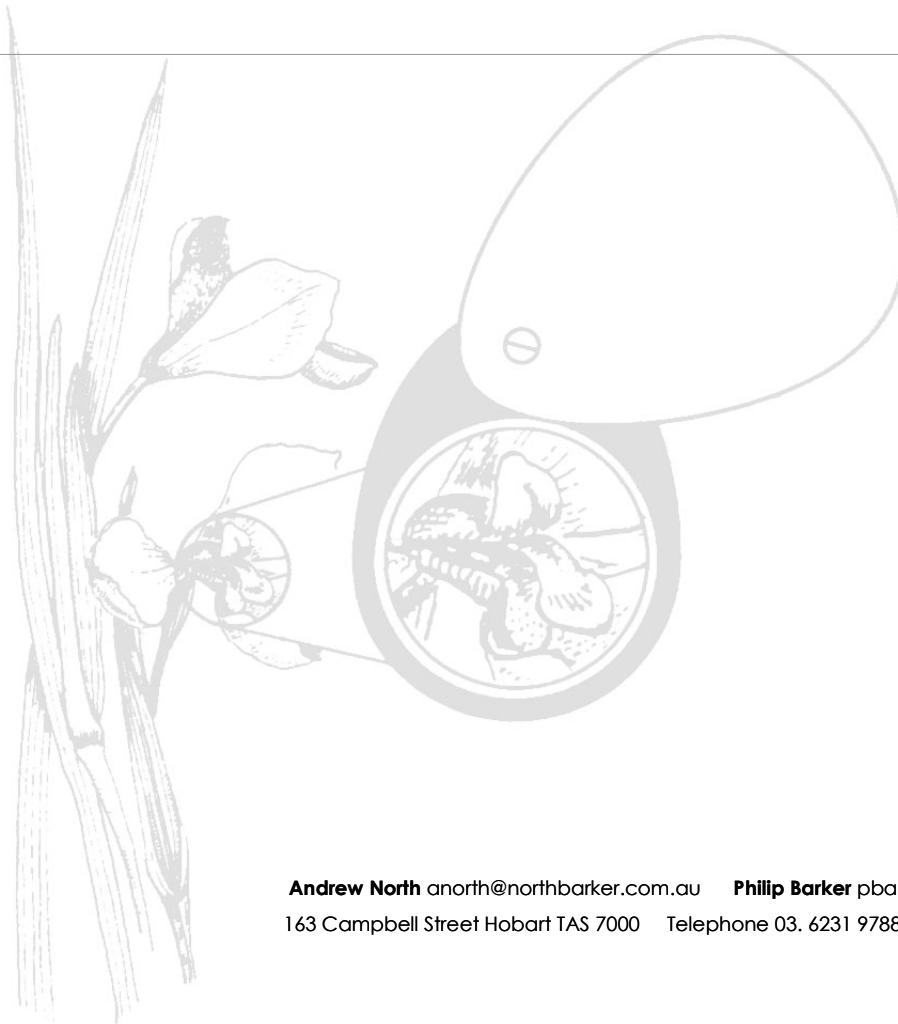




Rosny Hill Nature Recreation Area

SUN ORCHID ASSESSMENT

17th December 2018
For Greening Australia (NUN002)



Summary

Thelymitra bracteata (leafy sun-orchid) is known from only one sizeable population in Tasmania in the Rosny Hill Nature Recreation Area. It is a part of the *Thelymitra pauciflora* species-complex and can be difficult to distinguish from closely related members of the same genus. We use morphometric analyses on a wide range of characters in order to draw a distinction between *T. bracteata* and *T. arenaria*, a widespread and common orchid in Tasmania, with the goal of producing an accurate population estimate for *T. bracteata*.

Of the *Thelymitra* sp. measured, 69 were a good fit for the description of *T. bracteata*. Of these, 44 are within the design footprint outlined in the architectural report.

