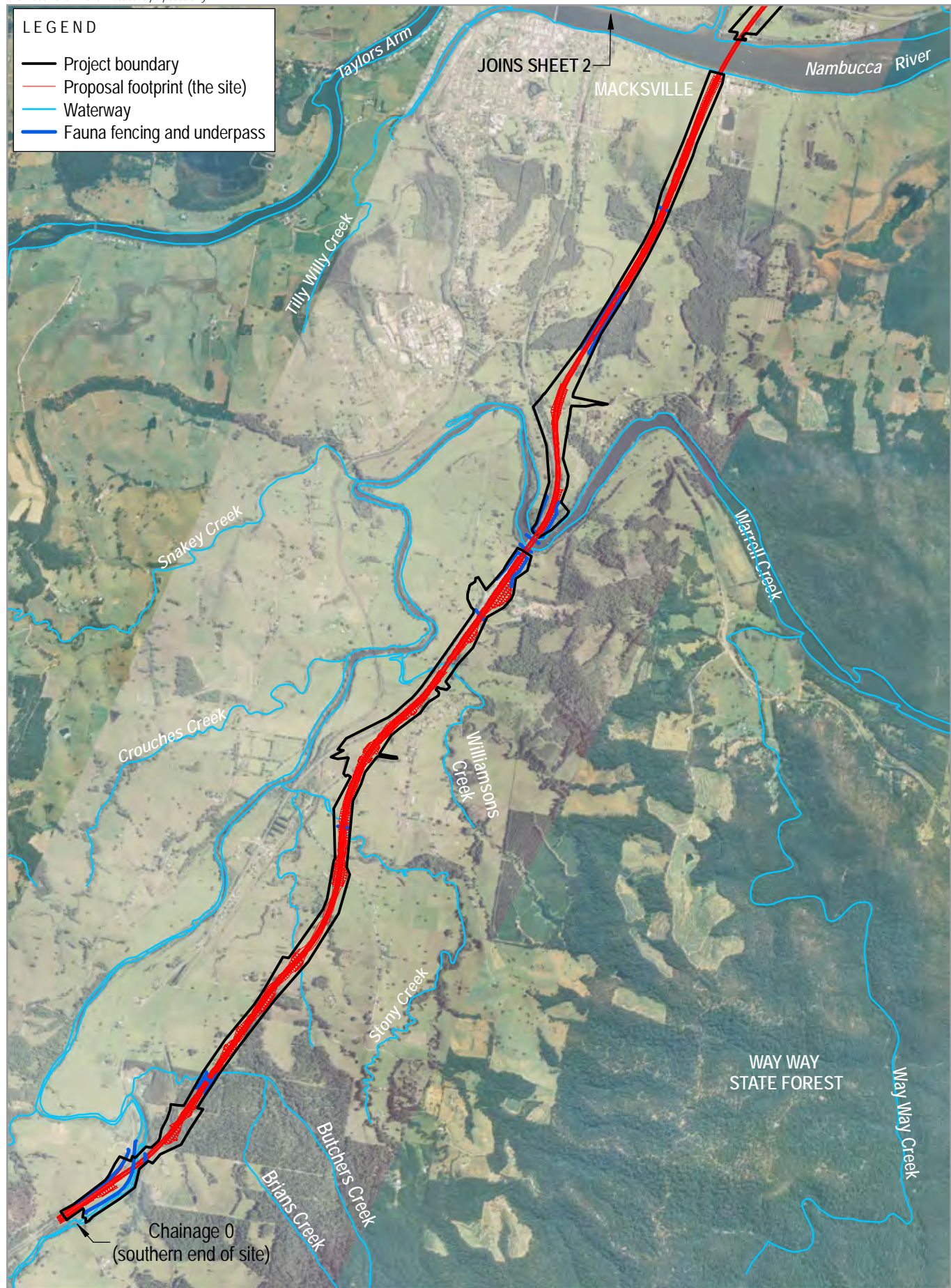
1.4 Plan Authors

The Weed Management Plan has been prepared by the following personnel from Project Ecologist, GeoLINK:

- David Havilah (Senior Ecologist).
- Veronica Silver (Senior Ecologist – Peer Review).

Qualifications and experience of the plan authors are provided in **Appendix A**.

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Weeds Occurring on the Site

2.1 Relevant Legislation

Legislation relevant to this plan includes:

- *Threatened Species and Conservation Act 1995* (TSC Act).
- *Noxious Weeds Act 1993* (NW Act).
- *Pesticides Act 1999*.
- *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act).

2.2 Weed Classification

For the purposes of this report, a 'weed' is defined as a plant growing in a terrestrial or aquatic area where it is not wanted (RMS, 2011). Weeds are generally classed into broad groups depending on their characteristics and potential impacts. The main groups of weeds considered within this report are described in Table 2.1.

Table 2.1 Classification of Weeds in NSW

<i>Classification</i>	<i>Description</i>
Weeds of National Significance (WONS)	Listed under the National Weeds Strategy
National Environmental Alert List Weeds	Identified under the National Weeds Strategy
Noxious	Require control under the Noxious Weeds Act 1993 (NSW) – Noxious weed declarations, their control class and control requirements are different for each local Government Area
Environmental	Represent a threat to the conservation values of a natural ecosystem
Agricultural	Represent a threat to agricultural production

2.3 Survey Methodology

A database search of the NSW Department of Primary Industries (DPI) Noxious Weed Declarations for the Nambucca Shire Local Government Area (LGA) was undertaken to obtain a list of noxious weeds as listed under the *Noxious Weeds Act, 1993* known for the LGA (refer to **Appendix B**).

Field surveys of all areas within the WC2NH project boundary were undertaken during the period from 21 to 28 July 2014 by two ecologists from GeoLINK in conjunction with other ecological surveys being undertaken for the project.

Surveys involved undertaking walking transects throughout the entire project corridor and mapping the locations of noxious weed infestations with IPADs and IGIS software. Detailed notes were taken of the location, size and composition of weed occurrences as well as photographs of infestations. Weed infestations as identified in the field were mapped using ARCGIS software.

2.4 Survey Results

2.4.1 General Findings

The weed surveys identified 38 (noxious and environmental) weed species which are listed in **Appendix C**.

Of particular note among the non-noxious weeds is Coolatai Grass (*Hyparrhenia hirta*) which occurs over existing roadside verges associated with the site. This species was noted by Nambucca Shire Council's weed officer as being of particular concern locally. It is noted that Camphor Laurel (*Cinnamomum camphora*) has recently been removed from the list of Noxious Weeds for the Nambucca Control area although is still treated on Council owned land.

2.4.2 Noxious Weeds

Eight listed 'Noxious weeds' were detected during the survey (refer to **Table 2.2**). Three of these species, Lantana (*Lantana camara*), Salvinia (*Salvinia molesta*) and Fireweed (*Senecio madagascariensis*) are also listed as Weeds of National Significance (WoNS). The invasion, establishment and spread of Lantana is also listed as a Key Threatening Process under the TSC Act. Noxious weed infestations mapped on the site are shown on **Illustrations 2.1 to 2.8**.

Lantana was the most prevalent of these species with occurrences throughout the site including large infestations in the Nambucca State Forest area.

Table 2.2 Listed Noxious Weeds Identified on the Site

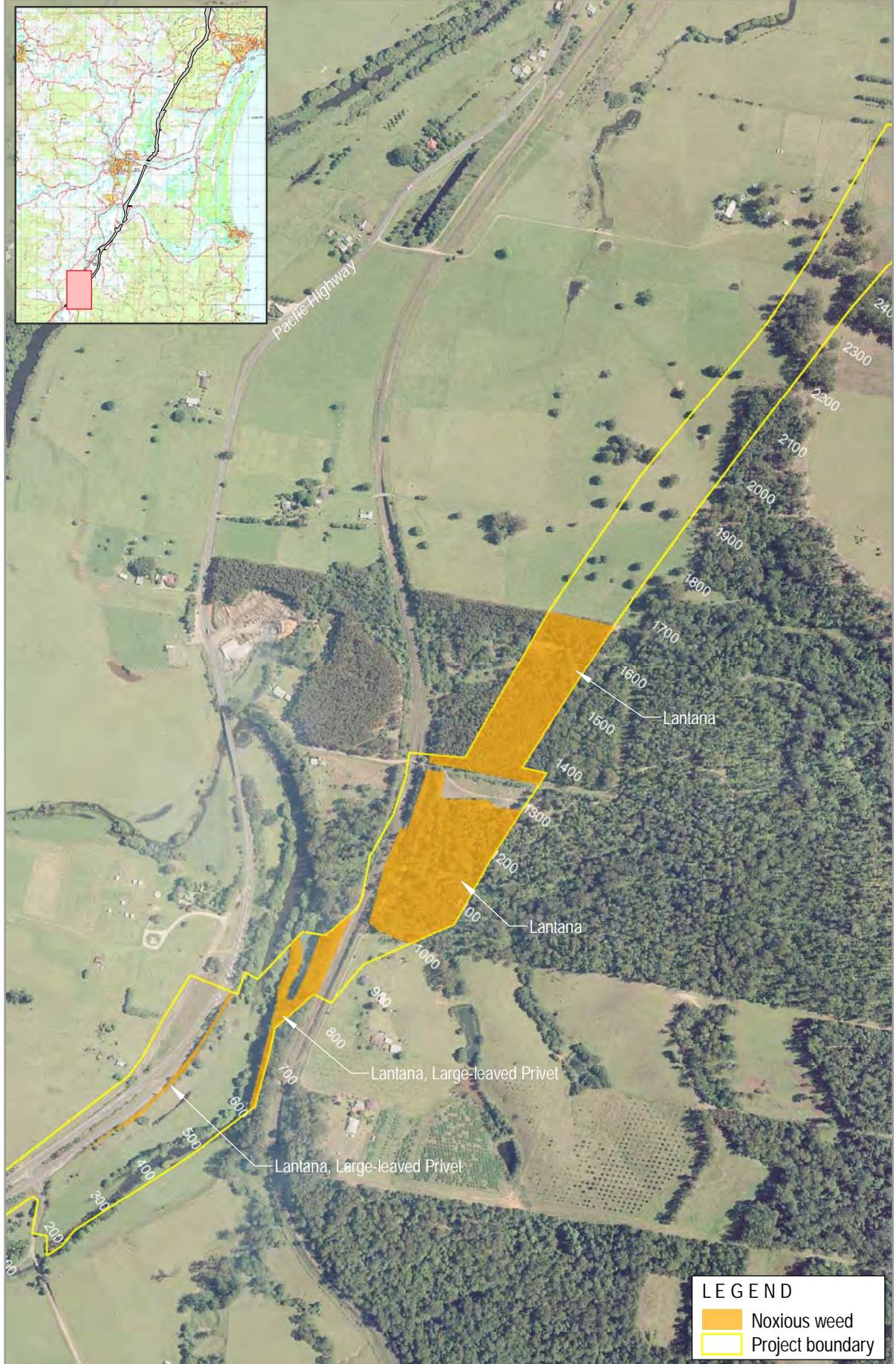
<i>Scientific Name</i>	<i>Common Name</i>	<i>Listing</i>	<i>Extent / Location</i>
<i>Ambrosia artemisiifolia</i>	Annual Ragweed	N5	Scattered occurrences along existing road reserve network
<i>Baccharis halimifolia</i>	Groundsel Bush	N3	A few scattered occurrences throughout the site
<i>Senecio madagascariensis</i>	Fireweed	N4	Common occurrence in cleared pasture areas associated with the site
<i>Ligustrum lucidum</i>	Broad-leafed Privet	N4	Primarily in a number of roadside areas (particularly in the south)
<i>Ligustrum sinense</i>	Narrow-leafed Privet	N4	Associated with a number of riparian zones within the site
<i>Rubus fruticosus</i>	Blackberry	N4	Scattered occurrences within cleared/ pasture lands
<i>Salvinia molesta</i>	Salvinia	N3 WoNS	Infestation associated with Swamp Sclerophyll forest occurring north of Bald Hill Road
<i>Lantana camara</i>	Lantana	N4, WoNS	Infestations scattered along the entire project site, particularly gullies and roadside areas within Nambucca State Forest

2.4.3 Control Requirements

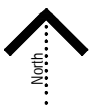
Noxious weeds declared under the *Noxious Weeds Act*, are required by law to be controlled by all landholders within a given control area. The control requirements for Noxious weed classes identified on the site are provided below:

- **N5:** There are no requirements to control existing plants of Class N5 weeds. However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.
- **N4:** 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.
- **N3:** The plant must be fully and continuously suppressed and destroyed.

