
**Distribution, habitat characteristics and conservation status of
Thismia rodwayi F. Muell. in Tasmania**

**A Report to Forestry Tasmania Conservation Planning Branch and the Forest
Practices Board**



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EXECUTIVE SUMMARY

Thismia rodwayi (fairy lanterns) is a seldom-seen subterranean plant occurring in Tasmania and the eastern states of the Australian mainland and New Zealand. A new record from a proposed State forest coupe near Archers Sugarloaf, in Tasmania's central north, prompted further surveys for the species.

Surveys were focussed on the proposed coupe HU302D and the immediate surrounding areas to determine the extent, abundance and habitat of the species to allow management recommendations to be developed. Surveys of similar forest in the wider Meander area were also undertaken. Less intensive surveys of sites elsewhere in the State with existing records of the species were also undertaken.

The surveys have substantially increased the knowledge of the habitat and distribution of this *Thismia*. Previously known from only 4 records, the species is now known from 21 sites, representing several populations, from 5 broad areas of the State (Judbury, Franklin, Mt Field, Meander, Ben Lomond). *Thismia rodwayi* was found only at wet sclerophyll forest sites with a eucalypt overstorey and a shrub-layer dominated by one or all of: *Pomaderris apetala* (dogwood), *Bedfordia salicina* (blanket bush) and *Olearia argophylla* (musk).

Management prescriptions have been developed for the proposed coupe HU302D. They include exclusion of most sites supporting the species, with one site to be included in the area proposed for harvesting to allow monitoring to take place. Broader management actions have also been developed.

Given the difficulties associated with the cryptic, and possibly ephemeral, nature of *Thismia*, and the fact that some disturbances (e.g. selective logging and fire) are apparently not detrimental to the species, surveys of further coupes for *Thismia* purely on the basis of apparently suitable habitat is not suggested at this stage. The exclusion of forestry operations from **all** potentially suitable habitat is considered to be an inappropriate management prescription because the habitat type is only loosely defined and is widespread. However, coupes within close proximity of a known *Thismia* site may warrant surveys, and/or habitat retention. As a guide, any coupes within three kilometres of known sites should be inspected for potential habitat at the time of preparing the forest practices plan. Potential habitat, based on our current knowledge, should be defined by the following attributes:

1. *A dense broad-leaved shrub layer dominated by Pomaderris apetala (dogwood), Bedfordia salicina (blanket bush) and/or Olearia argophylla (musk);*
2. *A moderate to sparse eucalypt canopy, or eucalypt forest surrounding the site;*
3. *Moist friable soil covered by humic leaf-litter;*
4. *Altitude range between 100 and 650 metres.*

If potential habitat is present, the Forest Practices Board Botanist should be contacted. If such habitat is not already contained in substantive formal or informal reserves close to the operational area, habitat retention prescriptions may be needed. Measures may include placement of wildlife habitat strips or wildlife habitat clumps, extension of streamside reserves and delineation of other areas where operations should be excluded or modified. We suggest that *Thismia* populations would be adversely affected by conversion of wet eucalypt forest to plantation because of the dramatic change in site characteristics.

Analysis of current information suggests that the listing of *T. rodwayi* under Schedule 5 (Rare) of the Tasmanian *Threatened Species Protection Act 1995* is appropriate.

BACKGROUND

Thismia rodwayi F. Muell. is a herbaceous flowering plant with an unusual subterranean habit that has occasionally lead to it being mistaken for a fungus. It is a member of the largely saprophytic monocot family Burmanniaceae, which includes over 120 species worldwide. The vast majority of taxa in this family occur in the tropics and subtropics. *Thismia rodwayi* is the only representative of the family known from Tasmania, and also occurs in the southeast Australian mainland. Two other species of *Thismia* occur on the Australian mainland (*T. clavarioides*: Thiele and Jordan 2002; *T. yorkensis*: Cribb 1995).

Since the holotype of *T. rodwayi* was collected in Tasmania in 1890, the species has been recorded in Victoria, NSW, Queensland and New Zealand. It is currently listed under Schedule 5 (rare) of the Tasmanian *Threatened Species Protection Act 1995*. It has been similarly listed in other states under equivalent legislation (Victorian *Flora and Fauna Guarantee Act 1988*, NSW *Threatened Species Conservation Act 1995*, Queensland *Nature Conservation Act 1992*), and also in New Zealand (*Wildlife Acts 1953-1996*). However, it is not listed under the national threatened species legislation in Australia (*Environment Protection and Biodiversity Conservation Act 1999*). Prior to the present study, it was unclear whether the listed status of this species in Tasmania accurately reflected its distribution and abundance.

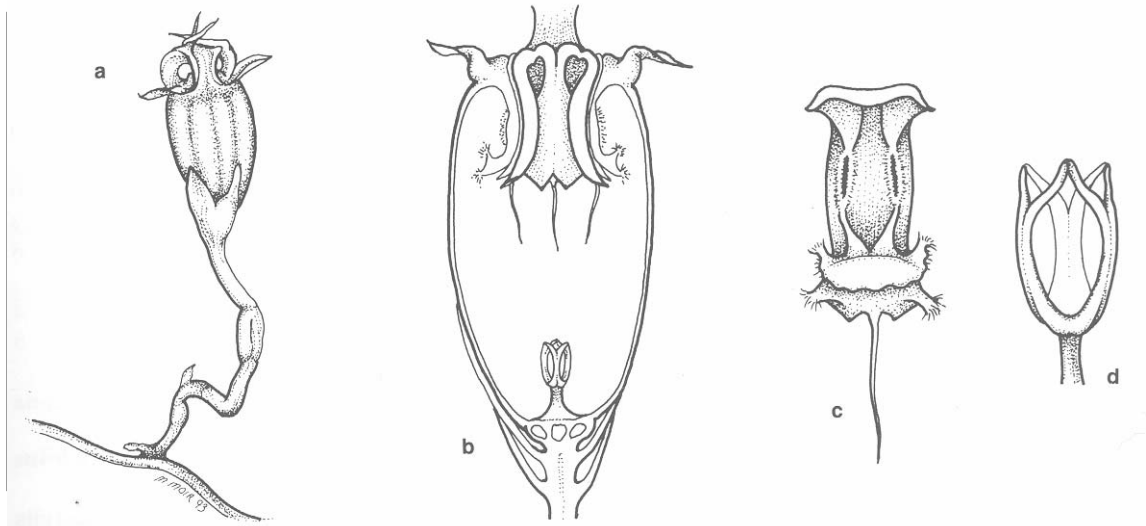


Figure 1. *Thismia rodwayi* **a** habit x2, **b** flower, longitudinal section, x4, **c** stamen x6, **d** style and stigmas x10. From Conn (1994).

The common name ascribed to *Thismia rodwayi* is 'fairy lanterns'. This name aptly describes the appearance of the small orange and red fleshy flowers that barely penetrate the soil surface, sometimes occurring just beneath, and are typically covered by leaf-litter. These brightly coloured flowers are 10-18 mm in length and have an obovate longitudinally striped floral tube (the 'lantern'), surmounted by six perianth lobes - the inner three arching inward and cohering at the top, and outer lobes spreading (Figure 1). The vegetative part of the plant is entirely subterranean and is colourless. The roots, which are about 1-1.5 mm thick, spread 4-15 cm, giving rise to erect flower stems (0.5-3 cm), which bear about six colourless bracts (these are the 'leaves'), increasing in size toward the terminal flower. The plant lacks chlorophyll, and is therefore incapable of photosynthesis. It is considered a saprophyte.