Acknowledgments

Project management: Grant Daniels

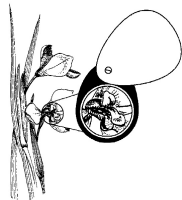
Field work: Grant Daniels, Richard White, Joe Atkinson

Report: Joe Atkinson, Andrew North

Mapping: Linda Drummond, Richard White

File Control

Version	Date	Author
Draft	13/12/2018	J. Atkinson
Version 1	14/12/2018	A. North
Version 2	17/12/2018	J. Atkinson



North Barker Ecosystem Services, 2018. This work is protected under Australian Copyright law. The contents and format of this report cannot be used by anyone for any purpose other than that expressed in the service contract for this report without the written permission of North Barker Ecosystem Services.

Table of Contents

1. INTRODUCTION	1
1.1. Background	1
1.2. Study Area	1
2. METHODS	4
2.1. Survey methods	4
2.2. Statistical methods	4
2.3. Limitations	4
3. RESULTS AND DISCUSSION	5
3.1. Field survey	5
3.2. Morphometric analysis	5
3.3. Extension surveys	7
3.4. Impact	7
4. CONCLUSION	9
5. REFERENCES	10
APPENDIX A – MORPHOMETRICS RESULTS AND FIGURES	11

1. Introduction

1.1. Background

This report was commissioned by Greening Australia in order to better understand the extent of *Thelymitra bracteata* (leafy sun orchid) on Rosny Hill and to provide context to any impacts resulting from the proposed development. *Thelymitra bracteata* is listed as endangered under the *Threatened Species Protection Act 1995* (TSPA). It is part of a complex and difficult to identify taxonomic group referred to as the *T. pauciflora* species-complex¹. The species occurs in Tasmania in a sizeable population at the Rosny Hill Nature Recreation Area (NRA). It shares this habitat with a closely related species, *T. arenaria*. *T. arenaria* is widespread and common in Tasmania. *T. bracteata* is thought to be distinguishable by other closely related species by its robust habit, large flat leaf, long bracts, partially decurrent lower flower pedicels, and greenish colour on the exterior of the sepals². *T. bracteata* has been confirmed from three other locations in Tasmania (George Town, Lenah Valley and Conningham) although no formal population assessment has been conducted at any of these other locations³. A fourth unconfirmed location has been identified at Lonnavaile⁴.

Thelymitra bracteata was first discovered at the Rosny Hill NRA in 2003, in a population of approximately 60 individuals. There was a lull in these numbers in 2007/08; however, in 2013 a population census recorded 75 individuals. The most recent survey in 2016⁵ found 195 individuals that shared a mixture of traits between *T. bracteata* and *T. arenaria*. It was estimated that “less than 30 of these were a good fit for *T. bracteata*”⁶.

An important component of this work is to accurately map the distribution of colonies of plants and to individually characterise the status of all individual intermediates within a colony. It is to be expected that some colonies will show variation but within each colony there may be good examples of each taxon along with a number of intermediates.

Morphometric analysis was conducted using the measurements of ten different characteristics for each individual, in order to accurately group intermediate plants to either *T. arenaria* or *T. bracteata*.

1.2. Study Area

The study area is located in the Rosny Hill Nature Recreation Reserve, on Hobart's eastern shore (Figure 1). The site encompasses the entire known sizeable population of *Thelymitra bracteata* based on Natural Values Atlas (NVA) records and previous reports. The site consists of three TASVEG units: lowland grassland complex (GCL),

¹ Jeanes (2004)

² Jeanes (2004), Jones (2010), Quarmby (2016)

³ Threatened Species Section (2010)

⁴ Wapstra (2018)

⁵ Quarmby (2016)

⁶ Quarmby (2016)

Allocasuarina verticillata woodland (NAV), and DVG (*Eucalyptus viminalis* grassy forest and woodland).

The Rosny Hill NRA occurs within the Clarence Council and the Southeast bioregion⁷. The site occurs entirely on dolerite and receives approximately 560 mm of rainfall annually⁸.

