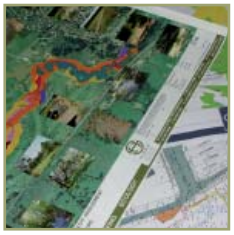

Distribution of Three Threatened Species

ANGOPHORA INOPINA
GREVILLEA PARVIFLORA SUBSP. PARVIFLORA
TETRATHECA JUNCEA

Prepared for
Johnson Property Group
PO Box A1308
Sydney South NSW 1235

Job Reference 24896 - January 2008

HARPER SOMERS O'SULLIVAN
PLANNING ▸ SURVEYING ▸ ECOLOGY
A member of RPS Group Plc

HARPER SOMERS O'SULLIVAN

PLANNING › SURVEYING › ECOLOGY

PREPARED BY:

RPS Harper Somers O'Sullivan Pty Ltd
PO Box 428
Hamilton NSW 2303
Tel: (02) 4961 6500
Fax: (02) 4961 6794
Web: www.rpshso.com.au

PROJECT: DISTRIBUTION OF THREE THREATENED SPECIES – ANGOPHORA INOPINA, GREVILLEA PARVIFLORA SUBSP. PARVIFLORA AND TETRATHECA JUNCEA	
CLIENT:	*JOHNSON PROPERTY GROUP*
OUR REF.	*24896*
DATE:	*JANUARY 2008*
APPROVED BY:	*DEBORAH LANDENBERGER*
SIGNATURE:	D Landenberger
CHECKED BY:	*CRAIG ANDERSON*
SIGNATURE:	C.T. Anderson

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1 INTRODUCTION

RPS Harper Somers O'Sullivan (RPS HSO) has been engaged by Johnson Property Group to gather and present data relating to the distribution and status of three threatened flora species within NSW.

These three threatened flora species include:

- ***Angophora inopina*** (Charmhaven Apple): listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and listed as Vulnerable on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- ***Grevillea parviflora ssp. parviflora*** (no common name): listed as a Vulnerable species under the TSC Act, and listed as a Vulnerable species under the EPBC Act.
- ***Tetratheca juncea*** (Black-eyed Susan): listed as a Vulnerable species under the TSC Act, and listed as a Vulnerable species under the EPBC Act.

1.1 Scope of Works

Records of threatened plant species are largely amassed via the findings of ecological surveys undertaken across NSW for a variety of reasons. Most surveys are undertaken by ecological consultants who hold a Scientific Licence under Section 132C of the *National Parks & Wildlife Act 1974* (NPW Act). As a requirement of this licence, licence holders must submit records of findings of threatened species to the NSW Department of Environment & Climate Change, who maintain ecological databases – namely the Atlas of NSW Wildlife.

As such, the Atlas of NSW Wildlife is generally seen as the best reference for understanding the distribution and numbers of threatened species. However, it is clear that total reliance on the Atlas data provides an incomplete picture for several reasons, namely:

- Records are generally only shown to the nearest kilometre, hence accuracy at a finer scale is misleading.
- Not all survey records are submitted as required and end up on the database, for a variety of reasons (NPWS officers, pers comm.)
- Numbers and counts are generally not supplied. As such a singular Atlas record may be for a large population of a given species, but only shows up as one record.
- Surveys are ongoing all the time, and as data submissions are generally made annually, there is always ecological data that has not as yet made it to the database.
- At times, there appears to be a lag between data submission and when it actually appears in the database (> 6 months is not unknown).
- Sensitive records may be withheld from the database by DECC (e.g. Wollemi Pine).

Combining this with the changes occurring in the land use landscape, including actual physical land clearance and also changes in conservation status / zoning of lands, it is recognised that all of the above factors contribute to a situation where it can be difficult to

accurately provide arrive at an informed position on an up-to-date status of the distribution, numbers and conservation status of a threatened species at any given point in time.

The study herewith, within the bounds of cost and time, attempts to gather and provide as much information as possible to provide an updated status on the three subject threatened flora species.

The proposed approach included:

- Obtaining the latest NPWS Atlas data for the three species.
- Approach contacts in DECC to see what is held in their internal databases / records and hopefully accessing.
- Approach other key consultants who we are aware have been working on these species and obtain their data.
- Gather as much data as possible from latest reports on key large parcels of land that are available on the public record.

In regards to above, DECC had no additional information for release to that available in the Atlas data.

Other consultants were largely unable to assist, either due to no data to provide, data already submitted to the Atlas, or data unable to be supplied due to commercial / client reasons.

Once this exercise was completed, the following analysis was undertaken:

- Generate and map area of occupancy for each species.
- Identify areas of occupancy (and known numbers where possible) conserved in existing conservation reserves.
- Generate a post Lower Hunter Regional Strategy (LHRS) status for the species assuming 100% development of lands identified for such in the LHRS, and taking into account areas conserved in both existing and proposed conservation reserves (from land dedications, new reserve creations etc as per the Lower Hunter Regional Conservation Plan).

It became apparent that generation of numbers was largely not possible within the scope of the study, and hence focus was shifted more onto identification and mapping of areas of occupancy, and concluding statements that could be drawn from the data available.

2 *ANGOPHORA INOPINA* (CHARMHAVEN APPLE)

2.1 Introduction

- listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act)
- listed as Vulnerable on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Angophora inopina is a small to large tree species which grows to 8m and is often multi-stemmed. It has short fibrous bark and the adult leaves are moderately glossy, coriaceous, mid-green, opposite, discolourous and paler beneath. The leaves are 4-11cm long and 0.8-2.6 cm wide. Inflorescences are compound and terminal with umbellasters 3 to 11 flowered. The general habit of *A. inopina* is dependent on environmental conditions, particularly fire history and other forms of disturbance. In areas of high frequency fires the tree takes on mallee form. This species has similar botanical affinities to *Angophora floribunda* (Rough-barked Apple), as both species have rough, fibrous bark and are similar in flower and fruit morphology (Bell, 2001).

2.2 Distribution

Angophora inopina is an endemic species of restricted distribution within New South Wales. It occurs in two distinct populations.

The 'northern' population has a known northern limit near Bulahdelah where a distinct population occurs. Records stretch through the Karuah area south to western Port Stephens.

The 'southern' population extend along the western side of Lake Macquarie from Wallsend in the north to Wyong in the south, with the majority of records being concentrated in the Charmhaven to Cooranbong area. Records occur as far east as the Gwandalan area. A lone record is also noted from the Quorrobolong area in the north-west.

The majority of this species occurs in southern Lake Macquarie-Wyong LGA's (Figures 2-1 and 2-2) and actuates to approximately 1250ha of occupied habitat across the area (Bell, 2001).

Table 2-1 Known records of *Angophora inopina*

Source	***Numbers of Angophora inopina***
Coal & Allied - Gwandalan *RPSHSO	3109
Atlas of NSW Wildlife Records	166
Total in region	**3275**

Table 2-2 Known Conservation areas with *Angophora inopina*

Conservation Areas	***Numbers of records of Angophora inopina***
Lake Macquarie State Conservation Area*	4
Coal & Allied Gwandalan Conservation Lands	3,000 (approx)
Karuah Nature Reserve*	5
Worimi Nature Reserve*	Unknown
Wallaroo Nature Reserve*	Unknown
Totals in Conservation Areas	**3,009**

**Atlas of NSW Wildlife Record*

The above figures are estimates only with the NPWS database records assuming that there was only one individual recorded at each location – no other population count data is available. These numbers are as such an underestimation of the population within the region, and are only useful from a species distribution viewpoint.

Recent work by RPS HSO (2007) within the Coal & Allied lands at Gwandalan show that at least 3,000 individuals will be conserved within the proposed conservation lands as an outcome of the Memorandum of Understanding (MoU) signed with the NSW State Government. This MoU was just one such agreement / outcome that has been fed into the LHRS and the LHRCP.

From a conservation distribution viewpoint, the species is protected in Conservation Reserves (both existing and proposed) in both the 'northern' and 'southern' populations.