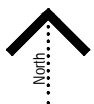
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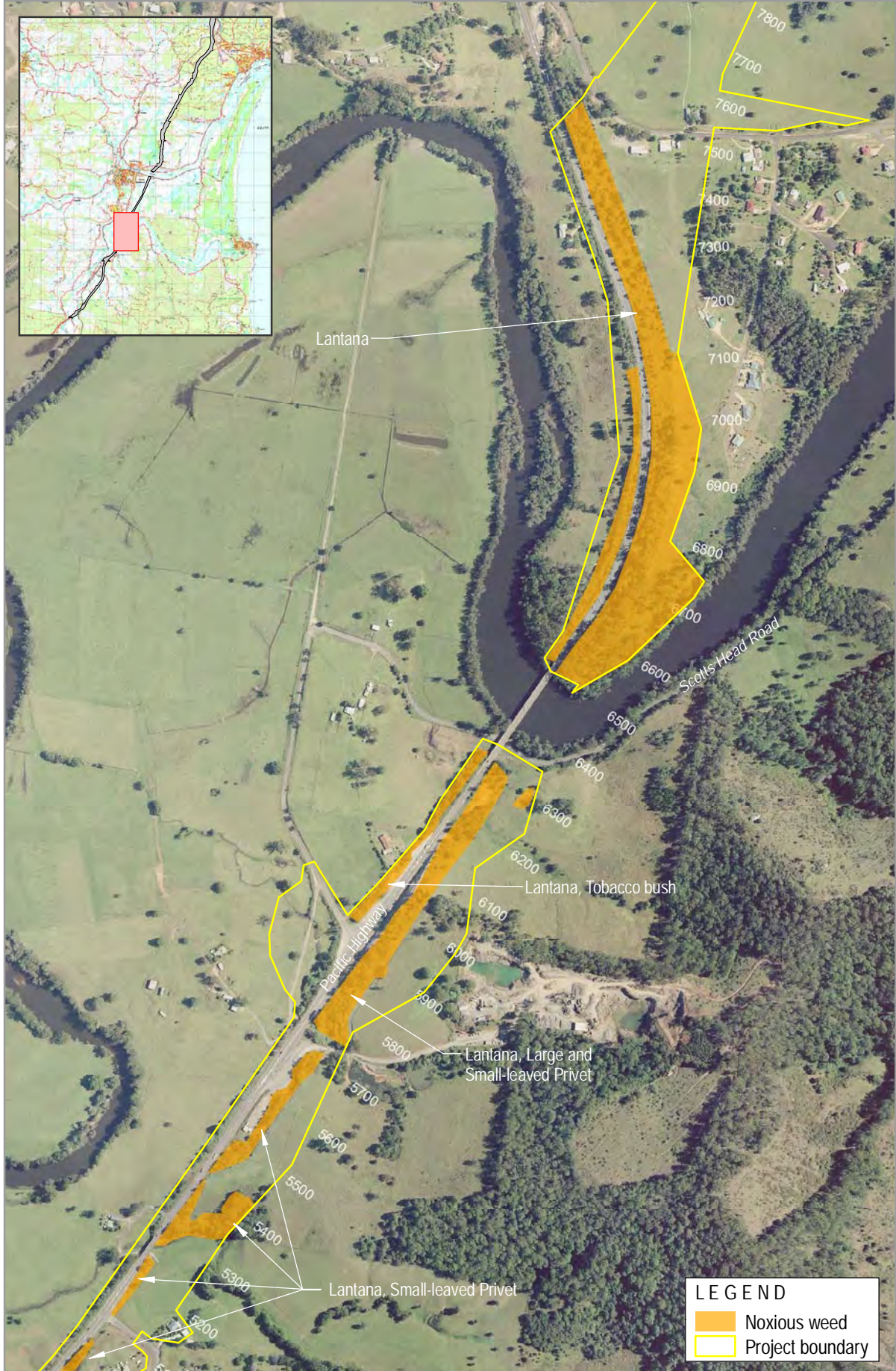


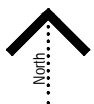
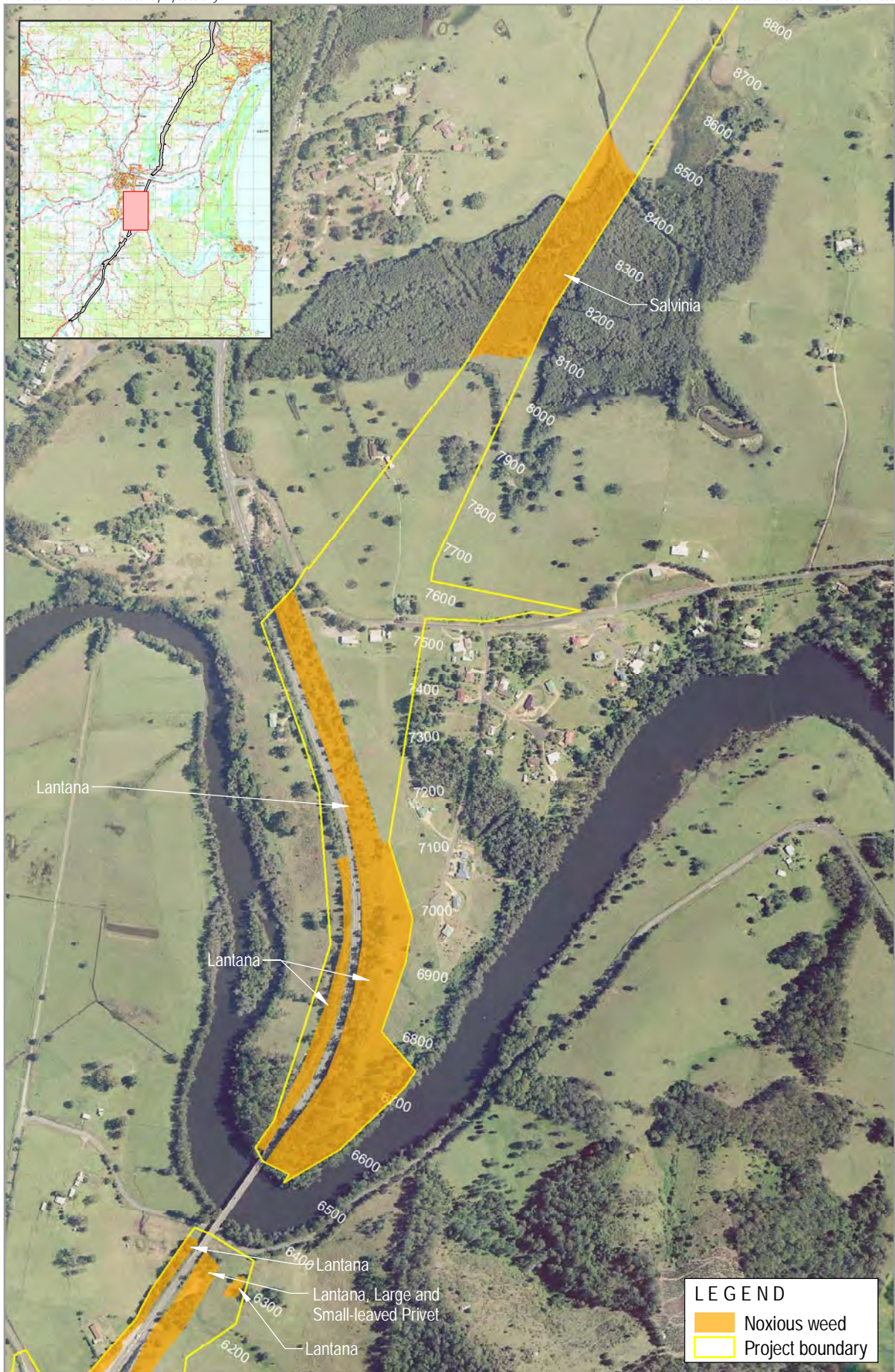
LEGEND
Orange box: Noxious weed
Yellow line: Project boundary



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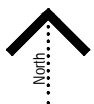
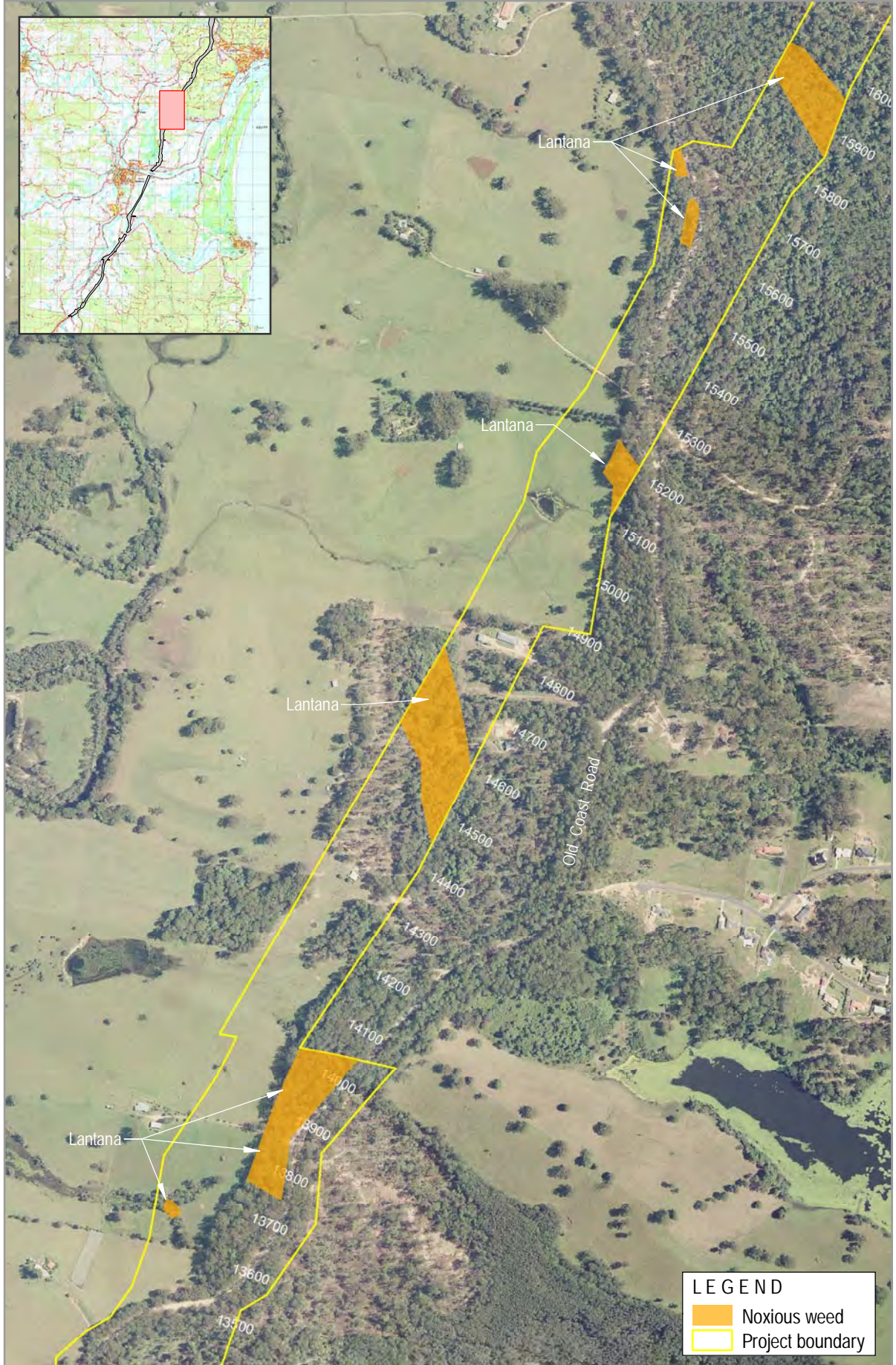
WC2NH Weed Management Plan
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Location of Noxious Weeds - Sheet 4 of 8

Illustration 2.4

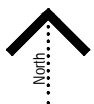
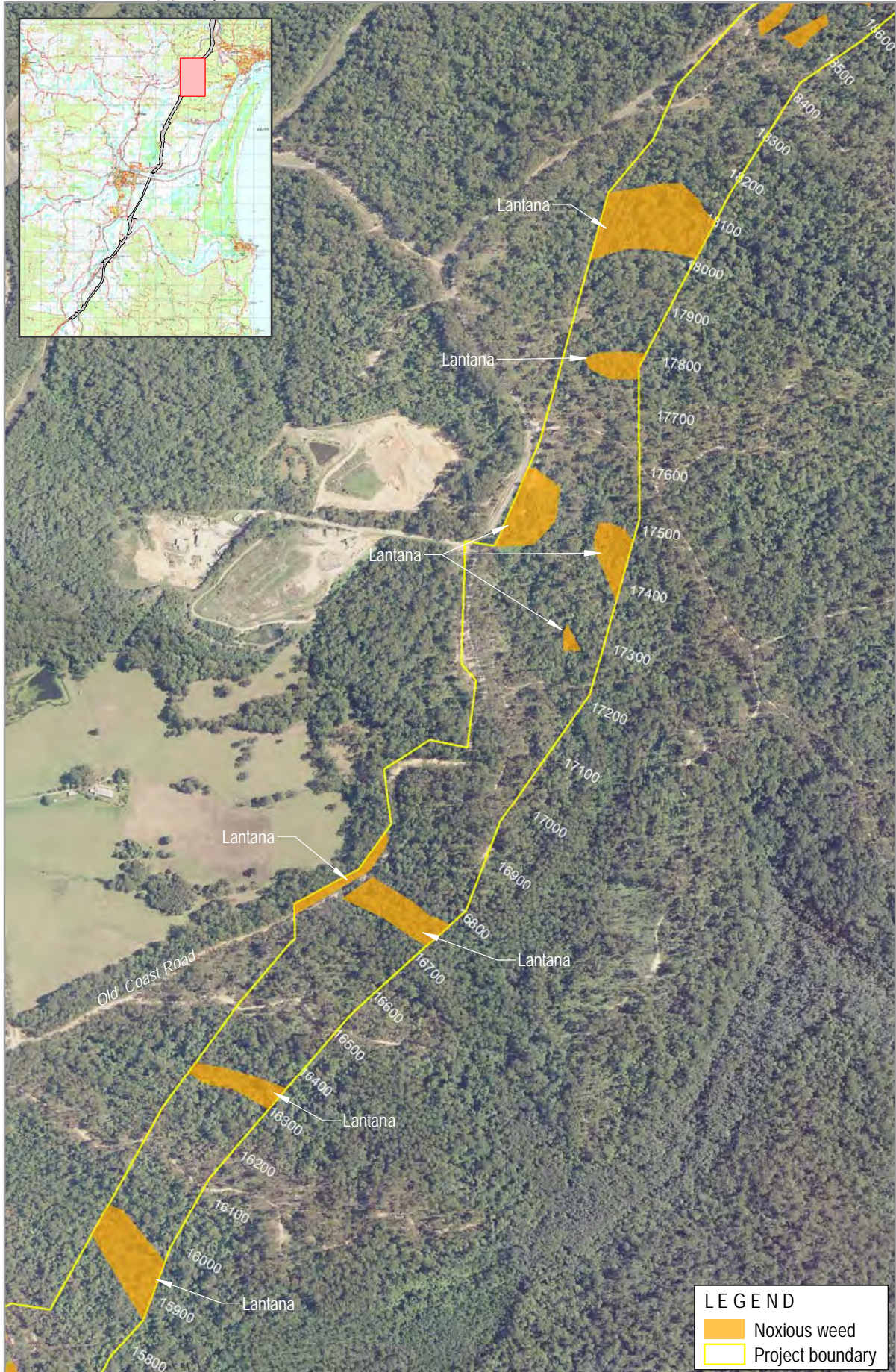


