Corunastylis littoralis Tuncurry Midge Orchid Combined Survey Results 2010/2011

North Tuncurry

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1 Introduction

RPS Newcastle has been commissioned by Landcom to undertake detailed surveys for the critically endangered *Corunastylis littoralis* (Tuncurry Midge Orchid). The survey work has been conducted over a proposed development site, Lot 331 DP 1104340, located at North Tuncurry (the site) and over various other lands between Old Bar in the north and Booti Booti National Park in the south.

The surveys were conducted over two successive flowering seasons in 2010 and 2011 and the purpose of the surveys was to:

- Ascertain the likely numbers of the orchid on the site;
- Gain a better understanding of the geographical range of the species;
- Establish the habitat preference; and
- Provide insights into the ecology of this poorly understood species.

The 2010 surveys within the site concentrated on habitat type known to support the orchid from previous survey work by others. These surveys recorded the majority of Tuncurry Midge Orchid (TMO) individuals within disturbed areas of the site and within adjacent heath habitats. It was therefore deducted, similar to the available literature on this species, that TMO responds well to disturbance, whether this is through mechanical, fire or other disturbance mechanisms. A question however remained as to whether TMO also occurred within the less disturbed dense core heath habitat, which occupies the majority of the site.

Accordingly the 2011 survey work within the North Tuncurry site focussed on stratified sampling of the under-surveyed heath habitats to ultimately estimate the potential population within this habitat on site. This habitat type had previously been under-surveyed due to the physical difficulty of walking through the dense, spiky heath.

In addition to the on-site surveys, additional off-site surveys were conducted in 2011, principally in lands within proximity to the site, which have had TMO previously recorded and / or have potential habitat present. The results of all survey work to date are presented in this report.

1.1 Background

TMO is listed as critically endangered under the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth) (EPBC Act) and Threatened Species Conservation Act 1995 (TSC Act). The species is a small midge orchid which has been recorded in the Tuncurry locality, NSW, within the Great Lakes Local Government Area (LGA). The critically endangered status of TMO is predominately due to its very restricted distribution and hence vulnerability to impacts such as weed invasion and habitat loss.

The site was first reported as being potentially important for TMO in Paget A (2008). Paget recorded 452 individuals from 21 locations scattered across the site. Records were mainly along access tracks, along the major power easement running north-south and within a 'core population' within the north of the site. Using this data, Paget estimated a total population size for the current site of between 600 and 1200 plants. Paget also undertook searches within potential habitat to the north and south of the site, particularly within Darawank Nature Reserve and Booti Booti National Park. No additional populations were recorded at that time.

In 2010 RPS undertook additional field surveys targeting the TMO within the site and throughout the wider Forster-Tuncurry area. RPS was able to collect new information on the distribution, abundance and habitat characteristics of the species. The 2010 RPS surveys recorded TMO within three locations:

- North Tuncurry. A total of 1812 individual plants were identified by RPS within the same area as identified by Paget (2008). Hereafter this population is referred to as the 'North Tuncurry population'.
- West of Wallamba River in Nabiac locality. A total of 58 individual plants were identified. New location. Hereafter this population is referred to as the 'West of Wallamba River population'.
- Booti Booti National Park. A total of 90 individual plants were identified. New location. Hereafter this population is referred to as the 'Booti Booti NP population'.

The 2011 surveys sought to establish the extent TMO population within lands outside the proposed development site and to further expand the understanding of TMO habitat usage through systematic quadrat surveys of the dense heath environs within the site.

2 Methods

2.1 On-site Surveys

A number of targeted surveys for TMO have been completed by RPS to date. These have been conducted over a range of areas and over two flowering periods. A standard search methodology has been maintained throughout. The general methodology has consisted of two RPS ecologists walking parallel transects spaced approximately 10m apart within habitat areas, walking transects and quadrat searches within known habitats within the site. These habitats included areas of disturbance such as power easements and tracks. Vegetation communities and habitats where the TMO has been previously recorded were also targeted. Where positive records are made, searches within adjacent vegetation are also undertaken in attempt to record additional individuals and improve the understanding of habitat associations. Above ground stems were counted and mapped using a differential Trimble Geo XH GPS with sub-metre accuracy (after post-processing).