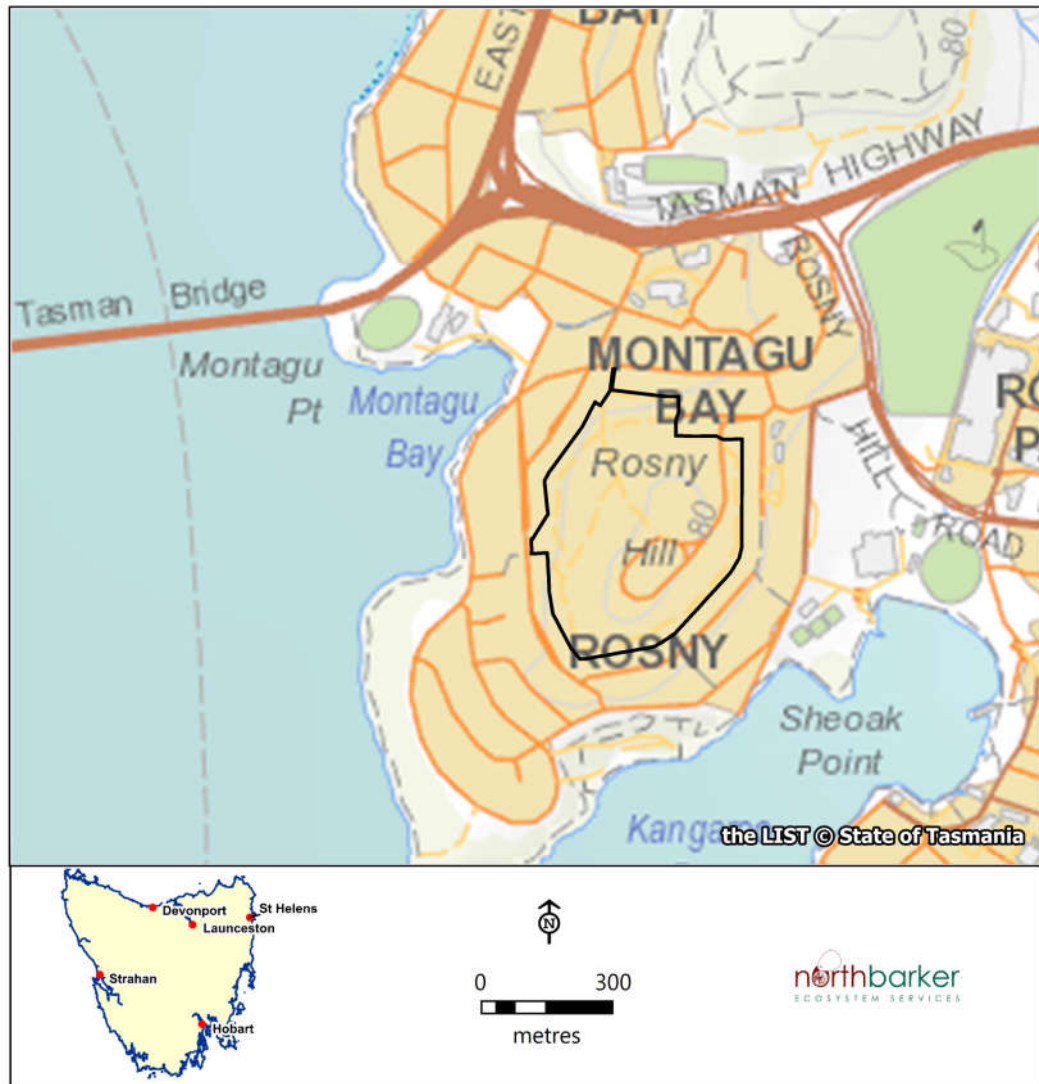


Figure 1: Study area in the Rosny Hill Nature Recreation Area

⁷ IBRA5 - Peters & Thackway (1998)

⁸ Bureau of Meteorology (2018)

The extension surveys were conducted on nearby hills and slopes, including Gordons Hill, Natone Hill, Glebe Hill, Knopwood Hill, and Mornington Hill (Waverley Flora Park) (Figure 2).



