Ecological Assessment Report

Precinct 1 and Components
Hunter Economic Zone

Prepared for:
HEZ Nominees Pty Ltd

Reference 23909 – May 2008

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PROJECT: HUNTER ECONOMIC ZONE: ECOLOGICAL ASSESSMENT REPORT - PRECINCT ONE AND COMPONENTS	
CLIENT:	HEZ NOMINEES PTY LTD ATF THE HEZ UNIT TRUST
OUR REF:	23909
DATE:	MAY 2008
APPROVED BY:	TOBY LAMBERT
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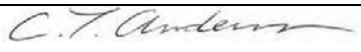
SIGNATURE:	

EXECUTIVE SUMMARY

1. This Report is called "HEZ Ecological Assessment Report: Precinct 1 and Components" (EAR). It forms part of a Part 3A Application to the NSW Department of Planning (DoP).

2. This EAR consists of a written statement plus accompanying maps identifying Precinct 1 and associated components.

3. This EAR contains an assessment of the ecological outcomes in relation to Precinct 1 of the HEZ. In addition, it contains brief summaries of the ecological impact assessment conclusions identified from the site-specific ecological impact assessment reporting for:

    - Station Street Extension
    - WIPS Management industrial manufacturing facility; and
    - Pelaw Main By-pass Concept Plan.

4. The assessment of the ecological outcomes for Precinct 1 relies upon the comprehensive ecological data-set developed in 2004 as part of the formulation of the HEZ Ecological Constraints Master Plan (ECMP).

5. The NSW State Government has previously approved rezoning and subsequent industrial development of the HEZ Estate. In particular, the Department of Environment and Climate Change (previously DEC) provided an Assumed Concurrence for development of the estate in March 2005.

6. The Commonwealth Government approved development of the HEZ Estate in May 2007. This included construction of the Station Street Extension. Development of the HEZ is to occur in accordance with the Development Lands Conservation Management Plan (DLCMP) and Conservation Lands Conservation Management Plan (CLCMP).

7. Whilst pre-emptive subdivision is not permitted in the HEZ Estate under Cessnock LEP 1989, the Concept Plan includes subdivision of Precinct 1. The Concept Plan, including the subdivision of the land, demonstrate how masterplanning can result in improved environmental, ecological and development outcomes at HEZ. Areas shown as being retained / conserved and / or restored will be guaranteed as a result of this masterplanning process. This is in contrast to the current piecemeal approach taken to individual development ecological conservation under the existing Habitat Management Strategy (HMS) which, while worthy, is likely to result in a disconnected and fragmented landscape of small conservation "islands".

8. In contrast, the Precinct 1 Concept Plan provides for a focus towards protection of the most important threatened species, endangered ecological communities and environmental features, including focus on:

    - Integration and protection of the Endangered Ecological Community (EEC) Hunter Lowland Redgum Forest,
    - Integration and protection of Green-thighed Frog riparian and aquatic habitat,
    - Integration and protection of *Rutidosis heterogama* and *Callistemon linearifolius*;

- Integration and protection of approximately 16% of mature trees, 30% of winter flowering mature trees and 13% of hollow bearing trees. Of particular importance is the retention of 30% of winter flowering mature trees as they are of high significance for the nationally and state-listed threatened Swift Parrot and Regent Honeyeater and exceed the minimum 10% retention required under the EPBC approval. This is in addition to the retention of approximately 500 mature *Corymbia maculata* and *Eucalyptus tereticornis* within 7(b) conservation zones.

- Retention of substantial connectivity (terrestrial and aquatic) through proposing 20m Conservation Setbacks from the road system in which existing natural vegetation will be retained. In addition, integration of substantive drainage areas into the proposed development.

- An ecologically sustainable stormwater capture, release and reuse system that will maximise water reuse efficiency and ensure that stormwater is captured and released at environmentally sensitive levels. This will incorporated capture and reuse of stormwater in tanks, the use of swales along roadsides and the use of on-site detention for each individual development.

Together, these measures will ensure that development of the first Precinct of the HEZ will set the standard in relation to the incorporation of significant ecological and environmental values into an industrial development design. This will ensure that the HEZ Estate will in fact become a "bushland" industrial estate, which is consistent with the original aims of the HEZ.

9. Assessment of the other components of the Part 3A application, including the Station Street Extension, WIPS Management Proposal and Pelaw Main By-pass has revealed that no significant impacts upon threatened species or EEC's are likely to occur.

10. Recommendations contained in this report are expected to feed into a Statement of Commitments that will apply to the proposal under Part 3A of the *EP & A Act 1979.*

CONTENTS

APPENDICES

GLOSSARY OF TERMS AND ABBREVIATIONS

AMR – Annual Monitoring Report

The Approval – The approval provided by DEW on 28th May 2007 in relation to development of the Hunter Economic Zone, application EPBC 2004/1417

BMS – HEZ Bushfire Management Strategy

BRP – Bushland Restoration Plan for the Conservation Lands

CCC – Cessnock City Council

CLCMP – Conservation Lands Conservation Management Plan

CLEP - Cessnock Local Environmental Plan 1989

Community Lands – lands identified as community lands on the map at Schedule 4 of the Approval

Conservation Lands – lands identified as conservation lands on the map at Schedule 1

Conservation Management Plans (or CMP's) – means the Development Lands Conservation Management Plan (DLCMP) and the Conservation Lands Management Plan (CLCMP)

DCP Part E - HEZ Development Control Plan No. 47 2006 (Draft)

DECC – The Department of Environment and Climate Change (NSW)

DEW – The Department of the Environment and Water Resources

Deferred Areas – lands identified as DEC Deferred Areas on the map at Schedule 5

Development Lands – lands identified as development lands on the map contained in Schedule 2 of the Approval

DGEAR's - Director General's Environmental Assessment Requirements

DLCMP – Development Lands Conservation Management Plan

DNR – Department of Natural Resources

DoL - NSW Department of Lands, responsible for Crown Lands

EA – Environmental Assessment report for the Part 3A Application

EAR - HEZ Precinct 1 and Components Ecological Assessment Report

EMS - HEZ Environmental Management Strategy 2004 (Draft)

ECMP – The HEZ Ecological Constraints Masterplan prepared by Harper Somers O'Sullivan 2004

EPBC Act – The Commonwealth Environment Protection and Biodiversity Conservation Act 1999

HEZ – The Hunter Economic Zone

HEZA – The Hunter Economic Zone Association, a coordinating body for the communal lands within HEZ

HEZ Estate – The entire Hunter Economic Zone area covered by the Hunter Employment Zone LEP

HEZ Nominees - HEZ Nominees Pty Ltd ATF The HEZ Unit Trust, the company responsible for development of the HEZ

HEZ Study Area – means land identified as the HEZ Study Area on the maps annexed to the DEW conditions contained in the Approval

HLRF – Hunter Lowland Redgum Forest (an endangered ecological community under the NSW Threatened Species Conservation Act 1995)

HMS - HEZ Habitat Management Strategy 2005 (Draft)

Infrastructure Lands – Lands identified as infrastructure lands on the map at Schedule 3A (Infrastructure Lands Traversing Conservation Lands) and Schedule 3B (Infrastructure Lands Traversing Development Lands) of the Approval

KSSW – Kurri Sand Swamp Woodland (an endangered ecological community under the NSW Threatened Species Conservation Act 1995)

LHSGIF – Lower Hunter Spotted Gum Ironbark Forest (an endangered ecological community under the NSW Threatened Species Conservation Act 1995)

NPWS – NSW National Parks and Wildlife Service (a division of DECC)

PER – The Public Environment Report to DEW prepared for the HEZ Estate

RFS – The Rural Fire Service of NSW

SIS – Species Impact Statement

TSC Act – The NSW Threatened Species Conservation Act 1995

WSUD – Water Sensitive Urban Design

1 INTRODUCTION

RPS Harper Somers O'Sullivan Pty Ltd (RPS HSO) has been commissioned by HEZ Nominees Pty Ltd ATF The HEZ Unit Trust (HEZ Nominees) to undertake an *Ecological Assessment Report* (EAR) over land within the Hunter Economic Zone (HEZ), for proposed development and conservation offsets. The proposal is to be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. Due recognition and consideration of the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994* has been made throughout this assessment.

1.1 Background

The HEZ Estate occupies approximately 3177ha of land. Following extensive studies, approximately 877ha was zoned for industrial development purposes, with the remaining approximately 2300ha of land set aside for conservation purposes.

The most important ecological study was the Ecological Constraints Master Plan (ECMP). The ECMP (RPS HSO 2004) is a comprehensive ecological database and a primary guiding document for the development of the HEZ industrial estate. The results of the ECMP data have been used to achieve adequate conservation outcomes for all of the threatened species and EEC's within the HEZ Study Area, which culminated in the Department of Environment and Conservation (DEC) issuing an assumed concurrence for the development of the HEZ, in March 2005.

The Assumed Concurrence advises that Council (and determining authorities under Part 5 assessment under the EPA Act) can assume concurrence for permissible development (as per the Local Environment Plan) in accordance with clause 64 of the *EP&A Regulation 2000*, provided the conditions within Attachment 1 of the concurrence document are met. For those species that required additional protection a small number of areas were deferred from development (Deferred Areas) until it could be shown that the species for which these areas had been deferred were adequately protected in the locality.

The following policies apply to the development of the HEZ:

- Cessnock Local Environmental Plan 1989 (CLEP);
- Cessnock DCP 2006 Part E Specific Area E.6: HEZ;
- HEZ Environmental Management Strategy 2004 (EMS) (Draft); and
- HEZ Habitat Management Strategy 2005 (HMS) (Draft).

CLEP is the local planning instrument. It outlines permissible development within various zonings, including those within the HEZ Estate. Objectives for 4(h) industrial zoned land include minimising clearing of native vegetation and conserving native vegetation corridors.

Part E.6 HEZ of Cessnock DCP 2006 (DCP Part E) specifically addresses development controls for the development of the HEZ Estate. Objectives include preservation of significant flora and fauna, EEC's and their habitat and also requirements for Vegetation Clearing Plans to be prepared for development applications. Setback widths from boundaries are also covered by this document, as are landscaping requirements. The Precinct 1 design has incorporated such objectives. While not complying exactly, it is believed that the outcomes achieved during the

masterplanning process have resulted in superior ecological outcomes overall in relation to threatened species and general habitat / connectivity issues.

The EMS is the overarching management strategy that contains a subset of management strategies for eight issues. These issues include Water Cycle, Air Quality, Bushfire, Transport and Habitat.

The HMS is one component of the EMS. It specifically applies to the management of native habitats as part of the development of the HEZ. It contains a number of Schedules that apply to various stages of development of the estate and to overall management of the ecological values of the estate. It requires utilisation of the ECMP data to minimise ecological impacts, individual site conservation measures, native species landscaping and ongoing bushland management. Such requirements have formed a core basis for design of the Precinct 1 subdivision layout.

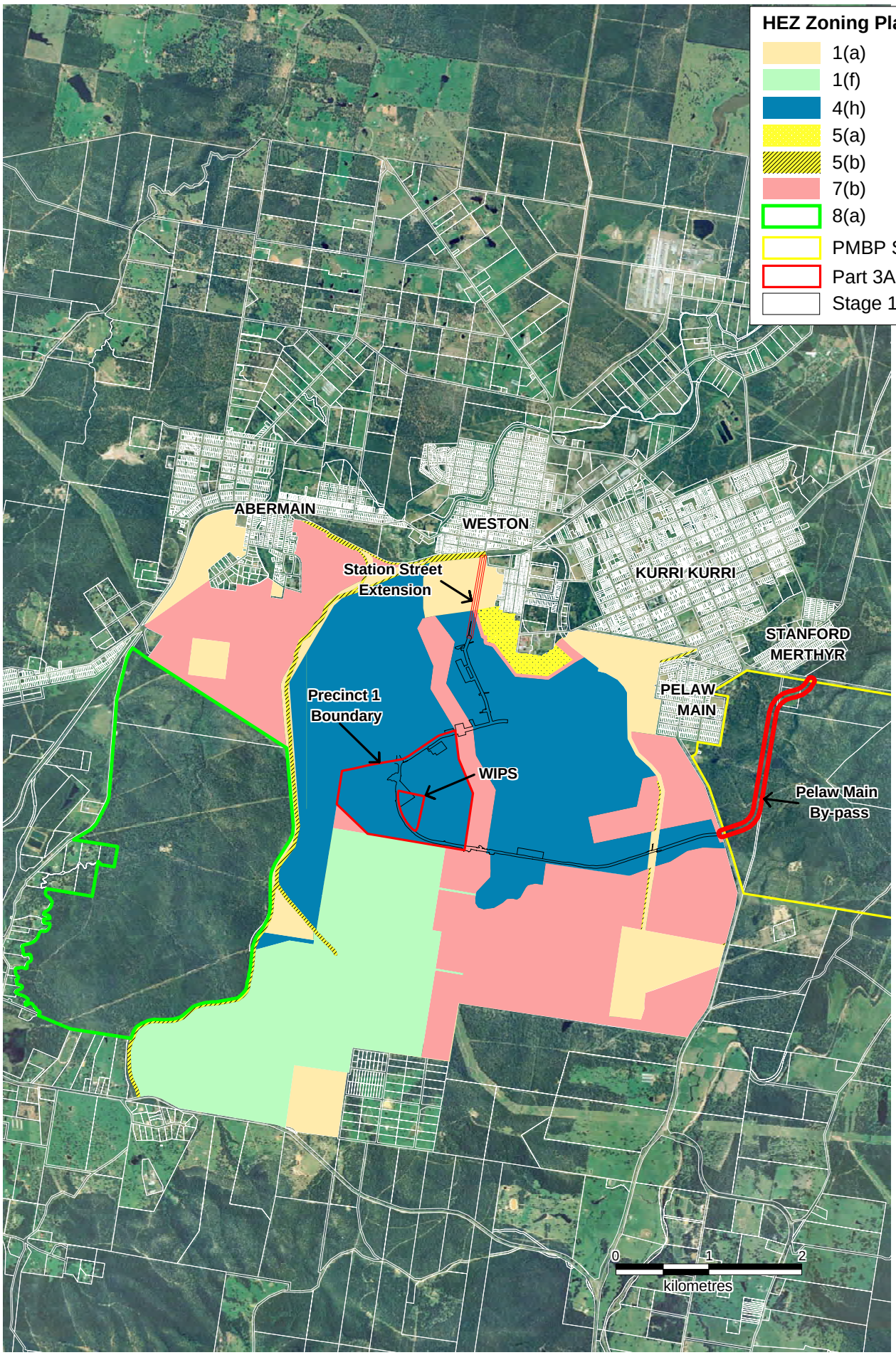
Rising from an extensive Public Environment Report (PER) process a Commonwealth EPBC approval was granted with conditions on 28th May 2007. The approval included a requirement for the preparation of Conservation Management Plans (CMP's) for the development and conservation lands. These plans were prepared, approved and are current. To the greatest extent possible it will be ensured that any Statement of Commitments entered into under Part 3A will be consistent with the CMP's. The Development Lands CMP is of most relevance to Precinct 1 design as it outlines threatened species objectives, including management of *Rutidosis heterogama* and 10% mature tree retention (including winter flowering species) for Regent Honeyeater, Swift Parrot and Grey-headed Flying Fox.