A saprophyte (Greek: *sapros*=rotting, *phyton*=plant) is a plant that derives its energy from rotting material. In fact, no plants are known to be able to feed directly on rotting material -

they need the help of a fungus. The fungal hyphae, in most cases, exist inside some of the root cells of 'saprophytic' plants, and convert rotting material into sugars using special enzymes. The plant can then digest the fungi (which is known as an endophyte). *Thismia rodwayi* has been observed to have most of the cells in the root cortex occupied by fungal hyphae (thread-like cells), and there is also a cobwebby coating of hyphae mixed with humus around the root (McLennan 1958). McLennan (1958) studied the relationship of *T. rodwayi* with its endophyte, and found the fungus inside the cortex cells to accumulate fat globules in hyphal bladders. These bladders would then discharge their contents into their host cells, presumably due to a digestive action of the host. These fat globules appear to be converted into a secondary substance; a polysaccharide, probably glycogen.

In addition to the paucity of data concerning distribution, abundance and habitat requirements of *Thismia rodwayi*, very little is known about the reproductive biology of the species. With regard to both life-cycle and ecology, anecdotal evidence is relied upon heavily, and in many cases the original source of published information is unknown. Rodway (1903) indicates the species to be known only from a “[g]ully on [the] eastern slope of Mount Wellington”, which is apparently a reference to his original collection site. He also states the flowering time to be December to January (Rodway 1903), although there are, even now, no official records in Tasmania from January, and it is not known whether Rodway's claim is based on his own observations. It should be noted that the species is known to flower in November in Tasmania (historical records and records from this study). One NSW source states that flowering occurs from spring to autumn, and fruits (fleshy cup-shaped capsules) are borne on the plant during summer and autumn (web: Clarence Catchment Rare Plant List). This source also notes that the species occurs on variable geology, and in several vegetation types, but cool, moist, humic soils are favoured. Conn (1994) also states the preferred habitat of this species to be “damp humus and leaf litter in deeply shaded tall forests and fern gullies”.

Until 2002 there were only three records of *Thismia rodwayi* held by the Tasmanian Herbarium. These were: Cascades (Mt Wellington) 1890; Lake Dobson Road at Mt Field 1930; and Little Denison River (via Judbury) 1968 (Table 1). In November 2002 a fourth specimen was lodged in the herbarium, collected by Sapphire McMullen-Fisher (University of Tasmania) at Lenah Valley, on the Wellington Range (included in Table 1). Interestingly, Curtis and Morris (1994) describe the distribution of *T. rodwayi* as “widespread”, although noting that it is seldom seen. Furthermore, these authors indicate it occurs in the Ben Lomond floristic region, as well as South West, Mt. Field and Mt. Wellington regions of Tasmania. It was apparently a specimen from the Ben Lomond region that was dissected for the illustration of the species in Curtis and Morris' text (1994), however this specimen was never curated, and therefore does not appear on the herbarium records (A. Buchanan, pers. comm.).

Thismia rodwayi recently to the attention of the Forest Practices Board when discovered by Sandy Tiffin and Nick Fitzgerald in State forest on the northern slopes of Archers Sugarloaf (coupe HU302D), near Meander, during an Understorey Network field day. A day-long search for more plants in the vicinity was subsequently conducted and was successful in uncovering a further 11 specimens. The known flowering of the species in this area represented a unique opportunity to assess its status, and gather ecological data relevant to developing management advice.

Table 1. Historical records of *Thismia rodwayi* held by the Tasmanian Herbarium. Location descriptions are as they appear on the herbarium record. The “Number” column gives the herbarium specimen number.

Location	Date	Altitude	Latitude	Longitude	Number
Cascades, Hobart	Dec 1890		42 54	147 17	25468
Mt Field Track (Mt Dobson Rd)	Nov 1923	300 m	42 41	146 42	23812
Little Denison River, via Judbury*	20 Oct 1968	120 m	42 58	146 46	51377 and 115634
~70 m uphill from the Lenah Valley fire track	01 Nov 2001	320 m	42 52	147 15	519153

*Two specimens apparently from the same site, however the location for specimen number 115634 is recorded as “Link Road between Russell River Road and Little Denison River”.

AIMS

This study aimed to address some basic questions about the distribution and ecology of *Thismia rodwayi* in Tasmania. It was precipitated by the need to develop management prescriptions appropriate for the species’ conservation, in particular, within production forest.

Attention was directed especially towards State forest in the Huntsman Forest Block, in the Mersey forestry district because of the recent discovery of *Thismia* within coupe HU302D, and the need to develop management prescriptions to incorporate into the forest practices plan. Surveys for this species were carried out with the aim of investigating the:

1. distribution of the species within coupe HU302D and within the general area;
2. environmental conditions under which the species exists;
3. reservation status of the species within the immediate area; and
4. effects of timber harvesting practices on species’ presence and/or abundance.

The improved knowledge of the distribution and ecology of the species will also assist in the development of a strategic approach to management of the species in the Huntsman Forest Block, and other potential sites.

A less intensive investigation of the species’ distribution and reservation status in the areas of the State containing previous records was also proposed, subject to the limitations of the project budget.

METHODS

Coupe HU302D

Site description

Coupe HU302D is about 100 ha in size, on a 'bench' with some gently sloping areas and a northerly aspect, on Jurassic dolerite and dolerite talus. Vegetation within the coupe graded from wet to dry sclerophyll forest and had a multi-aged structure, including some old growth trees. *Eucalyptus obliqua* was the dominant tree, with *E. amygdalina* (black peppermint), *E. viminalis* (white gum) and *E. delegatensis* (gum-topped stringybark) also present. Stumps with shoe marks throughout the area indicted selective logging had occurred more than 50 years ago.

Field methods

Two sampling methods were used in coupe HU302D on the 9th and 10th of November 2002, so as to both systematically search a range of habitats and maximise the probability of finding populations of *Thismia*.

1. Thirteen sites were selected to try to maximise sampling over the coupe area. They were spaced 100 to 400 metres apart using a quadrat based sampling method. At each site, five 1 m² quadrats were established, the first quadrat being positioned by random throw, and the subsequent quadrats being located about 5 m distance from the first quadrat, at cardinal points. The leaf litter was removed from within each quadrat, and the soil excavated to a depth of 1-5 cm. Details of the vegetation were recorded at each site, including approximate height and cover of each stratum. For the purposes of the vegetation description, each site was defined as an area of approximately 10 metres radius.
2. To more intensely sample sites that supported apparently favourable *Thismia* habitat (based on the past observation and historical records), random sampling was carried out at seven of the 13 sites sampled using the quadrat method. This was done using the same scratching and excavation techniques, but without the use of quadrats. The total area searched was estimated for each site.

A preliminary search conducted within HU302D approximately four weeks prior to the more intensive survey described above used a consistent method. The data from these initial sites are therefore included as part of this study.