Figure 2: Locations of extension surveys

2. Methods

2.1. Survey methods

Field work at Rosny Hill was undertaken on foot by three ecologists on the 5th of November. This day recorded a maximum temperature of 23.5°C, above the recommended 20°C, ensuring that surveying maximised the opportunity to capture the population when in full flower. Extension surveys were conducted between the 6th and 7th of November. These covered all recommended survey locations recommended in the *Survey Guideline for Thelymitra bracteata*⁹, other than Fishers Hill. There was 12 hours allocated to extension surveys. Search time was dictated on a site by site basis, given the suitability of each environment.

The surveys were undertaken in the first week of November as recommended by *Flowering Times for Tasmanian Orchids*¹⁰. The site was traversed using a Timed Meander Search Procedure¹¹ as well as targeted searches of previously known locations of *Thelymitra bracteata*.

Measurements for each plant included scape height, scape diameter, leaf length, leaf width, the presence of a flat or channelled leaf, sterile bract length, fertile bract length, number of flowers in the inflorescence, degree of pedicel decurrency, and flower colour. Pedicel decurrency was scored as 1 – low, 2 – medium. Some characters recommended in the survey guidelines¹² were not used including length and width of the free portion of the sterile fertile bracts, as well as colour of the fertile and sterile bracts. These were either considered to be highly correlated with other variables (e.g. overall bract length) or were consistently non-variable in the field.

2.2. Statistical methods

Principal components analysis (PCA) was conducted using all variables measured above. The scores on the first five axes were used in an agglomerative classification using Euclidean distance and Ward's linkage method.

Variables identified as most diagnostic in dividing the two groups by the PCA scores were plotted individually to compare groups from the cluster analysis and investigate if groups fit in to official descriptions for each taxon¹³. PCA scores are listed in Appendix A.

2.3. Limitations

Some individuals had completed flowering, resulting in a reduced number of observable flowers. Due to seasonal variations in detectability and identification, there may be some individuals present within the study area that have been overlooked.

⁹ Wapstra (2018)

¹⁰ Wapstra (2018)

¹¹ Goff et al. (1982)

¹² Wapstra (2018)

¹³ Jeanes (2004)

3. Results and Discussion

3.1. Field survey

The survey at the Rosny Hill Nature Recreation Area found 106 different individual plants either thought to be a good fit for *Thelymitra bracteata*, *T. arenaria*, or intermediate in form. Of these, 37 were considered a good fit for *T. bracteata* in the field, 26 for *T. arenaria*, and 43 showed intermediate characters.

3.2. Morphometric analysis

The Principal Components Analysis (PCA) found scape height, leaf length, sterile bract length, fertile bract length, and number of flowers in the inflorescence were the most diagnostic characters when dividing groups (Appendix A). When viewing variables by taxa (as identified in cluster analysis), those within *T. arenaria* or *T. bracteata* were consistent with official species descriptions (Table 1, Figure 3). However, outlier scores tended to overlap at the upper (in *T. arenaria*) and lower (in *T. bracteata*), across all variables to some degree. This suggests that for a single individual, one characteristic is not sufficient for separation to the species level, due to the minor overlap between characters.

Three individuals thought to be a good fit in the field for *T. bracteata* were grouped as *T. arenaria* in the cluster analysis, and four individuals thought to be *T. arenaria* were grouped as *T. bracteata*. All other individuals identified to the species level in the field were supported by this analysis (92% of total), suggesting that the two taxa are generally present and identifiable in the field despite the overlap in intermediate plants.

When variables are viewed by cluster analysis groups, including intermediates into their designated group, the bulk of scores for each variable remains within the range of each species description¹⁴. If all intermediate plants grouped as *T. bracteata* in the cluster analysis are treated as *T. bracteata* individuals, this results in an abundance estimate based on our survey of 69 total *T. bracteata* individuals.