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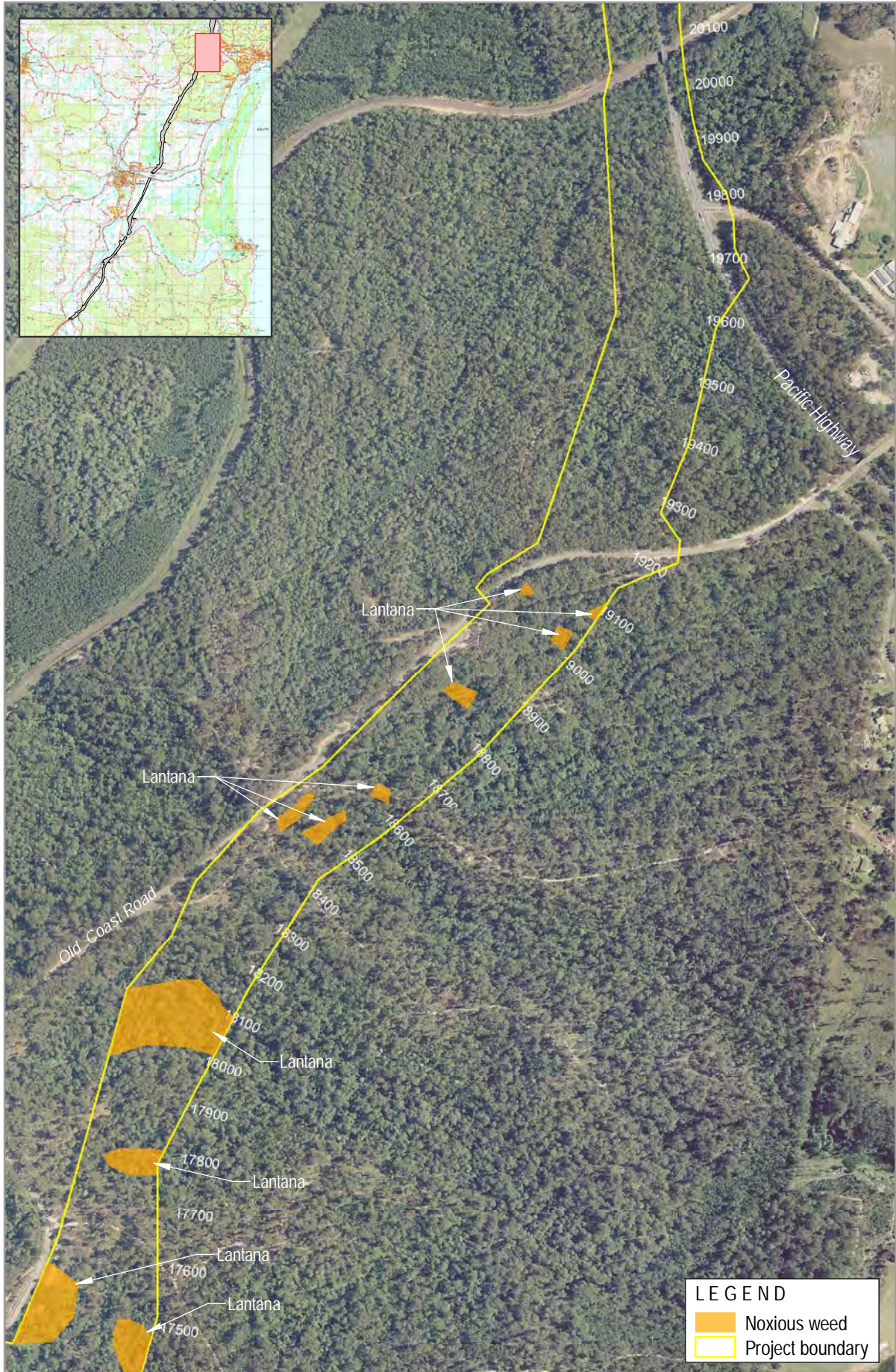
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Location of Noxious Weeds - Sheet 7 of 8

Illustration 2.7

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WC2NH Weed Management Plan
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Location of Noxious Weeds - Sheet 8 of 8

Illustration 2.8

Potential Impacts of the Project

The following sections identify the potential impacts associated with weeds and pathogens relevant to the WC2NH Project.

3.1 Introduction and Spread of Weeds

The project has the potential to introduce/ spread weeds to/ from the site via the movement of weed seeds or weed propagules. The spread of weeds could potentially occur by the following mechanisms:

- Weed sources transported to/ from the site by vehicles/ plant.
- Weed sources transported to site from imported soil/ gravel materials.
- Weed sources introduced to the site via hydro seeding and other landscaping applications.
- Weed sources spread at the site via movement of weed affected topsoil/ mulch.
- Weed sources spread at the site from proliferation of weeds species due to ground disturbance and lack of weed treatment.

3.2 Spread of Chytrid Fungus

Chytridiomycosis is an infectious disease that affects amphibians worldwide. It is caused by the chytrid fungus (*Batrachochytrium dendrobatidis*), a fungus capable of causing sporadic deaths in some amphibian populations and 100 per cent mortality in others. The disease has been implicated in the mass die-offs and species extinctions of frogs since the 1990s (SEWPAC, undated). Little is currently known of the distribution of chytrid in Australia but it is likely to be present within most Australian frog populations (Michael Mahony pers. comms 2013) Infection of amphibians with chytrid fungus resulting in *Chytridiomycosis* is listed as a key threatening process under the Commonwealth EPBC Act.

The project has the potential to spread Chytrid fungus to/ from frog populations occurring on the site. A separate Chytrid Management Protocol has been prepared for the project by the AFJV which is included as Appendix D.

3.3 Spread of *Phytophthora Cinnamomi*

Phytophthora cinnamomi is a soil borne pathogen that spreads in plant roots in warm, moist conditions. The pathogen appears to be widespread in coastal forests, but may also occur at higher elevations. Susceptible flora species display a range of symptoms; some are killed, some are damaged but endure, and some show no apparent symptoms. In some cases *P. cinnamomi* may contribute to plant death where there are other stresses present (OEH, 2013).

The infection of native plants by *P. cinnamomi* is listed as a Key Threatening Process on Schedule 3 of the *Threatened Species Conservation Act 1995* (TSC Act). Additionally, dieback caused by *P. cinnamomi* is listed as a Key Threatening Process under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The project has the potential to spread *P. cinnamomi* through earthmoving and movements of vehicles/ plant to and from site. Pathogen hygiene management will be undertaken in accordance with the RMS biodiversity guideline requirements (refer to Appendix E).

3.4 Spread of Myrtle Rust

Myrtle Rust is a plant disease caused by the exotic fungus *Uredo rangelii*. It was first detected in Australia on 23 April 2010 on the NSW Central Coast. Myrtle Rust is now likely to spread rapidly to the extent of its biological range as the spores are dispersed by wind (OEH, 2011). The introduction and establishment of exotic rust fungi of the order *Pucciniales* pathogenic on plants of the family *Myrtaceae* is listed as a Key Threatening Process under Section 3 of the TSC Act.

The project has the potential to spread Myrtle Rust through earthmoving and movements of vehicles/ plant to and from site. Pathogen hygiene management will be undertaken in accordance with the RMS biodiversity guideline requirements (refer to **Appendix E**).

Management Measures

The following sections provide the management measures to be implemented on the project in order to achieve the goals of this plan which are:

- Identify listed noxious and significant infestations of environmental weeds growing within the project boundary and provide maps showing these areas.
- Treat and dispose of all noxious weeds in accordance with their category under the Noxious Weeds Act 1993 prior to and during clearing/ grubbing activities.
- The ongoing suppression/ control of noxious and environmental weeds during the construction and post-construction (landscape maintenance period) stages.
- Minimise adverse impacts to biodiversity from weed control works.
- Best practice weed/ pathogen hygiene protocols to be undertaken for all plant/ machinery entering/ leaving site to minimise the spread of weeds and plant pathogens.
- Prevent the spread of weeds by best practice mulch and topsoil management.

4.1 Weed Control

4.1.1 General Approach

Nambucca Shire Council's Weed Officer has advised that the primary focus for weed control should be Noxious Weeds (Class 1, 2 and 3). It has been noted by Council's Weed Officer that Lantana is a low priority species given its prevalence in the area.

Initial weed control of Groundsel Bush and Salvinia infestations (Class 3 weeds) (refer to **Illustration 2.1**) would be undertaken prior to and during the clearing and grubbing stage of the project. Where possible, initial weed control would be undertaken by chemical treatment of weed infestations as discussed below. Where chemical treatment of weeds is not possible due to difficulties with access, mechanical removal of weeds would be undertaken.

Ongoing routine weed control is essential to successfully control any weed infestations associated with the project site. This weed control would target all noxious and environmental weeds to prevent the proliferation/ spread of such species during the project. Weed control will be undertaken by an experienced local weed contractor engaged by the AFJV at least every six months (when monitoring has determined that management is needed) during the construction stage of the project. Actions for weed control will be determined by weed monitoring to be undertaken by the project ecologist and AFJV environmental team (refer to **Section 5**).

Where serious weed concerns are identified on site (e.g. Class 1, 2 or 3 noxious weeds), consultation would be undertaken with Nambucca Shire Council's Weed Officer to determine the most appropriate form of weed control. Opportunities are to be explored with Council to collaboratively control weeds on the Project Site and on adjacent Council managed lands.

4.1.2 Weed Control Methods

4.1.2.1 Chemical Treatment of Weeds

Prior to clearing/ grubbing, infestations of noxious weeds (Class 1, 2 and 3) would be treated to avoid the spreading of live weed material and weed seed during clearing operations. Chemical treatment would also be the main method used to treat any noxious or environmental weeds following clearing operations. Chemical treatment methods would be as listed in the Noxious and Environmental Weeds Handbook (DPI, 2009) and

summarised in Table 4.1 and would primarily involve foliar spraying. The measures outlined in Table 4.2 will be undertaken to ensure pesticides are managed and used appropriately on the Project Site.

Table 4.1 Noxious Weed Control Methods

<i>Scientific Name</i>	<i>Common Name</i>	<i>Listing</i>	<i>Control Method</i>
<i>Ambrosia artemisiifolia</i>	Annual Ragweed	N5	Foliar spray (Triclopyr + picloram + Aminopyralid 350 ml in 1 L of water)
<i>Baccharis halimifolia</i>	Groundsel Bush	N3	Seedlings: Scrape and paint (Glyphosate) or foliar spray + surfactant if required Trees: Cut stump stem inject or basal spray applications (Glyphosate)
<i>Senecio madagascariensis</i>	Fireweed	N4, WoNS	Foliar spray (Triclopyr + picloram + Aminopyralid 350 ml in 1 L of water)
<i>Ligustrum lucidum</i>	Broad-leafed Privet	N4	Foliar spray (Metsulfuron-methyl 10 g per 100 L of water) – complete coverage is essential
<i>Ligustrum sinense</i>	Narrow-leafed Privet	N4	
<i>Rubus fruticosus</i>	Blackberry	N4	Foliar spray (Glyphosate 10-13 ml per 1L of water) – use higher rates on old, dense infestations
<i>Salvinia molesta</i>	Salvinia	N3 WoNS	Foliar spray (bioactive Glyphosate 1 L per 100 L of water)
<i>Lantana camara</i>	Lantana	N4, WoNS	Foliar spray (Glyphosate) treat summer-autumn
<i>Hyparrhenia hirta</i>	Coolatai Grass	-	Spot spray (Fluproponate 300 ml/ 100 L water) in winter and Spring

Source: Control methods taken from Noxious and Environmental Weed Control Handbook (DPI, 2009)

Table 4.2 Protocol for Management/ Use of Pesticides

<i>Action</i>	
1	Any use of herbicide will be in accordance with the Pesticides Act, 1999
2	Notification of pesticides used on site will be undertaken in accordance with the RTA's Pesticide Use Notification Plan (refer to G36)
3	Weed control works are to be only undertaken by experienced personnel with ChemCert accreditation (AQF3) in accordance with WorkCover requirements
4	The weed contractor is to select the most appropriate herbicide based on the information within this plan and current best practices for weed control
5	A biodegradable red dye is to be included with foliar spray to allow a visualisation of areas sprayed
6	Foliar spraying is only to be undertaken during periods of low wind (i.e. <10 km/ hr) to reduce overspray
7	Weeds treated with herbicide are to be left in situ for at least two weeks prior to clearing to allow effective kill rates for weeds
8	The Material Safety Data Sheet (MSDS) for herbicides to be used is to be read and held by any personnel involved with weed control works during weed control activities

4.1.2.2 Mechanical Removal of Weeds

Mechanical removal of weeds would be undertaken during the clearing/ grubbing stage where chemical treatment of weeds cannot be undertaken due to difficulties with access. Mechanical removal techniques would include:

- Excavators or bulldozers to be used to remove weeds including root systems. This material will be mulched for reuse.
- Camphor Laurel will be separated from other vegetation to allow for separate mulching and reuse.
- Seedlings or regrowth of weed species can be slashed/ brushcut before they seed.