During the 2011 surveys, a variation of this methodology was required to enable a population estimate to be calculated that included the heath environs on the North Tuncurry development site. A series of random plots were set up within the heath vegetation within the site, each being 40 x 40m (0.16ha) in size. Within each of these plots, two RPS ecologists walked parallel transects approximately 2m apart (refer to Figure 2-1 below).

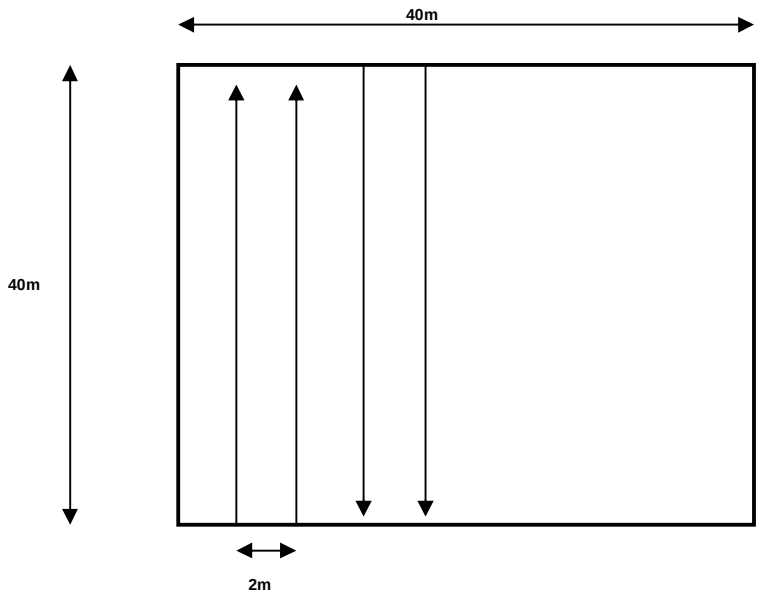


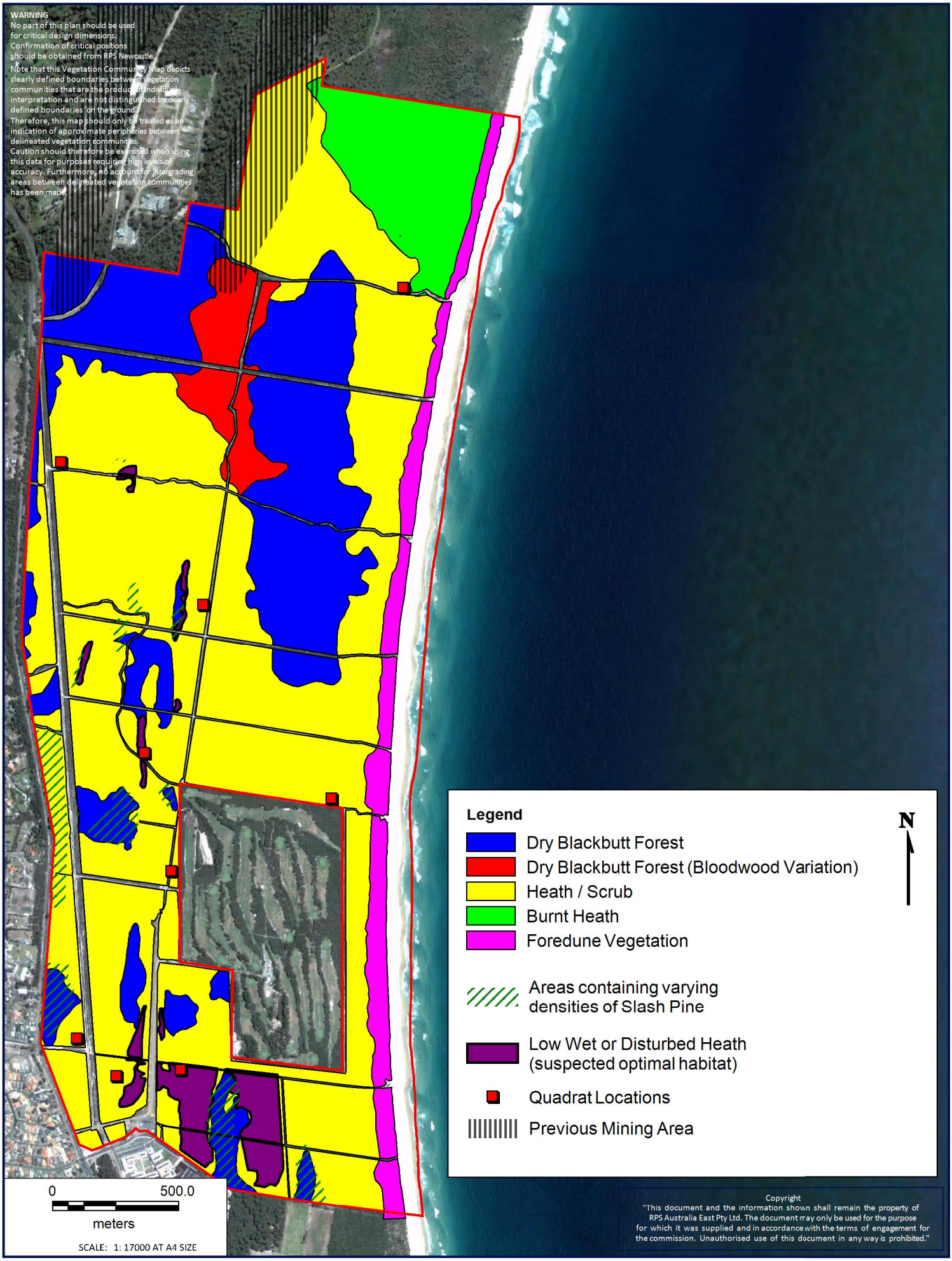
Figure 2-1: Diagram of plot (not to scale)