This EAR contains an assessment of the ecological outcomes in relation to Precinct 1 of the HEZ. In addition, it contains brief summaries of the ecological impact assessment conclusions identified from the site-specific ecological impact assessment reporting for:

- Station Street Extension;
- WIPS Management industrial manufacturing facility; and
- Pelaw Main By-pass Concept Plan.

All four components are important parts of the future development of the HEZ Estate.

Figure 1-1 provides an overview of the location of each of the four components in relation to each other.



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PROJECT: PART 3A ECOLOGICAL ASSESSMENT REPORT

CLIENT: HEZ NOMINEES PTY LTD ATF THE HEZ UNIT TRUST

TITLE: PROJECT LOCATION

PLAN PRODUCED BY:
HARPER SOMERS O'SULLIVAN
241 DENISON STREET
BROADMEADOW NSW 2292
PO BOX 428
HAMILTON NSW 2303
ABN 11 093 343 858
T: 02 4961 6500
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E: survey@hso.com.au
W: www.hso.com.au

FIGURE: 1-1
PAGE: 5

HUNTER ECONOMIC ZONE
Where industry thrives

CONTOUR INTERVAL: N/A	DATUM: MGA Zone 56 (GDA 94)
SCALE: 1: 48000 at A4 Size	JOB NUMBER: 23909
DATE: 7/12/2007	
DRAWN: T. Lambert	

1.2 Description of the Proposal

1.2.1 Precinct 1

Whilst pre-emptive subdivision is not permitted in the HEZ Estate under Cessnock LEP 1989, the Concept Plan includes subdivision of Precinct 1. The Concept Plan, including the subdivision of the land, demonstrate how masterplanning can result in improved environmental, ecological and development outcomes at HEZ. The Environmental Assessment (EA) contains the EDAW Precinct 1 plans for reference purposes.

Precinct 1 provides for a focus towards protection of the most important threatened species, endangered ecological communities and environmental features, including focus on:

- Integration and protection of the Endangered Ecological Community (EEC) Hunter Lowland Redgum Forest;
- Integration and protection of Green-thighed Frog riparian and aquatic habitat;
- Integration and protection of *Rutidosis heterogama* and *Callistemon linearifolius*;
- Integration and protection of approximately 16% of mature trees, 30% of winter flowering mature trees and 13% of hollow bearing trees. Of particular importance is the retention of 30% of winter flowering mature trees as they are of high significance for the nationally and state-listed threatened Swift Parrot and Regent Honeyeater and exceed the minimum 10% retention required under the EPBC approval.
- Retention of substantial connectivity (terrestrial and aquatic) through proposing 20 m Conservation Setbacks from the road system in which existing natural vegetation will be retained. In addition, integration of substantive drainage areas into the proposed development.
- An ecologically sustainable stormwater capture, release and reuse system that will maximise water reuse efficiency and ensure that stormwater is captured and released at environmentally sensitive levels. This will incorporated capture and reuse of stormwater in tanks, the use of swales along roadsides and the use of on-site detention for each individual development.

Together, these measures will ensure that development of the first Precinct of the HEZ will set the standard in relation to the incorporation of significant ecological and environmental values into an industrial development design. This will ensure that the HEZ Estate will in fact become a "bushland" industrial estate, which is consistent with the original aims of the HEZ.

1.2.2 Station Street

The proposed extension of Station Street joins the existing Station Street at the intersection of the railway line in Weston with the temporary end of Stage 2 Road (under construction) and is approximately 940 metres long. Its purpose is to complete the access into the HEZ from the north.

The proposal is located within the HEZ LEP area, specifically within 5(a), 1(a) and 7(b) zoned lands. The size of the road footprint has been minimised to reduce impacts upon the ecology of the site. An important part of the design of the Station Street extension has been to incorporate existing partially cleared and degraded areas. However in order for the road to be functional some clearing of habitat is still required.

1.2.3 WIPS Management

The current proposal is for a WIPS Management development incorporating the construction of a warehouse and office, with appropriate associated landscaping, car parking, access and services. The actual use is proposed to be for an industrial manufacturing facility for the production of wall and floor panels with acoustic and fire-rated properties.

Conservation and landscaped areas will exist around the internal boundaries of the site. This will include a 10m vegetated buffer along the western boundary, between the site and the HEZ Spine Road. A parcel of existing vegetation that incorporates a creekline within the southern corner of the site will also be retained. The total area of existing vegetation to be retained is approximately 0.96ha. Protection of this area will include fencing to exclude construction impacts from the southern creekline and *Grevillea parviflora* plants. A number of mature and hollow-bearing trees are also to be retained as part of this proposal within these retained areas. An additional 0.18ha of the area proposed for retention is currently cleared/regenerating due to the past construction of the HEZ Spine Road. Approximately 1.37ha of the site will be dedicated to landscaping, and an additional area of approximately 0.12ha will contain two detention basins.

1.2.4 Pelaw Main By-pass Concept Plan

The proposed action is for the Concept Approval of the Pelaw Main By-pass (PMBP) road to the HEZ industrial estate. In order to facilitate the required heavy vehicle movements from the HEZ to the Sydney / Newcastle Freeway (F3) to the east, it has been determined that a link road will ultimately be required to connect the HEZ from Leggetts Drive (MR195) to John Renshaw Drive. This PMBP is proposed to run from the main entry point to the HEZ development area (along Leggetts Drive), passing approximately 500m to the south and west of the village of Pelaw Main and linking with John Renshaw Drive (MR 588) approximately 400m to the east of the BP service station at Stanford Merthyr. This has been deemed necessary in order to avoid potential impacts on the amenity of Pelaw Main through which heavy vehicles would need to pass through with the road system in its current state. The design and location of the proposed Pelaw Main By-pass also gives consideration to the potential future alignment of an extension of the F3 Freeway from Seahampton to Branxton.

Preliminary investigations over the area across which the Pelaw Main By-pass is proposed to traverse (Harper Somers O'Sullivan 2002a), revealed a number of ecological constraints throughout the site. These included threatened flora and fauna species, one State-listed Endangered Ecological Community (listed at that time) and several regionally significant vegetation / habitat features. Based on these potential constraints and other site characteristics a 'Broad Preferred Road Corridor' was generated. Subsequently, a 'Preferred Road Alignment' has been forwarded, taking into consideration amendments to the alignment due to noise constraints pertaining to the village of Pelaw Main (that essentially saw the alignment shifted eastwards away form Pelaw Main. As a result, several further specific ecological surveys have been undertaken both along the alignment of the road itself and in adjacent areas.

1.3 Scope of the Study

This study is intended to investigate the potential ecological impacts of the proposal as required by the Part 3A DGEAR's. The primary impacts are likely to be associated with the removal of vegetation both in terms of direct impacts upon native stands of vegetation and to a lesser extent, upon habitat for native fauna within and directly adjacent to the proposed developments.

To ensure completeness, ecological fieldwork and assessment has covered the full extent of the lands to be affected, including surrounding areas.

At the state level, the proposal is to be assessed pursuant to Part 3A of the EPA Act. To this end, in October 2007, the DGEAR's were issued for the site. The 'General' and 'Key' Assessment requirements for investigations are:

General Requirements

The Environmental Assessment (EA) must include

1. an executive summary;

2. a description of the proposal, including construction, operation, and staging;

3. an assessment of the environmental impacts of the project, with particular focus on the key assessment requirements specified below;

4. justification for undertaking the project with consideration of the benefits and impacts of the proposal;

5. a draft Statement of Commitments detailing measures for environmental mitigation, management and monitoring for the project; and

6. certification by the author of the Environment Assessment that the information contained in the Assessment is neither false nor misleading.

Key Requirements

Flora and Fauna (all components) – the Environmental Assessment shall include a flora and fauna impact assessment in accordance with the DECC's *Guidelines for Threatened Species Assessment* (2005). Where the project adjoins land known to be a national park, reserve or other area of high conservation value, an assessment of direct and indirect impacts on this land shall be undertaken. This assessment shall also include an evaluation of potential impacts on any waterways, aquatic ecosystems or riparian zones potentially affected by the project. Where any off-sets are proposed, details of any proposed compensatory habitat or off-set strategy, including scale, scope, timing of implementation and how this fits within the context of the overall HEZ site, shall be described.

1.4 Definitions

The definitions given below are relevant to the DGEAR's:

'development' has the same meaning as in the NSW *Environmental Planning and Assessment Act 1979*.

'activity' has the same meaning as in the NSW *Environmental Planning and Assessment Act 1979*.

'proposal' is the development, activity or action proposed. Other terminology used for the 'proposal' includes the **'current proposal'** or **'development proposal'**.

The **'Site'** refers to the entire land holding, inclusive of development and conservation areas.

All other definitions are the same as those contained in the NSW *TSC Act*.

1.5 Qualifications and Licensing

Qualifications

The principal author of this report was Toby Lambert BEnvSc of RPS Harper Somers O'Sullivan Pty Ltd, with additional input from Craig Anderson BAppSc (EAM), Deborah Landenberger BSc (Hons), Allan Richardson BEnvSc (Hons), Robert Browne-Cooper BSc (BiolSci). Michael Roderick BAppSc (EAM), Lucas Grenadier BAppSc (EAM) (Hons) and Mark Evans BAppSc (EAM) are no longer at RPS HSO but also contributed to Pelaw Main By-pass assessments. The academic qualifications and professional experience of all RPS HSO ecologists involved in preparation of the EAR are documented in Appendix A, while qualifications for individual components are provided in the accompanying individual flora and fauna assessment reports.

Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 30 November 2007);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2008);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2010); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 26 May 2008).

1.6 Certification

As the principal author, I, Toby Lambert make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the site;
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995, National Parks and Wildlife Act 1974* and the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes*.

Signature of Principal Author and Certifier:

Toby Lambert
Senior Ecologist
RPS Harper Somers O'Sullivan

May 2008

2 METHODS

The DGEAR's stipulate assessment should have due regard to DECC's Threatened Species Assessment Guidelines. These guidelines refer the user to consult the Threatened Biodiversity Survey and Assessment Guidelines – Working Draft (DEC 2004) and any relevant recovery plans and threat abatement plans for ecological assessment. To this end these documents have formed the core basis for ecological assessment over the proposed development components. In general, it is considered that the level of survey achieved as a result of surveys such as the ECMP exceeds that which would normally be required under the guidelines.

2.1 ECMP Survey

The ECMP survey applies to all components of this application excepting the PMBP (due to it being outside of the HEZ LEP area). The survey methods are summarised below. For additional detail refer to the ECMP provided in Appendix B.

The development of the ECMP comprised of the following aspects:

- **Collation of existing flora and fauna datasets and survey reports** – The results of the numerous flora and fauna investigations that have been undertaken within the Hunter Economic Zone (HEZ) to date, in particular threatened species records, have been incorporated into the ECMP.

  Important information sources utilised include Bell (2001, 2004), Ecotone (1999; 2000, 2002a; 2002b), Harper Somers O'Sullivan (2002), NPWS Atlas of NSW Wildlife, and University of Newcastle (2001).

- **Vegetation survey & mapping over the entire HEZ study area** – A detailed vegetation survey and mapping report was undertaken by Stephen Bell (Eastcoast Flora Survey) on behalf of Harper Somers O'Sullivan. This was undertaken to replace the broad-scale vegetation maps of the HEZ previously produced by Ecotone (1999; 2000) and House (2003) – LHCCREMS, as well as that previously produced by Bell (2001) within the Werakata National Park section of the study area.

- **Detailed 4(h) development zone surveys and habitat investigations –** Detailed ecological investigations, using high accuracy DGPS (Differential Global Positioning System), were undertaken within the 4(h) development zone and the central 7(b) conservation zone corridor along Chinamans Hollow Creek. Extensions of the ECMP data were also undertaken to cover areas zoned as 1(a), 7(b) and 5(a) in late 2006. The key features detailed as part of the development zone habitat surveys included:

  - Keystone Mature Tree Species;
  - Hollow-bearing Trees;
  - 'Grid Pattern' Habitat Investigations; and
  - Threatened Species Surveys.

The 'Grid Pattern' Habitat Investigations included surveys of:

- *Grevillea parviflora* subsp. *parviflora*
- Other Threatened Flora Species
- Regionally Significant Flora
- *Allocasuarina* sp.
- Mistloetoe sp.
- Threatened Fauna Species
- Hollow / Fallen Timber
- Understorey Diversity
- Understorey Nectar Species
- Logging / Firewood Collection
- Fire History
- Erosion / Soil Disturbance
- Rubbish Dumping
- Weeds
- Feral Animals
- Special Habitat Features

- **Additional targeted threatened species surveys** – In addition to those threatened species surveys previously conducted within the HEZ study area, further targeted surveys for a select number of species were conducted so that a more comprehensive overview of the occurrence of these species within the HEZ could be attained. These species included *Acacia bynoeana*, *Callistemon linearifolius*, *Eucalyptus glaucina*, *Eucalyptus parramattensis ssp. decadens, Grevillea parviflora ssp. parviflora*, and *Rutidosis heterogama*. Mapping of Green-thighed Frog habitat quality along all creeklines was also undertaken.