The two detached *Thismia* flowers found incidentally in coupe HU302D by Nicholas Fitzgerald and Sandy Tiffin on the 15th of October 2002, are not included in the results presented here. This is because of the possibility that animals may have deposited them at the located site, and uncertainty about the location of the site itself. These specimens were not lodged in the herbarium due to their rapid deterioration (N. Fitzgerald pers. comm.).

One site, selected for its abundance of *Thismia* flowers during the December survey work, was re-inspected in mid-February.

Wider Meander area

State forest within the general area of the coupe was sampled based on apparent suitability of habitat and accessibility. This judgement was based on observations made during the more systematic sampling of coupe HU302D (see above). Vegetation was described for each site as described above, with the 'site' being defined at roughly the same scale (a circular area of 10 metres radius, see above). The approximate area of ground surface searched for *Thismia* was recorded in each case, and where the species was present the distance between the flowers was noted. It was not feasible to search all apparently suitable habitat sites, and nor was it feasible to search more extensively in what was considered 'unlikely' habitat.

Other areas of the State

Verification of known sites

The site of the 1968 record of the species, at Little Denison River, was searched on the 18th of December 2002, in the same way as outlined above.

The Lenah Valley site where the species was collected in November 2002 was searched on the 10th of January 2003.

Additional sites

Personal communication with numerous botanists, naturalists and other field workers who may have seen the species (such as those who regularly survey for litter invertebrates) was also undertaken. Based on an unconfirmed sighting of the species in the late 1980s (K. Bonham pers. comm.), a patch of forest on private land at the end of New Road, near Franklin, was also searched on the 18th of December 2002, as were several other sites with similar habitat within the general area.

RESULTS

Coupe HU302D

Thismia rodwayi was only recorded once using the random quadrat-based sampling method. However, the more extensive searching carried out at sites that seemed to represent good habitat resulted in *Thismia* being found at seven sites. The number of individual flowers found within each ‘population’ ranged from one to 24. A total of 56 *Thismia* flowers were recorded from approximately 150 m² of ground examined over the 16 sites in HU302D. Location, general environmental data and number of *Thismia* flowers recorded for all sites searched within the coupe are given in Table 2, and shown in Figure 2. Also marked on Figure 2 is the approximate location of two sites informally searched for *Thismia* during an initial field day (15th November 2002). The Appendix provides a summary of sites where *Thismia* was present.

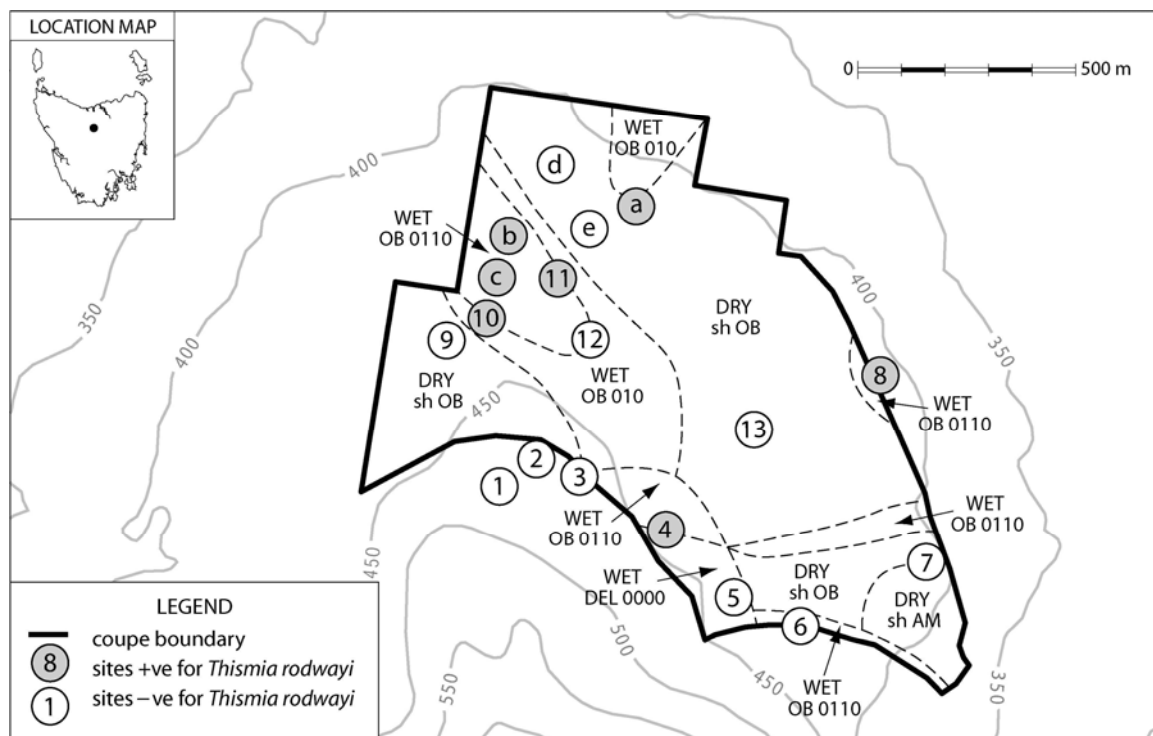


Figure 2. Coupe HU302D with sites searched for *Thismia rodwayi* and forest communities shown. The communities as mapped may contain localised areas of other communities.

All *Thismia* in the coupe area occurred in patches of wetter vegetation, not in the dry/damp sclerophyll forest that dominated most of the coupe area. *Eucalyptus obliqua* (stringybark) was the dominant canopy species throughout the coupe, and *Pteridium esculentum* (bracken), *Coprosma quadrifida* (native currant) and *Pultenaea juniperina* (prickly beauty)

were common in the understorey. Understorey species that were especially prominent where *Thismia* was found included *Bedfordia salicina* (blanket bush), *Pomaderris apetala* (dogwood) and *Blechnum nudum* (fishbone fern).

No *Thismia* flowers were found in mid-February during a re-inspection of one site within the Archers Sugarloaf survey area where flowers had been abundant in December (site number eight, Table 2).

Wider Meander area

Thismia was found at 7 of the 13 sites searched within the Meander area during this study. Four of these sites were in either formal or informal reserves, and three were in unreserved State forest. Details of all sites searched are given in Table 3, and their locations given in Figure 3. The total number of *Thismia* flowers found in the Meander area (excluding coupe HU302D) was 54. The total area searched was approximately 114 x 1 m² (an average of 8.8 x 1 m² per site, although search extent varied from 7 to 27 x 1 m²).

Only sites that had wet forest elements were chosen for surveying outside coupe HU302D, because the results of the within-coupe survey indicated such sites were the most likely habitat of the species. Most sites were on dolerite, or dolerite talus (Table 3), as this geology dominates the Meander area.