Table 1. Differences in species descriptions from Jeanes 2004, for key variables used in the cluster analysis.

Character	<i>Thelymitra arenaria</i>	<i>Thelymitra bracteata</i>
Leaf length	150 – 300 mm	200 – 450 mm
Flower number	2 – 12	5 – 20 (–30)
Scape height	250 – 400 mm	300 – 800 mm
Sterile bract length	25 – 85 mm	30 – 150 mm
Fertile bract length	6 – 22 mm	4 – 35 mm

¹⁴ Jeanes (2004)

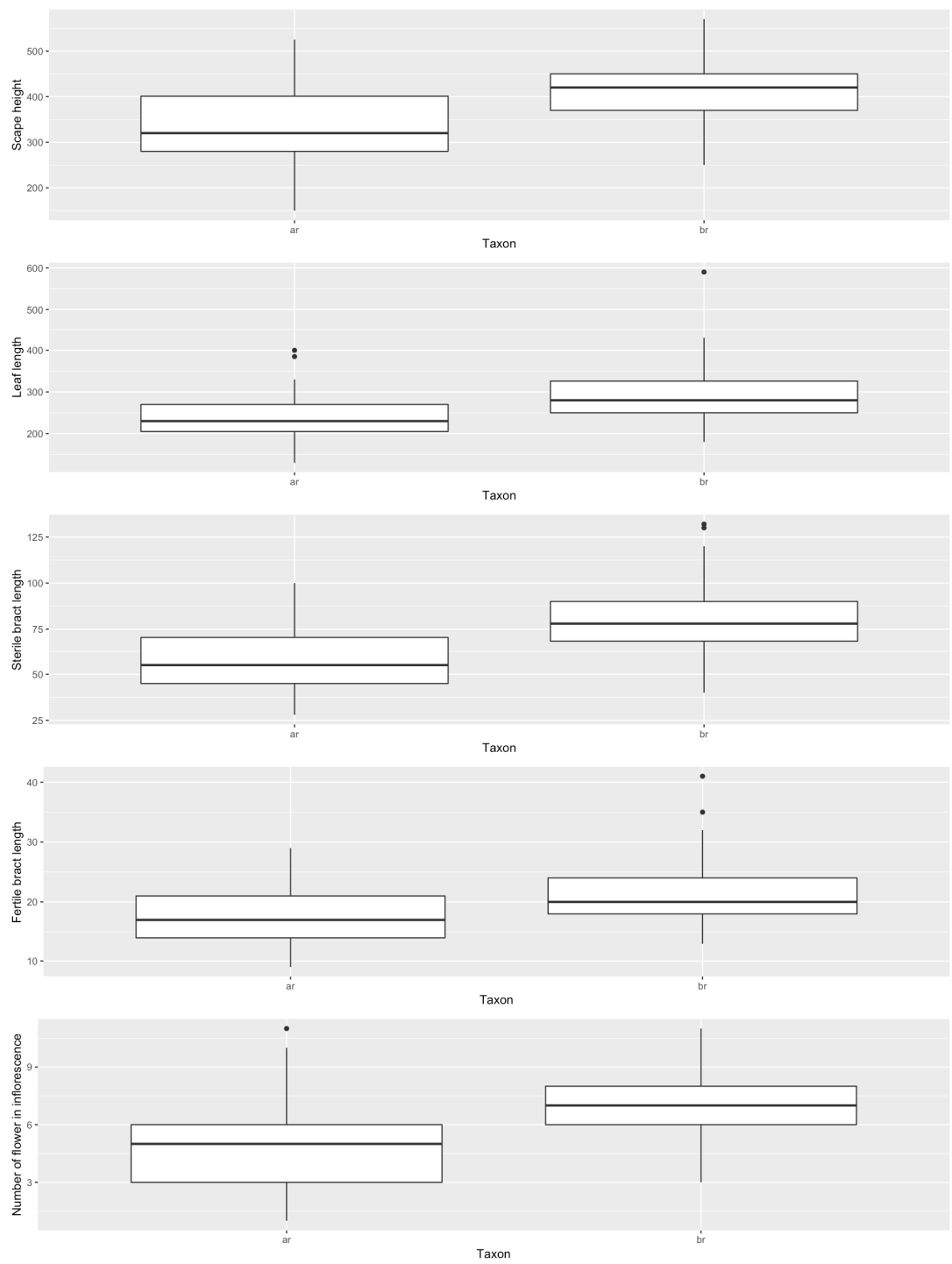


Figure 3. A comparison of the distribution of measured characteristics between Taxon