2.2 Field Survey

2.2.1 Precinct 1

Due to the nature of the development design for Precinct 1, additional ground truthing surveys were not considered to be required. The highly detailed existing ECMP data was used to identify threatened species, EEC and corresponding habitat issues within the area covered by Precinct 1. In addition there are requirements for ground-truthing to be undertaken at the site-specific level in order to consider any site-specific threatened species issues that may have arisen post-ECMP.

2.2.2 Station Street

In addition to the methods undertaken for the ECMP, the site was re-visited by RPS HSO on the 16th November 2007 to verify the ECMP data and make any necessary changes and observations (as per HMS requirement - Schedule 1(d)).

2.2.3 WIPS Management

In addition to the methods undertaken for the ECMP, the subject site was re-visited by RPS HSO on the 22nd March 2006, 12th of July 2006 and an additional visit on 23rd August 2006 to verify the ECMP data and make any necessary changes and observations (as per HMS requirement - Schedule 1(d)).

2.2.4 Pelaw Main By-pass Concept Plan

As previously mentioned, the PMBP was not covered by the ECMP survey. A summary is provided below of each of the survey methods utilised. For more detail refer to the accompanying PMBP SIS.

2.2.4.1 Flora Survey

The vegetation of the road alignment was mapped previously (Harper Somers O'Sullivan 2002a) utilising the following vegetation survey approach. The vegetation throughout the remainder of the study area was also mapped using a congruous survey approach to complement the existing mapping. Refinement of the mapping produced within the original PMBP Ecological Constraints Study was also undertaken during subsequent surveys.

2.2.4.2 Threatened Species

The distribution of threatened flora species along the road alignment was mapped using a Trimble GPS unit. The numbers of individual plants were counted where feasible, as in the case of *Acacia bynoeana*. Where large numbers of threatened plant species occurred, such as *G. p. parviflora* and *E. p. decadens,* representative sampling enabled an estimate of the number of threatened flora likely to be directly affected by the proposal.

The distribution of other threatened flora within the study area (other *A. bynoeana* populations and *E. glaucina*) was also mapped using a Trimble GPS unit.

Also undertaken were:

- Habitat Survey
- Hair Tubes
- Bat Call Detection
- Avifauna Survey
- Herpetofauna Survey
- Spotlighting
- Terrestrial Mammal Trapping
- Arboreal Mammal Trapping

- Secondary Indications and Incidental Observations

2.3 Development Design

2.3.1 Precinct 1

The development design process for Precinct 1 involved detailed development design over a period of approximately one year. This involved workshops attended by representatives of RPS HSO (Ecology and Bushfire), EDAW (Concept planners, landscape and WSUD), HEZ Nominees and various other disciplines (such as Archaeology, Traffic, Geotechnical etc.).

While considering the practicalities of an industrial estate design that was workable, the focus of these workshops was on ensuring that all aspects of the concept planning process was on Ecologically Sustainable Design (ESD).

The principles of Ecological Sustainable Development (ESD) were particularly relevant when designing the Precinct 1 Concept Plan to prevent environmental degradation from inappropriate practices. The ESD principles considered included:

- the precautionary principle;
- inter-generational equity;
- conservation of biological diversity and ecological integrity; and
- improved valuation, pricing incentive mechanisms to include environmental factors in the valuation of assets and services.

Major focuses of the development design from an ecological perspective were:

- Integration and protection of the Endangered Ecological Community (EEC) Hunter Lowland Redgum Forest;
- Integration and protection of Green-thighed Frog riparian and aquatic habitat;
- Integration and protection of *Rutidosis heterogama* and *Callistemon linearifolius*;
- Integration and protection of approximately 16% of mature trees, 30% of winter flowering mature trees and 13% of hollow bearing trees. Of particular importance is the retention of 30% of winter flowering mature trees as they are of high significance for the nationally and state-listed threatened Swift Parrot and Regent Honeyeater and exceed the minimum 10% retention required under the EPBC approval.
- Retention of substantial connectivity (terrestrial and aquatic) through proposing 20 m Conservation Setbacks from the road system in which existing natural vegetation will be retained. In addition, integration of substantive drainage areas into the proposed development.
- An ecologically sustainable stormwater capture, release and reuse system that will maximise water reuse efficiency and ensure that stormwater is captured and released at environmentally sensitive levels.

2.3.2 Station Street

The proposal is located within the HEZ LEP area, specifically within 5(a), 1(a) and 7(b) zoned lands. The size of the road footprint has been minimised to reduce impacts upon the ecology of the site. An important part of the design of the Station Street extension has been to incorporate existing partially cleared and degraded areas in combination with achieving a direct route that minimises requirements for vegetation removal. However in order for the road to be functional some clearing of habitat is still required.

2.3.3 WIPS Management

Through the provision of conservation areas that support threatened flora and fauna and other landscaped areas incorporated within the WIPS Management development, this proposal is considered to be consistent with the conditions of the DEC Assumed Concurrence. Approximately 0.96ha of existing vegetation is to be protected and retained as part of the proposed development, including fencing to exclude construction impacts from the southern creekline and *Grevillea parviflora* plants. A number of mature and hollow-bearing trees are also to be retained as part of this proposal within these retained areas.

2.3.4 Pelaw Main By-pass Concept Plan

Alternatives have been thoroughly investigated as part of the design process.

The Pelaw Main By-pass proposal is intrinsically allied with the greater HEZ development. An analysis of feasible alternatives to the HEZ has been discussed in previous studies. This discussion concluded that the HEZ proposal represented the culmination of a great deal of planning supported by ample fieldwork to generate the most efficient conservation outcome for known and potentially occurring threatened species and vegetation communities whilst achieving important economic, social and development outcomes. Detailed, ongoing studies continue to ensure that any other potential constraints are identified during ongoing phases of the planning process.

With this in mind, the need for a by-pass to the HEZ development area was considered essential. This was in order to facilitate the required heavy vehicle movements from the HEZ to the Sydney / Newcastle Freeway (F3) to the east via John Renshaw Drive. This has been deemed necessary in order to avoid potential impacts on the amenity of the township of Pelaw Main through which heavy vehicles would need to pass through with the road system in its current state. Within the framework of the HEZ project and given the location of the HEZ Spine Road, it is considered that no feasible alternatives to the positioning of the Pelaw Main By-pass exist. Furthermore, the design and location of the proposed Pelaw Main By-pass also gives consideration to the potential future alignment of an extension of the F3 Freeway from Seahampton to Branxton.

From the outset it was clear that the proposed Pelaw Main By-pass would require traversal of a State-listed Endangered Ecological Community (EEC), being Kurri Sands Swamp Woodland (KSSW). This scenario could not have been avoided and a preferred alignment was largely based upon minimising the area crossed and potential impacts upon this community. However, restrictions pertaining to noise impacts upon the village of Pelaw Main dictated that the alignment needed to be located further east than the most ecologically ideal alignment. Given these restrictions, it is considered that no feasible alternatives for the alignment exist. In the interim, the State-listed Lower Hunter Spotted Gum – Ironbark Forest (LHSGIF) community was also listed as an EEC. Likewise for KSSW, it is considered that no feasible alternatives for this community exist that could achieve the ecological outcomes whilst meeting the project objectives. These comments in relation to the two EEC's apply equally to the nationally-listed

threatened species that will be affected by the PMBP, which include *Acacia bynoeana, Eucalyptus parramattensis* ssp. *decadens* and *Grevillea parviflora* ssp. *parviflora*. While a small proportion of these species and their habitat may be affected by the PMBP, the vast majority will be retained in adjoining environs.

Therefore, the proposed PMBP alignment has been deemed to provide the most appropriate outcomes for both project and ecological objectives and no feasible alternatives are considered to exist.

3 RESULTS

3.1 Flora

All information in relation to the Precinct 1 vegetation significance is provided hereunder. The EA contains the EDAW Precinct 1 plans, which show the location of vegetation communities and threatened flora.

Summarised information is provided on each of the EEC's and threatened flora likely to be affected by the other components of the application. For more detailed information refer to the accompanying site-specific assessments.

3.1.1 Precinct 1

3.1.1.1 Endangered Ecological Communities

Lower Hunter Spotted Gum-Ironbark Forest

Characterised by Spotted Gum (*Corymbia maculata*) and various Ironbarks (predominantly *Eucalyptus fibrosa*). Other canopy species include *Eucalyptus agglomerata* (atypical form), *Eucalyptus beyeriana, Eucalyptus punctata*, and in a few restricted locations, *Corymbia eximia*. Dominance by *Melaleuca nodosa* in the shrub layer is indicative of past disturbance in some areas. This community occurs throughout a majority of Precinct 1.

Hunter Lowland Redgum Forest

A community generally dominated by Redgums (*Eucalyptus tereticornis, Eucalyptus amplifolia* subsp. *amplifolia, Eucalyptus glaucina*) and other species such as *Angophora floribunda, Eucalyptus punctata,* and occasionally *Eucalyptus crebra*. Understorey is grassy with scattered shrubs due to past disturbance. In some creek lines with impeded drainage, thickets of *Melaleuca linariifolia*, *Melaleuca styphelioides* and occasionally *Callistemon salignus* develop, over an understorey of sedges such as *Carex appressa* and grasses. This community occurs along the eastern boundary of Precinct 1 and continues into the 7(b) zoned conservation corridor. Its occurrence is associated with low-lying riparian areas within the HEZ Estate.

3.1.1.2 Threatened Flora

Three threatened species of flora are known to occur within Precinct 1. These are described below:

Grevillea parviflora subsp. parviflora

The exact numbers of *Grevillea parviflora* are not known. However the ECMP surveys mapped the density of this species within each grid. A detailed investigation of the status of this species within the HEZ study area revealed that a population estimate of 3,331,631 above-ground stems occurred within that area (Harper Somers O'Sullivan 2002b; 2002c). Exact locations were not identified due to the high numbers of this species throughout the HEZ.

Callistemon linearifolius

314 *Callistemon linearifolius* plants were recorded within the Precinct 1 area. The locations of these are provided in the accompanying EDAW Precinct 1 plans.

Rutidosis heterogama

458 *Rutidosis heterogama* plants were recorded within the Precinct 1 area. The locations of these are provided in the accompanying EDAW Precinct 1 plans.

3.1.2 Station Street

3.1.2.1 Endangered Ecological Communities

Two vegetation communities have been recognised as occurring on the site, namely Lower Hunter Spotted Gum – Ironbark Forest (LHSGIF) and Kurri Sand Swamp Woodland (KSSW), along with some existing cleared areas.

3.1.2.2 Threatened Flora

Three (3) threatened flora species occur on the site including *Callistemon linearifolius*, *Eucalyptus glaucina*, and *Eucalyptus parramattensis subsp decadens*. These species are all listed as Vulnerable under the *TSC Act,* while *Eucalyptus glaucina* and *Eucalyptus parramattensis subsp decadens* are also listed under the *EPBC Act*.

3.1.3 WIPS Management

3.1.3.1 Endangered Ecological Communities

One vegetation community occurs on the subject site, namely Lower Hunter Spotted Gum-Ironbark Forest (LHSGIF). This community is listed as an EEC under the *TSC Act 1995*. In addition, part of the site is already cleared.

3.1.3.2 Threatened Flora

One threatened flora species has been recorded within the subject site, namely *Grevillea parviflora* subsp. *parviflora*. *G. parviflora* subsp. *parviflora* is listed as Vulnerable under the *TSC Act* and the *EPBC Act*.

3.1.4 Pelaw Main By-pass Concept Plan

3.1.4.1 Endangered Ecological Communities

Four main vegetation communities were delineated as occurring within the study area for the PMBP, namely Kurri Sand Swamp Woodland (KSSW), Lower Hunter Spotted Gum / Ironbark Forest (LHSGIF), Grey Gum / Scribbly Gum Open Forest (GGSGF) and Freshwater Wetland Complex (FWC). Some low-lying areas within the study area were also characterised by creekline associations, although the vegetation within these areas was not considered significantly different to those vegetation communities previously outlined such that they would warrant classification as distinct assemblages. Examples include the creekline proximate to Leggetts Drive in the north-western corner of the study area and a major drainage line in the south-eastern corner of the study area. These areas have been included within the KSSW assemblage, although some species present (or at least frequencies thereof) may not be truly

indicative of the KSSW community. It should be noted that this community is highly variable in composition throughout its distribution, with up to ten (10) variants described (NPWS 2000; Bell 2004b).

3.1.4.2 Threatened Flora

Acacia bynoeana

A. bynoeana was recorded from a small number of plants along the proposed alignment and the associated buffer zone. It was also recorded near the southern boundary of the study area within KSSW. It has been recorded on the HEZ lands immediately adjacent to the south-west corner of the study area within similar habitat.

Grevillea parviflora subsp. parviflora.

The results show that *G. p. parviflora* is a relatively common to abundant understorey shrub species over large areas of the study area, the nearby HEZ and the Cessnock LGA. This species was found to occur in relative abundance over the majority of the PMBP study area, being absent only from cleared / disturbed areas and limited parts of the forested areas. This species appears to achieve the highest frequencies within KSSW and ecotonal areas with LHSGIF. Within the LHSGIF community the species maintains a more sporadic occurrence, being absent from an understorey containing dense thickets of *Melaleuca nodosa* and regenerating / juvenile Broad-leaved Ironbarks.

Callistemon linearifolius

Despite careful cross-checking with the morphologically similar *C. rigidus,* no specimens of *C. linearifolius* were located anywhere within the study area. Specimens of *C. rigidus* were found to occur in various locations throughout the LHSGIF community within the study area. Some confusion exists between the identification of this species and *C. linearifolius*, although the specimens in question were differentiated by the raised oil-dots on the leaves, lack of pronounced venation, leaf shape and other characteristics that are typical of *C. rigidus*. The Royal Botanic Gardens Sydney has confirmed other similar specimens taken from within the HEZ study area as *C. rigidus* (Inquiry No: 7148) (Harper Somers O'Sullivan 2002b). Further confusion may also occur with the juvenile leaves of *C. linearis*, which may superficially resemble *C. linearifolius* (authors pers. obs.). *C. linearis* was also confirmed to exist within the study area.