2.3 Habitat

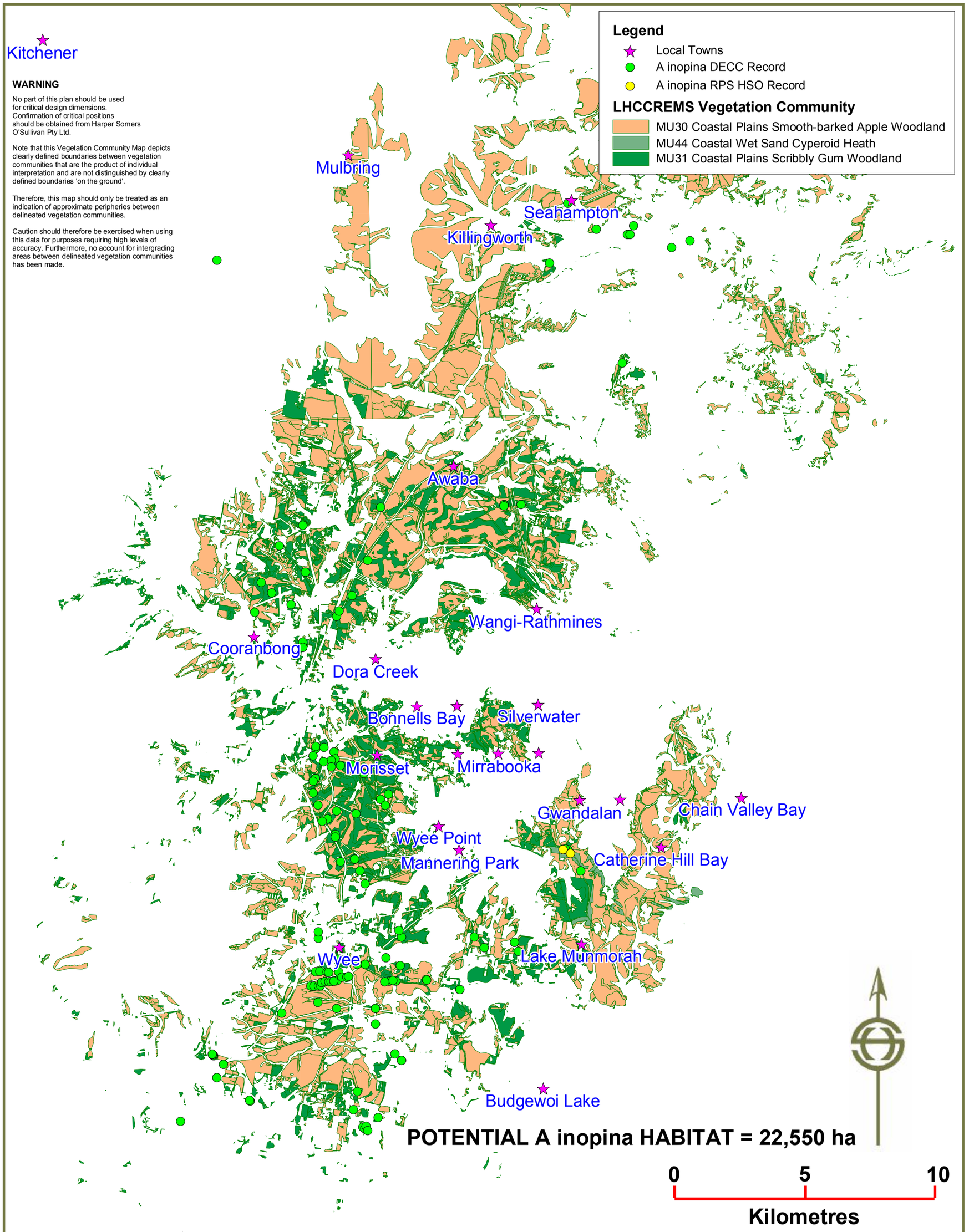
Angophora inopina occurs most frequently in three main vegetation communities:

1. *Eucalyptus haemastoma / Corymbia gummifera / Angophora inopina* Woodland/ Forest
2. *Hakea teretifolia / Banksia oblongifolia* Wet Heath
3. *Eucalyptus resinifera / Melaleuca sieberi / Angophora inopina* Sedge Woodland.

These three habitats within the central coast region occur on the Gorokan, Doyalson and Wyong Soil landscapes (Bell 2004b). Minor occurrences are also noted outside of these Soil Landscapes in differing vegetation formations.

Almost all known habitat for *Angophora inopina* occurs in a fire prone environment. The species is also known for its occurrence at a range of aspects and topographical positions (Bell 2001).

Given the above factors, it is considered likely that not all occurrences of this species have been documented across its range. To this end a desktop survey of potential habitat areas where *A. inopina* might occur was conducted. This survey identified potential *A. inopina* habitat by mapping those areas where both soil types and vegetation communities, upon which *A. inopina* is known to occur, overlap. The results of this survey are presented as two separate areas of *A. inopina*, representing those populations south and north of the Hunter River. The results are presented in Figures 2-1 and 2-2 respectively.



WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'.

Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities.

Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

TITLE: THREATENED FLORA MAPPING
POTENTIAL HABITAT - A inopina
SOUTH - HUNTER RIVER

CLIENT: JPG NORTH COORANBONG

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 131000 at A3 Size
DRAWN: A. Richardson
APPROVED: C. Anderson
DATUM: MGA Zone 56 (GDA 94)
DATE: 13/2/2008
LAYOUT REF: J:\JOBS\24k\24896 - North Cooranbong\Mapinfo 24896 A Inopina Dist Soils-Veg.WOR
CONTOUR INTERVAL: N/A
JOB REF: 24896

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Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'.

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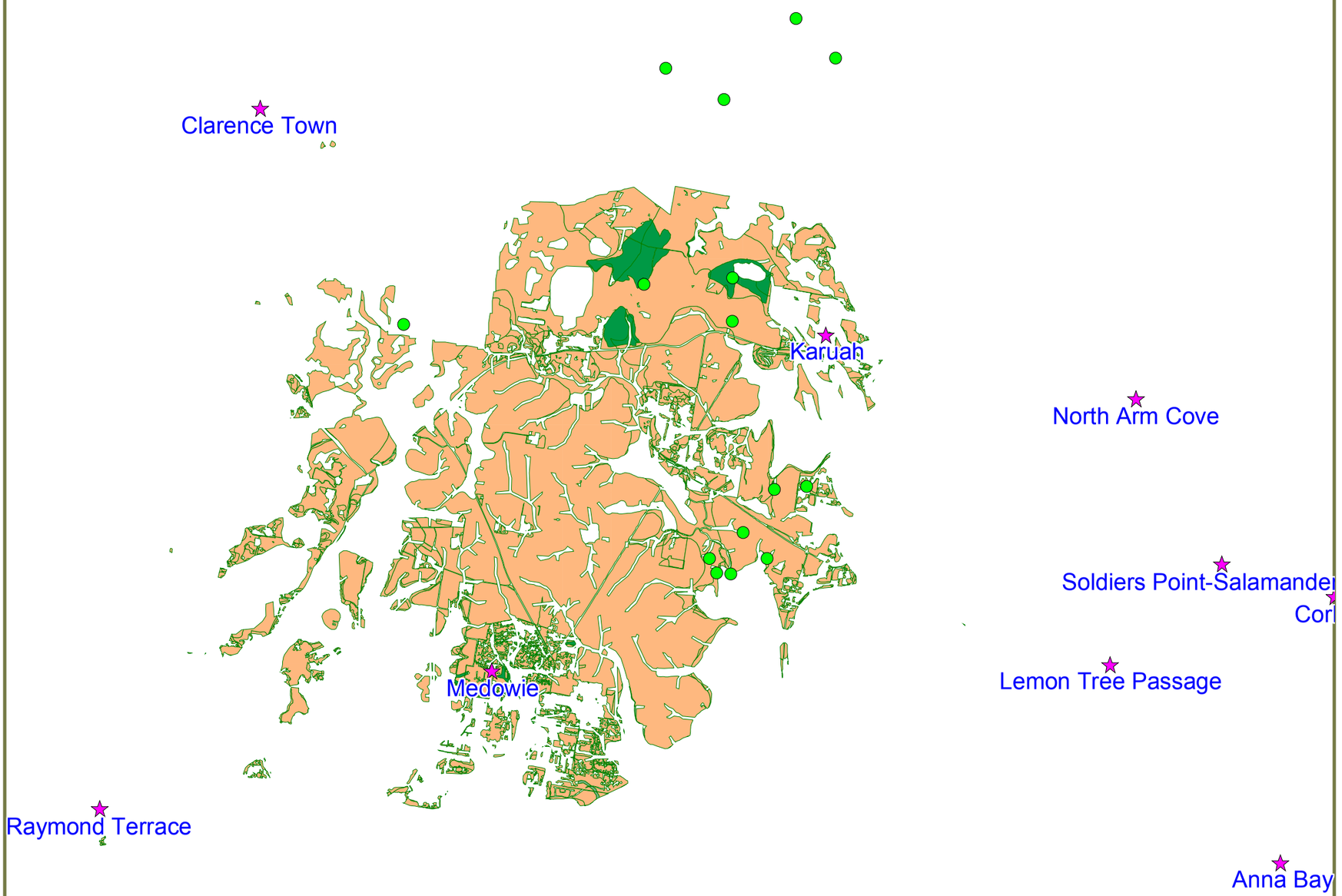
Legend

- Local Towns
- A inopina DECC Record

LHCCREMS Vegetation Community

- MU30 Coastal Plains Smooth-barked Apple Woodland
- MU44 Coastal Wet Sand Cyperoid Heath
- MU31 Coastal Plains Scribbly Gum Woodland