Given the variability of heath vegetation within the site, which may have potential implications towards TMO habitat suitability, several parameters were recorded within each quadrat. These included:

- species and percentage foliage cover (PFC) of each strata;
- height of vegetation;
- thickness of ground debris;
- percentage cover of ground debris; and
- disturbance levels.

Collection of these attributes within each quadrat has expanded the knowledge of the habitat preferences of TMO. Additionally it allows identification of areas of similar vegetation structure in the wider Great Lakes area that may accommodate TMO.

The surveyed quadrat locations are shown in Figure 2-2 below.



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TITLE: FIGURE 2 2: QUADRAT SURVEY LOCATIONS | LOCATION: TUNCURRY | DATUM: DATUM | PROJECTION: MGA ZONE 56 (GDA 94) | DATE: 10/6/2011 | PURPOSE: ECO INVENTORY | LAYOUT REF: J:\JOBS\26K\26414 - North Tuncurry\10-Drafting\Inventory Report Figures | VERSION (PLAN BY): PH (C-A4)

CLIENT: LANDCOM
JOB REF: 26414

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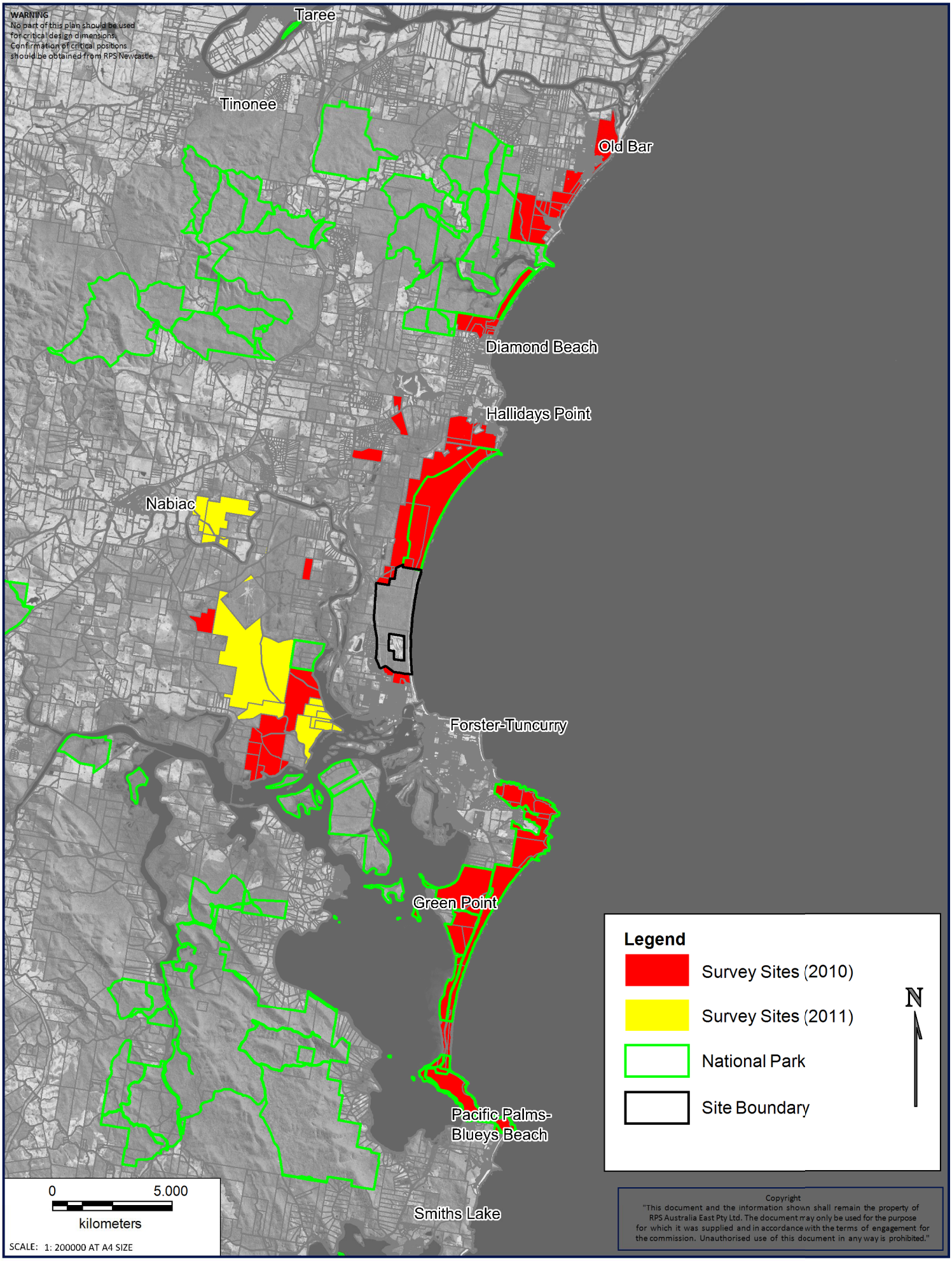
2.2 Off-site Surveys

Off-site areas were targeted by RPS in both 2010 and 2011 in order to ascertain the extent of the orchid population in the wider region (see Figure 2-3). Surveys included lands owned by Crown Lands, MidCoast Water (MCW) and Foster Local Aboriginal Land Council (FLALC).