Eucalyptus parramattensis ssp. decadens

E. p. decadens was found to occur as a dominant or co-dominant canopy species within the KSSW community. Several sporadic occurrences were also noted within transitional zones between the KSSW and LHSGIF communities.

KSSW was found to vastly dominate the study area and *Eucalyptus parramattensis ssp. decadens* is strongly associated with this community, occurring as the dominant tree species. Field investigations revealed that 399ha of KSSW exists on the study area, comprising 81.2% of the study area. This includes a small wetland area and creekline / wetland variants (dominated by *Melaleuca* spp.) in the north-western corner of the study area. This figure is slightly higher than the figure generated by Biosis (2001), which delineated 391.4ha of KSSW on the study area (as per LHCCREMS mapping). This is the largest remnant patch of this community known to exist (Biosis 2001).

Eucalyptus glaucina

Trees identified as being either specimens of *E. glaucina* or as trees containing *E. glaucina* genes were recorded close to the south-eastern corner of the study area. Here, seventeen (17) mature or semi-mature specimens were located in a 0.65ha area surrounding the disused railway verge. A similar number of juvenile trees were also recorded therein. Each of these trees (with the exception two individuals) were located in the immediate vicinity of the railway verge, and all trees were found within previously cleared / highly modified land. It is unclear whether these trees would have occurred in this area naturally, although three (3) of the trees were found to be quite mature.

Rutidosis heterogama

R. heterogama has been recorded within the adjacent HEZ lands. Recent targeted searches for this species throughout the HEZ lands have found that it generally occurs in areas west of the disused Richmond Main Railway line. The closest known occurrences of *R. heterogama* to the study area are approximately 1km to the west of the western boundary. Similar habitat to the areas within the HEZ lands that the species occurs is found within the Pelaw Main By-pass study area. Targeted surveys for this species have been undertaken in parts of the study area during periods when the species was known to be flowering in the locality. No specimens have been found in any part of the study area.

Detailed surveys were also carried out along the proposed road alignment, undertaken concurrently with targeted surveys within the HEZ lands at a time when the species was known to be flowering. Careful cross-checking was made with morphologically similar species encountered (such as *Brachycome* and *Helichrysum* spp.). No sign of this species could be noted along or within the vicinity of the proposed alignment.

3.2 Fauna

All information in relation to the Precinct 1 threatened fauna is provided hereunder. Summarised information is provided on each of the species likely to be affected by the other components of the application. For more detailed information refer to the accompanying site-specific assessments.

3.2.1 Precinct 1

The following threatened fauna species have been recorded within or adjacent to Precinct 1:

Litoria brevipalmata	Green-thighed Frog
Calyptorhynchus lathami	Glossy Black-Cockatoo
Climacteris picumnus victoriae	Brown Treecreeper
Pomatostomus temporalis temporalis	Grey-crowned Babbler
Melithreptus gularis gularis	Black-chinned Honeyeater
Lathamus discolor	Swift Parrot
Ninox strenua	Powerful Owl
Petaurus australis	Yellow-bellied Glider

The Green-thighed Frog and Powerful Owl have been recorded in the 7(b) corridor to the east, while the remainder have been recorded in the Precinct.

3.2.2 Station Street

The following threatened fauna species have been recorded within the HEZ Estate and could potentially be affected by the proposal.

Litoria brevipalmata	Green-thighed Frog
Calyptorhynchus lathami	Glossy Black-Cockatoo
Climacteris picumnus victoriae	Brown Treecreeper
Pomatostomus temporalis temporalis	Grey-crowned Babbler
Chthonicola sagittata	Speckled Warbler
Lathamus discolor	Swift Parrot
Neophema pulchella	Turquoise Parrot
Tyto novaehollandiae	Masked Owl
Ninox strenua	Powerful Owl
Xanthomyza phrygia	Regent Honeyeater
Stagonopleura guttata	Diamond Firetail
Lophoictinia isura	Square-tailed Kite
Melithreptus gularis gularis	Black-chinned Honeyeater
Petaurus australis	Yellow-bellied Glider
Petaurus norfolcensis	Squirrel Glider
Falsistrellus tasmaniensis	Eastern Falsistrelle
Miniopterus australis	Little Bentwing-bat
Miniopterus schreibersii	Eastern Bentwing-Bat
Mormopterus norfolkensis	East-coast Freetail-bat
Scoteanax rueppellii	Greater Broad-nosed Bat

Of these, Black-chinned Honeyeater, Powerful Owl and Yellow-bellied Glider have been recorded in the immediate vicinity.

3.2.3 WIPS Management

The following threatened fauna species have been recorded within the HEZ Estate and could potentially be affected by the proposal.

Litoria brevipalmata	Green-thighed Frog
Lathamus discolor	Swift Parrot
Neophema pulchella	Turquoise parrot
Callocephalon fimbriatum	Gang-gang Cockatoo
Ninox strenua	Powerful Owl
Tyto novaehollandiae	Masked Owl
Chthonicola sagittata	Speckled Warbler
Pomatostomus temporalis temporalis	Grey-crowned Babbler
Climacteris picumnus victoriae	Brown Treecreeper
Melithreptus gularis gularis	Black-chinned Honeyeater
Xanthomyza phrygia	Regent Honeyeater
Stagonopleura guttata	Diamond Firetail
Lophoictinia isura	Square-tailed Kite
Petaurus australis	Yellow-bellied Glider
Petaurus norfolcensis	Squirrel Glider
Miniopterus australis	Little Bentwing-bat
Miniopterus schreibersii	Eastern Bentwing-Bat
Mormopterus norfolkensis	East-coast Freetail-bat
Falsistrellus tasmaniensis	Eastern Falsistrelle
Scoteanax rueppellii	Greater Broad-nosed Bat

Threatened fauna species that have been recorded in the immediate vicinity of the site (within 0.5km) include Grey-crowned Babbler, Black-chinned Honeyeater, Brown Treecreeper and Yellow-bellied Glider. Squirrel Glider and Powerful Owl have been recorded within 2km of the subject site.

3.2.4 Pelaw Main By-pass Concept Plan

Two (2) threatened species have been recorded on site during fieldwork, being *Chthonicola sagittata* (Speckled Warbler) and *Petaurus norfolcensis* (Squirrel Glider).

Chthonicola sagittata (Speckled Warbler)

An individual of this species was observed foraging in the understorey of LHSGIF along the edge of the railway embankment during the September 2002 survey. Subsequent targeted searches in the area failed to locate any further evidence of the species, although given its sedentary habits, it is considered likely that the species utilises the open forest and woodland habitats throughout the study area and surrounding lands.

Petaurus norfolcensis (Squirrel Glider)

A single *P. norfolcensis* was observed during nocturnal fieldwork undertaken during recent surveys. This animal was located in the south-eastern corner of the study area within the GGSGF. Potential habitat exists for this species throughout the study area, although predominantly within the LHSGIF and GGSGF.

Melithreptus gularis (Black-chinned Honeyeater)

Although this species was not recorded on the study area, it has been widely recorded in the number of locations throughout the HEZ, with several records within 500 metres of the study area. Given that this species has been recorded within both Open Forest and Woodland communities within the HEZ and that such habitats are continuous with the study area (albeit dissected by Leggetts Drive), it is considered likely that this species would utilise the study area on what is likely to be an irregular basis.

Pomatostomus temporalis (Grey-crowned Babbler)

Although this species was not recorded during any fieldwork undertaken on the study area, six individuals have been previously recorded (June 2001) along the roadside reserve of Leggetts Drive, off the south-west corner of the study area. A number of additional sightings of the species have been recorded within the HEZ lands and it is suspected that one or more family groups occur within the area. It is considered likely that at least one of these group(s) would utilise the study area as part of their respective home range(s).

Climacteris picumnus (Brown Treecreeper)

The Brown Treecreeper has been recorded in several locations within the HEZ study area, including evidence of breeding. This species, although not detected during any fieldwork undertaken on the subject study area, is most likely to utilise the LHSGIF community and possibly the KSSW community (as it has been recorded within KSSW on the HEZ study area).

Ninox strenua (Powerful Owl)

Although this species was not recorded during any fieldwork undertaken on the subject study area, several records exist from the HEZ study area, including records noted during fieldwork undertaken as part of the Ecological Constraints Master Plan (ECMP) process (Harper Somers O'Sullivan 2004a). As potential hunting habitat is present within the study area, it is possible

that a local pair of *N. strenua* would utilise the study area as part of a larger hunting home range.

Lathamus discolor (Swift Parrot)

Although this species was not recorded on the study area (including surveys conducted when the species may be present in the region), it has been widely recorded in a number of locations throughout HEZ, with several records within close proximity to the study area, including a record from immediately south of Pelaw Main (in close proximity to the proposed alignment). The species occurrence appears to be associated with the winter-flowering of Eucalypts in the locality. Previous sightings in the broader locality have been of substantial numbers (100-200 individuals in 2000 and up to 120 individuals during 2005). Potential habitat for this species is largely restricted to the LHSGIF community.

Xanthomyza phrygia (Regent Honeyeater)

Although this species was not recorded within the study area (including surveys conducted when the species may be present in the region), it has been recorded in a number of locations throughout HEZ, with several records within close proximity to the study area (and including one record from 2005). The species occurrence appears to be associated with the winter-flowering of Eucalypts in the locality and the availability of flowering trees elsewhere (particularly west of the divide). Previous sightings in the broader locality have been of substantial numbers (up to 75 individuals in 2000). Potential habitat for this species is largely restricted to the LHSGIF community, although it has been recorded from the ecotone of this community with KSSW (HSO ecologists pers. obs.).

Litoria brevipalmata (Green-thighed Frog)

Although not recorded within the study area, this species has been previously recorded in two locations within the HEZ lands. One of these locations was within the same creekline (an unnamed tributary of Wallis Creek) that traverses through the site, approximately 1250 metres upstream of where the creekline enters the study area along Leggetts Drive.

This species is difficult to detect outside of breeding events where males congregate around ephemeral pools for several nights following heavy summer rainfalls. Creekline habitats within the study area are relatively intact and contain similar habitat features (i.e. riparian vegetation, soaks, ephemeral pools, overland flows, off-stream channels) to those where the species was previously recorded on the HEZ study area. Given these factors, it is not unlikely that this species occurs within the study area.

Mormopterus norfolkensis (Eastern Freetail-bat), *Miniopterus australis* (Little Bentwing-bat), *M. schreibersii* (Large Bentwing-bat) and *Scoteanax rueppellii* (Greater Broad-nosed Bat).

Although these bat species were not recorded during any fieldwork undertaken on the study area, they have been recorded in the adjacent HEZ lands. The HEZ lands are in close proximity to the study area and contains habitat generally congruous to those habitats found on the Pelaw Main By-pass study area. Therefore, as known populations exist on adjacent lands and potential habitat exists on the study area, there is potential for these species to occur within the study area.

4 THREATENED SPECIES AND COMMUNITIES ASSESSMENT

4.1 Identification of Subject Species and Communities

Those threatened flora and fauna species (listed under the *TSC Act 1995* and the *EPBC Act 1999*) that have been gazetted / recorded from within the vicinity of the site have been considered within this assessment (and accompanying component reports). EEC's and Endangered Populations known from the broader area have also been addressed.

Detailed investigations into the potential for those threatened species not recorded within HEZ is considered unnecessary. The threatened species and EEC's that are relevant have been subject to intensive survey and assessment via the ECMP process (State) and PER process (Commonwealth). The result has been that in March 2005 DECC provided an Assumed Concurrence for the industrial development of HEZ, while in May 2007 DEW also granted approval. Therefore impact assessment is provided for those species / EEC's recorded or previously covered by the ECMP and / or PER.

4.2 Threatened Flora

4.2.1 Precinct 1

4.2.1.1 Endangered Ecological Communities

Lower Hunter Spotted Gum-Ironbark Forest

In terms of impacts upon this community, Precinct 1 will result in the modification of approximately 86 hectares. Most of this is likely to be require clearing, although in some areas retention will occur in pockets. Approximately 11 hectares (or 11%) will be retained within the 20m habitat retention corridors along roadsides in addition to that conserved within designated conservation zones. The DECC Assumed Concurrence indicates that an adequate conservation outcome for this EEC has been achieved within the HEZ LEP area overall. It should be noted that this level of impact within Precinct 1 has also resulted from the prioritisation of the more significant HLRF EEC during the concept planning workshops.

Hunter Lowland Redgum Forest

In terms of impacts upon this community, Precinct 1 will result in the modification of approximately 6.8 hectares. Most of this is likely to be require clearing, although in some areas retention will occur in pockets. Approximately 6.6 hectares (or 49%) will be retained within the designated conservation and riparian protection areas in addition to that conserved within designated conservation zones. These outcomes are shown in the accompanying EDAW Concept Plan. The DECC Assumed Concurrence indicates that an adequate conservation outcome for this EEC has been achieved within the HEZ LEP area overall. This is particularly the case in relation to retention of a majority of this community on the site overall within the central 7(b) conservation corridor. It should be noted that this level of impact within Precinct 1 has also resulted from the prioritisation of the more significant HLRF EEC during the concept planning workshops.

4.2.1.2 Threatened Flora

Grevillea parviflora subsp. parviflora

This species occurs throughout the Precinct. The DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area. As such, impacts upon this species resulting from development of Precinct 1 are considered to be acceptable. It should be noted that some protection of this species is likely to occur within the 20m habitat retention corridors along roadsides in addition to those conserved within designated conservation zones.

Callistemon linearifolius

Of the 314 *Callistemon linearifolius* plants recorded within the Precinct 1 area 112 (36%) are likely to be retained. This is considered to be more than adequate – particularly given the level of conservation of the other major populations within 7(b) conservation zoned areas and also other Deferred Areas. Such conservation includes the protection of approximately 1400 plants within 7(b) conservation zones and Werakata National Park, and likely protection of a further approximately 1300 plants in Deferred Areas 5 and 6. The DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area (including Deferred Areas).