POTENTIAL A inopina HABITAT = 11,730 ha

0 5 10

Kilometres

TITLE: THREATENED FLORA MAPPING
POTENTIAL HABITAT - A inopina
NORTH - HUNTER RIVER

CLIENT: JPG NORTH COORANBONG

SCALE: 1: 131000 at A3 Size
DRAWN: A. Richardson
APPROVED: C. Anderson
DATUM: MGA Zone 56 (GDA 94)
DATE: 13/2/2008
LAYOUT REF: J:\JOBS\24k\24896 - North Cooranbong\Mapinfo 24896 A Inopina Dist Soils-Veg - North.WOR
CONTOUR INTERVAL: N/A
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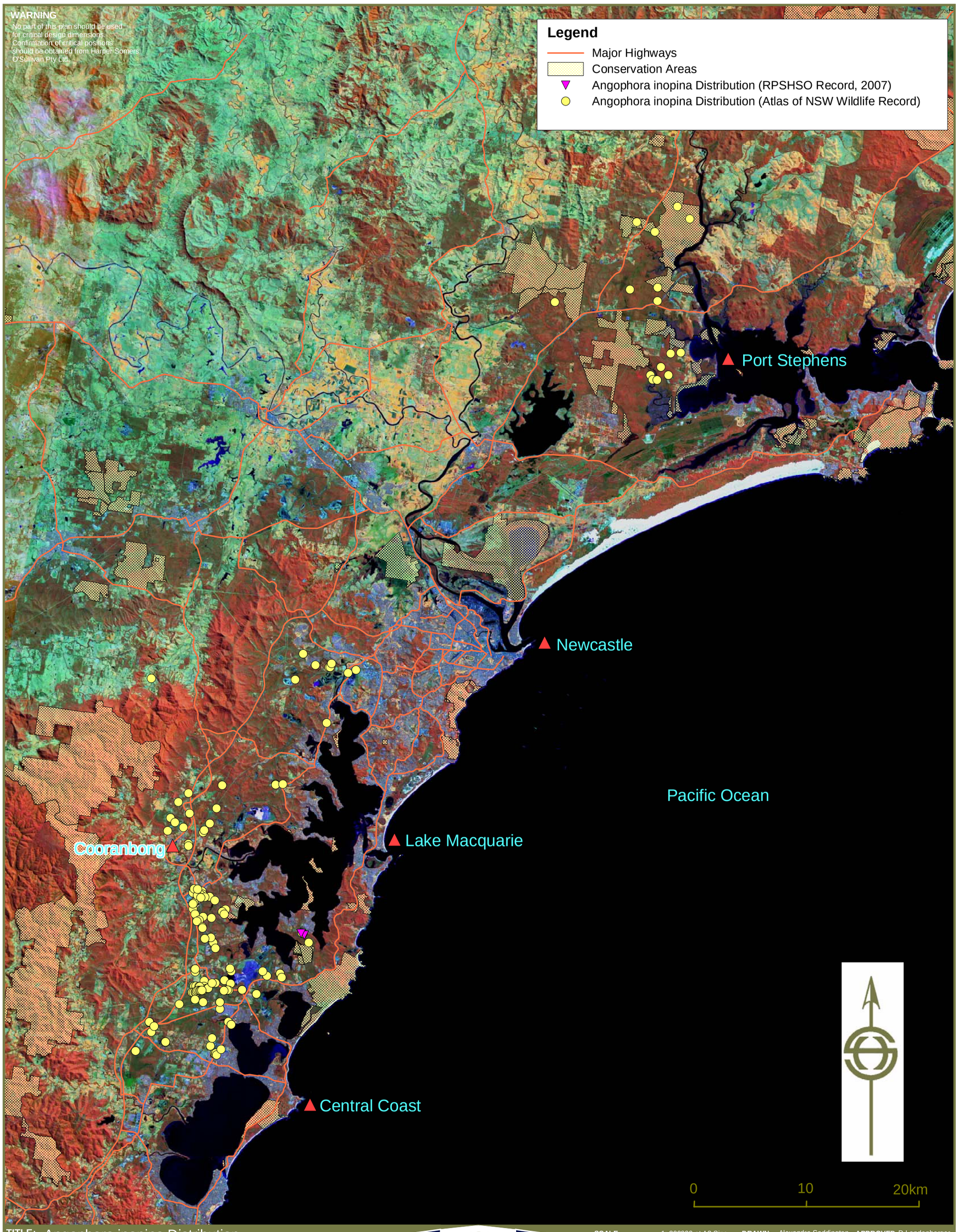
2.4 Conclusion

Whilst the distribution of *Angophora inopina* throughout its range appears well documented, little information is available in regards to numbers actually occurring in total.

Desktop survey works show that considerable habitat potential for *A . inopina* occurs south of the Hunter River with additional habitat occurring to the north (Figures 2-1 & 2-2). Given that the species occurs in a variety of vegetation types / aspects / topographical ranges, it is difficult to accurately predict actual occurrences at a desktop level, and therefore more accurate distribution mapping would need to be accomplished through on ground field surveys, if such data is required.

However, what is clear from this investigation is that:

- *Angophora inopina* is known to occur in at least five distinct conservation reserves (four existing, one proposed).
- The LHRS and associated MoU land dedications (Coal & Allied) will provide additional protection for this species within the Gwandalan area (@ 3000 specimens).
- Other proposed future developments not covered by existing MoU's may also add to areas conserved for *Angophora inopina* (and other species).



TITLE: Angophora inopina Distribution

CLIENT: Johnson Property Group

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 300000 at A3 Size **DRAWN:** Alexandra Saddington **APPROVED:** D.Landenberger

DATUM: MGA Zone 56 (GDA 94) **DATE:** 17/1/2008

LAYOUT REF: J:\JOBS\24k\24896 - North Cooranbong\Mapinfo 24896 Angophora inopina regionaldistribution A-A3.WOR