Any noxious weeds (Class 1, 2 and 3) removed by mechanical means will be collected and disposed of in accordance with the requirements within Table 4.3.

It is noted that the Nambucca Shire Council Weed Officer has advised that for lantana species, mechanical removal, mulching and subsequent reuse of mulch would be adequate weed suppression.

Table 4.3 Protocol for Disposal of Class 1, 2 and 3 Noxious Weeds

<i>Action</i>	
1	Noxious weed material (Class 1, 2 and 3) would be separated from native vegetation
2	Noxious weed material (Class 1, 2 and 3) would be disposed of at a licensed green waste facility or buried under non-structural fill
3	All loads containing Class 1, 2 and 3 noxious weed material are to be covered with heavy tarps and all efforts are to be employed by drivers to minimise the risk of spreading weed seeds and propagules on route to landfill

4.1.3 Control of Weeds in Ecologically Sensitive Areas

Ecologically Sensitive Areas within the Project Site include the following areas outside of the clearing limits:

- Endangered Ecological Communities (EECs).
- Locations of threatened flora.
- Threatened fauna habitat.
- Waterways and aquatic environments.

Given the sensitive nature of the above areas, additional care is required to minimise adverse impacts. The protocol provided in Table 4.4 describes measures to be undertaken within/ adjacent to Ecologically Sensitive Areas (refer to constraints mapped in CEMP Appendix A6 Sensitive Area Plans).

Table 4.4 Protocol for Weed Control of Ecologically Sensitive Areas

<i>Action</i>	
1	Environmental constraints mapping is to be reviewed prior to any weed control works commencing
2	Weed control contractor to be shown the locations of ecological constraints including undertaking an inspection of areas with a site Environmental Officer
3	Foliar spraying is only to be undertaken during periods of low wind (i.e. <10km/ hr) to reduce overspray
4	The use of Glyphosate biactive is to be used around all waterways and in sensitive areas as it has been formulated to reduce the toxicity of the product to certain organisms including frogs
5	The use of herbicide foliar spraying is to be minimised in and around waterways and in areas representing threatened frog habitat. Where possible cut/ paint methods should be used for woody weeds
6	A EWMS will be prepared for any weed control required within Ecologically Sensitive Areas
7	A Permit to Enter will be issued for any 'No-go' areas where weed control contractors are to work

4.2 Environmental Work Method Statements

Environmental Work Method Statements (EWMS) will be prepared for:

- General weed control works within the site.
- Weed control works to be undertaken within Ecologically Sensitive Areas.

The EWMS will include all relevant requirements contained within this WPMP.

4.3 Stabilisation of Areas

The use of cover crops is a highly effective method to reduce the establishment of weeds in disturbed areas of the site. Following vegetation removal, any bare soil areas should be stabilised as soon as practical using an appropriate sterile cover crop (rye grass in winter) to reduce erosion and further weed infestations.

4.4 Inductions and Site Awareness

An environmental induction will be prepared and delivered to all personnel involved with the project. Relevant points to be delivered in this induction in relation to weed management are as follows:

- Noxious weeds and weeds of significance with potential to occur on the site.
- Requirements for all personnel to report sightings (of noxious weeds) to the environmental team.
- Weed/ pathogen hygiene protocols to be implemented on the project including plant/ machinery wash down when entering and leaving the site. The location of wash down bays is to be explained.

Information on noxious and weeds of significance will be posted in site compounds and crib rooms to assist in developing awareness of reportable weeds on site.

4.5 Plant/ Machinery Wash Down Protocols

All plant/ machinery entering the site must be washed down/ cleaned prior to commencing work. This includes trucks, excavators, scrapers, site vehicles, backhoes and loaders. Cleaning shall be done with high pressure cleaners to remove soil and vegetative matter that may spread weeds or soil borne plant pathogens prior to entry of the site. A 'Clean Down Declaration' (refer to **Appendix F**) must be completed evidencing wash-down for plant entering or leaving the site. A summary of the wash-down protocol is provided in **Table 4.5**. Additional information related to specific wash-down procedures for Chytrid fungus and plant pathogens are provided in **Appendix D** and **Appendix E** respectively.

Table 4.5 Protocol for Plant/ Machinery Wash-down

<i>Action</i>	
1	Dedicated wash-down areas with high pressure cleaners will be established at the main site compounds
2	All vehicles/ plant commencing work on the site (and having worked on another construction site previously) are required to wash-down prior to entering the site. Site deliveries/ light vehicles would not be required to undertake vehicle wash-down/ declaration where they are remaining on formed access roads in areas cleared of Noxious weeds
3	A 'Clean Down Declaration' (refer to Appendix F) evidencing wash-down for plant entering the site is to be provided by the Plant Owner/ Operator to the AFJV Environmental team prior to plant/ machinery being permitted to commence work and kept with the item of plant/ machinery for its duration on site. The Clean Down Declaration is to be provided during the plant pre-acceptance process

<i>Action</i>	
4	Before leaving site all plant/ machinery is required to be washed down. A 'Clean Down Declaration' (refer to Appendix F) evidencing wash-down is to be provided to the AFJV Environmental team by the plant owner/ operator prior to plant/ machinery leaving the site
5	Additional wash-down will be required for any plant/ machinery working within areas of weed infestation (as identified within this plan and future weed monitoring reports) in order to prevent the spread of weeds within the site. The Clean Down Declaration system will be implemented for such areas
6	Rumble grids must be installed where appropriate at construction gates to minimise the risk of spreading weed seed/ plant pathogens via soil

4.6 Re-use of Topsoil/ Mulch

4.6.1 Mulch

All vegetation with the exception of noxious weeds would be mulched and reused in erosion and sediment controls and landscaping. In order to minimise the spread of weeds within mulch the following measures will be employed:

- Vegetation containing noxious weed material would not be mulched and reused with the exception of Lantana which Nambucca Shire Council's Weed Officer has agreed would not increase the risk of spreading this species.
- Camphor Laurel is to be separated from other vegetation, mulched and stockpiled separately.
- Camphor Laurel mulch is to be used in feature planting situations (such as interchanges) and not for batter treatments. This mulch can also be used in temporary applications such as erosion/ sediment control in areas away from waterways.
- All mulch is to be stockpiled and used only within the same landscape where it has been derived (e.g. forested areas within Nambucca State Forest, Floodplain etc).
- Mulch stockpiles are to be kept weed free by routine foliar spraying of emergent weeds as determined by ongoing monitoring (refer to **Section 5**).

4.6.2 Topsoil

The following measures are to be undertaken in order to minimise the spread of weed from the reuse of topsoil:

- Topsoil from areas of weed infestations (including noxious weeds) would not be reused with the exception of areas supporting Lantana which Nambucca Shire Council's Weed Officer has confirmed would be unlikely to increase the risk of spreading this species. Topsoil from weed infested areas will be isolated and either sterilised, encapsulated, or disposed of at an approved off site facility.
- Topsoil is to be stockpiled and used only within the same landscape where it has been derived (e.g. forested areas within Nambucca State Forest, Floodplain etc).
- Topsoil stockpiles are to be kept weed free by routine foliar spraying of emergent weeds as determined by ongoing monitoring (refer to **Section 5**).

4.7 Summary of Mitigation Measures, Responsibilities and Timing

Table 4.6 presents the main goals of weed management and includes a summary of the relevant mitigation measures that are to be employed. The table also describes who is responsible for implementing the measures and the timing/ frequency for the measure where applicable.

Table 4.6 Management Goals, Mitigation Measures, Responsibility and Timing

<i>Management Goal</i>	<i>Mitigation/ Control Measure</i>	<i>Responsibility</i>	<i>Timing/ Frequency</i>
<ul style="list-style-type: none"> Identify listed noxious and significant infestations of environmental weeds growing within the project boundary and provide maps showing these areas. 	Identify all noxious weeds occurring on the site prior to clearing/ grubbing commencing.	AFJV/ Project Ecologist (PE)	Completed as part of this WPMP
<ul style="list-style-type: none"> Treat and dispose of all noxious weeds in accordance with their category under the <i>Noxious Weeds Act 1993</i> prior to clearing/ grubbing commencing. No new weeds introduced to the project area. No increase in distribution of weeds currently existing within the project areas. 	Initial weed control of Groundsel Bush and Salvinia infestations (Class 3 weeds) (refer to Illustration 2.1) would be undertaken prior to and during the clearing and grubbing stage of the project. Where possible initial weed control would be undertaken by chemical treatment of weed infestations as discussed below. Where chemical treatment of weeds is not possible due to difficulties with access, mechanical removal of weeds would be undertaken.	AFJV/ Weed Contractor (WC)	Prior to and during clearing and grubbing stage
	Ongoing chemical treatment of weeds will be undertaken by an experienced local weed contractor engaged by the AFJV at least every six months if required during the construction stage of the project.	AFJV/ Weed Contractor (WC)	To be undertaken every six months after the commencement of construction if required
	Noxious weed material (Class 1, 2 and 3) would be separated from native vegetation and disposed of at a licensed waste facility.	AFJV	Where necessary
	Any use of herbicide will be in accordance with the Pesticides Act, 1999.	AFJV/ WC	
	Notification of pesticides used on site will be undertaken in accordance with the RMS' Pesticide Use Notification Plan.	AFJV	
	Weed control works are to be only undertaken by personnel with ChemCert accreditation (AQF3) in accordance with Workcover requirements.	AFJV/ WC	
	The weed contractor is to select the most appropriate herbicide based on the information within this plan and current best practices for weed control.	AFJV/ WC	
	A biodegradable red dye is to be included with foliar spray to allow a visualisation of areas sprayed.	AFJV/ WC	

<i>Management Goal</i>	<i>Mitigation/ Control Measure</i>	<i>Responsibility</i>	<i>Timing/ Frequency</i>
	Foliar spraying is only to be undertaken during periods of low wind (i.e. <10 km/ hr) to reduce overspray.	AFJV/ WC	
	Weeds treated with herbicide are to be left in situ for at least two weeks prior to clearing to allow effective kill rates for weeds.	AFJV	
	The Material Safety Data Sheet (MSDS) for herbicides to be used is to be read and held by any personnel involved with weed control works.	AFJV/ WC	
	An Environmental Work Method Statements (EWMS) will be prepared for general weed control works within the site; including specific measures for weed control works to be undertaken within Ecologically Sensitive Areas.	AFJV	
	Following vegetation removal, any bare soil areas should be stabilised as soon as practical using an appropriate sterile cover crop (rye grass in winter) to reduce erosion and further weed infestations.	AFJV	
	An environmental induction will be prepared and delivered to all personnel involved with the project on relevant weed management requirements.	AFJV	
	Information on noxious and weeds of significance will be posted in site compounds and crib rooms to assist in developing awareness of reportable weeds on site.	AFJV	
<ul style="list-style-type: none"> ▪ Minimise adverse impacts to biodiversity from weed control works. 	Environmental Constraints Mapping is to be reviewed prior to any weed control works commencing.	AFJV/ WC	Prior to weed control works commencing
	Weed control contractor to be shown the locations of ecological constraints including undertaking an inspection of areas with a site Environmental Officer.	AFJV/ WC	
	Foliar spraying is only to be undertaken during periods of low wind (i.e. <10 km/ hr) to reduce overspray.	AFJV/ WC	
	The use of Glyphosate biactive is to be used around all waterways and in sensitive areas as it has been formulated to reduce the toxicity of the product to certain organisms including frogs.	AFJV/ WC	
	The use of herbicide foliar spraying is to be minimised in and around waterways and in areas representing threatened frog habitat.	AFJV/ WC	
	An EWMS will be prepared for any weed control required within Ecologically Sensitive Areas.	AFJV/ WC	
	A Permit to Enter or Early Works Permit will be issued for any 'No-go' areas where weed control contractors are to work.	AFJV	