Rutidosis heterogama

Of the 458 *Rutidosis heterogama* plants recorded within the Precinct 1 area, 54 (12%) are likely to be retained. This is considered to be more than adequate – particularly given the level of conservation of the other major populations within 7(b) conservation zoned areas and also other Deferred Areas. Such conservation includes the protection of approximately 2000 plants within 7(b) conservation zones and Werakata National Park, and likely protection of a further approximately 900 plants in Deferred Areas 2 and 4. In addition, reuse of topsoil for landscaping / rehabilitation from where this species is affected by clearing is hoped to assist in providing opportunities for this species to naturally regenerate post-development. The DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area (including Deferred Areas).

4.2.2 Station Street

4.2.2.1 Endangered Ecological Communities

Lower Hunter Spotted Gum – Ironbark Forest

The current proposal will involve the removal of approximately 0.41ha of LHSGIF.

Within the HEZ LEP area, a total of approximately 1,840ha of this vegetation community has been mapped. Of this, approximately 1,105ha (i.e. 60% of occurrence) occurs within zones created and managed for conservation purposes i.e 7(b) 'Habitat Protection' and 8(a) 'National Park'. A further 68ha (3.7% of occurrence) is also currently reserved within the DECC Deferred Areas.

Following the listing of LHSGIF as an EEC, the DECC issued a revised assumed concurrence that states that an adequate conservation outcome for this community has been achieved within the HEZ LEP area.

Therefore it can be stated that the proposal will not have an adverse effect on the extent of the LHSGIF such that the local occurrence is likely to be placed at risk of extinction.

Kurri Sand Swamp Woodland

Within the HEZ Study Area, 703ha of KSSW have been mapped (Bell 2004), including disturbed remnants. The current proposal will involve the removal of approximately 0.89ha.

However, the conservation zones within the HEZ LEP are likely to have produced an adequate conservation outcome for this community. In fact the DECC Assumed Concurrence states that an adequate conservation outcome for this community has been achieved within the HEZ LEP area. Therefore it can be stated that the proposal will not have an adverse effect on the extent of the KSSW such that the local occurrence is likely to be placed at risk of extinction.

4.2.2.2 Threatened Flora

Callistemon linearifolius, Eucalyptus parramattensis subsp decadens and *Eucalyptus glaucina* were recorded either within or adjoining the proposed Station Street Extension. It was concluded that:

- The one *Callistemon linearifolius* is not likely to be affected by the proposal;
- 47 out of a total of 115 *Eucalyptus parramattensis subsp decadens* are likely to require removal as a result of the proposal; and
- Of the three *Eucalyptus glaucina recorded,* none are likely to be impacted by the proposal.

The loss of 47 *Eucalyptus parramattensis* would represent a relatively small incremental loss in terms of the population outside of the site. Adequate conservation outcomes (populations) for this species are maintained within the conservation zones of the HEZ and in the DECC Deferred Areas.

A suitable conservation outcome exists for this species locally, with large populations secured within Werakata National Park, conservation areas of HEZ and the buffer lands of the aluminium refinery north of Kurri Kurri. Many examples can also be found in the immediate locality of healthy specimens of *E. parramattensis* subsp. *decadens* occurring along road fringes and in manicured parkland environments (e.g. roadsides edges in Neath, Abermain, Weston). Therefore, it is considered unlikely that the proposal will place the local population(s) of the species at the risk of extinction. The DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area.

4.2.3 WIPS Management

4.2.3.1 Endangered Ecological Communities

Lower Hunter Spotted Gum – Ironbark Forest

The proposal will involve the removal of approximately 4.93ha of LHSGIF.

Within the HEZ LEP area, a total of approximately 1,840ha of this vegetation community has been mapped. Of this, approximately 1,105ha (i.e. 60% of occurrence) occurs within zones created and managed for conservation purposes i.e 7(b) 'Habitat Protection' and 8(a) 'National Park'. A further 68ha (3.7% of occurrence) is also currently reserved within the DEC Deferred Conservation Areas.

Following the listing of LHSGIF as an EEC, the DEC issued a revised assumed concurrence that states that an adequate conservation outcome for this community has been achieved within the HEZ LEP area.

Therefore it can be stated that the proposal will not have an adverse effect on the extent of the LHSGIF such that the local occurrence is likely to be placed at risk of extinction.

4.2.3.2 Threatened Flora

Grevillea parviflora subsp. parviflora was recorded within the site.

Detailed survey efforts have mapped 40 individual *G. parviflora* subsp. *parviflora* stems (approximately 14 actual plants) in the southwest of the study area, of which all will be retained within the retained vegetation within the site. The proposal will remove approximately 4.93ha of potential habitat for this species however, this is unlikely to have a significant impact upon the population as a whole within the HEZ Estate. The DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area.

4.2.4 Pelaw Main By-pass Concept Plan

4.2.4.1 Endangered Ecological Communities

Lower Hunter Spotted Gum – Ironbark Forest

The proposed road will require removal of 2.4ha of LHSGIF with a further 3.0ha considered likely to be modified by the proposed road via edge effects and other indirect impacts. As a result, 5.4ha of LHSGIF will be affected by the proposal, comprising 8.0% of the total on the study area. The LHSGIF within the study area is considered to be of relatively poor quality due to rubbish dumping, frequent fire events, track construction and past clearing have all contributed to the current degraded condition of LHSGIF. In general, it is asserted that this community exists within the study area in a relatively high state of degradation. It is considered that the habitat to be removed / modified can be considered as not important to the long-term survival of LHSGIF in the locality. This is given the small area to be removed / modified, the poor quality of habitat and large areas (over 1,000 ha) of higher quality habitat within the adjoining HEZ study area of LHSGIF that will be conserved within secure conservation areas.

Kurri Sand Swamp Woodland

The current proposal will require the removal approximately 6.7ha of KSSW with modification of approximately 6.6ha due to edge effects within the road easement. The proposal will also result in the isolation of KSSW that will remain post road construction. Primarily, this would occur between the proposed road alignment and the township of Pelaw Main to the west. Approximately 39ha of KSSW would be isolated from the remainder of KSSW in the study area by the proposed road. This represents 9.3% of the total amount of KSSW found within the study area. The area of KSSW, which may be isolated from the remainder of KSSW, suffers from edge effects associated with a history of human settlement within Pelaw Main. This area was found to contain several discarded vehicles and illegally dumped rubbish. Many of the vehicles have been burnt out and evidence of an unusually high fire frequency is apparent in this area (such as via the dominance of Blady Grass within the groundcover layer). Several cleared patches and a small wetland area also exists. The proposal is likely to exacerbate this degradation. However, given the present state of the KSSW in that area, further degradation of this patch is unlikely to be at the significant detriment to the study area patch of KSSW. The habitat to be removed / modified / fragmented can therefore be considered as not important to the long-term survival of the KSSW in the locality.

4.2.4.2 Threatened Flora

Acacia bynoeana

A. bynoeana was recorded from a total of five (5) specimens along the proposed alignment. A further six (6) specimens were recorded within or immediately adjacent to the 25m impact buffer. A further three (3) plants were recorded approximately 10m to the north of the 'impact buffer' in the vicinity of these plants. Therefore, a total of fourteen (14) specimens could be removed / affected by the proposal. It should be noted that a small number of individual plants could potentially occur within the general vicinity of where the specimens were located, although this is estimated to be less than an additional ten (10) individuals.

Populations of *A. bynoeana* have been identified within the Cessnock area, including within the HEZ and neighbouring lands. Populations within the HEZ study area appear to be quite sizeable, with rough estimates (based on previously reported densities; see Bell & Driscoll 2002) of more than 3000 plants (Bell 2004b). Within the Cessnock LGA, further populations have been recorded near Ellalong (south-west of the HEZ Study Area) and Heddon Greta (immediately north-east of the township of Kurri Kurri). The Ellalong population is thought to be well in advance of one hundred (100) individuals (Harper Somers O'Sullivan 2005) whilst the Heddon Greta population size is also likely to be greater than 100 plants (HSO ecologists pers. obs.). More recent fieldwork has also shown that substantially sized stands of this species exist in other parts of the Cessnock LGA, whilst further afield populations have also been recently recorded from near North Rothbury and Yengo National Park (S. Bell pers. comm.).

Within the context of the local population of this species, this is not considered to be a significant number of individuals. However, given the limited distribution and frequency of the species (i.e. it generally does not occur in high frequencies within large parts of its range), the removal of any number of individuals could be regarded as being potentially significant. Notwithstanding, it is considered unlikely that the proposal will have an adverse effect upon the life cycle of this species such that the local population is likely to be placed at risk of extinction, although it could result in extinction on a finer scale (i.e. the stand of plants along and within the immediate vicinity of the alignment).

Grevillea parviflora subsp. parviflora.

G. p. parviflora was found to occur in abundance as an understorey plant within large sections of the study area. This species was located within each of the three forested communities throughout the study area. It was found at the greatest density within KSSW and LHSGIF, although most consistently within KSSW where it often occurred as a co-dominant low shrub species.

A detailed investigation of the status of this species within the adjacent HEZ study area revealed that a population estimate of 3,331,631 above-ground stems occurred within that area (Harper Somers O'Sullivan 2002b; 2002c). Based on these detailed population estimate investigations, a broad population estimate of 1,239,217 above-ground stems has been determined to exist within the Pelaw Main By-pass study area. Note that the rhizomatous nature of this species may have some influence on the validity of these figures, although for the purposes of proportional estimates and assessment, it is considered sufficient at the present time. Furthermore, field investigations have revealed that *G. p. parviflora* occurs locally at a greater density on the majority of the subject study area than on the HEZ lands (authors pers. obs.) and therefore this figure may actually be a proportional underestimate.

In relation to the impact of removal of vegetation from the road alignment, the number of plants to be directly affected has been estimated to be 16,930 above-ground stems. This figure was generated via ground sampling and counting of individual plants along the entire proposed road alignment. Although lower than a value calculated using population estimates as outlined

above, such a figure has resulted due to the noted low density of *G. p. parviflora* in much of the proposed alignment. This represents an approximation of 1.36% of the total population occurring within the study area. Therefore, given the estimated study area population and the proportion likely to be affected, it would be difficult to conclude that the proposed road would result in an adverse effect upon the life cycle of *G. p. parviflora* such that a viable local population will be placed at risk of extinction. As for the other threatened flora species, proper management of the proposed conservation lands to the east of the alignment will need to occur to ensure the viability of populations therein.

Eucalyptus parramattensis ssp. decadens

E. p. *decadens* was found to occur commonly throughout the study area, largely in association with KSSW. This species was found to be generally restricted to this community (some scattered individuals occur within transitional zones between KSSW and LHSGIF) and is a recognised keystone species of the KSSW assemblage. Ground surveys were undertaken to determine the number of *E. p. decadens* that are likely to be affected by the proposal. These investigations found that approximately 651 individuals will be either removed or directly affected by the proposal. The bulk of these trees were located within the KSSW in the middle section of the proposed road.

Although no population estimates have been made for *E. p. decadens*, the size of the population within the study area is likely to be significant given that 399ha of KSSW exists therein, the majority of which contains, or is dominated by, *E. p. decadens*. As such, the proportional loss of individuals may not be significant given the occurrence of large numbers of the species throughout the remainder of the study area. However, as alluded to within the KSSW assessment, such a large stand of *E. p. decadens* representing an unbroken gene pool resource must be regarded as significant in conservation terms and any level of impact therein should also be regarded as significant.

However, given that conservation agreements will protect the majority of land to the east of the alignment, a favourable conservation outcome will be achieved for this species (given that much of that land is potential / occupied habitat). Such an outcome could be viewed as potentially offsetting the impacts of the proposed road and would suggest that an adverse effect upon the life cycle of this species such that a viable local population will be placed at risk of extinction is unlikely to occur as a result of the proposal.

4.3 Threatened Fauna

4.3.1 Precinct 1

Green-thighed Frog

This species habitat was given high priority for protection during the Concept Planning workshops. Outcomes of the final Precinct 1 design include:

- Protection of the two main riparian areas mapped as providing Low – Medium quality habitat for this species (and an overall majority of its habitat within Precinct 1);

- Consideration of this species' habitat requirements such that the WSUD principles that will be applied to the development will result in both additional recreation of potentially suitable breeding habitat including ephemeral depressions and the general maintenance of the hydrological regime post-development (both water quality and quantity);

- While the existing hydrological regime will be generally maintained, a small increase in the regularity of flooding events is likely. This could actually be beneficial to this species as it would increase the numbers of rare flooding events that this species requires to breed.

Such an approach to consideration of this species requirements is consistent with the requirements of the DECC Assumed Concurrence.

Glossy Black-Cockatoo

While much of this species habitat will require modification, the DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area.

Brown Treecreeper, Grey-crowned Babbler and Black-chinned Honeyeater

While much of this species habitat will require modification, the DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area.

Swift Parrot

This species habitat was given high priority for protection during the Concept Planning workshops. Outcomes of the final Precinct 1 design include:

- Protection of a total of 49 out of 159 winter flowering mature *Corymbia maculata* (Spotted Gum) and *Eucalyptus tereticornis* (Forest Red Gum). This is approximately 30% retention of this species (and the Regent Honeyeaters) primary foraging habitat. This is in addition to the retention of approximately 500 mature *Corymbia maculata* and *Eucalyptus tereticornis* within 7(b) conservation zones;

This retention of winter flowering mature trees is in addition to the retention of large area of this species foraging habitat within conservation areas resulting from the HEZ LEP process.

Powerful Owl

While much of this species habitat will require modification, the DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area. In addition approximately 13% of hollow bearing trees are to be retained within Precinct 1 along with 589 hollow bearing trees (containing a total of 1505 hollows) in the 7(b) conservation zones. This will protect existing and potentially future nesting habitat for this species.

Yellow-bellied Glider

While much of this species habitat will require modification, the DECC Assumed Concurrence indicates that an adequate conservation outcome for this species has been achieved within the HEZ LEP area. In addition approximately 13% of hollow bearing trees are to be retained within Precinct 1 along with 589 hollow bearing trees (containing a total of 1505 hollows) in the 7(b)

conservation zones. This will protect existing and potentially future nesting habitat for this species.