CONTOUR INTERVAL: N/A

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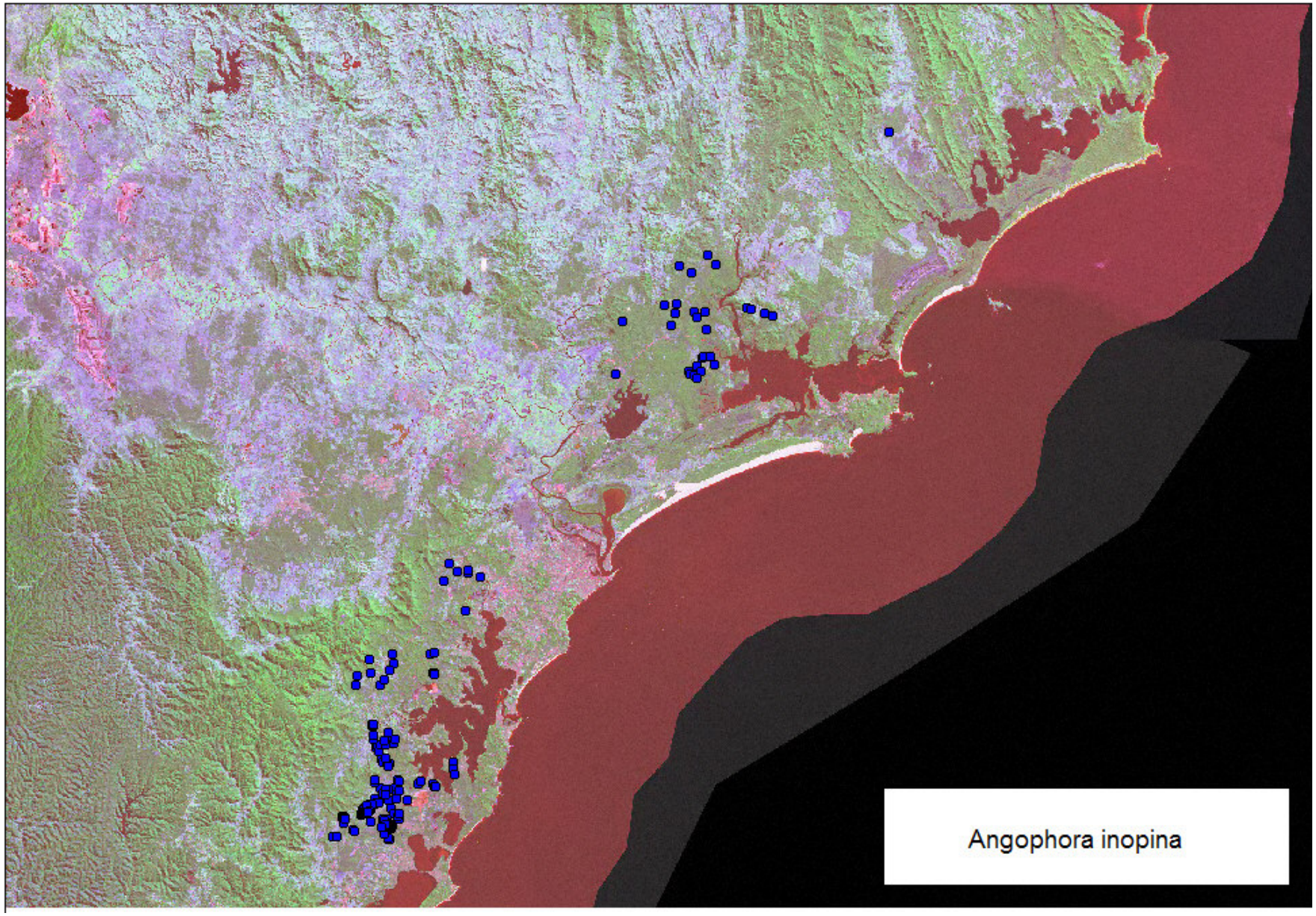
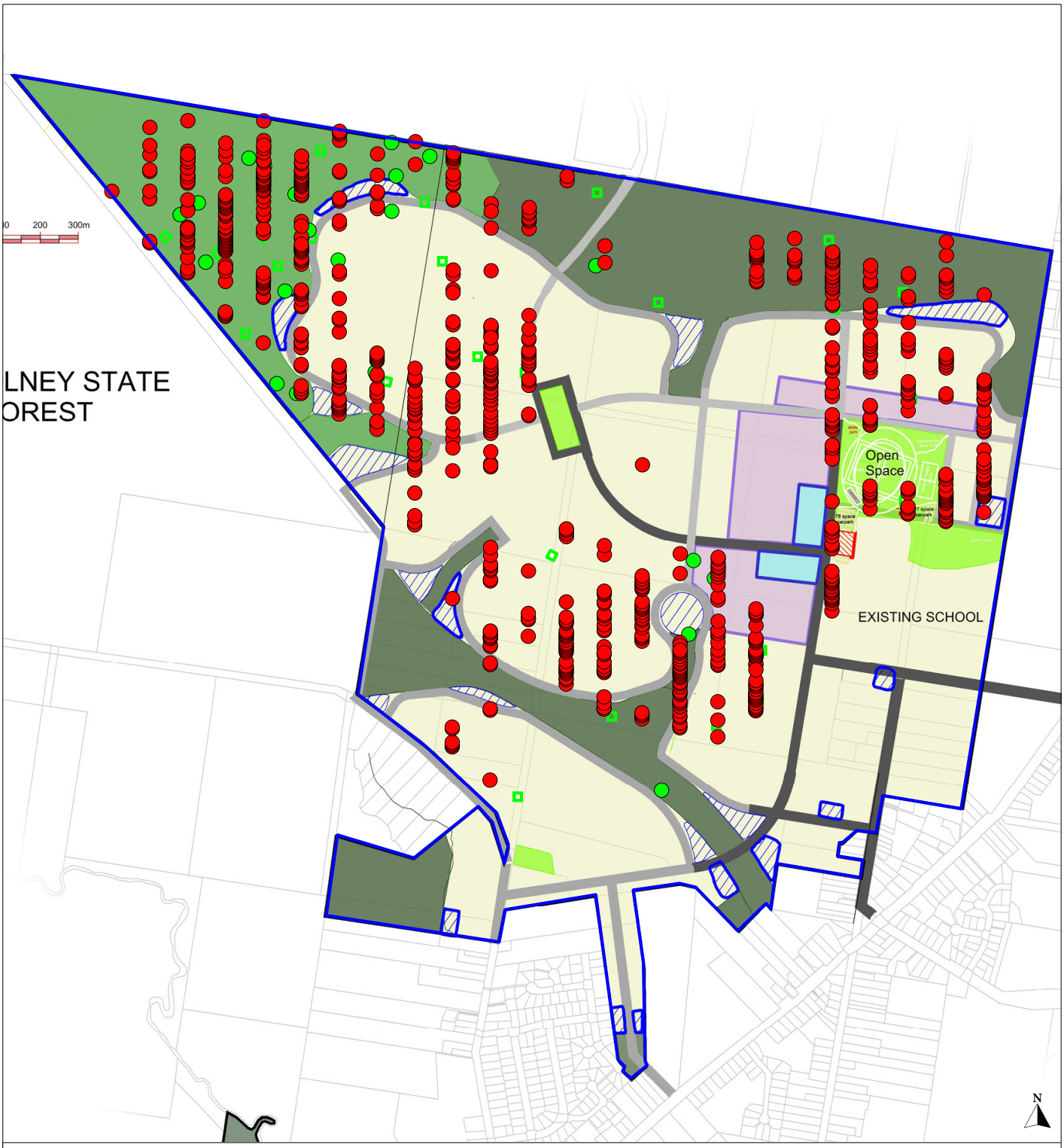

Angophora inopina



Legend

0 300 600
metres

Site boundary

Angophora inopina recorded along transects in 2008

Angophora inopina recorded in spot locations (Clements et al. 2004, 2005)

Angophora inopina recorded in quadrats (Clements et al. 2004, 2005)

Angophora inopina recorded on the Site

3 GREVILLEA PARVIFLORA SSP. PARVIFLORA

3.1 Introduction

- listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act)
- listed as Vulnerable on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Grevillea parviflora ssp. parviflora is a low open to erect shrub, 0.3-1m tall with linear leaves mostly 1.5-3.5 cm long and .8 to 2mm wide (Harden 2002). Conflorescences are erect and usually 6-12 flowered with white flowers. Flowering time is generally from July to October. It is likely that the *G. parviflora* complex (and allied species) requires taxonomic revision (B. Makinson pers. comm.).

3.2 Distribution

Grevillea parviflora ssp. *parviflora* is distributed from Prospect to Camden and Appin, with distinct populations occurring near Putty, Cessnock and Cooranbong. Simplistically, it occurs in two distinct areas:

- the 'southern' area occurring south west of Sydney; and
- the 'northern' area stretching from the Central Coast, west to Cessnock and north to Port Stephens.

The 'southern' population occurs as isolated records in the north near Prospect to the Bargo area and Camden and Appin.

The 'northern' population has a known northern limit near Karuah as a small number of records. The highest concentrations of records occurs in the Kurri Kurri / Cessnock area. Other records occur west of Lake Macquarie from Toronto in the north to Wyong in the south.

Surveys undertaken within the Cessnock LGA have shown that *Grevillea parviflora ssp parviflora* is a relatively common understorey species over a large portion of forested lands, including the Hunter Economic Zone (HEZ) study area (Harper Somers O'Sullivan 2002b; Harper Somers O'Sullivan 2002c). A number of records of the species from the locality are known from secure habitats within Werakata National Park (Bell 2004a; Atlas of NSW Wildlife 2005) and from a number of other 'unprotected' locations around Kurri Kurri, Heddon Greta (NPWS Atlas of NSW Wildlife 2005), Ellalong (Harper Somers O'Sullivan 2005b) and on the western slopes of the Sugarloaf Range (HSO ecologists pers. obs.). Approximate numbers for the region can be seen in Table 3-1. Figures 3-1 and 3-2 depict the distribution of this species within the region and NSW.

There is approximately two thirds of the HEZ site that will be set aside for conservation. This would equate to around 660,000 of the species being protected in this area alone. This species is currently conserved within Werekata National Park and Karuah Nature Reserve (Table 3-2).

Recent work by RPS HSO (2005) within Hardie Holdings lands at Ellalong Lagoon show that 'scattered clumps' of this species will be conserved within the proposed conservation lands

as an outcome of the Memorandum of Understanding (MoU) signed with the NSW State Government. This MoU was just one such agreement / outcome that has been fed into the LHRS and the LHRCP.

Table 3-1 Known distribution of *Grevillea parviflora ssp. parviflora*

Source	***Numbers of Grevillea parviflora***
Hunter Economic Zone (HEZ) Kurri Kurri site *RPSHSO	1,000,000
Atlas of NSW Wildlife Record	217
Total in region	**1,000,217**

Table 3-2 Known conservation areas with *Grevillea ssp. parviflora*

Conservation Areas	***Numbers of Grevillea parviflora***
Werekata National Park*	19
HEZ Conservation Areas (incorporating portions of Werakata NP)	660,000 (approx estimate)
Karuah Nature Reserve*	1
Hardie Holding Ellalong Lagoon Conservation Land	unknown
Total	**660,020++**

*Atlas of NSW Wildlife Record

The above figures are estimates only with the NPWS database records assuming that there was only one individual recorded at each location – no other population count data is available. These numbers are as such an underestimation of the population within the region, and are only useful from a species distribution viewpoint. The Werakata NP numbers are a particularly pertinent example of this.

From a conservation distribution viewpoint, the species is protected in Conservation Reserves (both existing and proposed) in three separate reserves within the 'northen' population (i.e. Hunter Valley / Central Coast area).

3.3 Habitat

Grevillea parviflora ssp. parviflora mainly grows in sandy or light clay soil areas. It may be found in flat low-lying area such as in Lower Hunter Valley and Lake Macquarie populations, but also occurs at higher altitudes in areas south of Sydney. Preferring areas with a good source of available light, it is common for the species to be found in open, slightly disturbed sites such as tracks, trails and road verges.

G. parviflora subsp. *parviflora* has been recorded from a range of communities including two endangered communities; Shale Sandstone Transition Forest (south of Sydney) and the Kurri Sand Swamp Woodland (Lower Hunter). It is also found in open-forest of *Corymbia maculata-Angophora costata* on Narrabeen Group and Permian Sandstones (Dooralong), Sydney Sandstone Ridgetop Woodland (Wedderburn) and Castlereagh Ironbark Woodland (Kemps Creek)., Lower Hunter Spotted Gum – Ironbark Forest (Kurri Kurri), Yellow Bloodwood Woodland (Ellalong) and Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland (Cooranbong).