<i>Management Goal</i>	<i>Mitigation/ Control Measure</i>	<i>Responsibility</i>	<i>Timing/ Frequency</i>
<ul style="list-style-type: none"> No transfer of plant diseases or pathogens to or from the project work areas. Best practice weed/ pathogen hygiene protocols to be undertaken by personnel and applied to all plant/ machinery entering/ leaving site to minimise the spread of weeds and plant pathogens. 	Dedicated wash-down areas with high pressure cleaners will be established at the main site compounds.	AFJV	For the duration of the construction stage works
	All vehicles/ plant commencing work on the site (and having worked on another construction site previously) are required to wash-down thoroughly upon entering the site.	AFJV	
	A 'Clean Down Declaration' (refer to Appendix F) evidencing wash-down for plant entering the site is to be provided by the AFJV Environmental team prior to plant/ machinery commencing work and kept with the item of plant/ machinery for its duration on site. Site deliveries/ light vehicles would not be required to undertake vehicle wash-down/ declaration where they are remaining on formed access roads in areas cleared of Noxious weeds.	AFJV	
	Before leaving site all plant/ machinery is required to be washed down. A 'Clean Down Declaration' (refer to Appendix F) evidencing wash-down is to be provided by the AFJV Environmental team prior to plant/ machinery leaving the site.	AFJV	
	Rumble grids must be installed where appropriate at construction gates to minimise the risk of spreading weed seed/ plant pathogens via soil.	AFJV	
	Implement measures within the Chytrid Protocol (refer to Appendix D) and Plant Pathogen Protocol (refer to Appendix E) to prevent the spread of the chytrid fungus.	AFJV	
<ul style="list-style-type: none"> Prevent the spread of weeds by best practice mulch and topsoil management. 	<p>Mulch</p> <p>Vegetation containing noxious weed material (with the exception of Lantana) would not be mulched and reused.</p>	AFJV	
	Camphor Laurel is to be separated from other vegetation, mulched and stockpiled separately.		
	Camphor Laurel mulch is to be used in feature planting situations (such as interchanges) and not for batter treatments. This mulch can also be used in temporary applications such as erosion/ sediment control in areas away from waterways.	AFJV	
	Mulch is to be stockpiled and used only within the same landscape where it has been derived (e.g. forested areas within Nambucca State Forest, Floodplain etc).	AFJV	
	Mulch stockpiles are to be kept weed free by routine foliar spraying of emergent weeds as determined by ongoing monitoring (refer to Section 5).	AFJV	

<i>Management Goal</i>	<i>Mitigation/ Control Measure</i>	<i>Responsibility</i>	<i>Timing/ Frequency</i>
	<p>Topsoil</p> <p>Topsoil from areas of weed infestations (including noxious weeds) would not be reused with the exception of areas supporting Lantana which Nambucca Shire Council's Weed Officer has confirmed would be unlikely to increase the risk of spreading this species. Topsoil from weed infested areas will be isolated and either sterilised, encapsulated, or disposed of at an approved off site facility.</p>	AFJV	
	<p>Topsoil is to be stockpiled and used only within the same landscape where it has been derived (e.g. forested areas within Nambucca State Forest, Floodplain etc).</p>	AFJV	
	<p>Topsoil stockpiles are to be kept weed free by routine foliar spraying of emergent weeds as determined by ongoing monitoring (refer to Section 5).</p>	AFJV	
<ul style="list-style-type: none"> Compliance with relevant legislation and project requirements. 	<p>All measures stated above.</p>	AFJV	

Weed Monitoring Program

A weed monitoring program is to be implemented during the construction and post-construction (landscape maintenance period) of the project to measure the success of mitigation measures identified in Section 4 of this plan. The monitoring program aim is to identify any weed infestations or signs of plant pathogens and provide a mechanism for the development and implementation of additional management measures (e.g. additional weed control).

5.1 Methods

The monitoring program will involve routine inspections of all areas of the Project Site, to identify occurrences of noxious/ environmental weeds and signs of plant pathogens.

5.1.1 Fixed Point Photograph Points

Fixed photograph points are to be established at 15 locations within the project site to monitor the change in weed levels and detect any signs of plant pathogens. This number of sites is considered adequate to sample areas of native vegetation to be retained within the project site. Photo points are to be placed in areas of native vegetation outside the clearing limits (but inside the project boundary) and should be spread across different vegetation types, EEC and threatened flora/ fauna habitats associated with the site. The locations of photo points are to be determined by the project ecologist during the first weed monitoring session. A star picket and metal tag (with identification code) would be used to mark all locations with a photograph to be taken during monitoring sessions always facing in the same direction.

5.1.2 Weed Infestation/ Plant Pathogen Surveys

Surveys of the entire project site will be undertaken routinely by the project ecologist to identify noxious/ environmental weed infestations. Substantial weed infestations are to be mapped and provided to the AFJV Environmental team in a brief report. The AFJV will also monitor weed infestations on the construction site through the Weekly Environmental Checklist process.

Searches for signs of dieback (indicative of *P. cinnamom*) and Myrtle Rust will be undertaken in areas of native vegetation retained within the project site. Any such signs are to be investigated further with testing to be undertaken if required.

5.2 Timing

Weed monitoring would commence at the start of the construction stage of the project which is anticipated to be in late-November 2015. It is envisaged that weed monitoring surveys would be undertaken on a monthly basis for the first six months after commencement of construction (or as necessary responding to seasonal and climatic conditions) and then every six months after that until the completion of the post-construction landscape maintenance period. The frequency of monitoring will be largely dependant on previous weed control efforts and seasonal factors and as such the project ecologist would determine the frequency of monitoring based on these factors.

5.3 Reporting and Adaptive Management

At the completion of each weed monitoring event a brief report would be prepared documenting the findings and any priority weed control actions to be implemented by the AFJV. These actions will be provided to the weed control contractor for implementation during weed control works to be undertaken every six months.

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Appendix A

Plan Authors CVs

David HAVILAH

B Sc (Biol)



Ecologist

Qualifications

Bachelor of Science (Biology), Sydney University, 2003

Professional Affiliations

Member, Ecological Consultants Association of NSW

Member, NSW Wildlife Information, Rescue and Education Services Inc (WIRES-Northern Rivers)

Experience

David is an experienced ecological consultant who has developed a broad range of skills from working on a variety of small and large-scale projects. He specialises in undertaking terrestrial flora and fauna surveys and providing high quality ecological reports within Queensland and New South Wales. This work has included designing and implementing threatened species management plans and ecological monitoring programs. David has a detailed working knowledge of environmental legislation relevant to ecological impact assessment and an ability to balance practical applications of environmental requirements with good environmental outcomes.

Key Experience and Skills

A large focus of David's work has been providing ecological services on large infrastructure projects. He has been engaged as the Project Ecologist for construction contractors on a number of sections of the NSW Pacific Highway upgrade project. This work has included providing technical advice, ecological surveys and assessments and managing threatened species on these projects.

David's skills and key areas of expertise include:

- Design, implementation and management of ecological monitoring programs.
- Determining and documenting best practice and innovative management plans for threatened species occurring on infrastructure projects.
- Undertaking detailed systematic terrestrial flora / fauna surveys and vegetation / weed mapping.
- Preparing high quality ecological / environmental assessments for a broad range of projects in accordance with NSW, QLD and Federal environmental legislation.
- Preparing vegetation management plans and environmental management plans.
- Providing peer reviews of ecological assessments.
- Providing technical advice, ecological surveys and reporting in the role of project ecologist for large-scale infrastructure projects.
- Supervising and delivering pre-clearing surveys and spotter / catcher (fauna capture / relocation services) as part of large infrastructure projects.
- Delivering environmental awareness presentations.

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Veronica SILVER

B EnvSc Grad Dip (UrbRegPlan)

Senior Associate / Ecologist / Planner



Qualifications

Bachelor of Environmental Science (Environmental Management),
The University of Newcastle, [2000]
Graduate Diploma of Urban and Regional Planning, The University of New England, [2007]

Professional Affiliations

Member, Planning Institute Australia
Member, Environment Institute of Australia and New Zealand
Member, Ecological Consultants Association of NSW Inc.
Member, Australian Network for Plant Conservation Inc.

Professional Short Courses

- Planning for Bushfire Prone Areas
- Certificate IV Bushland Regeneration
- Certificate IV Workplace Training and Assessment
- Certificate II Australian Land Conservation and Restoration
- Project Management, Chifley Business School
- Effective Communication, Negotiation and Mediation, Chifley Business School
- Urban Design, Chifley Business School
- Acid Sulfate Soils: Identification, Assessment and Management
- Woodland Birds Identification and Ecology
- Signed English, TAFE Newcastle

Licences

- Scientific Licence (SL100152) issued by the Office of Environment and Heritage.
- Animal Research Authority issued by the Animal Care and Ethics Committee of the Director-General of NSW Department of Primary Industries to undertake fauna surveys throughout NSW and SE Queensland.

Experience

Veronica has been a key member of GeoLINK's ecology team since 2004. She specialises in flora / fauna field surveys; ecological monitoring; bushfire assessment; environmental impact assessment and bushland regeneration.

Veronica has further diversified her skills and knowledge in the built environment, having completed a Graduate Diploma of Urban and Regional Planning through The University of New England in 2007.

Veronica possesses high level project management skills, developed through working with a broad range of public and private sector clients on challenging environmental projects. Having project managed a variety of ecological and planning projects; she has significant skills in liaison and the management of multidisciplinary teams.



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Appendix B

Noxious Weeds Declarations – Nambucca Shire LGA

Noxious weed declarations

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Noxious weed declarations for Nambucca Shire Council

Note: this control area includes the local council areas of - Nambucca

Weed	Class	Legal requirements
African boxthorn [<i>Lycium ferocissimum</i>]	4	The plant must not be sold, propagated or knowingly distributed
African feathergrass [<i>Pennisetum macrourum</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African turnip weed [<i>Sisymbrium runcinatum</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African turnip weed [<i>Sisymbrium thellungii</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Aleman grass [<i>Echinochloa polystachya</i>]	2	The plant must be eradicated from the land and that land must be kept free of the plant
Alligator weed [<i>Alternanthera philoxeroides</i>]	2	The plant must be eradicated from the land and that land must be kept free of the plant
Anchored water hyacinth [<i>Eichhornia azurea</i>]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Annual ragweed [<i>Ambrosia artemisiifolia</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Arrowhead [<i>Sagittaria calycina</i> variety <i>calycina</i> (syn. <i>Sagittaria montevidensis</i> subspecies <i>calycina</i>)]	4	The plant must not be sold, propagated or knowingly distributed
Artichoke thistle [<i>Cynara cardunculus</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Asparagus [<i>Asparagus</i> species] Ex <i>A. aethiopicus</i> <i>A. africanus</i> <i>A. asparagoides</i> <i>A. declinatus</i> <i>A. falcatus</i> <i>A. macowanii</i> var. <i>zuluensis</i> <i>A. officinalis</i> <i>A. plumosus</i> <i>A. racemosus</i> <i>A. virgatus</i>	4	The plant must not be sold, propagated or knowingly distributed
Asparagus fern [<i>Asparagus virgatus</i> (syn. <i>Protasparagus virgatus</i>)] A Weed of National Significance	2	The plant must be eradicated from the land and that land must be kept free of the plant
Athel tree / Athel pine [<i>Tamarix aphylla</i>] A Weed of National Significance	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Bathurst/Noogoora/Hunter/South American/Californian/cockle burrs [<i>Xanthium</i> species]	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread

Bear-skin fescue [<i>Festuca gautieri</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Bellyache bush [<i>Jatropha gossypifolia</i>]	2	The plant must be eradicated from the land and that land must be kept free of the plant
Bitou bush [<i>Chrysanthemoides monilifera</i> subspecies <i>rotundata</i>] A Weed of National Significance	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Black knapweed [<i>Centaurea xmoncktonii</i>]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Black willow [<i>Salix nigra</i>] A Weed of National Significance	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Blackberry [<i>Rubus fruticosus</i> aggregate species] except cultivars Black satin Chehalem Chester Thornless Dirksen Thornless Loch Ness Murrindindi Silvan Smooth stem Thornfree	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed This is an All of NSW declaration
Boneseed [<i>Chrysanthemoides monilifera</i> subspecies <i>monilifera</i>] A Weed of National Significance	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Bridal creeper [<i>Asparagus asparagoides</i> (syn. <i>Myrsiphyllum asparagoides</i> , <i>Asparagus medeoloides</i>)]	4	The plant must not be sold, propagated or knowingly distributed
Bridal veil creeper [<i>Asparagus declinatus</i> (syn. <i>Asparagus crispus</i> , <i>Myrsiphyllum declinatum</i>)] A Weed of National Significance	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Broad-leaf pepper tree [<i>Schinus terebinthifolius</i>]	3	The plant must be fully and continuously suppressed and destroyed
Broomrapes [<i>Orobanche</i> species except the native <i>O. cernua</i> variety <i>australiana</i> and <i>O. minor</i>]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Burr ragweed [<i>Ambrosia confertiflora</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cabomba [All <i>Cabomba</i> species except <i>C. furcata</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cat's claw creeper [<i>Dolichandra unguis-cati</i> (syn. <i>Macfadyena unguis-cati</i>)] A Weed of National Significance	3	The plant must be fully and continuously suppressed and destroyed
Cayenne snakeweed [<i>Stachytarpheta cayennensis</i>]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cecropia [<i>Cecropia</i> species]	2	The plant must be eradicated from the land and that land must be kept free of the plant
Chilean needle grass [<i>Nassella neesiana</i>]	4	The growth of the plant must be managed in a manner that