The general methodology for off-site lands consisted of two RPS ecologists' walking parallel transects spaced approximately 10 m apart within habitat areas, walking transects and quadrat searches within known habitats within the site. This methodology was consistent with the previously outlined on-site survey methodology. These habitats included areas of disturbance such as power easements and tracks. Where positive records were made, searches within adjacent vegetation were also undertaken in an attempt to record additional individuals and improve the understanding of habitat associations. Above ground stems were counted and mapped using a differential Trimble Geo XH GPS with sub-metre accuracy (after post processing).



TITLE: FIGURE 2-3: REGIONAL OFFSITE ORCHID SURVEY LOCATIONS

LOCATION: NORTHERN GREAT LAKES

DATUM: DATUM

PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 10/6/2011

PURPOSE: REPORT FIGURE

LAYOUT REF: 26414 - North Tuncurry\10-Drafting\Orchid Investigation Areas\2011 TMO Report Figures

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3 Results

3.1 Combined Surveys

In 2010, 1275 individuals were located within the site (Refer to Figure 3-1). An additional 537 individuals were recorded to the immediate northwest of the site adjacent to the tip. The large number of orchids, which were detected within and to the northwest of the site, potentially extends the areas of 'core population' as described by Paget (2008). Additional observations of orchids have also been made within other areas of the site.