Despite the range of associated communities several understorey species which are common to several of the known sites of *Grevillea parviflora* subsp. *parviflora* include *Allocasuarina littoralis, Daviesia ulicifolia, Kunzea ambigua, Banksia spinulosa, Leptospermum trinervium, Melaleuca nodosa, Pimelea linifolia, Themeda australis, Entolasia stricta* and *Eragrostis brownii*.

Given the above factors, it is considered likely that not all occurrences of this species have been documented across its range. This matter is further compounded by the taxonomic uncertainty surrounding identification of the *G. parviflora* group. Further work is required in this regard.

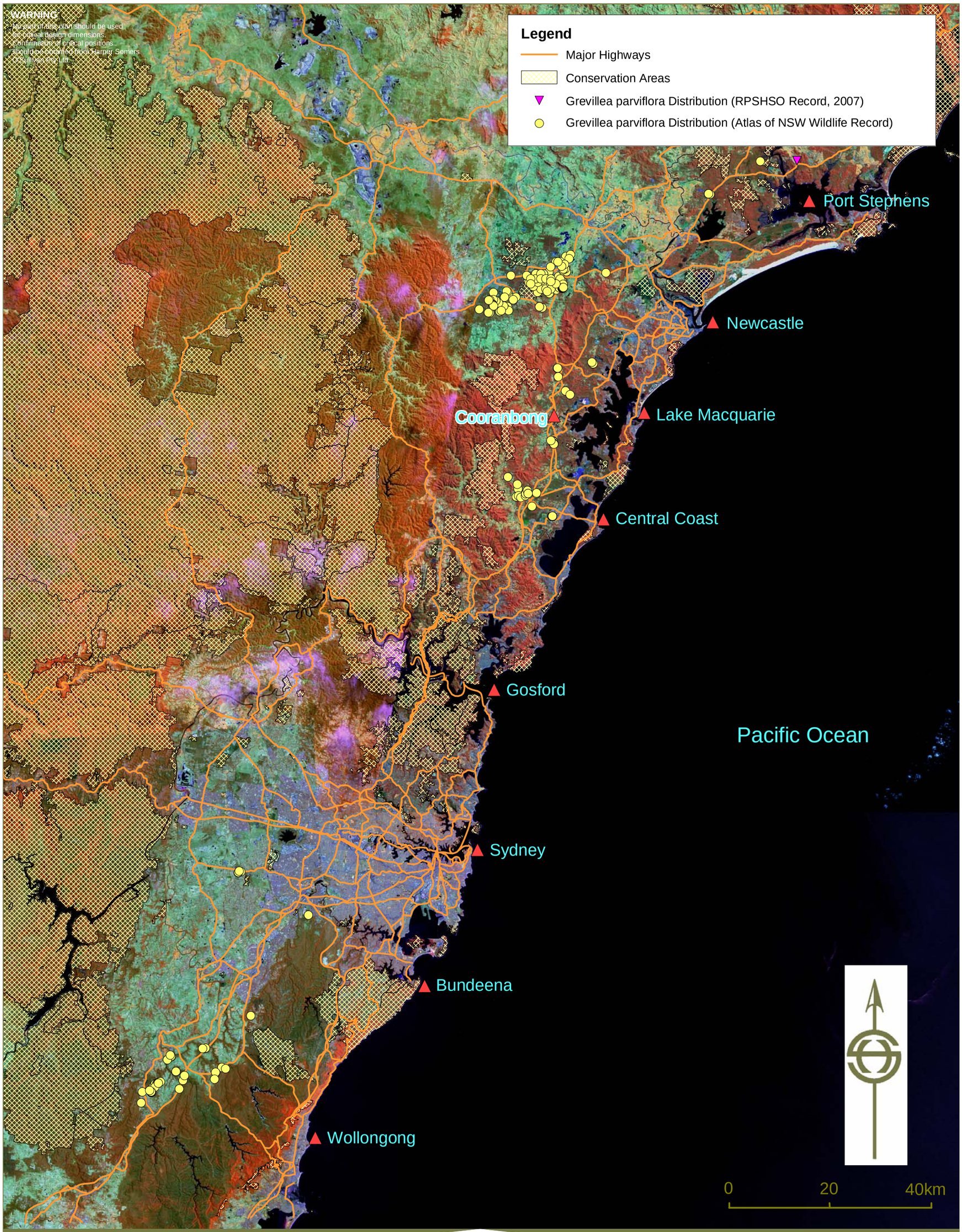
3.4 Conclusion

Whilst the distribution of *Grevillea parviflora ssp. parviflora* throughout its range appears well documented, liitle information is available in regards to numbers actually occurring in total.

Further survey works, data collection and collation would be required to more accurately inform the actual status of the species. Given that the species occurs in a variety of vegetation types / soil landscapes, it is difficult to accurately predict occurrence at a desktop level.

However, what is clear from this investigation is that:

- *Grevillea parviflora ssp. parviflora* is known to occur in at least four distinct conservation reserves (two formal reserves, one proposed, HEZ conservation 7(b) areas).
- The LHRS and associated MoU land dedications (Hardie Holdings) will provide additional protection for this species within the Ellalong area.
- Other proposed future developments not covered by existing MoU's may also add to areas conserved for *Grevillea parviflora ssp. parviflora* (and other species).



TITLE: Grevillea parviflora Distribution

CLIENT: Johnson Property Group

SCALE: 1: 670000 at A3 Size

DRAWN: Alexandra Saddington **APPROVED:** D. Landenberger

DATUM: MGA Zone 56 (GDA 94) **DATE:** 18/1/2008

LAYOUT REF: J:\JOBS\24k\24896 - North Cooranbong\Mapinfo 24896 Grevillea parviflora regionaldistribution A-A3.WOR