A Weed of National Significance		continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Chinese celtis [Celtis sinensis]	3	The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Chinese tallow tree [Triadica sebifera]	3	The plant must be fully and continuously suppressed and destroyed
Chinese violet [Asystasia gangetica subspecies micrantha]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Climbing asparagus fern [Asparagus plumosus (syn. Protasparagus plumosus)] A Weed of National Significance	2	The plant must be eradicated from the land and that land must be kept free of the plant
Climbing asparagus fern [Asparagus plumosus (syn. Protasparagus plumosus)] A Weed of National Significance	4	The plant must not be sold, propagated or knowingly distributed
Clockweed [Gaura parviflora]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cockspur coral tree [Erythrina crista-galli]	3	The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Corn sowthistle [Sonchus arvensis]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Dodder [All Cuscuta species except the native species C. australis, C. tasmanica and C. victoriana] Includes All Cuscuta species except the native species C. australis, C. tasmanica and C. victoriana	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
East Indian hygrophila / Hygro [Hygrophila polysperma]	3	The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Espartillo [Amelichloa brachychaeta, Amelichloa caudata]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Eurasian water milfoil [Myriophyllum spicatum]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Fine-bristled burr grass [Cenchrus brownii]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Fireweed [Senecio madagascariensis] A Weed of National Significance	4	The plant must not be sold, propagated or knowingly distributed
Flax-leaf broom [Genista linifolia] A Weed of National Significance	4	The plant must not be sold, propagated or knowingly distributed
Fountain grass [Pennisetum setaceum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable

		weed must be complied with This is an All of NSW declaration
Frogbit / Spongeplant [Limnobium laevigatum and L. spongia]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Gallon's curse [Cenchrus biflorus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Gamba grass [Andropogon gayanus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Giant devils fig [Solanum chrysotrichum]	3	The plant must be fully and continuously suppressed and destroyed
Giant rat's tail grass [Sporobolus pyramidalis]	3	The plant must be fully and continuously suppressed and destroyed
Giant reed / Elephant grass [Arundo donax]	4	The plant must not be sold, propagated or knowingly distributed
Glaucous star thistle [Carthamus glaucus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Golden thistle [Scolymus hispanicus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Green cestrum [Cestrum parqui]	3	The plant must be fully and continuously suppressed and destroyed
Grey sallow [Salix cinerea] A Weed of National Significance	2	The plant must be eradicated from the land and that land must be kept free of the plant
Ground asparagus [Asparagus aethiopicus (syn. Protasparagus aethiopicus)]	4	The plant must not be sold, propagated or knowingly distributed
Groundsel bush [Baccharis halimifolia]	3	The plant must be fully and continuously suppressed and destroyed
Harrisia cactus [Harrisia species]	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Hawkweed [Hieracium species]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Heteranthera / Kidneyleaf mud plantain [Heteranthera reniformis]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Honey locust [Gleditsia triacanthos]	3	The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Horsetail [Equisetum species]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Hydrocotyl / Water pennywort [Hydrocotyl]	1	The plant must be eradicated from the land and that land must

ranunculoides]		be kept free of the plant This is an All of NSW declaration
Hygrophila [Hygrophila costata]	2	The plant must be eradicated from the land and that land must be kept free of the plant
Hymenachne [Hymenachne amplexicaulis and hybrids] A Weed of National Significance	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Karoo thorn [Acacia karroo]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Kochia [Bassia scoparia (syn. Kochia scoparia) except B. scoparia subspecies trichophylla] except Bassia scoparia subspecies trichophylla	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Koster's curse / Clidemia [Clidemia hirta]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Kudzu [Pueraria lobata]	3	The plant must be fully and continuously suppressed and destroyed
Lagarosiphon [Lagarosiphon major]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Lantana [Lantana species] A Weed of National Significance	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Leafy elodea / Dense waterweed / Egeria [Egeria densa (syn. Elodea densa)]	4	The plant must not be sold, propagated or knowingly distributed This is an All of NSW declaration
Lippia [Phyla canescens]	4	The plant must not be sold, propagated or knowingly distributed except incidentally in hay or lucerne This is an All of NSW declaration
Long-leaf willow primrose [Ludwigia longifolia]	3	The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Mahonia / Chinese holly [Berberis lomariifolia (syn. Mahonia lomariifolia)]	3	The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Mexican feather grass [Nassella tenuissima]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Mexican poppy [Argemone mexicana]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Miconia [Miconia species]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Mikania vine [Mikania micrantha]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration

Mimosa [Mimosa pigra] A Weed of National Significance	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Ming (Pom pom / Zig zag) asparagus fern [Asparagus macowanii var. zuluensis (syn. A. retrofractus)]	2	The plant must be eradicated from the land and that land must be kept free of the plant
Montpellier broom / Cape broom [Genista monspessulana] A Weed of National Significance	3	The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Mossman River grass [Cenchrus echinatus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Mysore thorn [Caesalpinia decapetala]	3	The plant must be fully and continuously suppressed and destroyed
Pampas grass [Cortaderia species]	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Paper mulberry [Broussonetia papyrifera]	2	The plant must be eradicated from the land and that land must be kept free of the plant
Parthenium weed [Parthenium hysterophorus] A Weed of National Significance	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Pond apple [Annona glabra] A Weed of National Significance	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Prickly acacia [Vachellia nilotica (syn. Acacia nilotica)] A Weed of National Significance	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Prickly pear [Opuntia species except O. ficus-indica]	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Prickly pear [Cylindropuntia species] A Weed of National Significance	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed This is an All of NSW declaration
Privet (Broad-leaf) [Ligustrum lucidum]	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Privet (Narrow-leaf/Chinese) [Ligustrum sinense]	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Red rice [Oryza rufipogon]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Rhus tree [Toxicodendron succedaneum (syn. Toxicodendron succedanea, Rhus succedanea)]	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed This is an All of NSW declaration
Rubber vine [Cryptostegia grandiflora]	1	The plant must be eradicated from the land and that land must

A Weed of National Significance		be kept free of the plant This is an All of NSW declaration
Sagittaria [Sagittaria platyphylla (syn. Sagittaria graminea variety platyphylla)] A Weed of National Significance	4	The plant must not be sold, propagated or knowingly distributed
Salvinia [Salvinia molesta] A Weed of National Significance	3	The plant must be fully and continuously suppressed and destroyed
Scotch broom / English broom [Cytisus scoparius subspecies scoparius] A Weed of National Significance	4	The plant must not be sold, propagated or knowingly distributed
Senegal tea plant [Gymnocoronis spilanthoides]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Serrated tussock [Nassella trichotoma] A Weed of National Significance	4	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Siam weed [Chromolaena odorata]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Sicklethorn [Asparagus falcatus]	2	The plant must be eradicated from the land and that land must be kept free of the plant
Silver-leaf nightshade [Solanum elaeagnifolium] A Weed of National Significance	4	The plant must not be sold, propagated or knowingly distributed
Smooth-stemmed turnip [Brassica barrelieri subspecies oxyrrhina]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Soldier thistle [Picnomon acarna]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Spotted knapweed [Centaurea stoebe subspecies micranthos]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Texas blueweed [Helianthus ciliaris]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Tropical soda apple [Solanum viarum]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Water caltrop [Trapa species]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Water hyacinth [Eichhornia crassipes] A Weed of National Significance	3	The plant must be fully and continuously suppressed and destroyed
Water lettuce [Pistia stratiotes]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration

Water soldier [Stratiotes aloides]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
White blackberry / Mysore raspberry [Rubus niveus]	3	The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Willows [Salix species except S. babylonica, S. xreichardtii, S. xcalodendron, S. cinerea and S. nigra] Includes all Salix species except S. babylonica, S. xreichardtii, S. xcalodendron	4	The plant must not be sold, propagated or knowingly distributed
Witchweed [Striga species except the native Striga parviflora]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Yellow bells [Tecoma stans]	3	The plant must be fully and continuously suppressed and destroyed
Yellow burrhead [Limnocharis flava]	1	The plant must be eradicated from the land and that land must be kept free of the plant This is an All of NSW declaration
Yellow nutgrass [Cyperus esculentus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration



Appendix C

Weeds Detected on the Project Site

Table C1 Weed Species Detected within the Project Corridor

<i>Family</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Listing</i>
Noxious Weeds			
Asteraceae	<i>Ambrosia artemisiifolia</i>	Annual Ragweed	N5
Asteraceae	<i>Baccharis halimifolia</i>	Groundsel Bush	N3
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	N4
Oleaceae.	<i>Ligustrum lucidum</i>	Broad-leafed Privet	N4
Oleaceae.	<i>Ligustrum sinense</i>	Narrow-leafed Privet	N4
Rosaceae	<i>Rubus fruticosus</i>	Blackberry	N4
Salviniaceae	<i>Salvinia molesta</i>	Salvinia	N3, WoNS
Verbenaceae	<i>Lantana camara</i>	Lantana	N4, WoNS
Environmental/ Agricultural Weeds			
Apocynaceae	<i>Gomphocarpus physocarpus</i>	Balloon Cotton Bush	
Araliaceae	<i>Schefflera actinophylla</i>	Umbrella Tree	
Asparagaceae	<i>Asparagus aethiopicus</i>	Asparagus Fern	
Asteraceae	<i>Ageratum houstonianum</i>	Blue Billygoat Weed	
Asteraceae	<i>Bidens pilosa</i>	Cobbler's Pegs	
Asteraceae	<i>Onopordum acanthium subsp. acanthium*</i>	Scotch Thistle	
Asteraceae	<i>Tagetes minuta</i>	Stinking Roger	
Basellaceae	<i>Anredera cordifolia</i>	Madeira Vine	
Commelinaceae	<i>Commelina benghalensis</i>	Hairy Commelina	
Commelinaceae	<i>Tradescantia fluminensis (albiflora)</i>	Wandering Jew	
Convolvulaceae	<i>Ipomoea cairica</i>	Coastal Morning Glory	
Davalliacea	<i>Nephrolepis cordifolia</i>	Fishbone Fern	
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken	
Fabaceae	<i>Desmodium uncinatum</i>	Silver-leaved Desmodium	
Fabaceae (Caesalpinioideae)	<i>Senna pendula var. glabrata</i>	Winter Senna	
Lauraceae	<i>Cinnamomum camphora</i>	Camphor Laurel	
Myrtaceae	<i>Psidium guajava</i>	Guava	
Ochnaceae	<i>Ochna serrulata</i>	Ochna	
Passifloraceae	<i>Passiflora subpeltata</i>	White Passionflower	
Poaceae	<i>Hyparrhenia hirta</i>	Coolatai Grass	
Poaceae	<i>Sporobolus fertilis</i>	Giant Parramatta Grass	
Poaceae	<i>Andropogon virginicus</i>	Whiskey Grass	
Poaceae	<i>Paspalum mandiocanum</i>	Broad-leafed Paspalum	
Poaceae	<i>Paspalum urvillei</i>	Vasey Grass	
Poaceae	<i>Setaria sphacelata</i>	South African Pigeon Grass	
Rutaceae	<i>Murraya paniculata</i>	Orange Jessamine	
Solanaceae	<i>Solanum mauritianum</i>	Wild Tobacco Bush	
Verbenaceae	<i>Verbena bonariensis</i>	Purpletop	

<i>Family</i>	<i>Scientific Name</i>	<i>Common Name</i>	<i>Listing</i>
Aquatic Weeds			
Haloragaceae	<i>Myriophyllum aquaticum</i>	Parrots Feather	
Salviniaceae	<i>Azolla filiculoides</i>	Red Azolla	



Appendix D

Chytrid Management Protocol



1.1 Frog Hygiene Protocols

Frog hygiene protocols aim to prevent the spread of amphibian chytrid fungus during the Warrell Creek to Nambucca Heads Pacific Highway Upgrade Project. Indications of this pathogen have to date not been detected within the local frog population. As the pathogen typically exists within water bodies, topsoil and the upper soil profile, this protocol focuses on controlling the potential spread of this pathogen during the “high risk stage” which is defined as being when in contact with the existing natural ground surface within the Giant Barred Frog and Green Thighed Frog hygiene management areas (as defined in Map 1 to Map 3 of this protocol).

1.1.1 Wash Down

- Wash down procedures for vehicles, plant and footwear are to be implemented when entering / exiting the frog hygiene management area (refer to Map 1 to Map 3) at any time when these items have been in contact with the existing natural ground surface. Once topsoil and vegetative material has been removed from the designated frog hygiene management zone, new plant and equipment entering the zone would not require wash-down whereas plant and equipment leaving the zone and having had contact with the natural ground surface will still require wash-down.
- Wash down bays will be implemented at appropriate entry / exit points.
- Wash down bays will incorporate an area for site personnel to disinfect boots when entering / leaving sterile zones during clearing / grubbing and stripping of topsoil.
- Wash down bays will be situated at least 100 m from waterways.
- Wash down areas will be contained with wash-down material (liquid and sediment) to be removed off site to a licensed waste facility.
- All construction personnel must be made aware of the requirements for wash down with this procedure to be a hold point for works commencing.
- Disinfection will be via the use of proprietary available Chloramine and Chlorhexidine based fungicides, cleaning products containing benzalkonium chloride or bleach and alcohol (ethanol or methanol).
- 70% isopropyl wipes may be suitable for the disinfection of small equipment.

1.1.2 Excavated Topsoil

- Excavated topsoil from the frog hygiene management zone must be either reused within the same creek catchment or buried on site.
- If the material is to be stockpiled and reused at a later date, the origin of this material must be tracked and wash-down procedures implemented when reuse occurs.

1.1.3 Entry into GBF / GTF Habitat (outside the Project Site)

- A “permit to enter” system will be established to regulate entry of personnel into areas of GBF / GTF habitat occurring outside of the Project Site.
- Any entry into areas of GBF / GTF habitat (outside the Project Site) will require personnel to disinfect boots before / after entering such areas. Portable spray packs with appropriate disinfectant (refer to **Appendix A**) will be made available at wash down bays.
- All personnel will be made aware of their responsibilities relating to Chytrid management on the site.

1.1.4 Vehicle Movements

- Vehicle movements will be restricted to designated tracks, trails and parking areas by a specific Vehicle Movement Plan (VMP) which will apply at all times throughout the works.
- Vehicle movements within the frog hygiene management areas will be kept to a minimum during excessively wet or muddy conditions.
- Designated parking and turn-around points must be provided on hard well-drained surfaces within the frog hygiene management zone.