In the wider area, surveys undertaken in 2010 and 2011 have established a greater range of occurrence than previously known for this species (Figure 3-1). A total of 90 individuals have been recorded south of Forster in the Booti Booti National Park area. Similarly, 62 individuals have been recorded to the west of Tuncurry, closer to Nabiac. A small number of additional plants were also recorded in 2011.

Table 3-1: Combined Orchid Results

Location	Paget (2008)	RPS (2010)	RPS (2011)	TOTAL
North Tuncurry Project Site	452	1275	11	**1738**
Adjacent to Tip offiste	130	537		**667**
Crown Lands North		4		**4**
Crown Lands South		54		**54**
MidCoast Water Lands North			2	**2**
MidCoast Water Lands South			2	**2**
Booti Booti NP		90		**90**
TOTAL	**582**	**1960**	**15**	**2557**

Note: The above data assumes that orchid locations recorded by Paget (2008) have not been re-recorded by RPS (2010-2011).

In summary, a total of 1975 stems have been recorded from the RPS combined surveys to date. This is made up of 1286 stems within the study site, 90 within National Parks, 537 adjacent to the tip (in Aboriginal Title Claim Areas), 58 Crown Land and 4 within MCW land. Paget's 2008 survey work recorded 582 stems, predominately within the 'core population' on and adjacent to the site in the north. On this basis, of the total recorded population 1738 stems exist on site and 819 occur offsite.

3.2 Site Population Estimates

During the 2011 survey period, two ecologists conducted a number of randomly placed 40 x 40 metre quadrats within the dominant heath vegetation community within the site. Within each of the quadrats, a range of attributes were recorded along with the numbers of TMO, including:

- Floristic dominance within each strata (canopy, mid and ground);
- Foliage cover (percent foliage cover based on the Specht methodology);
- Leaf litter percentage and type; and

- Disturbance level.

This methodology was discussed with OEH prior to undertaking the surveys.

A total of nine quadrats searches were undertaken during the survey yielding a total of 11 individuals. The nine quadrats represent a total area of 1.44ha or 0.5% of the heath vegetation community within the site. All the TMO individuals were recorded from a single quadrat and were located in relatively close proximity to each other (within a 20 metre area).

A basic population estimate was then calculated for the heath community across the site using the mean number of stems recorded per hectare of survey effort. This resulted in an estimate of 2323 plants across the site within the heath community only. Whilst this is a relatively simplistic way of calculating an estimate, it does provide an initial indication of how many TMO might potentially be present within the heath community. Additional calculation methods are outlined below that also provide alternatives for deriving population estimates.

In an effort to qualify this general estimate further, a 95% Confidence Interval (CI) for the mean was also calculated as per the methodology described by Krebs (1999). The CI gives an interval estimate indicating a value range for the mean plants per hectare value for which if the experiment was repeated the likelihood of getting a value between those ranges is 95%. This range can be expanded out using the vegetation community area to extrapolate the population estimate. The 95% CI for the observed data (n=9, $\overline{\chi}$=1.22) revealed a range of 11 – 6861. Although the lower range of the interval is defined by the number of individuals observed during the study, the upper range is quite large and is a result of the high variability in the observed data (SD=3.6, SE=1.2).

Use of these two methods, gives an estimated TMO population within only the heath vegetation on site of 2323 plants, with the true value likely to be somewhere between 11 and 6861 plants as indicated above.

For further clarification of the distributional patterns, the heath community was further broken down based on the height class structure across the site. The single plot where the orchids were recorded during this survey was floristically similar to the majority of the heath vegetation within the site but differed slightly in that it showed signs of past fire disturbance and/or land clearance. The community structure as a result of these disturbances was very low in height (0.5 – 1m) over most of the quadrat, with the ground layer dominated by more sedges than the surrounding areas. This vegetation has affinities with wet heath and is very similar to the habitats in which orchids have been recorded in other areas off-site. It is considered that this quadrat may skew the results for the core (thick and tall) heath community even though the species diversity is very similar. On this basis if this quadrat was excluded from the heath community in general, the population estimates for the core mature heath theoretically becomes zero and better fits the observed distribution within this community thus far.