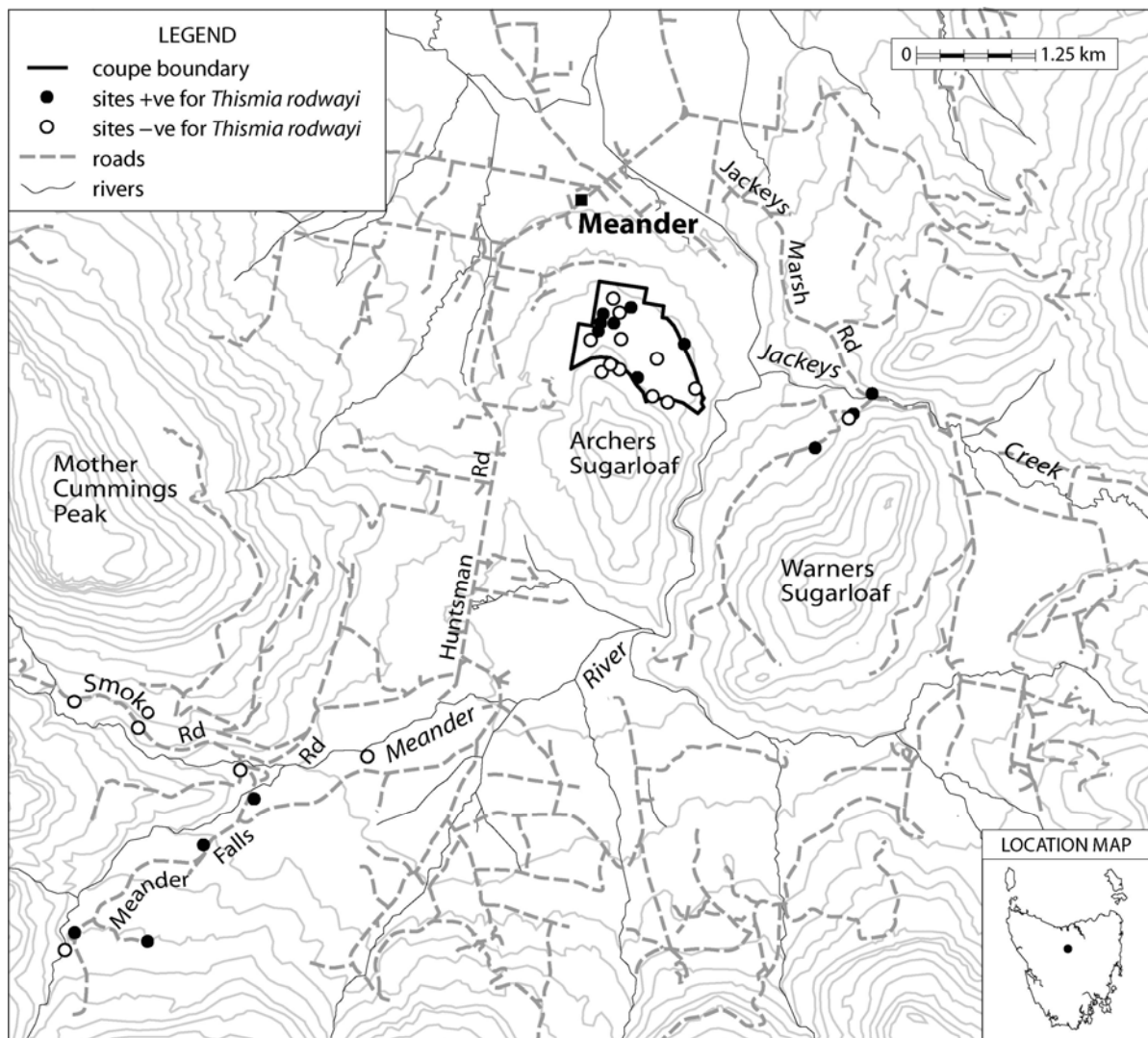


Figure 3. The Meander area, showing sites searched for *Thismia rodwayi*.

General observations regarding *Thismia rodwayi* in-situ

Thismia was found in various stages of flowering, from small buds to senescent flowers and even the early stages of fruit formation. Flowers in different stages of development were often found at the same site. Flowers were observed to occur at the interface between soil and leaf litter, and rarely just below the soil surface. Leaf litter covered them in all cases and was typically 2-4 cm thick. The composition of the leaf litter was variable. However, it was always predominantly made up of broad-leaved understorey species such as *Bedfordia salicina* (blanket bush) and *Pomaderris apetala* (dogwood).

Flowers (putatively representing individuals) were commonly clustered in groups of 2-12 (although usually less than 5) across an area of less than 1 m². At the sites where the species was abundant several such clumps were found. These clumps were sometimes close enough to each other to appear almost as one large clump (i.e. less than about 2 m apart) or were seemingly 'connected' by one or two flowers spaced between them.

Other areas of the State

Verification of known sites

Thismia was not found at Little Denison River (the site of the 1968 record) when searched on the 18th of December 2002. The current habitat at this site appeared dry (very low moisture in leaf litter) compared to sites where the species has recently been recorded (e.g. in the Meander area). The geology was mudstone. Staff from the Tasmanian Herbarium had also looked for *Thismia* at this site (in November 2002) and had a negative result (A. Buchanan pers. comm.).

No *Thismia* was found when the Lenah Valley site (where *Thismia* was found in late spring 2002) was searched in January 2003. The leaf litter and soil was very dry at this time, as several weeks of warm dry weather preceded. The vegetation was very similar to where *Thismia* was found during this study, with dense *Pomaderris apetala* (dogwood) and *Olearia argophylla* (musk), and *E. regnans* (giant ash) and *E. obliqua* (stringybark) the dominant eucalypts.

Additional sites

Seven *Thismia* flowers were found at the end of New Road, near Franklin, at approximately the same location as the anecdotal sighting by Kevin Bonham in the late 1980's. Five of these were in a single clump. A further two were spaced about 10 metres from each other, more than 100 m from this clump but in the same vegetation. These plants were situated on a west-facing slope on dolerite. The dominant canopy tree was *Eucalyptus delegatensis* (gum-topped stringybark). *Atherosperma moschatum* (sassafras), *Pomaderris apetala* (dogwood) and *B. salicina* (blanket bush) formed a thick tall shrub layer. *Blechnum wattsii* (hard waterfern) was common but only locally dense.

An additional record of *Thismia* was made at Blue Gum Hill, about 4.5 km from the above-mentioned site. This site, which is on private land, was dominated by *E. regnans* (giant ash) regrowth (approximately 30-40 years old) with a 5-15 metre tall understorey of *Pomaderris apetala* (dogwood), *Olearia argophylla* (musk) and *Acacia melanoxylon* (blackwood) plus a moderately dense fern layer, comprising mostly *Polystichum proliferum* (cathead fern). Five *Thismia* flowers were found here, in a single clump.

The general locations of all sites where *Thismia* was found in the course of this study are shown in Figure 4, together with historical records.