1.1.5 Frog Handling

The Project Ecologist and personnel licensed / authorised to handle GBF / GTF are to adhere to the following hygiene protocols in accordance with the *Hygiene Protocols for the Control of Disease in Frogs* (NPWS, 2008) (refer to **Appendix A**): -

- New gloves / bags will be used for each frog captured;
- Individual bags / containers will be used for each frog held and containers (if reusable will be washed) prior to reuse. Containers will be labelled with the date and location);
- When moving between separate sites during frog surveys, footwear / waders will be thoroughly cleaned and disinfected;
- When moving between separate sites during frog surveys, equipment used (such as callipers, scales etc) will be thoroughly cleaned and disinfected; and
- Vehicle tyres will be washed / disinfected before and after visiting frog sites.
- Vehicle tyres can be disinfected with the aforementioned disinfectants or cleaning products with active ingredient benzalkonium chloride (See **Appendix A**).
- Should a sick frog be identified the project environmental staff are to be notified to ensure that controls remain effective and that staff are reminded of their responsibilities. Manage the sick frog in accordance with the protocol.

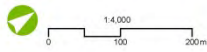
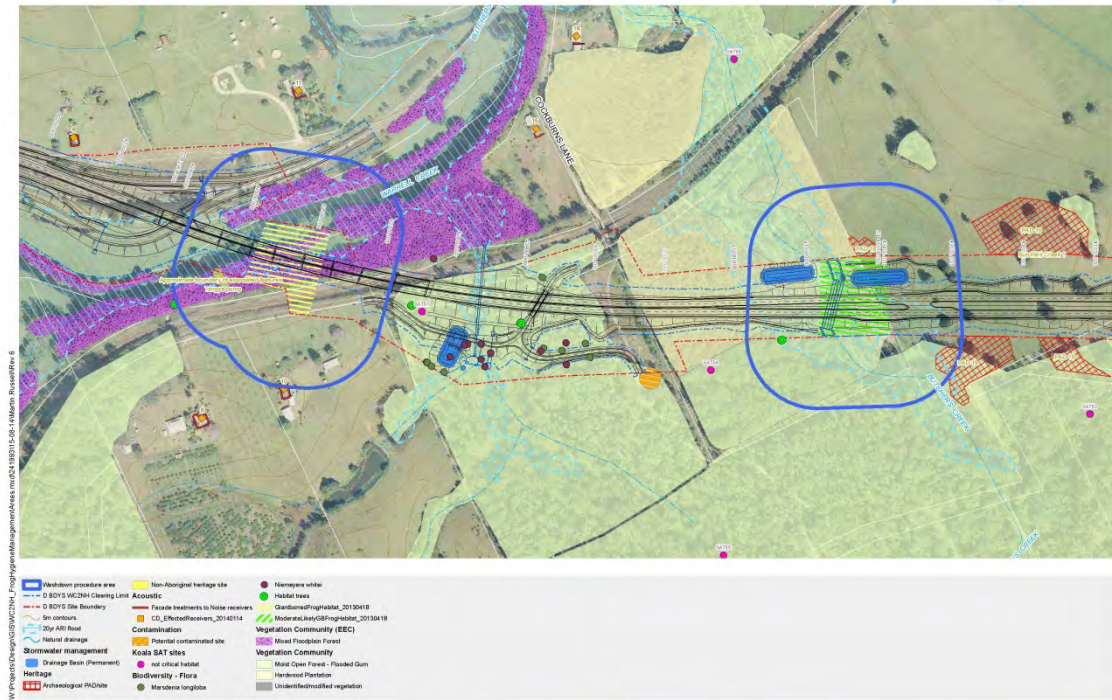
1.2 Frog Hygiene Management Areas

Frog hygiene management areas have been created based on previous ecological assessment and in locations that have been identified as one of the following:

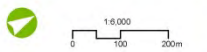
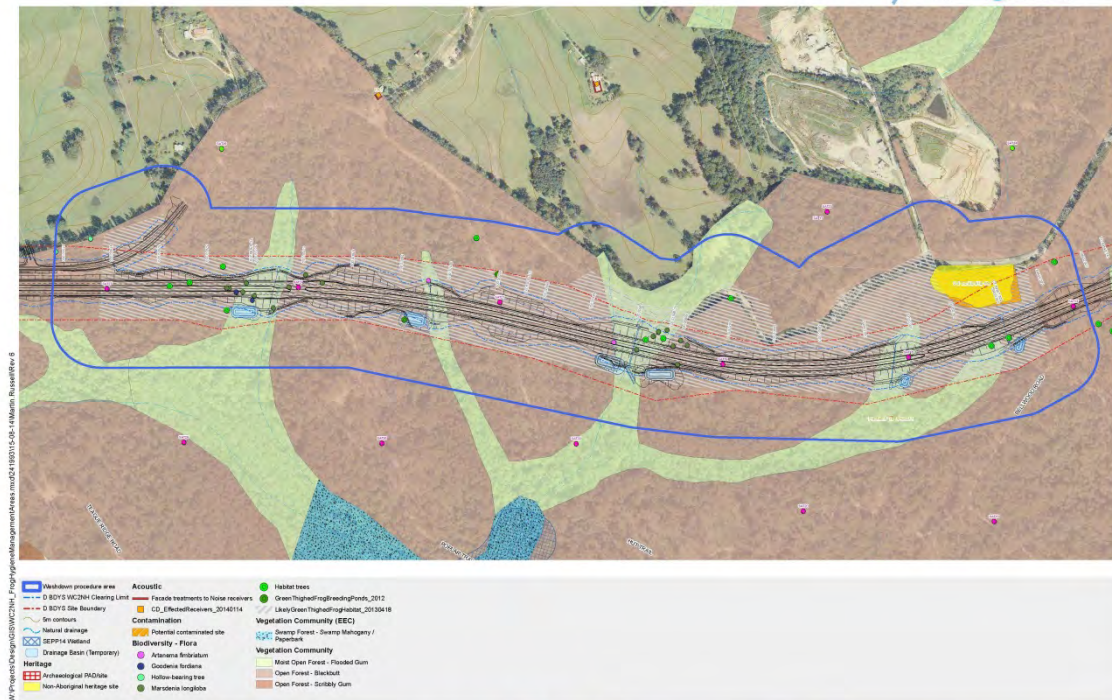
- Green Thighed Frog habitat;
- Likely Green Thighed Frog habitat;
- Giant Barred Frog habitat; and
- Moderately likely Giant Barred Frog habitat.

The locations of the frog hygiene Management Areas are shown in the Frog Hygiene Management Area Maps (Figure 1 to Figure 3). The five locations are all between chainage 42400 and 61000, as identified below:

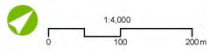
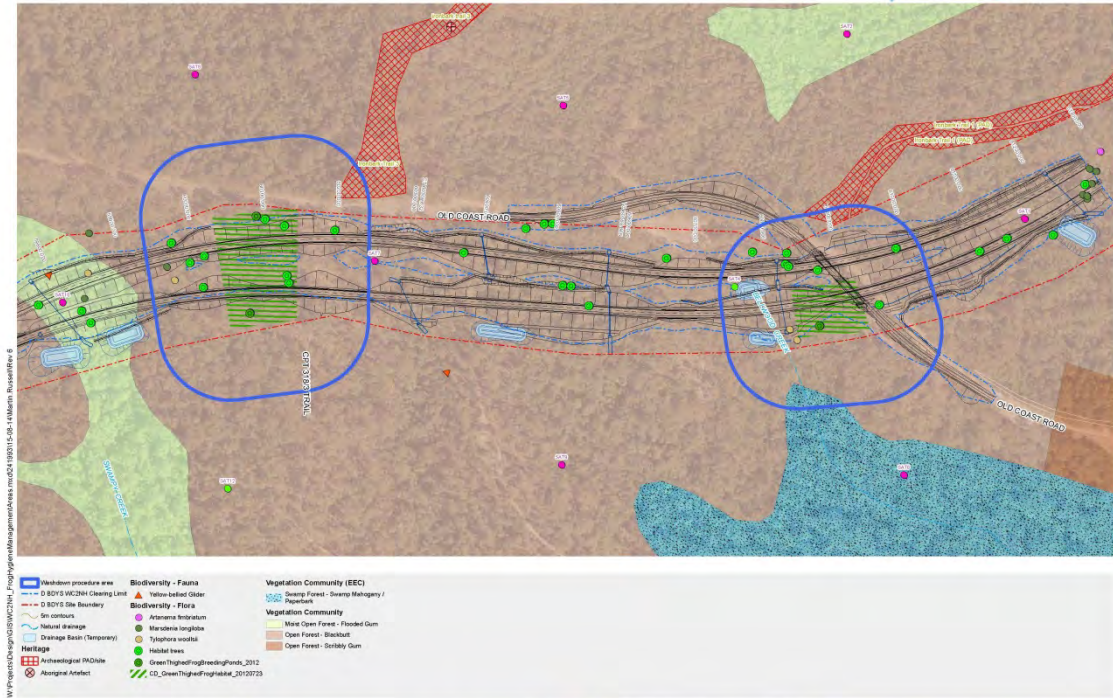
- Near Swampy Creek and CPT 318/3 Trail. Between chainage 59900 and 60300;
- Adjacent to Bellwood Creek. Between chainage 60700 and 61000;
- Between Teague Ridge Road and Belwood Road. Between chainage 57300 and 59500;
- On the eastern side of Warrell Creek. Between chainage 42400 and 42750; and
- Butchers Creek travels through the site. Between chainage 43200 and 43550.



PACIFIC HIGHWAY UPGRADE WARRELL CREEK TO NAMBUCCA HEADS
 Projection: GDA 1994 MGA Zone 56 Source: RMS, AAD/JV FIGURE: Frog Hygiene Management Areas (Map 1 of 3)



PACIFIC HIGHWAY UPGRADE WARRELL CREEK TO NAMBUCCA HEADS
 Projection: GDA 1994 MGA Zone 56 Source: RMS, AAD/JV FIGURE: Frog Hygiene Management Areas (Map 2 of 3)



PACIFIC HIGHWAY UPGRADE WARRELL CREEK TO NAMBUCCA HEADS
 Projection: GDA 1994 MGA Zone 56
 Source: RMS, AAD/JV
FIGURE: Frog Hygiene Management Areas (Map 3 of 3)

**APPENDIX A - HYGIENE PROTOCOLS FOR THE CONTROL OF DISEASE
IN FROGS (NPWS, 2008)**

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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This hygiene protocol is an adaptation of the Declining Amphibian
Population Task Force (DAPTF) Fieldwork Code of Practice and
the recommendations of Speare et al. (1999) and has drawn on
recommendations from earlier guidelines prepared by Environment
ACT.

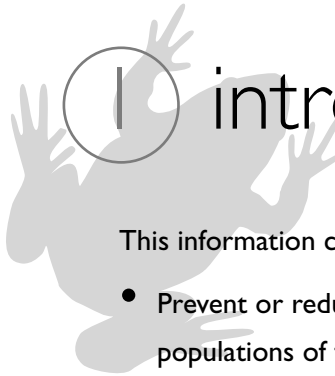
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hygiene protocol for the control of disease in

frogs

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I 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, arctic 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.

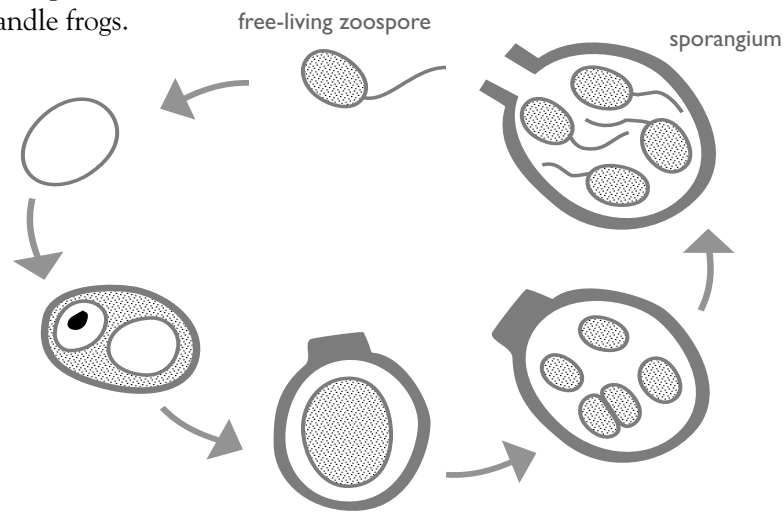
The infective stage of *B. dendrobatidis* is the zoospore and transmission requires water (Berger et al., 1999). Zoospores released from an infected amphibian can potentially infect other amphibians in the same water. More research is needed on the dynamics of infection in the wild. *B. dendrobatidis* 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 I. Please note Footnote I 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.

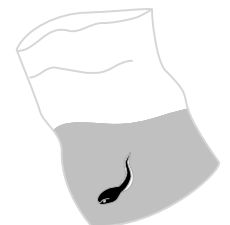
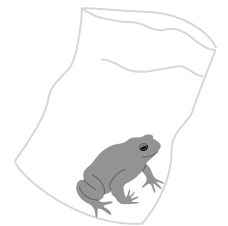
Where handling of frogs is necessary the risk of pathogen transfer should be minimised as follows:

- Hands should be either cleaned and disinfected between samples or a new pair of disposable gloves used for each sample¹. 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*®.



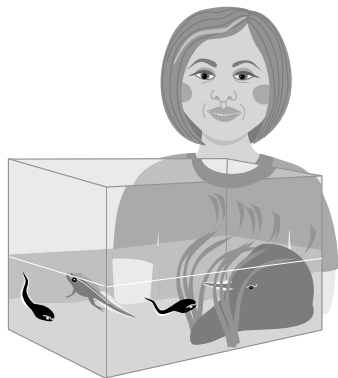
3 captive frog hygiene management

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.