4.3.2 Station Street

The results of the ECMP data have been utilised to achieve adequate conservation outcomes for all of the threatened fauna within the HEZ Study Area, which culminated in the Department of the Environment and Climate Change (DECC) issuing an Assumed Concurrence (2005) for the development of the Hunter Economic Zone, in March 2005. This document advises that Council (and determining authorities under Part 5 assessment under the EPA Act) can assume concurrence for permissible development (as per the Local Environment Plan) in accordance with cl. 64 of the *EP&A Regulation 2000*, provided the conditions within Attachment 1 of the concurrence document are met. In regard to Part 5 assessments, Section 112C (Clause 3 - relating to the provisions of 79B) of the EPA Act, is applicable to the Assumed Concurrence (2005).

Application of Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (Seven Part Tests) to the relevant threatened fauna indicated that no significant impacts would be expected as a consequence of the proposal.

4.3.3 WIPS Management

The results of the ECMP data have been utilised to achieve adequate conservation outcomes for all of the threatened fauna within the HEZ Study Area, which culminated in the Department of the Environment and Climate Change (DECC) issuing an Assumed Concurrence (2005) for the development of the Hunter Economic Zone, in March 2005. This document advises that Council (and determining authorities under Part 5 assessment under the EPA Act) can assume concurrence for permissible development (as per the Local Environment Plan) in accordance with cl. 64 of the *EP&A Regulation 2000*, provided the conditions within Attachment 1 of the concurrence document are met. In regard to Part 5 assessments, Section 112C (Clause 3 - relating to the provisions of 79B) of the EPA Act, is applicable to the Assumed Concurrence (2005).

Application of Section 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (Seven Part Tests) to the relevant threatened fauna indicated that no significant impacts would be expected as a consequence of the proposal.

4.3.4 Pelaw Main By-pass Concept Plan

Two (2) threatened species have been recorded on site during fieldwork, being *Chthonicola sagittata* (Speckled Warbler) and *Petaurus norfolcensis* (Squirrel Glider).

Chthonicola sagittata (Speckled Warbler)

C. sagittata was recorded within the study area. An individual of this species was observed foraging in the understorey of the LHSGIF along the edge of the railway embankment in the northern end of the study area during the initial surveys (Harper Somers O'Sullivan 2002a). Numerous subsequent targeted searches in the area have failed to locate any further evidence of the species, although given its sedentary habits, it is considered possible that the species utilises the open forest and woodland habitats throughout the study area and surrounding lands.

The amount of habitat to be removed as a result of the proposal is not considered significant in either the context of the habitat extant within the study area nor within the context of habitat that occurs locally or on a regional scale. The proposal would see the direct loss / impact upon 18.7ha of potential habitat for this species. Moreover, the proposal will have the effect of

isolating habitat for this species to the west of the road alignment, in effect increasing the fragmentation of the remnant study area. The area to be isolated is approximately 85ha in size and combined with the area to be affected, this reduces the size of the larger forested remnant study area from approximately 480ha (excluding cleared areas) to 396ha. This remnant size figure is considered sufficient to support viable long-term populations of this species.

Petaurus norfolcensis (Squirrel Glider)

This species was recorded within the study area. A single animal was observed during nocturnal fieldwork undertaken during recent surveys. This animal was located in the south-eastern corner of the study area within the Grey Gum / Scribbly Gum Open Forest. This part of the study area is not proximate to the proposed road alignment. Notwithstanding, potential habitat does exist for this species along the road alignment. However, this is predominantly in the form of foraging habitat, as a relatively small amount of potential nesting habitat occurs. This is due mainly to the young age class of the trees found therein such that only sixteen (16) trees were found to foster hollows suitable for this species (comprising a total of 25 individual hollows).

The removal of foraging habitat under the proposal is not considered to be significant to any local populations of this species due to the abundance of similar, and more suitable, habitat within the Cessnock locality. Furthermore, the proposal will result in the removal / impact upon only a small proportion of the study area and as a result large areas of potential foraging habitat should remain unaffected throughout the remnant study area. Likewise, an abundance of more suitable nesting habitat will remain unaffected and also occurs commonly in the locality. The removal of trees containing hollows suitable for this species represents only an incremental loss of such habitat both in the context of the study area and within the locality.

Other potentially occurring threatened species *Melithreptus gularis* (Black-chinned Honeyeater), *Pomatostomus temporalis* (Grey-crowned Babbler), *Climacteris picumnus* (Brown Treecreeper), *Ninox strenua* (Powerful Owl), *Lathamus discolor* (Swift Parrot), *Xanthomyza phrygia* (Regent Honeyeater), *Litoria brevipalmata* (Green-thighed Frog), *Mormopterus norfolkensis* (Eastern Freetail-bat), *Miniopterus australis* (Little Bentwing-bat), *M. schreibersii* (Large Bentwing-bat) and *Scoteanax rueppellii* (Greater Broad-nosed Bat). The linear nature of the proposed PMBP and the relatively small area to be affected is not likely to result in a significant impact upon these species.

4.4 Key Threatening Processes (KTP)

A Key Threatening Process (KTP) is defined in the *TSC Act (1995)* as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities. Something can be a threat if it:

- *adversely affects two or more threatened species, populations or ecological communities; or*
- *could cause species, populations or ecological communities that are not currently threatened to become threatened.*

Key Threatening Processes are listed in Schedule 3 of the *TSC Act 1995*. Those potentially applicable to the proposal, are as follows:

1. **Loss of Hollow-bearing trees**
2. **Clearing of native vegetation**
3. **Human-caused climate change**

4. **Infection of native plants by *Phytophthora cinnamomi***
5. **Invasion of native plant communities by exotic perennial grasses**
6. **Removal of dead wood and dead trees**
7. **Predation by the Feral Cat**
8. **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands**
9. **Lantana camara**

1. Loss of Hollow-bearing trees

The proposals require the removal of some hollow-bearing trees and as such are considered as contributing to the Key Threatening Process "Removal of Hollow-bearing Trees". A number of trees to be removed will contain hollows and due to their potential use by threatened fauna, particularly arboreal fauna, forest owls and Microchiropteran bats, removal has the potential to impact upon local populations of dependant species. Habitats within the site regarded as most likely to be impacted upon are open woodland habitats.

The proposal is likely to represent a relatively small cumulative impact, with regard to this KTP, due in large part, to the greater abundance of higher quality habitat that will be secured as conservation lands elsewhere within the site and over time these lands will provide additional hollows.

2. Clearing of Native Vegetation

The proposals will require the removal of native vegetation and as such are considered to contribute to the Key Threatening Process "Clearing of Native Vegetation". Vegetation that will be removed for the proposals includes primarily LHSGIF and KSSW. Whilst removal of these EEC's / habitats will occur, extensive lands have been conserved within the HEZ LEP area and are likely to be conserved surrounding the PMBP.

3. Human caused climate change

The proposal is likely to contribute to the Key Threatening Process "Human Caused Climate Change" as a result of clearing vegetation. It is considered that clearing and modification of the landscape would constitute only a minor incremental increase in the effects of this KTP. Thus the extent to which the proposal could contribute to this process is considered unlikely to be significant.

4. Infection of native plants by Phytophthora cinnamomi

Phytophthora cinnamomi is a water mould (like a fungus) that attacks the roots of susceptible plants, in many cases killing the plants. In some native plant communities, epidemic disease can develop causing death of large numbers of plants.

P. cinnamomi may spread with the movement of infected soil or plant material by people, animals and may be transport by percolating through the soil, in creeks or storm runoff. People can also transported the fungus to new areas on dirt adhering to vehicles, items they are carrying or footwear.

Humans have the capacity to spread the fungus long distances and across barriers which sets us apart from the natural mechanisms which normally spread this water mould. Therefore, not a lot can be done to control the natural spread of the water mould or to destroy it, in native plant communities. Due to the use of heavy machinery that will be used for construction of the development estate there is opportunity for the KTP "Infection of native plants by *Phytophthora cinnamomi*". The transportation of *Phytophthora cinnamomi* from other areas may occur by the movement of soils attached to earth moving machinery. Precautionary measures such as clearing of machinery prior to clearing can help to limit the potential for this KTP to occur.

5. Invasion of native plant communities by exotic perennial grasses

There is opportunity for the KTP "Invasion of native plant communities by exotic perennial grasses" to occur within the site due to the removal of vegetation and the exposing of underlying soils. For the most part, this KTP already occurs along tracks and road verges within the site. It is expected that those measures employed to reduce potential sediment and erosional impacts to surrounding areas will contribute to minimising the potential for this KTP to impact upon surrounding Conservation Lands.

6. Removal of dead wood and dead trees

During the clearing of vegetation within the site a number of dead trees are likely to be removed and this may represent opportunity for the KTP "Removal of dead trees and dead wood". It is unlikely that this KTP will represent a significant threat to threatened species occurring within the site, provided an ecologist is present during clearing works as is a requirement at HEZ and for the PMBP. Consideration should be given to selective relocation of dead trees and logs into conservation lands.

7. Predation by feral cats

The increase of development within the area has the potential to increase opportunities for the KTP "Predation by feral cats". This KTP is unlikely to be significantly exacerbated by the proposals.

8. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

The displacement of natural vegetation communities within development is likely to increase the opportunity for the KTP "Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands". This is due to increased water flows and runoff potentials as a consequence of water falling upon manmade surfaces. Of greatest risk with regard to this KTP are HLRF and fauna associated with this community such as Green-thighed Frog. Impact to these threatened entities will be prevented by the implementation of best-practise WSUD and sediment and erosion control procedures.

10. Lantana camara

There is a small opportunity for *Lantana camara* to establish, due to the removal of canopy vegetation and the exposing of underlying soils. This exotic plant species already occurs within the site in relatively low densities in some areas. It is expected that this plant is limited in its success by the lack of available nutrients in the natural soils in the area. It is likely that the development will considerably reduce the incidence of Lantana within the development estate via the required ongoing management of weeds. Nevertheless there will still be opportunities for this KTP at the edges of the development without appropriate management. It is expected that those measures employed to reduce potential sediment and erosional impacts to surrounding areas will contribute to minimising the potential for this KTP.

No other KTP's are believed to be relevant to the current proposal.

4.5 SEPP 44 (Koala Habitat Protection)

This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.

4.5.1 First Consideration – Is the Land 'Potential Koala Habitat'?

Two species of tree listed in Schedule 2 of the above policy as a 'Koala Feed Tree Species' occurs on the site, namely *Eucalyptus punctata* (Grey Gum) and *Eucalyptus tereticornis* (Forest Red Gum). These trees occur at densities of greater than 15% of the total tree component. Therefore the site qualifies as 'Potential Koala Habitat', and further provisions of the policy apply.

4.5.2 Second Consideration – Is the Land 'Core Koala Habitat'?

Searches were made for any secondary indications of Koalas on the site within those areas determined to be 'Potential Koala Habitat'. Such searches targeted features such as scats or distinctive scratch marks on the trunks of trees. Searches for direct observations of Koalas were also conducted during diurnal and nocturnal surveys. No animals were noted on site and no secondary evidence of the presence of Koalas could be found. It should also be noted that there are only a handful of isolated records of Koalas from the locality. Therefore the site does not qualify as 'Core Koala Habitat' and no further provisions of this policy apply.

4.6 SEPP 14 (Coastal Wetlands)

Mapping of SEPP 14 'Coastal Wetlands' was consulted to determine if vegetation within the vicinity of the site might be deemed as Coastal Wetlands under the SEPP. No such wetlands occur and therefore no further provisions of this policy apply to the site.

5 DEVELOPMENT & CONSERVATION OUTCOMES

5.1 Offsets

The Lower Hunter Region's vegetation is of bio-geographic significance as it supports a transition between the northern and southern plant and animal assemblages. This north-south link is not evident elsewhere in the Hunter Valley. The Region also forms an east-west migratory pathway and a drought refuge for inland species.

The ecological features of the greater Tomalpin site have been previously assessed by Ecotone Ecological Consultants (1999), which was in the form of a Flora and Fauna Investigation and Planning Assessment Report. Following the results of this study, further specific targeted investigation was undertaken by Ecotone in the form of a Supplementary Report (2000). This report was devised to provide additional information and clarification of site characteristics as requested by NPWS and other government departments.

Based on the findings of the Ecotone studies, a conservation agreement was reached encompassing the proposed rezoning configuration within the site to the satisfaction of NPWS. This agreement recognised the broad-scale holistic outcomes for the entire Tomalpin area, and this agreement was a basis for the rezoning configuration submitted to and gazetted by the Minister for Planning. Approximately 877ha was zoned for industrial development purposes, with the remaining approximately 2300ha of land set aside for conservation purposes. However, it was highlighted that further study and impact assessment would be required for individual components of any future development proposal upon the site.

In summary, the conservation outcomes resulting from the original rezoning:

- Conserve in perpetuity key strategic parcels of land that complete regional biodiversity conservation corridors and buffer areas;
- Provide large intact areas of conserved habitat that will function as regional biodiversity gene pools;
- Protect an important array of vegetation communities, flora and fauna species, and natural landscape assets, including threatened species and EEC's;
- Achieve additional conservation benefits within the development zones via appropriate design and management practices.

In addition, development design for Precinct 1 will result in:

- Integration and protection of the Endangered Ecological Community (EEC) Hunter Lowland Redgum Forest;
- Integration and protection of Green-thighed Frog riparian and aquatic habitat;
- Integration and protection of *Rutidosis heterogama* and *Callistemon linearifolius*;
- Integration and protection of approximately 16% of mature trees, 30% of winter flowering mature trees and 13% of hollow bearing trees. Of particular importance is the retention of 30% of winter flowering mature trees as they are of high significance for the nationally and state-listed threatened Swift Parrot and Regent Honeyeater and exceed the minimum 10% retention required under the EPBC approval. This is in addition to the

retention of approximately 500 mature *Corymbia maculata* and *Eucalyptus tereticornis* within 7(b) conservation zones.

- Retention of substantial connectivity (terrestrial and aquatic) through proposing 20 m Conservation Setbacks from the road system in which existing natural vegetation will be retained. In addition, integration of substantive drainage areas into the proposed development.