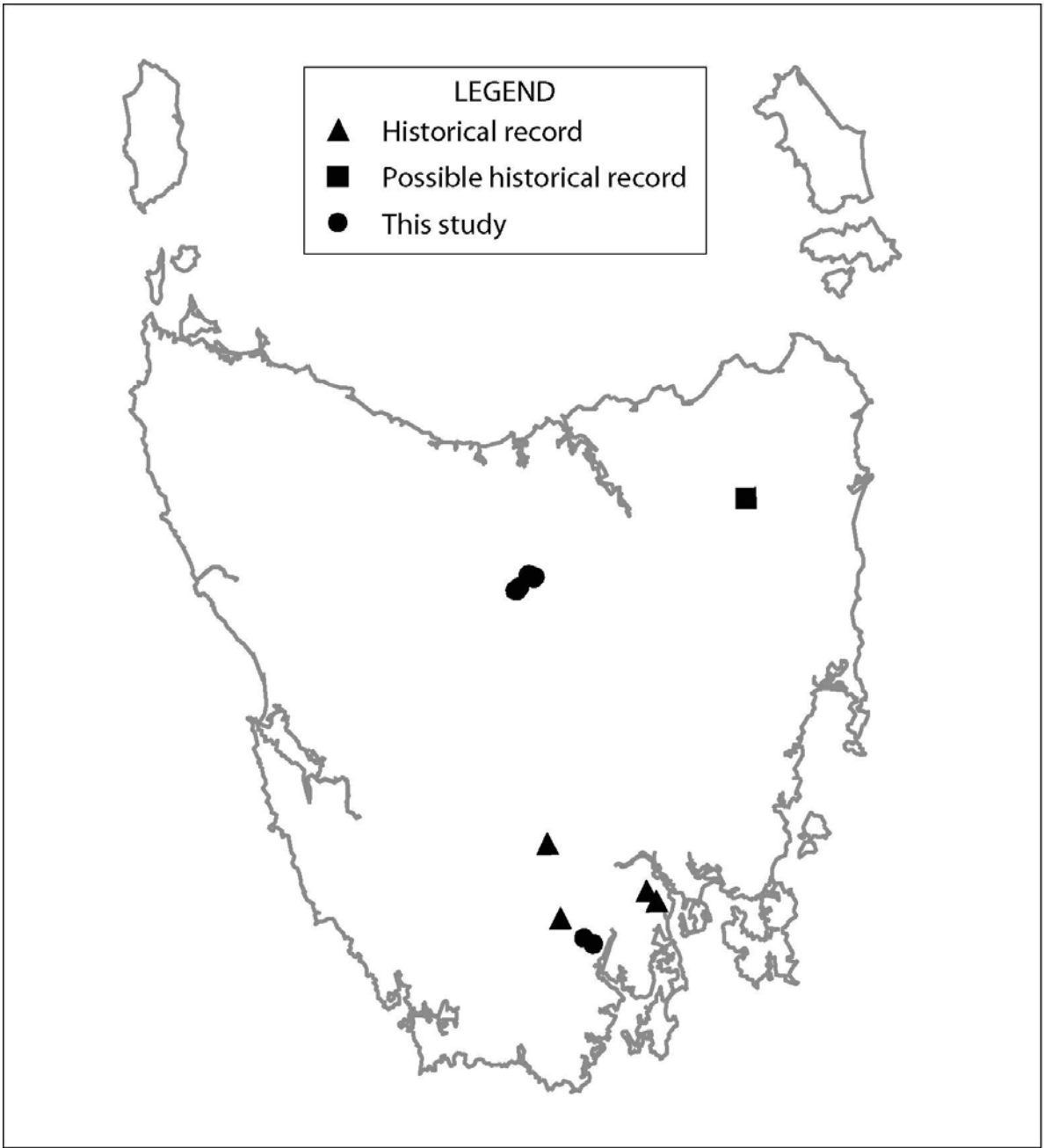


Figure 4. Known distribution of *Thismia rodwayi* in Tasmania.

Table 2. Details of sites searched for *Thismia rodwayi* within coupe HU302D. Sites 1-13 were surveyed on the 9&10/12/02. Sites a, b and c were surveyed during a preliminary search on the 15/11/02. See Appendix for summary of presence-only sites. The forest community abbreviations are those of Kirkpatrick *et al* (1988) and Duncan and Brown (1985).

Site	Easting	Northing	Altitude (m)	Slope (degrees)	Aspect	Landform	Rock cover (%)	Forest Community	RFA Community ¹	Scratched (m ²)	Number of <i>Thismia</i>
Positive sites											
4	468008	5386663	445	2	NE	Mid-slope/shelf	10-20	WET-OB0110	OT	11	3
8 ²	468500	5387020	405	<2	NE	Mid-slope/shelf	<2	WET-OB0110	OT	20	24 (plus 15 ³)
10	467597	5387160	435	2	N	Shelf	<5	WET-OB0110	OT	15	2
11	467759	5387242	430	2	N	Shelf	<5	WET-OB0110	OT	15	1
a	467940	5387408	415	<5	N	Mid-slope/shelf	<5	WET-OB010	OT	15	3
b	467647	5387340	425	0	0	Shelf	0	WET-OB0110	OT	15	5
c	467621	5387245	436	<2	N	Mid-slope/shelf	<5	WET-OB0110	OT	15	3
Negative Sites											
1	467628	5386771	470	<5	NE	Mid-slope	5	WET-OB0110	OT	5	0
2	467713	5386834	455	<5	NE	Mid-slope	<5	WET-OB010	OT	5	0
3	467814	5386795	455	<5	NE	Mid-slope	5	WET-OB0110	OT	5	0
5	468166	5386516	440	5	NE	Mid-slope	5	WET-OB0110	OT	5	0
6	468319	5386449	425	5	E	Drainage depression	5	WET-OB0110	OT	5	0
7	468609	5386594	405	<5	E	Mid-slope	30-40	DRY-shAM	AD	5	0
9	467507	5387108	405	0		Shelf	5	WET-OB010	OT	5	0
12	467833	5387111	437	3	NNE	Shelf	30	WET-OB0110	OT	5	0
13	468209	5386901	425	1	NE	Shelf	0	DRY-shOB	O	5	0

¹ OT = Tall *E. obliqua* forest, O = Dry *E. obliqua* forest, AD = *E. amygdalina* forest on dolerite.

² One *Thismia* flower was found using the quadrat sampling method at this site.

³ These additional 15 flowers were about 20 metres north of the formally sampled and described site, but were too close to be considered an additional site. *Pomaderris apetala* rather than *Olearia argophylla* was locally dominant, however, the site was otherwise very similar.

Table 3. Sites searched for *Thismia rodwayi* in the Meander area, outside coupe HU302D. SSR= *streamside reserve*; FR= *Forest Reserve*. See Appendix for summary of presence-only sites. The forest community abbreviations are those of Kirkpatrick *et al* (1988).