There are other historical records of observations of *T. bracteata* in other locations at the site (Figure 5). Despite targeted searches in these locations, no plants were found during the current survey. While some of these historical populations are outside the development footprint, the large majority of the populations known extent at the site falls within the footprint (Figure 5).

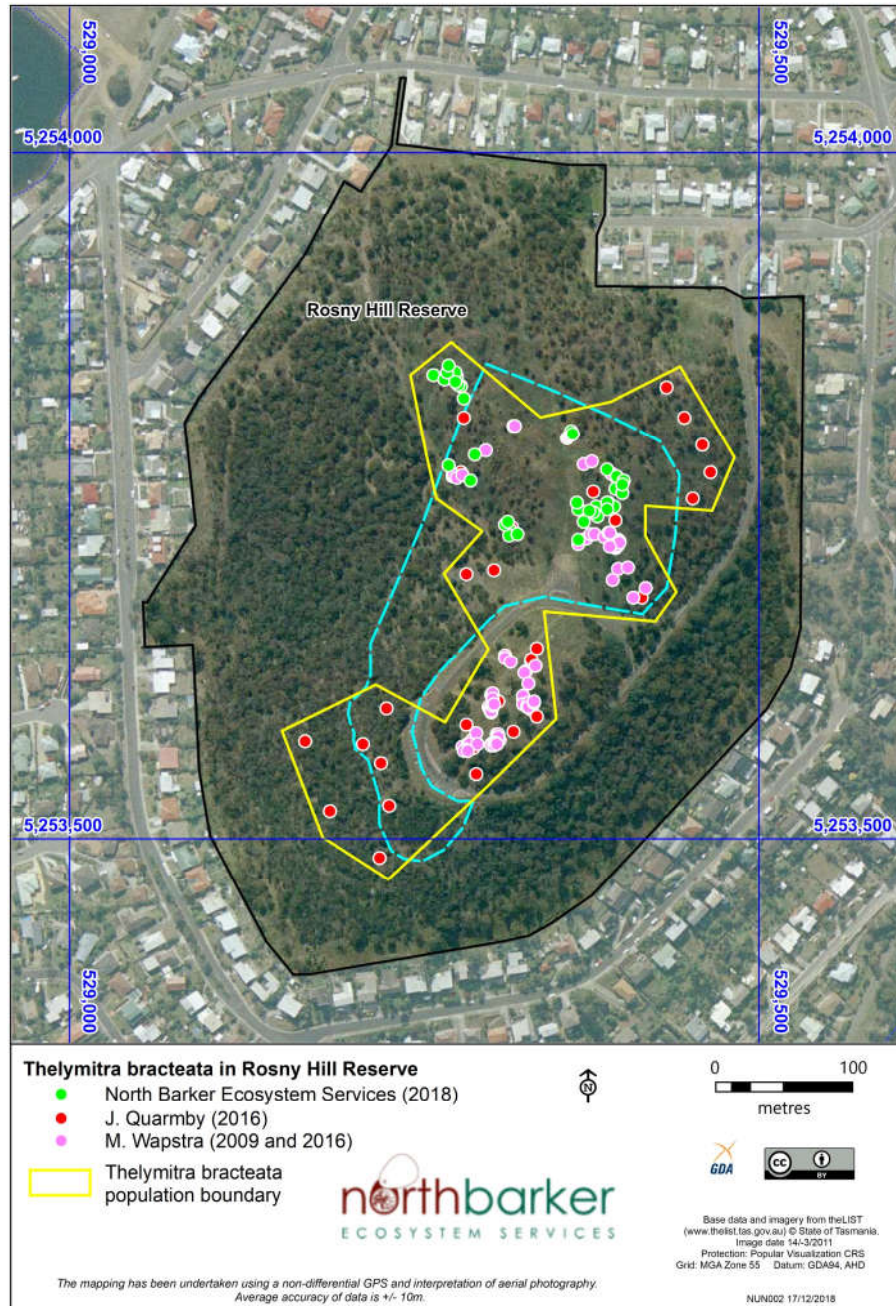


Figure 5: Historical observations (from 2009 onwards) of *Thelymitra bracteata* combined with the present study in the Rosny Hill Nature Recreation Area

4. Conclusion

Though part of a cryptic taxonomy, differentiation between *Thelymitra arenaria* and *T. bracteata* is possible when measuring a wide range of characters. Given the results of our morphometric analyses we estimate that we surveyed approximately 69 plants that were a good fit for *T. bracteata*. It is likely that given the current and historical extent of *T. bracteata* in the Rosny Hill NRA, that the indicative development footprint will have a significant effect on the population¹⁵.

¹⁵ Hunter Developments (2018)

5. References

- Bates, R.J. (2010). The *Thelymitra pauciflora* R.Br. complex (Orchidaceae) in South Australia with the description of seven new taxa. *Journal of the Adelaide Botanic Gardens* 24: 17-32.
- de Salas, M.F. and Baker, M.L. (2018) A Census of the Vascular Plants of Tasmania, Including Macquarie Island. (Tasmanian Herbarium, Tasmanian Museum and Art Gallery, Hobart) www.tmag.tas.gov.au - ISBN 978-1-921599-85-9 (PDF).