CONTOUR INTERVAL: N/A

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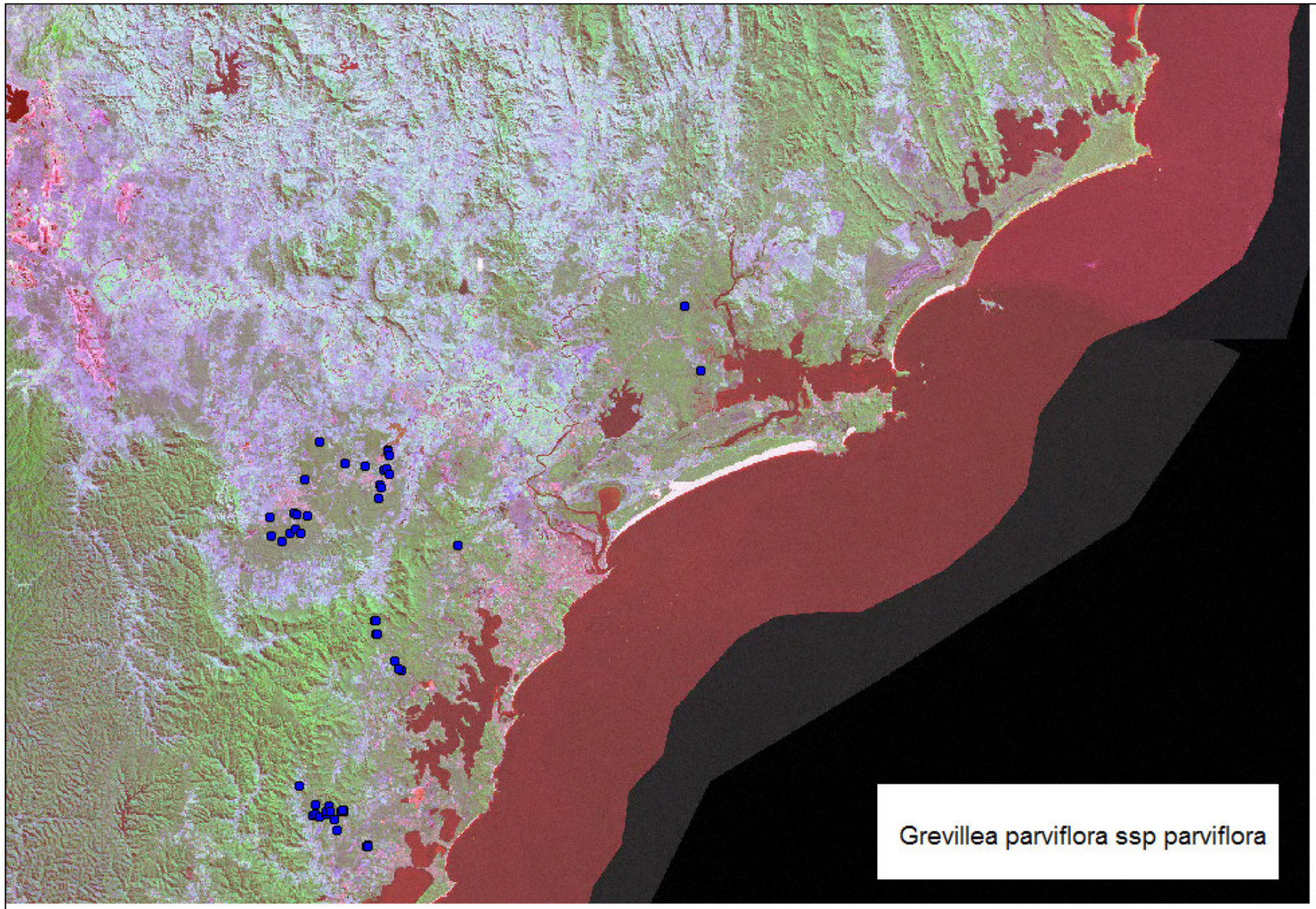
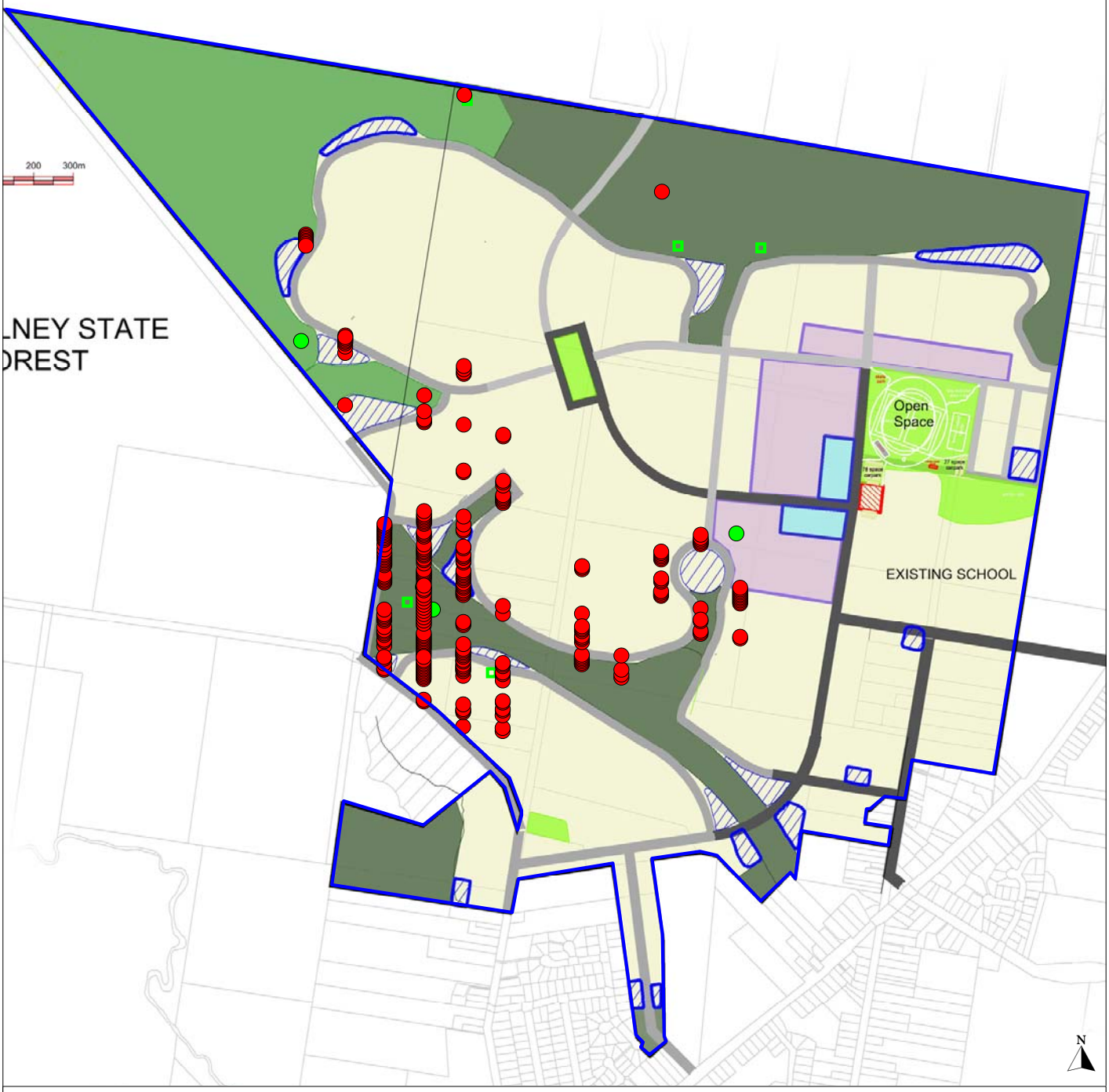

Grevillea parviflora ssp parviflora



Legend

0 300 600
metres

Site boundary

Grevillea parviflora subsp. parviflora recorded along transects in 2008

Grevillea parviflora subsp. parviflora recorded in spot locations (Clements et al. 2004, 2005)

Grevillea parviflora subsp. parviflora recorded in quadrats (Clements et al. 2004, 2005)

Greville parviflora subsp. parviflora recorded on the Site

4 *TETRATHECA JUNCEA* (BLACK-EYED SUSAN)

4.1 Introduction

- listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act)
- listed as Vulnerable on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Tetratheca juncea, of the family Tremandraceae, occurs as a small shrub, with prostrate stems up to 60cm long, usually less than 20cm high. It has distinctly angular stems and branches, with leaves reduced to minute scales. It produces four petalled purple to pink and occasionally white flowers, mainly from July to December, although flowering outside these times is not uncommon.

4.2 Distribution

Tetratheca juncea is distributed in distinct populations, generally in coastal districts. Simplistically, it occurs in two distinct areas:

- the 'southern' area occurring around Lake Macquarie; and
- the 'northern' area including an isolated population at Buladelah, and a population stretching around the north western sector of Port Stephens.

Historical sightings are also recorded in Sydney, but are now thought to be extinct.

The majority of this species is found in the Lake Macquarie LGA with major populations fringing around Lake Macquarie (Figures 4-1, 4-2 and 4-3).

Table 4-1 Known distribution of *Tetratheca juncea* in the region and known Conservation Areas.

Source	Numbers of *Tetratheca juncea*
Jillaby State Recreation Area ****	1
Wallaroo Nature Reserve****	1
Karuah Nature Reserve****	5
Tingira Heights Nature Reserve****	2
Awabakal Nature Reserve**	87
Glenrock Nature Reserve** & ****	1220
Wallarah National Park and Habitat Corridor at Murrays Beach*	9900
Munmorah State Conservation Area**	296
Lake Macquarie State Conservation Area**	29
Coal & Allied Catherine Hill Bay Proposed Offset lands	7,057
Coal & Allied Gwandalan Proposed Offset lands	6,591
Coal & Allied Nords Wharf Proposed Offset lands	5,933
Proposed Rosegroup Offset lands***	214
Atlas of NSW Wildlife Records	828
Total in region	**32,164**
Total in Conservation Areas	**31,336**

*Data from Conacher Travers (2007)
** Data from Payne (2000)
***Data from RPSHSO (2007) and Wildthing (2003a)
**** Atlas of NSW Wildlife Records

The numbers outlined above are an underestimation of the total amount within conservation reserves as each NPWS record has been assumed to be one specimen, which is clearly not the case. These numbers are as such an underestimation of the population within the region, and are only useful from a species distribution viewpoint.

At the time of production of the original *Tetratheca juncea Plan of Management* (Payne, 2000), it was suggested that the total *T. juncea* population was probably in the order of 10,000 specimens. However, numerous surveys since this time have discovered numbers far in excess of this figure on individual holdings. Whilst the total number of specimens of the species has not been determined, it is clear that it is at least in the order of hundreds of thousands, if not more. All of the conservation goasl outlied in Payne (2000) have ben met and exceeded.

As an example, within the Coal & Allied lands at Catherine Hill Bay only the habitat within the development areas has been targeted for final counts and it is estimated that 350ha of occupied habitat occurs, containing thousands of clumps of the species. Surveys on other holdings on the Wallarah Peninsula have likewise identified large populations of this species. The majority of these areas either occur with recently created reserves, or areas proposed to become reserves as part of MoU land transfers associated with the LHRS and LHRCP.

4.3 Habitat

Tetratheca juncea prefers habitat with strong competition from a high density of native plants that indicates a balance between fire and succession (Payne 2000). It has also shown a preference for dry ridges with shady conditions (Payne, 2000).

It occurs in sandy heath and dry sclerophyll forests throughout its range. Norton (1994) and Payne (2000) have described the preferred habitat attributes as:

- sites with clay soils derived from conglomerates with a neutral pH;
- low nutrient soils that have a dense cover of grasses and Fabaceous species
- sloping sites below ridgelines, extending to approximately midslope;
- sites situated between 30 and 70m above sea-level;
- sites with a predominantly south-east to south-west aspect;
- areas providing partial shade, as in Open Woodlands.

Tetratheca juncea has, however, been identified in different habitats to those described above and it is believed that the species is adaptable so long as micro-climatic conditions are favourable. *Tetratheca juncea* occurs along the conglomerate cliffs adjoining Lake Macquarie at Sunshine. They may at times occur on creek lines and at Bulahdelah it is found in rock crevices on cliff faces. The Bulahdelah population is thought to be disjunct, although recent discoveries of large populations on the northern shores of Port Stephens around North Arm Cove possibly provide a linkage to the northern stands. According to Payne (2000) *Tethratheca juncea* will preferentially grow on Munmorah Conglomerate geology and the Awaba Soil Landscape Unit. The most commonly found associating species are, *Angophora costata* (Smooth-barked Apple), *Eucalyptus globoidea* (White Stringybark), *Corymbia gummifera* (Red Bloodwood), *Acacia myrtifolia* (Myrtle Wattle), *Acacia uncinatum*, *Pultenea stipularis*, *Dillwynia retorta* (Heathy Parrot Pea), *Leptospermum trinervium* (Paperbark Tea-tree) and *Gompholobium latifolium* (Broad-leaf Wedge-pea).