- An ecologically sustainable stormwater capture, release and reuse system that will maximise water reuse efficiency and ensure that stormwater is captured and released at environmentally sensitive levels. This will incorporated capture and reuse of stormwater in tanks, the use of swales along roadsides and the use of on-site detention for each individual development.

5.2 Key Thresholds Assessment (Part 3A)

As required by the Draft *Guidelines for Threatened Species Assessment* for Part 3A applications (DEC / DPI 2005), the following assessment of Key Thresholds (four in total) is provided for the proposals.

1. Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.

It is considered that the information presented within this document, and in particular the proposal that includes the significant conservation of vast areas of endangered vegetation and threatened species habitat, as detailed within the ECMP, DECC Assumed Concurrence, and this EAR, is likely to result in a maintained if not an improved outcome for biodiversity values within the region.

2. Whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.

The threatened species, populations and ecological communities considered within the report occurring within the areas to be affected by the proposals are well represented in the existing and proposed conservation lands (for both HEZ and the PMBP). This is demonstrated by the Assumed Concurrence granted by DECC in 2005 that identifies that adequate conservation has occurred for the relevant threatened species and EEC's. The proposals are considered unlikely to reduce the long-term viability of a local population of species or endangered ecological community.

3. Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.

The threatened species, populations and ecological communities considered within the report occurring within the affected areas are well represented in the conservation lands, and are also represented or have potential habitat within other conservation offset lands and considered unlikely to be placed at risk of extinction.

4. Whether or not the proposal will adversely affect critical habitat.

There is no declared "Critical Habitat" within the HEZ or PMBP site locality, and as such the proposal will not adversely affect any such habitat.

6 AQUATIC AND RIPARIAN ASSESSMENT

6.1 Overview

In general, the drainage pattern on the HEZ Estate is one of a series of shallow creeklines or depressions feeding into the central Chinaman's Hollow Creek within the 7(b) zoned conservation corridor and into Hebburn Dam in the north. Practically all of these are ephemeral, remaining dry for the majority of the year. As such, permanent "aquatic" habitat is limited.

Certainly ephemeral riparian habitat does exist, and it is within such riparian areas that habitat for the Green-thighed Frog exists. The main focus of the riparian assessments undertaken to date within the HEZ (and surrounds including PMBP) has been to determine habitat quality for this species of threatened frog. It relies on flooding of ephemeral pools, pock-mark depressions and soaks during periods of high rainfall, during which it breeding quickly within a very short timeframe. Apart from the significance for this species of frog, no other threatened species of fish is likely to occur, with at most common species such as Short-finned or Long-finned Eel and Yabbies possibly using the pools within the ephemeral riparian habitat.

6.2 Green-thighed Frog

As part of the ECMP survey process, riparian habitats were categorised in relation to their habitat quality for the Green-thighed Frog. These were categorised as per the below:

All creeklines within the 4(h) development zone and representative areas of the conservation zones (such as along Chinamans Hollow Creek - where the species was previously recorded) of the HEZ were walked with GPS and each section or 'reach' of stream was afforded a habitat suitability ranking. This was undertaken in order to more accurately assess the extent and distribution of potential habitat for the species throughout the HEZ. Some consideration was also afforded to the extent of the likely Green-thighed Frog habitat in the general locality.

The habitat suitability ranking for the Green-thighed Frog was based on the following scale:

Unsuitable Habitat
Areas that the Green-thighed Frog is highly unlikely to utilise for either breeding, foraging or sheltering habitat.

Definitions:

- Creekline filled in; and/or
- Concrete channel; and/or
- Low quality habitat that has a high level of disturbance (eg. clearing, grazing, containing debris and dumped rubbish, weeds, pollution).

Low Quality Habitat
Areas where the Green-thighed Frog is considered to have some minor chance of occurrence and have the potential to utilise the area for foraging or sheltering purposes only.

Definitions:

- Dry intermittent stream with no pock-mark depressions or areas capable of forming pools, however containing relatively intact riparian / fringing vegetation; and/or
- Creekline with permanent to ephemeral pools that are moderately degraded (eg. some clearing, weeds, pollution); and/or
- Dams with open water and little or no riparian / fringing / emergent vegetation; and/or
- Moderate quality habitat that has some level of disturbance (eg. clearing, grazing, weeds, pollution, erosion).

Moderate Quality Habitat
Areas where the Green-thighed Frog is considered to have a moderate chance of occurrence and have the potential to utilise the area for breeding, foraging and sheltering purposes. Some areas such as the small dry intermittent streams within the Spotted Gum / Ironbark Forest associations would have otherwise been mapped as Low Quality Habitat if not for the recording of the species within these areas.

Definitions:

- Ephemeral stream with some pock-mark depressions or areas capable of retaining water and containing relatively intact riparian / fringing vegetation (including drier Spotted Gum / Ironbark associations); and/or
- Stream with permanent to semi-permanent pools divided by overland flow paths and containing relatively intact riparian vegetation including sedges; and/or
- Intact wetlands (semi-permanent to ephemeral in nature) containing riparian, fringing, or emergent vegetation; and/or
- High quality habitat that has some level of disturbance (eg. clearing, grazing, weeds, pollution, erosion).

High Quality Habitat
Areas where the Green-thighed Frog is considered to have the highest chance of occurrence and have the potential to utilise the area for breeding, foraging and sheltering purposes.

Definitions:

- Ephemeral stream with broad overland flow paths, pock-mark depressions and/or oxbows capable of retaining water, intact riparian vegetation including sedges, and little or no disturbance and/or

Known occurrences where the species has been previously recorded.

6.3 Use of Green-thighed Frog Habitat Data

This data was used during the Precinct 1 workshops to identify constraints in relation to the occurrence of Green-thighed Frog habitat and / or associated riparian habitat.

High significance was accorded to this species habitat as part of the Precinct 1 Concept Plan design and correspondingly riparian habitat in general.

The design of Precinct 1 incorporates:

- Retention of major formed ephemeral depressions;
- Recreation of habitat at the edge of lots that could potentially be suitable for this frog species as an extension of foraging habitat adjacent to its core breeding habitat and known area of occurrence.

No significant riparian habitat occurs within the vicinity of Station Street Extension. In relation to the WIPS Management proposal the main drainage line has been incorporated within the retained vegetation area, while a primary drainage line was not considered to be significant (as agreed with DNR).

6.4 Use of WSUD

EDAW has ensured that the development of Precinct 1 will be in accordance with best practice and in keeping with the principles of WSUD. Features incorporated into the precinct design and objectives include:

- Stormwater harvesting in tanks and re-use on-site;
- Industrial site design to minimise the generation of stormwater pollutants;
- Having a general target to reduce potable water demand by 40%;
- On-site detention for each development to capture and treat individual site runoff;
- A system of swales and raingardens associated with the roadsides to capture and treat runoff from the road system;
- Instream riparian works to improve the stability of existing nick point erosion heads via use of measures such as rock shutes.

Combined, these measures will ensure that impacts to the Green-thighed Frog and riparian / aquatic habitats are managed to the greatest possible standards.

7 IMPACTS UPON ADJOINING CONSERVATION AREAS

Land to the immediate south of Precinct 1 is a future part of Werakata National Park. The main 7(b) conservation corridor occurs to the immediate east of Precinct 1, while a small triangle of 7(b) land also occurs in the south western corner of the Precinct.

In terms of requirements to protect these areas measures include:

- Where any works occur adjoining the National Park / Conservation Area fencing is to be erected to exclude construction. Permanent fencing must also be erected post construction along the interface with Conservation Lands. This must also be 'fauna friendly' and preferably consist of post and wire rural type fencing;

- Appropriate clearing procedures should be followed during construction to ensure that Conservation Areas are not detrimentally impacted upon

- Boundary flagging and survey pegs are required to delineate the interface of the Development Lands and Conservation Areas

- Felled trees, cleared vegetation, soil or other non-approved foreign materials are not permitted to be placed or encroach upon the Conservation Areas

- A qualified ecologist shall be present during clearing works to ensure that compliance with these actions.

- Signage indicating restriction of access into the National Park / Conservation Area is to be erected;

- No additional runoff or erosion is permitted to enter the National Park / Conservation Area;

- Fire will be controlled from entering the National Park / Conservation Area as far as is practical;

- The HEZ Estate is to undergo continuing weed management to ensure that areas such as adjoining National Parks / Conservation Areas are not exposed to weeds.

Given these management requirements, which are outlined in various documents such as the HMS and DLCMP, impacts upon adjoining conservation areas are expected to be negligible, if not positive. Positive outcomes will be achieved for the 7(b) lands as these will be managed in perpetuity by the HEZA in relation to issues such as weeds, erosion, pests (such as foxes) access etc. Such measures are outlined in the CLCMP.

8 RECOMMENDATIONS

Recommendations are provided hereunder. These recommendations relate to Precinct 1 only. Recommendations for the other components of the application are contained within those accompanying reports.

8.1 Development Applications

a) The Ecological Constraints Master Plan (ECMP) dataset should be utilised for ecological reporting and assessment purposes;

b) The ECMP data should be verified in the field prior to reporting as conditions in the field may have changed over time. This should include at the least a one day walk over as well as any additional requirement identified by ecologists (including additional threatened species searches, stag-watching, etc.).

c) Where there are additional listings of threatened species, endangered populations, and ecological communities further targeted site-specific surveys should be undertaken;

d) Field surveys, reporting, and impact assessment must be carried out by a person or persons with qualifications and experience in undertaking ecological surveys in the locality. Curriculum vitae's of persons undertaking ecological assessments should be included as an appendix to flora and fauna assessment reports;

e) Reporting should demonstrate compliance with the Commonwealth DLCMP or provide justification where any deviations from the requirements of the DLCMP are needed;

f) Future records and observations of threatened flora and fauna identified during additional surveys should be documented in threatened species reports and are to include details of location, an estimate of population size, and a description of habitat attributes;

g) Reference to any potential impacts on adjoining conservation areas from a development proposal should be clearly indicated;

h) Any proposed conservation / mitigation measures should be clearly defined within development application documentation;

i) Outline conservation measures to be implemented on individual sites to protect significant habitats or potential wildlife corridors;

j) Preparation and submission of a landscape concept plan with any development application using locally native species;

k) Details such as fencing should accompany any development application outlining any potential impacts on wildlife;

l) A vegetation clearing plan should be prepared which details the extent of clearing and measures to protect adjoining habitat areas (such as fencing / flagging edge of clearing and habitat trees). This should be prepared and submitted with the development application.

8.2 Conservation Zones

a) Where development is approved and adjoins any conservation zone / area, the edge of clearing and/or boundary should be identified by surveyors prior to commencement of any works on site including vegetation clearing and/or construction works. A temporary fence or exclusionary tape is to be erected for identification purposes. A star picket and plain wire fence with coloured flagging would be considered appropriate and is essential as a means of preventing the possible entry of machinery into reserved land.

b) Soil and vegetation debris should not be stockpiled within conservation areas. All personnel involved in the clearing and construction operations for the development should be inducted on the significance of the conservation areas of the site prior to commencement of any works including clearing.

c) Best practice erosion and sedimentation control measures are to be installed in all appropriate drainage areas where surface runoff is likely to enter conservation zones, in particular riparian corridors. Control devices should be regularly checked and maintained throughout the duration of the clearing and construction phases, and particularly after each period of substantial rainfall;

d) Conservation zones including 7(b) lands and DEC Deferred Areas should be actively managed for conservation purposes via the HEZA estate management structure;

e) The interface between the 7(b) zoned lands (or other conservation areas) and a development site should be maintained in the long term so that weeds do not enter these areas or further degradation of bushland does not occur. Details to be provided on Landscape Plan submitted as part of the development application.

8.3 Development of Precinct 1 and associated infrastructure

a) Clearing of native vegetation for approved developments should be restricted to the development "footprint", including (but not limited to) building envelopes, carparking areas, services, asset protection zones and as detailed on any vegetation clearing plan;

b) Retained habitat areas within development allotments are along roadsides should be actively managed by individual owners and/or through the HEZA estate management structure.

8.4 Habitat Removal and Animal Welfare

a) A qualified ecologist should be present during all on-site clearing operations on the site to address any fauna welfare issues and to ensure that clearing occurs in accordance with any approvals;

b) Machinery and on-site construction workers should be made aware of their responsibilities and procedures concerning native vegetation during the construction process via a site induction and regular briefings by the on-site ecologist;

c) Exceptions to the above can be made for minor clearing works (ie. less than 0.1 hectare)

d) The locations of the nearest veterinary surgeries to the site should be determined prior to tree felling activities in case an animal is badly hurt and has to be transported and treated or euthanized;

e) Wildlife crossing signs appropriate street lighting and adequate speed reduction measures should be installed throughout Precinct 1, in areas adjoining or crossing the Environmental Protection (Conservation) Zone and National Park.

8.5 Habitat Compensation

a) Suitable natural hollows can be salvaged during the tree clearing operation and stockpiled for later use in the fauna habitat re-creation program. Natural hollows can be re-erected in trees within the habitat protection zones and reserved habitat areas within allotments provided adequately sized hollows are salvaged. Some natural hollows would require a base to be added, using either ply or recycled wood and screws instead of nails;

b) Large rocks or hollow logs removed during the clearing operation should be sensitively re-located into reserved habitats within allotments or conservation zones;

c) Artificial nest boxes of suitable size variation designed to cater for a diversity of fauna species, are to be erected in trees within 7(b) lands and retained habitats within the 4(h) lands. The numbers of nest boxes to be provided would be determined at the time of development approval and is to be based on the approximate number of habitat trees removed during the tree clearing operation. Given that significant areas of the 4(h) lands are likely to be cleared (4(h) lands containing over 7,000 hollows), it is considered that the principle of no net loss of hollows cannot be met in all practicality. Therefore the appropriate number of nest boxes to be erected as part of a development application should be determined by an ecologist and be dependent on the site characteristics and proximity to conservation zones and key wildlife corridors.

d) Maintenance and monitoring of nest boxes by HEZA should be undertaken on a three monthly basis. Failure to maintain nest boxes could potentially be detrimental to the faunal diversity as feral pest species have potential to take over nest boxes, in particular honeybees. Monitoring will also identify their level of acceptance and use by fauna and can greatly assist in and improve the success of future nest box programs. This process involves an inspection of each nest box and replacing any fallen or damaged nest boxes and removal of boxes containing feral bees or removal of nesting material from boxes occupied by pest bird species such as starlings, common mynahs and sparrows.