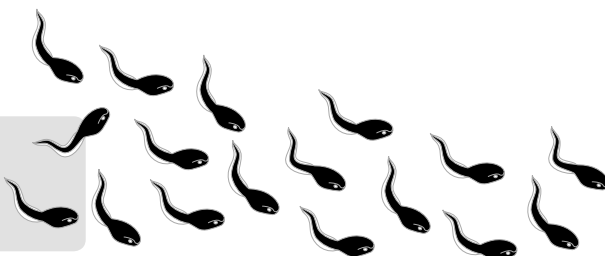


Careful maintenance of your enclosures will ensure a safe and hygienic environment for captive frogs and tadpoles.

3.2 Tadpole treatment

In most instances:

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



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).

3.3 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 gracilentata*, *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 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 below². 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.

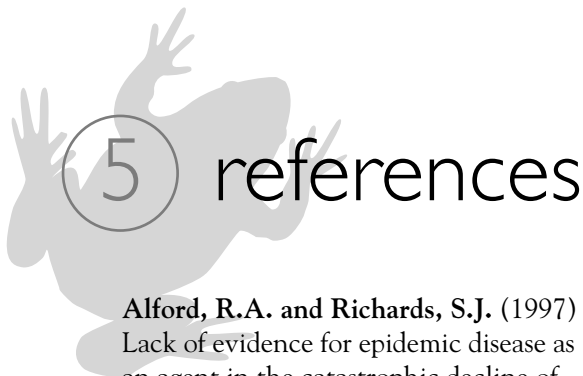
- Disposable gloves should be worn when handling sick or dead frogs. Avoid handling food and touching your mouth or eyes as this could transfer pathogens and toxic skin secretions from some frog species.
- New gloves and a clean plastic bag should be used for each frog specimen to prevent cross-contamination. 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'.

²The 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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Pechmann, J.H.K., Scott, D.E., Semlitsch, R.D., Caldwell, J.P., Vitt, L.J. and Gibson, J.W. (1991) Declining amphibian populations: the problem of separating human impacts from natural fluctuations. *Science* 253: 892-895.

Pounds, J.A. and Crump, M.L. (1994) Amphibian declines and climate disturbance: the case for the golden toad and harlequin frog. *Conserv. Biol.* 8: 72-85.

Pounds, J.A., Fogden, M.P.L., Savage, J.M. and Gorman, G.C. (1997) Test of null models for amphibian declines on a tropical mountain. *Conserv. Biol.* 11: 1307-1322.

Powell, M.J. (1993) Looking at mycology with a Janus face: A glimpse of chytridiomycetes active in the environment. *Mycologia* 85: 1-20. Ê

Richards, S.J., McDonald, K.R. and Alford, R.A. (1993) Declines in populations of Australia's endemic tropical rainforest frogs. *Pacific Conserv. Biol.* 1: 66-77. Ê

Speare, R., Berger, L. and Hines, H. (1999) How to reduce the risk of you transmitting an infectious agent between frogs and between sites. Amphibian Diseases Home Page 22/1/99, (<http://www.jcu.edu.au/dept/PHTM/frogs/ampdis.htm>).

Voight, L. (2001) Frogfacts No. 8. Frog hygiene for captive frogs (draft publication). FATS. Group. Sydney.

appendix I

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:

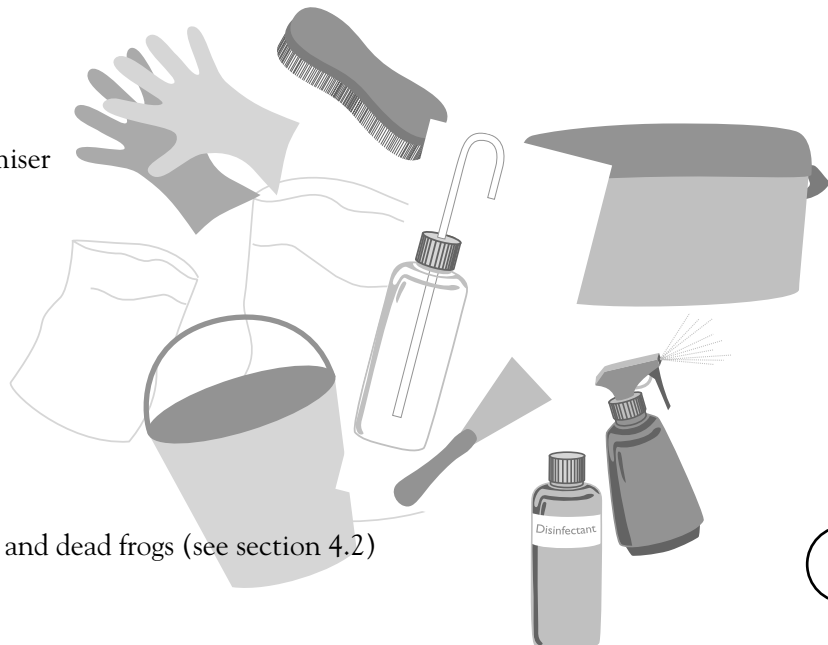
- Has your proposed field trip been sufficiently well planned to consider hygiene issues?
- Have you taken into account boundaries between sites (particularly where endangered species or populations at risk are known to occur)?
- Have footwear disinfection procedures been considered and a strategy adopted?
- 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

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.

designated sick and dead frog recipients

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 of 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

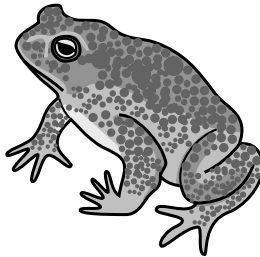
For information on the possible identity of displaced frogs contact:

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) Ê
RSPCA Australian Capital Territory Inc.
Wildlife Carers Network (Central West) Ê
WIRES branches in Western NSW Ê
Cudgegong Wildlife Carers Ê

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: _____ status at time of collection: _____ date sent: _____
male/female healthy(H)/ sick(S)/ dead(D) 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: _____ vegetation type: _____ micro habitat: _____
eg creek, swamp, forest eg rainforest, sedgeland 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: _____ dead/sick tadpoles: _____
eg limb(s) missing, abnormal shape or length eg numbers/behaviour

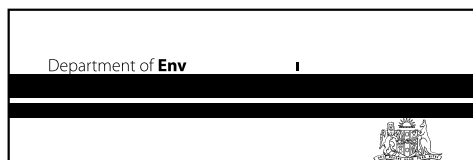
unusual appearance of egg masses: _____ recent use of agricultural chemicals in area: _____
eg grey or white eggs eg pesticides, herbicides, fertilisers

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



**NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE**

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





Appendix E

Pathogen Management Protocol

TABLE 7.1: BEST PRACTICE HYGIENE PROTOCOLS TO PREVENT THE INTRODUCTION OR SPREAD OF PATHOGENS ON RTA PROJECT SITES AND DURING MAINTENANCE WORKS.

Best Practice Hygiene Protocols	Phytophthora (<i>Phytophthora cinnamomi</i>)	Chytrid (<i>Batrachochytrium dendrobatidis</i>)
Test for presence if determined in REF or environmental assessment	<ul style="list-style-type: none"> • Soil test by a NATA approved laboratory. 	<ul style="list-style-type: none"> • Water test by a NATA approved laboratory.
Work programs	<ul style="list-style-type: none"> • Minimise work during excessively wet or muddy conditions. • Programming of works should always move from uninfected areas to infected areas. 	<ul style="list-style-type: none"> • Minimise work during excessively wet or muddy conditions. • Programming of works should always move from uninfected areas to infected areas.
Restrict access	<ul style="list-style-type: none"> • Set up exclusion zones with fencing and signage to restrict access into contaminated areas. 	<ul style="list-style-type: none"> • Set up exclusion zones with fencing and signage to restrict access into contaminated areas.
Inductions	<ul style="list-style-type: none"> • All personnel (including visitors) to be inducted on Phytophthora management measures for the site. 	<ul style="list-style-type: none"> • All personnel (including visitors) to be inducted on chytrid management measures for the site.
Vehicles and machinery	<ul style="list-style-type: none"> • Provide vehicle wash down facility. • Restrict vehicles to designated tracks, trails and parking areas. • Provide parking and turn-around points on hard, well-drained surfaces. 	<ul style="list-style-type: none"> • Provide vehicle wash down facility. • Restrict vehicles to designated tracks, trails and parking areas. • Provide parking and turn-around points on hard, well-drained surfaces.
Personnel and equipment	<ul style="list-style-type: none"> • Provide boot wash down facility. • Restrict personnel to designated tracks and trails. 	<ul style="list-style-type: none"> • Provide boot wash down facility. • Disinfect with cleaning products containing benzalkonium chloride or 70 per cent methylated spirits in 30 per cent water. • Disinfect hands or change gloves between the handling of individual frogs and between each site. • Only handle frogs when necessary. Use the 'one bag-one frog' approach.
New material	<ul style="list-style-type: none"> • Use a certified supply of plants and soil that is disease-free. 	<ul style="list-style-type: none"> • n/a
Disposing of material	<ul style="list-style-type: none"> • Retain all potentially affected materials within the contaminated area. • Ensure stockpiles of mulch, topsoil and fill material are separated to avoid potential contamination and spread. 	<ul style="list-style-type: none"> • To avoid cross contamination, generally avoid transferring water between two or more separate waterbodies.
Further information	<ul style="list-style-type: none"> • National best practice guidelines for management of Phytophthora for biodiversity conservation in Australia (O'Gara et al. 2005). 	<ul style="list-style-type: none"> • Hygiene protocol for the control of disease in frogs, Information Circular Number 6 (Wellington and Haering 2008).

Best Practice Hygiene Protocols	Fusarium wilt (eg Panama disease)	Myrtle rust (<i>Uredo rangelli</i>)
Test for presence if determined in REF or environmental assessment	<ul style="list-style-type: none"> Contact DPI before carrying out the works in former banana sites to see if and where Fusarium wilt is present. 	<ul style="list-style-type: none"> Before carrying out works in bushland, consult: <ol style="list-style-type: none"> The DPI Myrtle Rust Management Zone map (www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust/zones) to determine reporting required and whether you are working in a high risk area, and Local offices of OEH/NPWS for additional rust records and risk assessments. Photograph potentially infected plants and send to: biosecurity@industry.nsw.gov.au for confirmation.
Work programs	<ul style="list-style-type: none"> No earth work should occur during heavy rainfall or after extended rainfall. Programming of works should always move from uninfected areas to infected areas. 	<ul style="list-style-type: none"> Programming of works should always move from uninfected areas to infected areas.
Restrict access	<ul style="list-style-type: none"> Set up exclusion zones with fencing and signage to restrict access into contaminated areas. 	<ul style="list-style-type: none"> Set up exclusion zones with fencing and signage to restrict access into contaminated areas.
Inductions	<ul style="list-style-type: none"> All personnel (including visitors) to be inducted on Fusarium wilt management measures for the site. 	<ul style="list-style-type: none"> All personnel (including visitors) to be inducted on Myrtle rust management measures for the site.
Vehicles and machinery	<ul style="list-style-type: none"> Provide vehicle wash down facility. All vehicles to be washed with Truckwash® and then disinfected with Castrol Farmcleanse® (or equivalent). For medium-long term projects, install a concrete wash down bay which will capture the water in a trench or bunded area. Water used for wash downs must not be used for dust control. 	<ul style="list-style-type: none"> Provide vehicle wash down facility. All vehicles and machinery to be washed with Truckwash® (or equivalent). Restrict vehicles to designated tracks, trails and parking areas. For medium-long term projects, install a concrete wash down bay which will capture the water in a trench or bunded area. Water used for wash downs must not be used for dust control.
Personnel and equipment	<ul style="list-style-type: none"> Provide boot wash down facility. Remove mud/dirt from footwear and equipment and disinfect with Castrol Farmcleanse® (or equivalent). 	<ul style="list-style-type: none"> Personnel working in an infected site should shower and launder clothes (especially hats) before moving to another bushland site. Provide boot wash down facility. Footwear and equipment to be cleaned of soil/mud then sprayed with 70 per cent methylated spirits in 30 per cent water.
New material	<ul style="list-style-type: none"> Ensure that new soil being brought onto the site is disease-free. 	<ul style="list-style-type: none"> Use a certified supply of plants and soil that is disease-free (the Australian Nursery Industry <i>Myrtle Rust Management Plan</i> (McDonald 2011) provides best practice Myrtle rust management that is to be expected from suppliers).
Disposing of material	<ul style="list-style-type: none"> Run-off water must not be used for dust control or irrigation and it is not to be released. Topsoil from potentially infected plantations must only be stockpiled and used within contaminated areas of the plantation. 	<ul style="list-style-type: none"> Plant material should be buried on site if possible. Do not dispose of waste at another bushland site. Buried material sites must be mapped to prevent re-exposure, especially if located near utility easements. If material cannot be buried advice should be sought from DPI.
Further information	<ul style="list-style-type: none"> Fusarium wilt management procedures should be included in the Construction Environmental Management Plan (CEMP) or associated plans. 	<ul style="list-style-type: none"> DPI handout prepared for Myrtle rust response 2010–11: <i>Preventing spread of Myrtle Rust in bushland</i>. Information on managing Myrtle rust can be obtained from: www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust The OEH Interim management plan for Myrtle rust in bushland (2011).



Appendix F

Clean Down Declaration Certificate