Location or coupe name	Easting	Northing	Altitude (m)	Slope (degrees)	Aspect	Landform	Geology	Rock cover (%)	Forest Community	RFA community ¹	Scratched (m ²)	Number of <i>Thismia</i>
Positive sites												
HU311X	470277	5386284	450	<5	NW	Mid-slope	Dolerite	<5	WET-OB0110	OT	5	5
HU322D	462859	5380724	610	10	N	Drainage depression	Dolerite talus	5	WET-DEL0111	DT	8	7
Jackeys Creek FR	470474	5386494	440	20-25	SE	Slope near river	Dolerite	<5	WET-VIM0011	WV	10	13
HU311Y	469875	5385927	435	1	W	Mid-slope	Dolerite	<5	WET-DEL0100	DT	7	3
Meander River SSR A	463447	5381741	510	20	N	Gully	Dolerite talus	5-10	WET-DEL1000	DT	25-30	5
Meander River SSR B	461997	5380691	590	3	N	Drainage depression	Dolerite talus	5	WET-DEL0110	DT	20-25	18
Meander River SSR D	463980	5382231	465	1-3	N	Riparian flats	Dolerite talus	<1	WET-DEL0111	DT	10-12	3
Negative sites												
HU311X	470222	5386288	450	5	NW	Mid-slope	Dolerite	<5	WET-DEL0100	DT	25	0
Smoko Rd A	462752	5383020	570	25-30	S	Mid-slope	Permian mudstone	<5	WET-DEL0111	DT	20	0
Smoko Rd B	462084	5383300	600	25-30	S	Mid-slope	Permian mudstone	<5	WET-DEL0111	DT	15	0
Smoko Rd SSR	463828	5382583	470	0	-	Riparian flats	Permian mudstone	<5	WET-DEL0111	DT	17	0
Meander River SSR C	465160	5382723	435	0	NE	Riparian flats	Dolerite talus	<5	WET-VIM0011	VW	10	0
Meander FR	461983	5380679	600	15	E	Mid-slope	Permian mudstone	7-10	RAIN-C3.1	M+	7	0

¹ OT = Tall *E. obliqua* forest, DT = Tall *E. delegatensis* forest, WV = *E. viminalis* wet forest, M+ = Callidendrous/thamnic rainforest fertile substrates

DISCUSSION

Abundance and distribution of Thismia in coupe HU302D and elsewhere in the Meander area

Thismia was found only in the wetter communities within coupe HU302D, and such communities occupied less than one third of the total area (Figure 2). The total area searched within the coupe, in forest that could be broadly classified as wet sclerophyll forest was 121 m² (over 10 sites). These communities were *Eucalyptus obliqua-Olearia lirata-Pultenaea juniperina* wet sclerophyll forest, *Eucalyptus obliqua-Acacia dealbata-Olearia argophylla* wet sclerophyll forest and *E. delegatensis-Bedfordia salicina-Lomatia tinctoria* wet sclerophyll forest, as defined by Kirkpatrick *et al.* (1988).

A rough estimate of population can be made by extrapolating from the 56 individual flowers recorded over this area to the approximately 30 ha of wet forest in the coupe. It is reasonable to assume the obstructions such as logs, rocks and other vegetation prevent about half this habitat being occupied by *Thismia*, thus the potential area is reduced to 15 ha. If *Thismia* were to occupy this 15 ha at the same density as in surveyed areas, the total population would be about 69 000. This figure is likely to be generous, as the fine scale habitat variation probably makes large areas of the wet forest types unsuitable for the species.

Outside the coupe, but within the Meander area, wet forest is relatively common. Searches for *Thismia* at suitable looking sites had a surprisingly high success rate considering the obscure nature of the species. It is premature, however, to assume that the species has an extensive distribution through these forests, as forest type may only be a crude indicator of suitable habitat for *Thismia*.

Distribution and ecology of Thismia rodwayi

Thismia rodwayi is now known from over 20 sites (including historical records) from several regions of the State. It appears to occur within wet sclerophyll forest dominated by *Eucalyptus obliqua*, *E. delegatensis*, *E. regnans* or *E. viminalis*. Of the several scientists working on leaf litter species (mostly invertebrates) who were contacted regarding *Thismia* during this study, only one responded with a possible sighting (i.e. Kevin Bonham, who reported possibly seeing the species near New Road in Franklin during the 1980s). The lack of chance encounters by people frequently looking in potential *Thismia* habitat suggests the species is either very patchy in its distribution, or only flowers once every several years. In either case, we consider it likely that *Thismia* is more widespread throughout Tasmania's wetter forest types than current records suggest. Its extremely cryptic growth habit and the possibility that it has an ephemeral flowering frequency, make new records unlikely unless it is specifically targeted by surveys conducted during its known flowering period.

The field work conducted for this study provided many opportunities for observations to be made regarding the ecology of *Thismia*. However, there was not sufficient replication for a statistical approach to data analysis.

Several species appear to be associated with *Thismia* (both in the Meander area and elsewhere), but none were obligate. A dense tall shrub layer was common to all sites, with the dominant species being *Olearia argophylla* (musk), *Bedfordia salicina* (blanket bush), *Pomaderris apetala* (dogwood) or *Acacia melanoxylon* (blackwood), often with all of these species present. Although *Eucalyptus obliqua* (stringybark) was commonly the dominant eucalypt around Meander, the occurrence of *Thismia* at some

sites with *E. delegatensis* (gum-topped stringybark), *E. regnans* (giant ash) and *E. viminalis* (white gum) as dominants or co-dominants in the tree stratum suggests eucalypt species may not be important in defining suitable habitat. Within coupe HU302D the presence of *Blechnum nudum* (fishbone fern) was strongly associated with the presence of *Thismia*. However, this was not the case in other areas, especially wetter forest types such as near the Meander River and at New Road near Franklin in the south of the State, which had a relatively sparse ground fern layer. Coupe HU302D was at the drier end of the habitat spectrum of *Thismia*, according to the observations of this study, and it seems likely that in this forest type *Blechnum nudum* (fishbone fern) is indicative of wetter sites and therefore more suitable *Thismia* habitat. It may also contribute to creating a suitable microhabitat at ground level when a dense shrub layer is lacking. It should also be noted that several sites searched within this coupe had dense *B. nudum* but no evidence of *Thismia*.

Leaf litter composition and thickness is likely to be an important habitat variable for *Thismia*, given its saprophytic means of nutrition. The composition of the leaf litter where *Thismia* was found was variable (between broad-leaved shrubs as already mentioned) but the moisture content and thickness seemed fairly consistent. The upper layer of leaves was often quite dry but the layer just above the soil was usually damp, dense and cohering.

Given that *Thismia* extracts all its energy from underground (albeit via a fungus), soil and geology are habitat factors that might be expected to limit its distribution. In this study *Thismia* was generally found in loamy clay, ranging from quite friable to dense and compacted. Dolerite or dolerite talus was the underlying geology of all the sites where *Thismia* was found during this study. However, the Little Denison River site where the species was recorded in 1968 is on Permian mudstone, suggesting that geology may not be a crucial habitat factor. This is further supported by the knowledge that the species occurs in New Zealand, where there is no dolerite.

Whether the *Thismia* found in the Meander area is best considered as a single population, a meta-population or a collection of isolated populations depends on their connectivity. This is difficult to discern without a better knowledge of the species' means of fertilisation and dispersal. Speculation by biologists involved in or interested in this project has generated several hypotheses regarding both pollinators and dispersal agents. The pollination mechanism remains poorly understood and therefore insects, mammals or lizards are all possible pollinators at this point. Peter McQuillan (University of Tasmania) made the following comments regarding potential pollinators and dispersal agents:

'The bright colour of Thismia suggests a pollination agent with colour vision; most mammals, and I think therefore most marsupials, are colour blind, although they are not necessarily excluded. Birds see colour of course, but the mode of presentation seems inappropriate.'

Lizards are a possibility, with their colour vision and a litter searching behaviour. A nectar reward might be expected. The Burmanniaceae is close to the Orchidaceae I notice, and a deception reward may be offered. Andrew Hingston suggested to me that they may mimic fungi and therefore be attractive to bettongs.'