- DPIPWE (2018). NVR_Rosny_Hill_05-Jun-2018, DPIPWE, Natural Values Atlas, Threatened Species Section, Department of Primary Industries, Parks, Water and Environment, Hobart.
- DPIPWE (2013). Department of Primary Industries, Parks, Water and Environment. TASVEG 3.0, Released November 2013. Tasmanian Vegetation Monitoring and Mapping Program, Resource Management and Conservation Division.
- Jeanes, J.A. (2004). A revision of the *Thelymitra pauciflora* R.Br. (Orchidaceae) complex in Australia. *Muelleria* 19: 19-79
- Jones, D. (2006). *A complete guide to Native Orchids of Australia including the Island Territories*. New Holland Publishers, Sydney.
- Kitchener, A. and Harris, S. (2013). From Forest to Fjaeldmark: Descriptions of Tasmania's Vegetation. Edition 2. Department of Primary Industries, Parks, Water and Environment, Tasmania.
- Natural and Cultural Heritage Division (2015). *Guidelines for Natural Values Surveys - Terrestrial Development Proposals*. Department of Primary Industries, Parks, Water and Environment.
- Peters, D. & Thackway, R. (1998). A New Biogeographic Regionalisation for Tasmania. Tasmanian Parks and Wildlife Service, Hobart.
- Quarmby, J. (2016). *Leafy sun-orchid (Thelymitra bracteata) in Rosny Hill Nature Recreation Area: Distribution and Population Census*. Report to City of Clarence, November 2016.
- TSS (Threatened Species Section). (2010). *Listing Statement for Thelymitra bracteata (leafy sun-orchid)*. Department of Primary Industries, Parks, Water & Environment, Hobart.
- Wapstra, M. (2018). *Flowering Times of Tasmanian Orchids: A Practical Guide for Field Botanists*. Self-published by the author (4th edition, July 2018 version).