Given the above factors, and its cryptic nature making it largely undetectable in the non-flowering period, it is considered likely that not all occurrences of this species have been documented across its range. Further work is required in this regard.

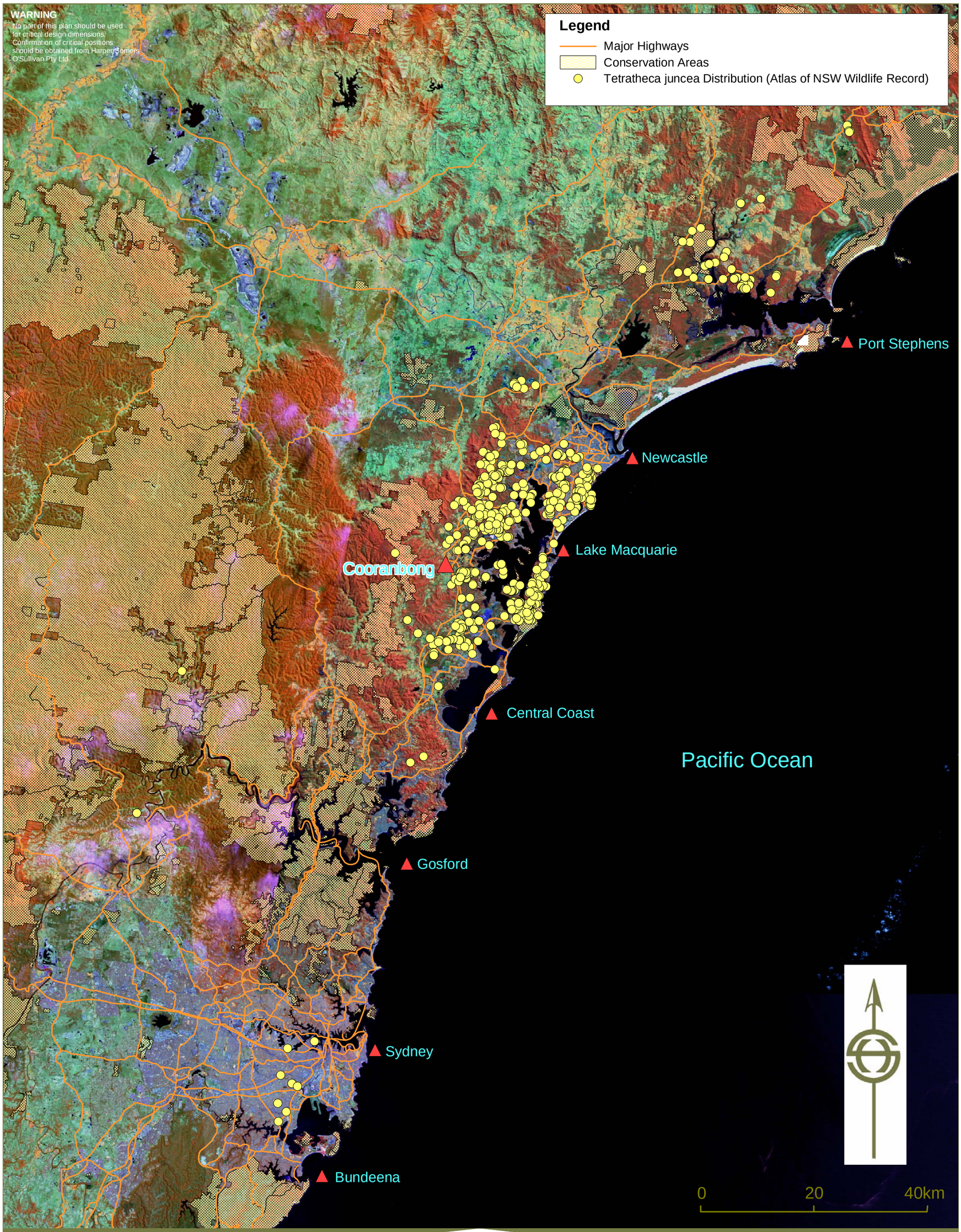
4.4 Conclusion

Whilst the distribution of *Tetratheca juncea* throughout its range appears well documented, liitle information is available in regards to numbers actually occurring in total.

Further survey works, data collection and collation would be required to more accurately inform the actual status of the species. Given that the species occurs in a variety of vegetation types / soil landscapes, it is difficult to accurately predict occurrence at a desktop level.

However, what is clear from this investigation is that:

- the species is far more abundant than evidence suggested at the time of its listing as a threatened species.
- It is known to be protected in a large number of existing and proposed conservation areas, and is considered to be adequately protected in the Lake Macquarie area.
- The LHRS and associated MoU land dedications (Coal & Allied, Rosegroup) will provide additional protection for this species within the Wallarah Peninsula / Southern lLke Macquarie area.
- Other proposed future developments not covered by existing MoU's may also add to areas conserved for *Tetratheca juncea* (and other species).



TITLE: Tetratheca juncea Distribution

CLIENT: Johnson Propert Group

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 600000 at A3 Size

DRAWN: Alexandra Saddington

APPROVED: D. Landenberger

DATUM: MGA Zone 56 (GDA 94)

DATE: 17/1/2008

LAYOUT REF: J:\JOBS\24k\24896 - North Cooranbong\Mapinfo\24896Tetratheca juncea regionaldistribution A-A3.WOR

CONTOUR INTERVAL: N/A

JOB REF: 24896

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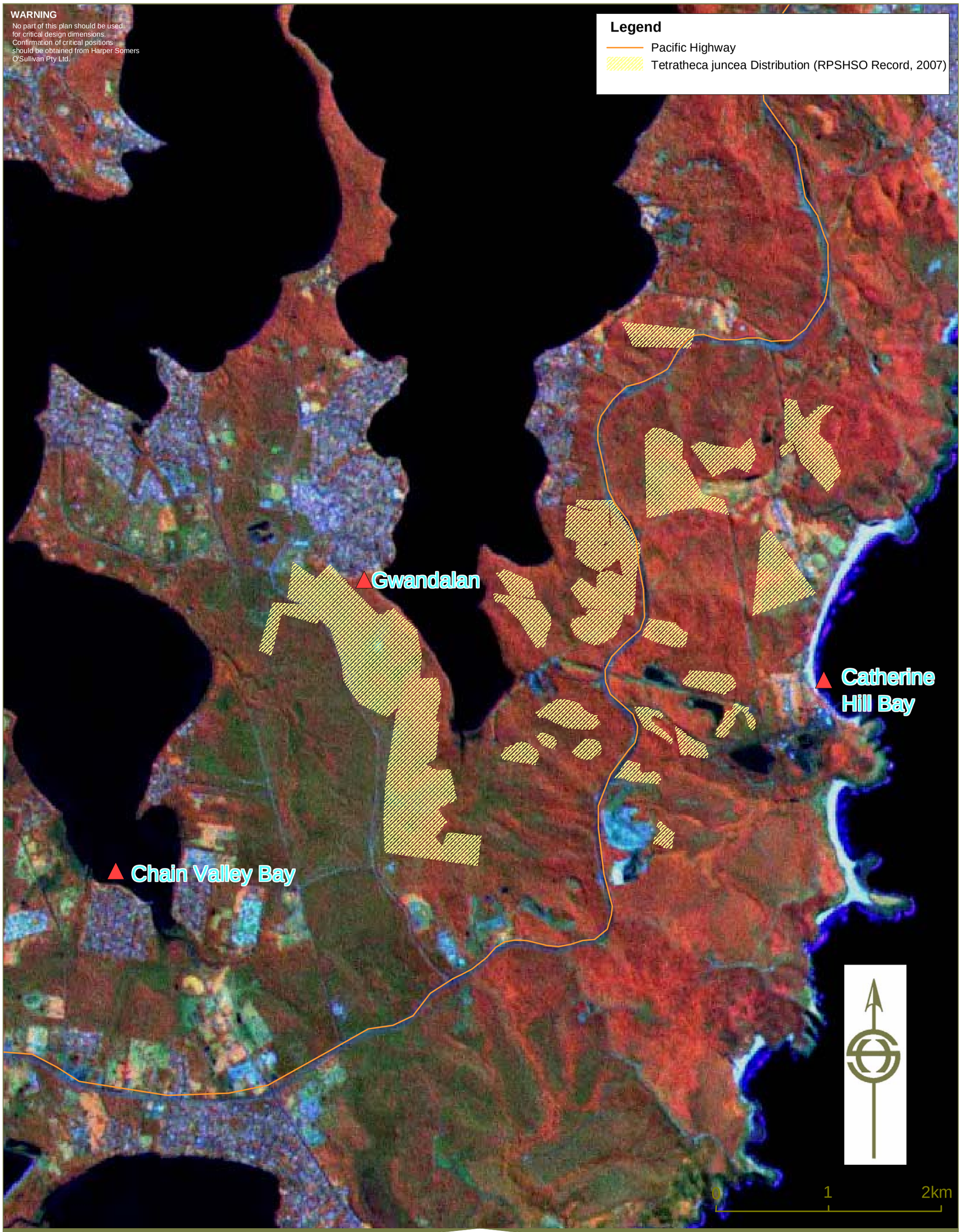