Similarly, if the observed frequency of plants found in the “wet heath” quadrat (68.75/ha) is applied to the other areas of wet and / or low heath identified on site (15.77ha) we

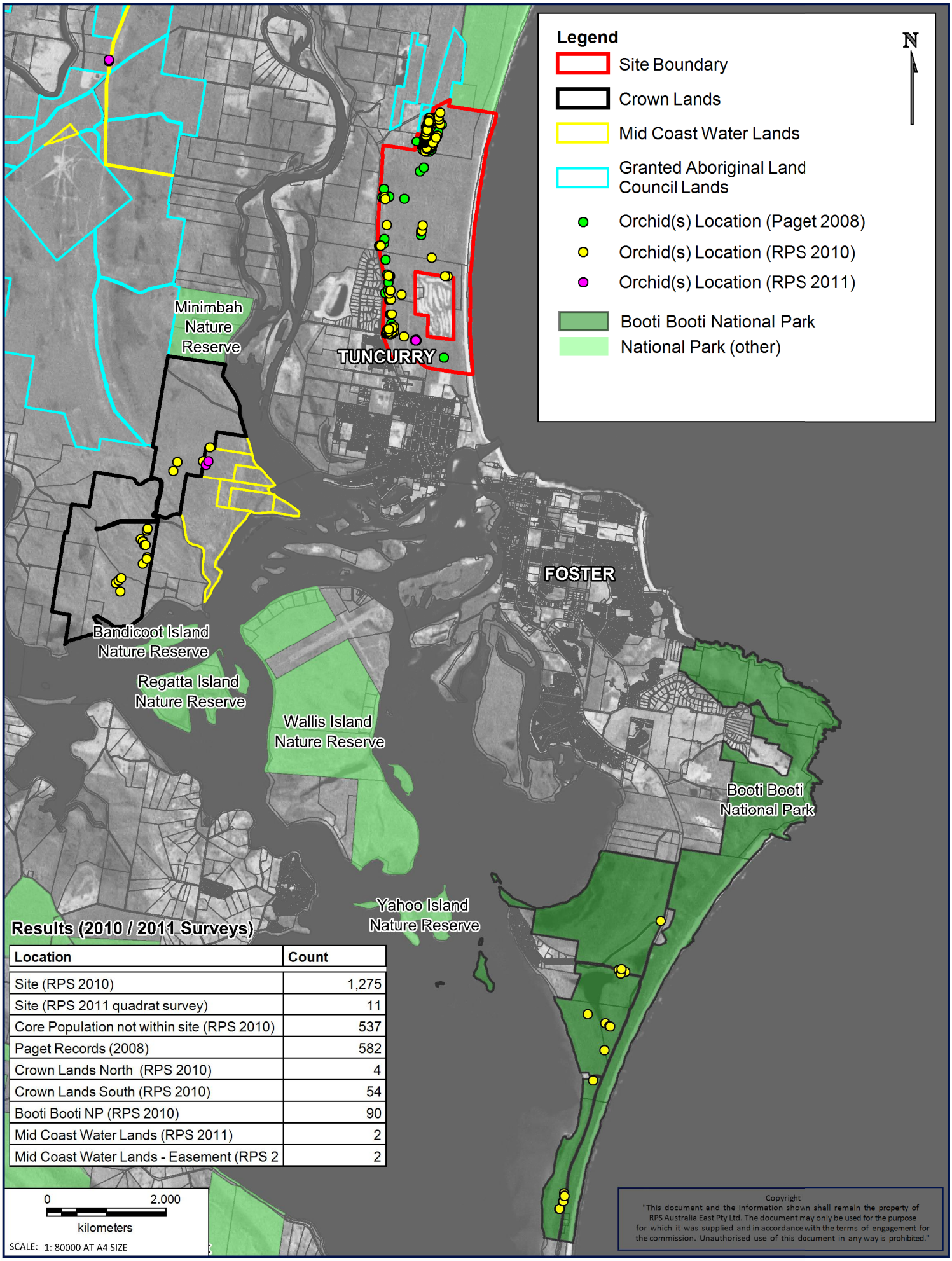
obtain a basic population estimate of 1084 plants occurring in the wet and / or low heath community. Again such an estimate is based on pure extrapolation from data obtained within one plot with no replication and should be interpreted with caution, however it is the opinion of the authors that this figure is likely to be the most accurate based on the observed characteristics of this species as a disturbance responsive species. This is particularly the case given that the more open nature of this variation of heath type appears to have a more open or disturbed structure.