Appendix A – Morphometrics results and figures

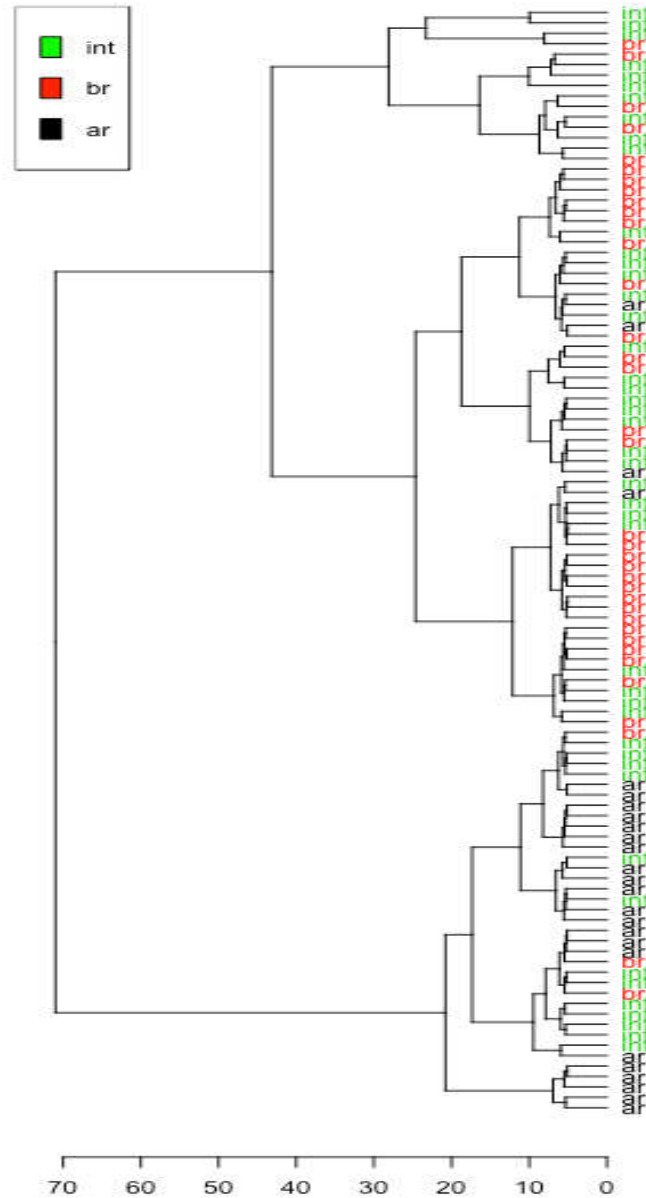


Figure 1: Hierarchical clustering of measurements of *Thelymitra* spp. on Rosny Hill, using Euclidean distance and Ward's linkage method. Colours represent taxon estimate at time of measurement, int = intermediate, br = *bracteata*, ar = *arenaria*.

Table 1: Principal component scores used in the cluster analysis. *PC* = Principal component.

	<i>PC1</i>	<i>PC2</i>	<i>PC3</i>	<i>PC4</i>	<i>PC5</i>
<i>Scape.height</i>	0.418	-0.054	0.239	-0.276	0.251
<i>Scape.diam</i>	0.125	-0.590	-0.317	0.144	0.250
<i>Leaf.length</i>	0.383	0.017	0.358	-0.243	0.304
<i>Leaf.width</i>	0.370	0.185	-0.115	0.424	-0.002
<i>Flat.or.channelled</i>	0.205	0.417	-0.425	0.284	0.565
<i>Sterile.bract.length</i>	0.421	-0.080	0.199	-0.191	-0.011
<i>Fertile.bract.length</i>	0.368	0.110	-0.228	0.065	-0.482
<i>No..flowers</i>	0.400	-0.019	-0.074	0.104	-0.476
<i>Pedicel.decurrence</i>	0.107	-0.620	-0.275	0.004	0.047
<i>Flower.colour</i>	0.015	0.192	-0.589	-0.729	-0.036
Standard deviation	1.99	1.20	1.07	0.99	0.84
Proportion of variance	0.40	0.14	0.11	0.10	0.07
Cumulative proportion	0.40	0.54	0.65	0.75	0.82