The robust nature of the corolla may also suggest some adaptation to handling by a larger animal than an insect. The most common larger litter invertebrates such as

carabids have strongly antibiotic exteriors, which tend to kill pollen quickly. Also the dispersed distribution of the flowers may mitigate against insect pollination.

I presume the seeds are tiny, numerous and lack endosperm, but without access to an airstream are probably dispersed by vertebrates via dung as you suggest.'

(edited from an e-mail correspondence to Fred Duncan)

The reproductive biology of other species of *Thismia* is likewise speculative at this stage. Thiele and Jordan (2002) suggest the flower structure of *T. rodwayi* and *T. clavarioides* resembles that of orchids pollinated by fungus gnats, and that an insect pollinator may be constrained once inside the flower, and be forced to leave via the gaps between anther filaments.

The observation that *Thismia* flowers typically occur in clumps of less than 1 m² suggests either very localised proliferation, or an individual plant which is stoloniferous, producing numerous flowers.

There are clearly many aspects of the reproductive biology of *Thismia* that require further research. However, it seems likely based on the above speculative comments that pollen is transported only short distances (less than 1 km), and seeds are dispersed over similar, or slightly longer distances. Given the current uncertainties, the Meander area might best be considered as a collection of local populations, or a meta-population.

Thismia may finish flowering by January. This is indicated by the absence of flowers from the Lenah Valley site when searched in early January, and from one site within coupe HU302D (where flowers had been abundant in early December) in mid-February. It is possible that the exceptionally dry conditions experienced Statewide in January and February 2003 shortened the flowering period for *Thismia* this season. It is also possible that the flowering of *Thismia* in the summer of 2002-2003 was influenced, perhaps even triggered, by the unseasonably high rainfall of the previous summer. The timing and duration of flowering (including potentially influential environmental variables) require further study.

Possible impact of logging or other disturbance

There has been no direct monitoring of the effect of logging or other disturbance on *Thismia*, in Tasmania or elsewhere. Looking at the disturbance history where the species has now been recorded therefore provides the only indication of its likely response. It is clear from the findings of this study that the species occurs in forest that has been subjected to some (although perhaps not intensive) disturbance from past logging.

The HU302D coupe has been selectively logged for sawlogs (*Eucalyptus obliqua* would have been the preferred species). Shoe-marks on stumps indicate that most of the logging occurred at least 50 years ago. Several overgrown tracks run through the area. Some of the regrowth eucalypts seem to date from this period of disturbance. Younger regrowth was also common, particularly in the drier forests, with occasional fire or localised disturbance events (e.g. windthrow of trees) facilitating a pulse of successful regeneration.

In the surrounding area *Thismia* was found in two coupes on Warners Sugarloaf (HU311X and HU311Y) plus one east of Meander Falls (HU322D). The coupes on Warners Sugarloaf were logged (clearfelled) in 1985 and 1986. Information regarding the exact logging methods employed, location of any exclusion zones and the

intensity of the burn was not examined. From inspection of these sites it seems possible they may have escaped intense burns as they are located near the coupe boundaries, and contain noticeably wetter vegetation than the rest of the coupe. The coupe east of Meander Falls (HU322D) has not been clearfelled, but seems likely to have been selectively logged around the 1960's (J. Morley pers comm.).

From the likely disturbance history of the sites described above it seems that disturbance from logging does not preclude the presence of the species 15-60 years after the disturbance event. The case for the species being disturbance tolerant is strengthened by its presence at Blue Gum Hill (near Glen Huon) at a site that also appeared to be regrowth within this age range.

Thismia has not been recorded from plantations, either as part of this study or opportunistically. We suggest that *Thismia* populations would be adversely affected by conversion of wet eucalypt forest to plantation because of the dramatic change in site characteristics (including potential pollinators or dispersal of seeds) and the likelihood that a dense broad-leaved shrub understorey and suitable litter layer will not develop in a typical rotation period or under typical plantation management practice. Such conversion has occurred extensively in areas with the potential to support *Thismia* (including the base of the Western Tiers, upper Derwent Valley and Franklin area). This hypothesis will not be easily tested, as current conservation requirements would preclude conversion to plantation of sites known to support *Thismia*.

The extent of disturbance tolerated (or perhaps required) by *Thismia* remains uncertain. Most, if not all, of the sites at which *Thismia* has been recorded have experience wildfire within the last 60 years. The effect of forestry activities is ambiguous due to imprecise history of logging at specific *Thismia* sites within these coupes. The silvicultural regimes proposed for coupe HU302D include seed tree retention and advanced growth retention. The advice on the Forest Practices Plan for coupe HU302D included (with the approval of the Threatened Species Unit) a recommendation to log one area of the coupe now known to contain *Thismia*, so it can be used to observe the effect of this logging technique on the long-term survival of the species. Other *Thismia* sites within the coupe will be included in exclusion zones.

Conservation status

Thismia is now known from 21 sites in Tasmania (including historical sites referred to in this report): 19 of these are on public land and two on private land. Note that the exact location of Rodway's 1890 site is not known. It could be on private land or Crown land that is now part of Wellington Park. It is assumed here that it is part of Wellington Park. Of the records on public land, four are located in formal reserves (Jackeys Creek Forest Reserve, Wellington Park, Mt Field National Park), four are in informal reserves (such as streamside reserves applied under the *Forest Practices Code*, or other areas excluded from forestry operations under Forestry Tasmania's Management Decision Classification system, and 11 are in unreserved State forest. Seven of the latter 11 sites are in coupe HU302D, and probably represent one or two populations.

Reservation status

Thismia rodwayi has been listed on Schedule 5 (Rare) of the Tasmanian *Threatened Species Protection Act 1995* since the Act was passed. Considering that the species was known from only three records at that time and little population data was

available, a listing that reflected a higher level of threat may have been warranted, but have been withheld because there was no indication of population decline or the presence of a threatening process.

The additional distribution and population data provided by this study allow the conservation status of the species to be assessed using the Threatened Species Unit's Conservation Status Assessment Program. However, there is still a lack of data concerning population stability and potential threats. The fact that *Thismia* has now been found in areas known to have been disturbed by fire or selective logging (and in some cases both) in the last 50 years suggests these are not highly threatening processes. It should also be noted that the forest types apparently favoured by the species are common, widespread and well reserved in Tasmania. However, conversion of wet eucalypt forest to plantation is likely to be threatening, as described above.

In the absence of further data concerning threats, *Thismia* cannot be confidently listed as either endangered or vulnerable (guidelines for listing: TSU 2002). However, the small number, extent and size of known populations suggest a stochastic risk, and it fulfills three of the category 'B' criteria for listing as a rare species (TSU 2002) – see Table 5. The species may also fit into category 'A' (TSU 2002) on the grounds of populations being small and localized. However, this category only applies when an on-going process is known to be threatening the species distribution or total numbers such that it would cause the species to qualify for a higher extinction risk category unless the threatening process was abated.

Table 5. The criteria for 'rare' (Schedule 5) satisfied by *Thismia rodwayi*. The criteria are taken from a pamphlet produce by the Threatened Species Unit (TSU 2002).