Although a number of other attributes were collected during the quadrat searches on site, no comparisons can be drawn as orchids were only located in one plot. What can be ascertained however, is that the vegetation community the orchids were recorded in was floristically very similar to the majority of the heath vegetation within the site but and importantly differed slightly in that it showed signs of past fire disturbance and/or land clearance. The community structure therefore was very low in height (0.5 – 1m) over most of the quadrat with the ground layer dominated by more sedges than the surrounding areas (Refer to Plates 3-1 and 3-2).

Plate 3-1: TMO quadrat 5 vegetation structure

Plate 3-2 Typical ground cover in TMO plot 5

As the plot where the orchid was found shows great similarity floristically to other areas of heath both on site and in the wider locality we can start to estimate populations within potential habitat sites. Despite the lack of knowledge about the distribution and flowering regimes of this species, population estimates based on areas of similar habitat where the orchids are known to occur may provide a valuable insight into the potential population size in the Great Lakes LGA.



Results (2010 / 2011 Surveys)

Location	Count
Site (RPS 2010)	1,275
Site (RPS 2011 quadrat survey)	11
Core Population not within site (RPS 2010)	537
Paget Records (2008)	582
Crown Lands North (RPS 2010)	4
Crown Lands South (RPS 2010)	54
Booti Booti NP (RPS 2010)	90
Mid Coast Water Lands (RPS 2011)	2
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TITLE: FIGURE 3-1: 2010/2011 TUNCURRY MIDGE ORCHID SURVEY SURVEY RESULTS
LOCATION: NORTH TUNCURRY
DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)
DATE: 03/6/2011
PURPOSE: ECOLOGICAL
LAYOUT REF: 26414 - North Tuncurry\10-Drafting\Orchid Investigation Areas\2011 TMO Report Figures
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3.3 Habitat Characteristics

3.3.1 SEWPAC Listing Advice

The Listing Advice from SEWPAC for the TMO (TSSC 2011) describes this species as occurring on well-drained, open sand ridges in low dense heath dominated by Straggly Baeckea (*Ochrosperma lineare*), in sparse shrubland of Tree Broom-heath (*Monotoca elliptica*) and Daphne Heath (*Brachyloma daphnoides*), and in Teatree (*Leptospermum* spp.) thickets in Blackbutt (*Eucalyptus pilularis*) woodland, with little ground cover beneath the shrubs (Jones, 2006; Paget, 2008 in TSSC, 2011). The species is described as a coloniser of disturbed spaces in coastal heathland and woodland (TSSC 2011).

3.3.2 Previous Habitat Knowledge

Habitat requirements for this species are however still not well understood and current surveys continue to locate the orchid growing in new areas and within new vegetation associations. Paget (2008) lists a range of habitat types for this species and suggests the favoured habitat to be Blackbutt Woodland with a shrubby understorey as this is what is present at the "core population" to the north of the site. Paget (2008) described the possible habitat characteristics at that time as:

1. *The type location was described in the literature as being Coast Teatree Thickets but on revisiting the site it was determined to be Blackbutt (Eucalyptus pilularis) Woodland with a shrubby understorey of Lemon-scented Tea-tree (Leptospermum polygalifolium ssp cismontanum).*
2. *Nearby to the type site was a dry ridge which was considered to be even better habitat, and this ridge was almost treeless (only a few scattered Blackbutts Eucalyptus pilularis) with a sparse shrubland of Monotoca elliptica and Brachyloma daphnoides.*
3. *Some parts of the site contained a mixed Flaky-barked Teatree (Leptospermum trinervium) and Saw Banksia (Banksia serrata).*
4. *Other parts of the site 100-200m south of the Tuncurry Tip and southwards towards the Tuncurry TAFE were dominated by low (< 1.5m tall) dense heathland dominated by Ochrosperma lineare (syn. Baeckea linearis), with a range of other heathland species (eg. Eriostemon australasius, Dillwynia retorta)*

During the 2010 and 2011 surveys, plants have been observed growing in association with *Caustis recurvata*, young *Leptospermum trinervium* (Flaky-barked Teatree) and *O. lineare*. Within Site 3, TMO was also commonly found within open woodlands dominated by *Eucalyptus signata* (Scribbly Gum).