8.6 Animal Control

a) Pest eradication programs should be ongoing and followed up by monitoring. They should take into account peak breeding times of the target species and avoid impacts on non-target native species;

b) Pest eradication programs should be prepared and carried out by suitably qualified personnel and approved by Council and co-ordinated with any National Parks (DEC) program, prior to application. It may be possible to develop a joint program with the DEC to maximise effectiveness;

c) Any future industrial allotments in close proximity to conservation zones and/or containing retained habitat areas should be prohibited from housing cats and dogs, including security dogs.

d) Where security dogs are allowed, such lots shall provide adequate fencing to restrict dogs from entering the adjoining bushland.

e) Dogs should be prohibited from all conservation areas;

f) In areas where dogs are permitted, such as appropriate portions of the subdivision, entry would only be allowed on the strict provision that dogs be restrained at all times.

g) Where appropriate signs shall be erected along walking trails within conservation zones to enforce the prohibition of domestic pets in these areas.

8.7 Weed Eradication and Control

a) A weed eradication and control program should be established with the aim of preventing weeds colonising conservation zones and retained habitats in 4(h) lands. The program will need to be the responsibility of individual landowners. The HEZ Association should encourage all landowners to participate in this program and be responsible for monitoring and reporting. Cessnock City Council will need to implement its regulatory role to enforce this condition of the HMS;

b) Monitoring of weeds should be undertaken as part of the overall monitoring program and follow up weed removal operations undertaken if required;

c) Disturbed areas within the HEZ have potential to be rapidly colonised by exotic weed species. Disturbed areas should be stabilised and regenerated as soon as possible.

8.8 Bushland Revegetation / Regeneration

a) A comprehensive bushland revegetation program(s) should be adopted as a means of enhancing the quality of the retained habitats within the HEZ Development zones and disturbed portions of the 7(b) zone. The program will need to be responsibility of individual landowners and /or the HEZ Association who will be responsible for monitoring and reporting on the program.

8.9 Landscaping

a) A Landscape Plan should be prepared detailing the types of locally native plant species planned for use on the site and methods of planting;

b) All future landscaping works within allotments and roadside verges should be encouraged to only use locally indigenous plant species. This would involve collecting seed from local plant species at appropriate times and local propagation of species for re-use in landscaping sites;

c) A list of appropriate local endemic plants to be used in landscaping and bush regeneration works within the HEZ is available as collated by Bell and contained in the ECMP;

d) Where such species are not viable or commercially available, other suitable non-invasive native species may be utilised provided that they can clearly be demonstrated to be non-invasive and benign to the surrounding natural environment. In this regard any landscaping plan that proposes species not specifically listed by Bell must be accompanied by a written justification.

e) Landscaping works should include the minimal use of fertilisers in order that local soil and water conditions are not substantially changed and to maintain suitable habitat for native fauna;

8.10 Monitoring

Monitoring requirements are restricted to lands owned by HEZ Nominees and managed through the HEZ Association. On the basis of these factors, the initial monitoring program should be based on the following prescriptions:

(a) The HEZ Association (when established) should produce an annual monitoring and compliance report;

(b) The monitoring / compliance program and annual report should include:

   i. Threatened flora and fauna, biodiversity, and demographic monitoring of selected / sensitive sites within both 4(h) and 7(b) lands. A specific program is to be established by the HEZ Association and undertaken by a suitability qualified ecologist / consultant;

   ii. Monitoring of nest boxes on a three monthly basis;

   iii. Progress / works undertaken to date for revegetation, and pest and weed control programs.

(c) The monitoring / compliance annual report should highlight compliance achievements / failures, and where necessary include recommendations for further works to remedy such failures.

(d) Any monitoring program must be independently verifiable by determining authorities.

9 CONCLUSION

This EAR contains an assessment of the ecological outcomes in relation to Precinct 1 of the HEZ. In addition, it contains brief summaries of the ecological impact assessment conclusions identified from the site-specific ecological impact assessment reporting for:

- Station Street Extension;
- WIPS Management industrial manufacturing facility; and
- Pelaw Main By-pass Concept Plan.

The assessment of the ecological outcomes for Precinct 1 relies upon the comprehensive ecological data-set developed in 2004 as part of the formulation of the HEZ Ecological Constraints Master Plan (ECMP).

The NSW State Government has previously approved rezoning and subsequent industrial development of the HEZ Estate. In particular, the Department of Environment and Climate Change (previously DEC) provided an Assumed Concurrence for development of the estate in March 2005.

The Commonwealth Government approved development of the HEZ Estate in May 2007. This included construction of the Station Street Extension. Development of the HEZ is to occur in accordance with the Development Lands Conservation Management Plan (DLCMP) and Conservation Lands Conservation Management Plan (CLCMP).

Whilst pre-emptive subdivision is not permitted in the HEZ Estate under Cessnock LEP 1989, the Concept Plan includes subdivision of Precinct 1. The Concept Plan, including the subdivision of the land, demonstrate how masterplanning can result in improved environmental, ecological and development outcomes at HEZ. Areas shown as being retained / conserved and / or restored will be guaranteed as a result of this masterplanning process. This is in contrast to the current piecemeal approach taken to individual development ecological conservation under the existing Habitat Management Strategy (HMS) which, while worthy, is likely to result in a disconnected and fragmented landscape of small conservation “islands”.

In contrast, the Precinct 1 Concept Plan provides for a focus towards protection of the most important threatened species, endangered ecological communities and environmental features, including focus on:

- Integration and protection of the Endangered Ecological Community (EEC) Hunter Lowland Redgum Forest;
- Integration and protection of Green-thighed Frog riparian and aquatic habitat;
- Integration and protection of *Rutidosis heterogama* and *Callistemon linearifolius*;
- Integration and protection of approximately 16% of mature trees, 30% of winter flowering mature trees and 13% of hollow bearing trees. Of particular importance is the retention of 30% of winter flowering mature trees as they are of high significance for the nationally and state-listed threatened Swift Parrot and Regent Honeyeater and exceed the minimum 10% retention required under the EPBC approval. This is in addition to the retention of approximately 500 mature *Corymbia maculata* and *Eucalyptus tereticornis* within 7(b) conservation zones.

- Retention of substantial connectivity (terrestrial and aquatic) through proposing 20 m Conservation Setbacks from the road system in which existing natural vegetation will be retained. In addition, integration of substantive drainage areas into the proposed development.

- An ecologically sustainable stormwater capture, release and reuse system that will maximise water reuse efficiency and ensure that stormwater is captured and released at environmentally sensitive levels. This will incorporated capture and reuse of stormwater in tanks, the use of swales along roadsides and the use of on-site detention for each individual development.

Together, these measures will ensure that development of the first Precinct of the HEZ will set the standard in relation to the incorporation of significant ecological and environmental values into an industrial development design. This will ensure that the HEZ Estate will in fact become a "bushland" industrial estate, which is consistent with the original aims of the HEZ.

Assessment of the other components of the Part 3A application, including the Station Street Extension, WIPS Management Proposal and Pelaw Main By-pass has revealed that no significant impacts upon threatened species or EEC's are likely to occur.

Recommendations contained in this report are expected to feed into a Statement of Commitments that will apply to the proposal under Part 3A of the *EP & A Act 1979.*

APPENDIX A RPS HSO QUALIFICATIONS

Curriculum Vitae

Name: CRAIG ANDERSON

Office: RPS HARPER SOMERS O'SULLIVAN

Position in Company: Director - Environment

Qualifications / Memberships:

Bachelor Applied Science (Environmental Assessment & Management) University of Newcastle, NSW (1994)
Currently undertaking Graduate Diploma in Archaeological Heritage through University of New England

Ecological Consultants Association of NSW (ECA)
Planning Institute of Australia (PIA)
Frog and Tadpole Study Group (FATS)
Hunter Birds Observers Club (HBOC)
Bird Observers Club of Australia (BOCA)
Australasian Bat Society (ABS)
Hunter Heritage Network (HHN)

Waterways Authority Boating Licence
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Areas of Expertise:

- Production of complex ecological impact assessment documents
- Detailed understanding of environmental legislation
- Conflict resolution and environmental impact mediation
- Land and Environment Court hearings
- Flora, habitat, and fauna surveys including threatened species
- Bushfire Threat Assessment & Management reporting
- Project Management (including areas outside environmental concern)

Experience Includes:

2001 – current	Director - Environment RPS Harper Somers O'Sullivan, Newcastle.
2000 – 2001	Senior Ecologist & NSW Projects Manager Wildthing Environmental Consultants, Salt Ash.
1996 – 1999	Ecologist Wildthing Environmental Consultants, Salt Ash.
1995 – 1996	Ecologist / Environmental Officer Pulver Cooper & Blackley, Newcastle.

Curriculum Vitae

Name:	TOBY LAMBERT
Office:	RPS HARPER SOMERS O'SULLIVAN
Position in Company:	Senior Ecologist
Qualifications / Memberships:	B.Env.Sc. Ecological Consultants Association of NSW NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority

Areas of Expertise:

- Environmental and ecological impact assessment reporting
- Flora, fauna and habitat survey methodology design and management
- Detailed understanding of threatened species legislation and issues
- Terrestrial fauna surveys
- Renewable energy assessment
- Bushland and vegetation management
- Complex holistic project management
- Local, State and Commonwealth project co-ordination
- Dispute resolution and mediation

Experience Includes:

Dec 2005 - Current	Senior Ecologist RPS Harper Somers O'Sullivan, Broadmeadow, NSW
Mar 2005 - Nov 2005	Senior Project Manager Cumberland Ecology, Epping, NSW
Mar 2004 - Mar 2005	Principal Consultant – Co-founder Keystone Ecological, Kariong, NSW
Jan 1998 - Jan 2004	Ecologist / Senior Ecologist Conacher Travers Environmental Consultants, Somersby, NSW
June 1997 - Dec 1997	Environmental Scientist Australian Defence Industries (ADI), St Mary's, NSW
Early 1997	Field Assistant Anne Clements and Associates, North Sydney, NSW
1996	Research Assistant University of Newcastle, Callaghan, NSW

Curriculum Vitae

Name:	ALLAN RICHARDSON
Office:	RPS HARPER SOMERS O'SULLIVAN
Position in Company:	Ecologist
Qualifications / Memberships:	B.Env.Sc. (Environmental Management) B.Env.Sc. (Hons) (Biology) 2002 Hunter Environmental Institute Scholarship Hunter Bird Observers Club Waterways Authority Boating Licence NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority

Areas of Expertise:

- Ornithological Surveys and Research
- Terrestrial flora and fauna surveys
- Flora & Fauna Assessment and Reporting
- GPS Survey and GIS Mapping Projects
- Site and Logistics Management
- Tertiary Tutoring and Demonstrating

Experience Includes:

Jan 2005 – Current	Ecologist RPS Harper Somers O'Sullivan
Jul 2003 – May 2004	Casual Tutor/Demonstrator The University of Newcastle
Jul – Nov 2003	Casual Tutor/Demonstrator The University of Newcastle
Jan 2002	Ornithological Surveyor Wetland Care Australia, Ballina
Nov 1998 – Sep 2000	Manager, Caretaker, Ecologist Yarrahapinni Youth, School and Ecology Centre
Nov 1997	Ornithological Surveyor State Forests
1979 – 1998	Metal Fabrication Trade and Sub-contract Carpentry

Curriculum Vitae

Name:	DEBORAH LANDENBERGER
Office:	RPS HARPER SOMERS O'SULLIVAN
Position in Company:	Ecologist/ Botanist
Qualifications / Memberships:	B. Sc (Hons) Australian Plant Society Australian Ecological Society Australasian Native Orchid Society NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority

Areas of Expertise:

- Expert Botanist
  - Flora identification and habitat assessment
  - Targeted threatened flora surveys
  - Delineation and mapping of vegetation communities
  - Endangered Ecological Community (EEC) assessment
- Project Management and quote preparation
- Fauna habitat identification
- Experience with GPS/GIS for project design and mapping
- Environmental reporting and assessment
- Detailed understanding of environmental legislation

Experience Includes:

June 2006 – Current	Ecologist/ Botanist RPS Harper Somers O'Sullivan, Broadmeadow, NSW
Mar 2005 – Jun 2006	Botanist Conacher Travers, Gosford, NSW
Dec 2004 – Mar 2005	Research Assistant/Casual Demonstrator University of Newcastle, Newcastle, NSW

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Robert Browne-Cooper

Office: RPS Harper Somers O'Sullivan

Position in Company: Ecologist

Qualifications / Memberships:
B. Sc. (Biol)
Grad Dip Ed (Science Ed)
Cert Lab Prac (Biol Sci)
Member of the Society of Frogs & Reptiles (SOFAR)
WA Driver's Licence (Class C)
Senior First Aid
OHS General Induction for Construction Work (Green Card)
HUET – Helicopter Underwater Escape Training
TBOSIET – Offshore Safety Induction & Emergency Training
ARPA Accreditation – Agricultural Resources Protection Act
Author of several books on Australian Native Fauna

Areas of Expertise:

- Terrestrial flora and fauna surveys
- Flora & Fauna Assessment and Reporting
- Understanding of Environmental Legislation and threatened flora species issues
- Tree Clearance Supervision and Fauna Handling
- Wetland Sampling, Testing and Monitoring for Water Quality

Experience Includes:

September 2007 – Current	Ecologist RPS Harper Somers O'Sullivan, Broadmeadow, NSW
February 2007 – September 2007	Ecologist Bamford Consulting Ecologists WA
March 2004 – December 2006	Technical Officer Department of Food and Agriculture WA
February 2003 – January 2004	Completed a Grad Dip Ed
March 1995 – December 2003	Zoo Keeper Perth Zoological Gardens Board
June 1985 – March 1995	Laboratory Technician Water Corporation WA