Criteria	Comments for <i>Thismia rodwayi</i>
B. Extent of occurrence <2000 sq km	Extends from the Meander area in the central north, to Mt Field in the central south (about 120 km), south east to the Glen Huon area (about 50 km), and to the Hobart area (about 40 km). The total extent of occurrence is approximately 670 sq km.
B. Area of occupancy <50 ha	The clumped and patchy distribution of <i>Thismia</i> suggests that the actual area occupied by the species at each site is small, even when clumps are spread out. It therefore unlikely that it occupies even a single hectare at each site. The total area of occupancy is estimated to be less than 20 ha.
B. Most mature individuals in <10 populations	If a record of <i>Thismia</i> is considered a distinct population when more than 500m from any other record and suitable habitat is not continuous, 90% of individuals occur in just four populations (all in the Meander area).

It is clear from the comments in Table 5 that *Thismia* satisfies criteria for being listed as 'rare' based on very conservative estimates of population size and extent. The unconfirmed record from the Ben Lomond region has not been included in this assessment, however this single record would not prevent its qualification as rare under criterion B. There is a high likelihood that more populations exist due its typical habitat being widespread and common in Tasmania (but it is interesting to note the paucity of records and the infrequent recording of the species). The cryptic nature of *Thismia* necessitates a precautionary approach. Long term monitoring of population size and distribution is likely to be logistically difficult for this species, but such work

would provide valuable data on potential threatening processes, such as plantation establishment and land clearance.

MANAGEMENT RECOMMENDATIONS

Recommendations given for coupe HU302D

Subsequent to this research, the Forest Practices Board made the following recommendations to take account of the presence of *Thismia* in coupe HU302D:

- Most areas that contain favourable habitat for *Thismia* (based on the sampling conducted for this report) should be excluded from the forestry operation.
- One site containing *Thismia* should be logged in a similar manner to that proposed for the rest of the coupe. This site is located at GR ⁴67940mE ⁵³87408mN. The purpose of this is to assess the response of *Thismia* to this type of operation, and disturbance in general. Fieldwork may be needed prior to logging to better determine the distribution of *Thismia* at the site.

The Threatened Species Unit (DPIWE) has approved the above recommendations.

Suggested actions for other coupes containing potential habitat

The cryptic nature of this species makes assessment of its distribution difficult. With regard to appropriate management in forestry areas, there are several issues that arise from this difficulty:

- There are likely to be many sites, including sites where forestry operations are proposed, where the species has not been discovered. There are almost certainly some sites that contained *Thismia* that have been logged in ignorance of its presence.
- What appears to be suitable habitat for the species is common in many areas of the State (perhaps due to our fairly crude understanding of relevant habitat factors).
- Surveying for the species is extremely time consuming.
- Surveying can only occur when flowers are present, which appears to be over a 2-month period in late spring/early summer. This time frame may not always be practical from a forestry perspective. Also flowering may not occur every year.

Given these difficulties, and the fact that some disturbances (e.g. selective logging and fire) are apparently not detrimental to the species, surveys of further coupes for *Thismia* purely on the basis of apparently suitable habitat is not suggested at this stage. The exclusion of forestry operations from **all** potentially suitable habitat is also considered inappropriate as a management prescription because the habitat type is only loosely defined and is apparently common in native production forest. However, coupes within close proximity of a known *Thismia* site may warrant surveys, and/or habitat retention. As a guide, any coupes within three kilometres of known sites should be inspected for potential habitat at the time of preparing the forest practices plan. Potential habitat, based on our current knowledge, should be defined by the following attributes:

1. A dense broad-leaved shrub layer dominated by *Pomaderris apetala* (dogwood), *Bedfordia salicina* (blanket bush) and/or *Olearia argophylla* (musk);
2. A moderate to sparse eucalypt canopy, or eucalypt forest surrounding the site;

3. *Moist friable soil covered by humic leaf-litter;*
4. *Altitude range between 100 and 650 metres.*

If potential habitat is present, the Forest Practices Board Botanist should be contacted. If such habitat is not already contained in substantive formal or informal reserves close to the operational area, habitat retention prescriptions may be needed. Measures may include placement of wildlife habitat strips or wildlife habitat clumps, extension of streamside reserves and delineation of other areas where operations should be excluded or modified.

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Appendix. Summary of *Thismia rodwayi* sites. N.D. indicates no data. Forest type codes are defined by Kirkpatrick *et al* (1988). Tenure abbreviations: Pr = Private land, St = State production forest, R = formal reserve, IR = Informal reserve or special management zone.

Date	Location (Recorder)	Tenure	Easting	Northing	Altitude (m)	Landform	Geology	Forest community	Number	Herb. No.
Historical records										
DEC 1890	Cascades, Hobart	R (?)	521800	525000	290	N.D.	Dolerite	N.D..	N.D..	25468
NOV 1923	Mt Field Track (Mt Dobson Rd)	R	475500	5274300	300	N.D.	N.D.	N.D..	N.D..	23812
20/10/68	Little Denison River via Judbury	IR	481000	5242800	120	N.D.	N.D.	N.D..	N.D..	115634
?1980s	Ben Lomond region	?	560000	5420000	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
(record unconfirmed - grid reference is for the centre of the region)										
01/11/02	Lenah Valley fire track	R	521400	5352200	320	midslope/gully	Dolerite	WET-REG 1001		519153
Records from this study										
15/11/02	Archers Sugarloaf	St	467940	5387408	415	slope/bench	Dolerite	WET-OB010	3	519512
15/11/02	Archers Sugarloaf	St	467647	5387340	425	bench	Dolerite	WET-OB0110	5	519510
15/11/02	Archers Sugarloaf	St	467621	5387245	436	slope/bench	Dolerite	WET OB0110	3	519511
09/12/02	Archers Sugarloaf	St	468008	5386663	445	slope/flat	Dolerite	WET OB0110	3	
09/12/02	Archers Sugarloaf	St	468500	5387020	405	midslope/shelf	Dolerite	WET OB0110	39	
10/12/02	Archers Sugarloaf	St	467597	5387160	435	shelf	Dolerite	WET OB0110	2	
10/12/02	Archers Sugarloaf	St	467759	5387242	430	shelf	Dolerite	WET OB0110	1	
10/12/02	Warners Sugarloaf	St	470277	5386284	450	midslope	Dolerite	WET OB0110	5	
10/12/02	Jackeys Creek FR	R	470474	5386494	440	slope near river	Permian mudstone	WET VIM-0011	13	
11/12/02	Warners Sugarloaf	St	469875	5385927	435	midslope	Dolerite	WET DEL0100	3	
11/12/02	Meander River	IR	463447	5381741	510	gully	Dolerite talus	WET-DEL1000	5	
11/12/02	Meander River	IR	461997	5380691	590	drainage depression	Dolerite talus	WET-DEL0110	18	
11/12/02	East of Meander River	St	462859	5380724	610	drainage depression	Dolerite talus	WET-DEL0111	7	
11/12/02	Meander River	IR	463980	5382231	465	riparian flats	Dolerite talus	WET-DEL0111	3	
18/12/02	New Rd, Franklin	Pr	495197	5230445	435	midslope	Dolerite	WET DEL0110	5	
18/12/02	New Rd, Franklin	St	495195	5230252	440	midslope	Dolerite	WET DEL0110	2	
18/12/02	Blue Gum Hill, Glen Huon	Pr	491200	5232900	470	midslope	Dolerite	WET-REG1001	5	