The largest known occurrence of the species occurs on Crown land located to the north of the Tuncurry township. The crown land at North Tuncurry within which the orchid occurs has a long and diverse disturbance history, and has been for the most partially to totally cleared at various stages of the last 100+ years. In the past, the site was used as a Prisoner Afforestation Camp and operated as a pine plantation with Tuncurry State

Forest declared in 1916 and revoked in 1976 (Whelans, 2007). Records also show that the site was previously occupied by mining leases, with a sand mining path to the north of the site evident on the air photos from 1980 and 1988 (Whelans, 2007). The Foster Tuncurry Golf Club was established in the area in the early 1980's. A rubbish tip and airstrip also occupied parts of the land. Based on these past land uses, it is apparent that TMO is a disturbance responsive species.

All areas of Site 3, where TMO was recorded, were also found to be disturbed, predominately by fire. In addition, those individuals recorded from Booti Booti National Park were within a power easement, similar to that of the on-site areas occupied by TMO. Despite quadrat surveys within denser heath habitats, this species has so far only been recorded within sandy habitats that are disturbed, have been disturbed in the recent past or possibly are low growing / stunted open habitat types, such as wet heaths. The data collected to date suggests that this species is disturbance responsive and potentially disturbance reliant to complete its lifecycle.

3.3.3 Preferred Habitat Observations Summary

In summary the preferred habitat characteristics observed so far during the Paget and RPS studies appear to consist of:

- Areas located within the currently known distribution of this species, from Pacific Palms in the south to Darawank Nature Reserve in the north and west to the Minimbah locality, including areas as close to the coastal foredune as 200m;
- Areas with a sand or sandy substrate;
- Vegetation communities such as Blackbutt Forest, Scribbly Gum Woodland and Heath, with an open understorey predominantly resulting from previous disturbances. Specific characteristics of these habitats include:
  - Disturbed Blackbutt Open Forest;
  - Re-growth heath communities dominated by *Caustis recurvata*, young *Leptospermum trinervium* (Flaky-barked Teatree) and *Ochrosperma lineare;*
  - Thick stands on *L. trinervium* with intermittent *Banksia serrata;* and
  - Low and / or Wet Heath.
- Disturbance which may have included:
  - Bushfires, resulting in a temporarily more open understorey;
  - Historical clearing activities and subsequent regrowth (particularly but not only sand mining); and
  - Construction and maintenance of tracks and transmission easements.
- The Tuncurry Midge Orchid has been found to occur in partial shade, filtered light or full sun positions. It has been recorded growing through foliage of low shrubs, such as regrowth *Leptospermums* and amongst *C. recurvata*.
- This species does not seem to occur where leaf litter is thick, as caused by Banksias, Slash Pine or Eucalypts.

While disturbance does not seem to be essential to the species occurrence it appears evident that disturbance significantly increases opportunities for this species and correspondingly numbers of plants in these disturbed areas.

Plate 3-3: Typical disturbed *C. littoralis* habitat within the site

Plate 3-4 – Typical vegetation structure of *C. littoralis* habitat within the more dense vegetation communities within the site

Plate 3-5: Scribbly Gum Woodland Habitat of Site 3

4 Conclusion

The following conclusions can be gained from the information presented in this document:

- The total number of TMO individuals recorded within the site by RPS, during the 2010 and 2011 surveys, is 1286 stems;
- The total number of TMO individuals recorded outside of the site by RPS, during the 2010 and 2011 surveys, is 689;
- The total number of TMO individuals recorded by Paget (2008), within the site is 452;
- The total number of TMO individuals recorded by Paget (2008), outside the site is 130
- Having regard to all available information on the rationale outlined in this report the estimated population in the heath area on site is approximately 1100; and
- The TMO seems to prefer disturbed habitats in general and within heath habitat it appears to prefer wet and / or low heath or disturbed environs.

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