TITLE: Tetratheca juncea Distribution, Gwandalan

CLIENT: Johnson Propert Group

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 30000 at A3 Size

DRAWN: Alexandra Saddington

APPROVED: D. Landenberger

DATUM: MGA Zone 56 (GDA 94)

DATE: 17/1/2008

LAYOUT REF: J:\JOBS\24k\24896 - North Cooranbong\Mapinfo 24896Tetratheca juncea gwandalanidistribution A-A3.WOR

CONTOUR INTERVAL: N/A

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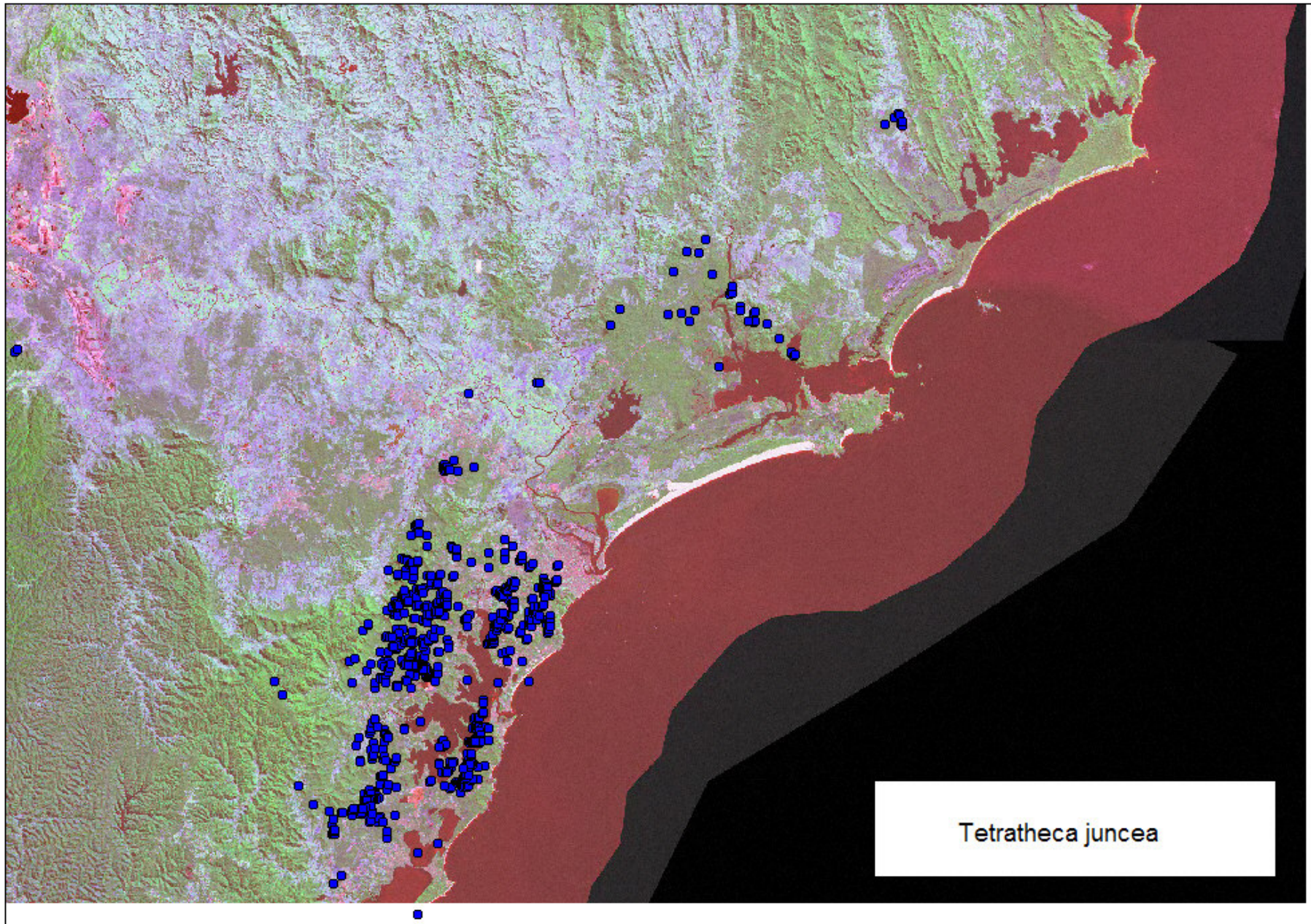
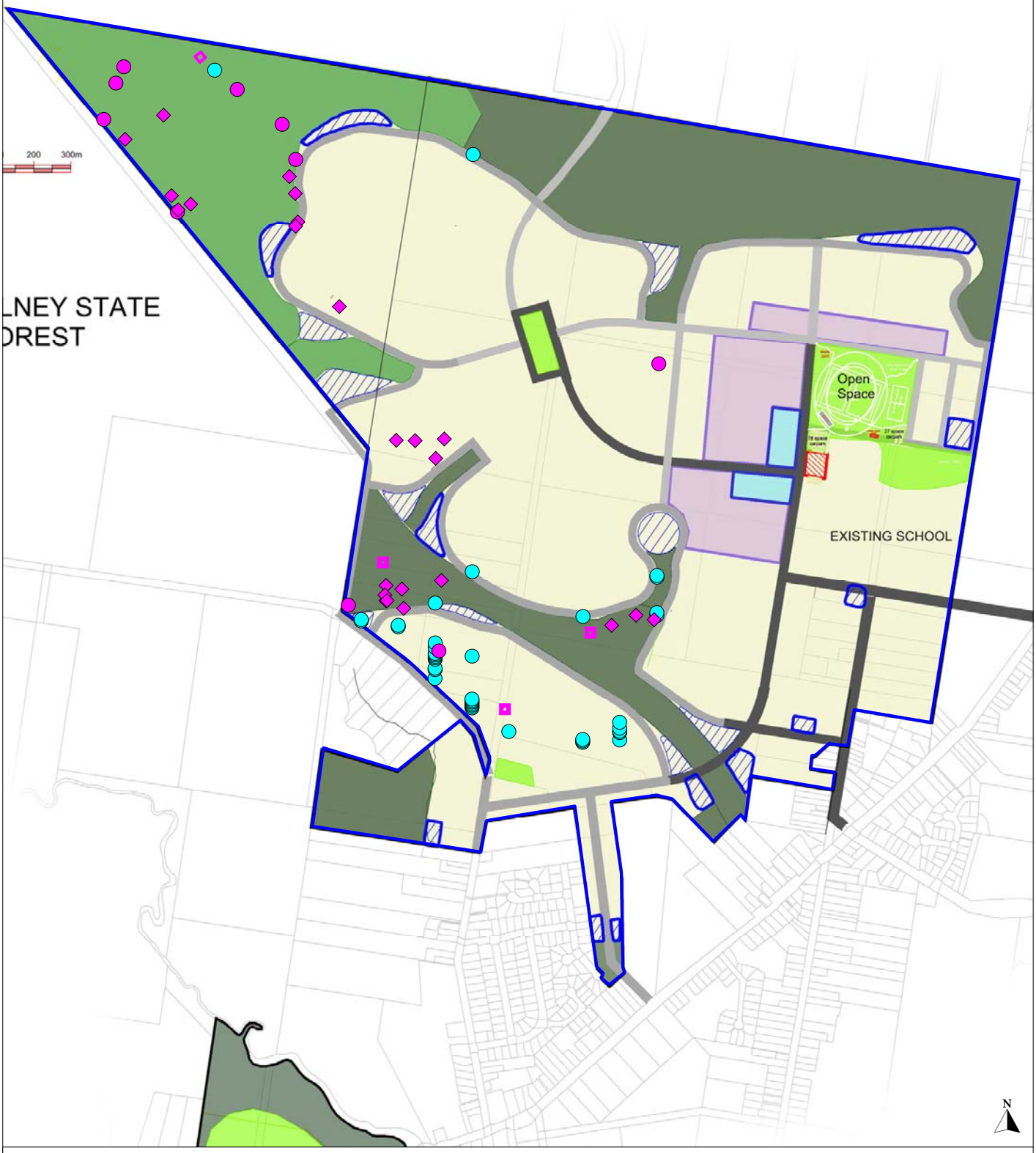

Tetratheca juncea



Legend

0 300 600
metres

- Site boundary
- Tetratheca juncea recorded along transects in 2008
- Tetratheca juncea recorded in spot locations (Clements et al. 2004, 2005)
- Tetratheca juncea recorded in quadrats (Clements et al. 2004, 2005)
- Additional T. juncea records on the Site by Michael Murray/ACA

Tetratheca juncea recorded on the Site

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