



# Narrow-leaved wilsonia (*Wilsonia backhousei*)

2019–20 surveys



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### Photos:

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# Executive summary

Narrow-leafed wilsonia (*Wilsonia backhousei*) is a threatened long-lived perennial subshrub less than 15 cm tall that can form large mats depending on the site condition (Photo 1). It is mainly confined to the Australian coastline and inland saline environments. The only other recorded location is one site in the north of the South Island of New Zealand. It grows in coastal saltmarsh, an endangered ecological community, but also occurs on the coastline and the margins of coastal lakes. The plant can tolerate a range of salinity levels and can recover after protracted immersion. This species is known to occur in national parks, Crown and private land.

Prior to this survey, the extent and recorded locations of narrow-leafed wilsonia in New South Wales had not been surveyed since 2009 (Saintilan 2009a). As part of the Saving our Species (SoS) program this site-managed species was targeted for an updated survey, although not all sites in New South Wales were included in this work. Fifteen sites were surveyed between Jervis Bay, south to Pambula Lake. Of these, 13 sites had current populations of the species.

For all sites surveyed with narrow-leafed wilsonia present, habitat, associated plant species and potential threats were recorded. The outer perimeters of the populations were georeferenced, to give an indication of the population extent, but cover of narrow-leafed wilsonia within these areas varied significantly between sites. The largest site surveyed in this study was recorded in the Jervis Bay area, but population size varied significantly between sites surveyed. A single narrow-leafed wilsonia plant can cover up to 225 m<sup>2</sup> and forms large continuous mats. During the survey it was unclear how many genetic individuals were present at each site, and genetic analysis may be required to clarify this.

Potential threats include trampling (minor) and motor vehicle use in saltmarsh. Sea level rise, where there is limited capacity for the plant to retreat inland, and invasion of the saltmarsh zone by mangroves are other possible threats. Due to the harsh growing conditions, weeds present little or no threat at the currently known sites.

Based on the results of this survey, it is recommended that narrow-leafed wilsonia remains in the site-managed management stream of the SoS program. The sites should be re-surveyed in 5 years, in 2025–26, to ensure the populations remain stable and the long-term survival of this species is assured. Seed collection is recommended for the NSW sites as little seed of this species is held in the NSW Seedbank at the Australian Botanic Garden, Mount Annan. Herbarium collections for all NSW sites are also recommended.



# 1. Background

Narrow-leaved wilsonia (*Wilsonia backhousei*) is a perennial shrub less than 15 cm tall that can form large mats and has a sprawling habit. It is strongly associated with coastal saltmarsh, an endangered ecological community, and is mainly found on the margins of saltmarshes and coastal lakes. It can also be found growing on coastal rock shelves, but populations in these locations were observed to be very small. As with other saltmarsh species, *Wilsonia backhousei* has a high tolerance to ranges of salinity and soil water content (Saintilan 2009a).

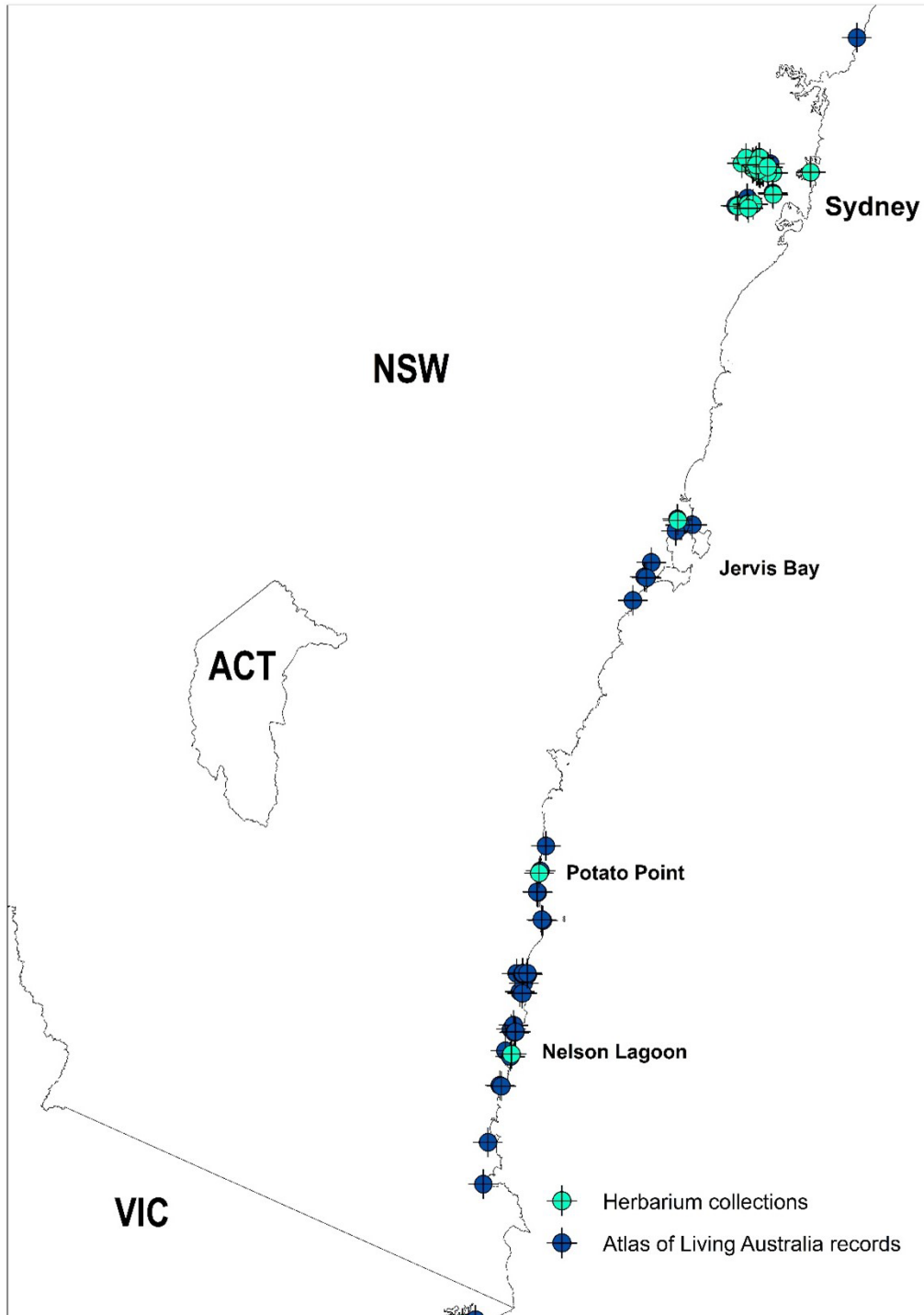


**Photo 1**      **Narrow-leaved wilsonia at Wowly Gully, Jervis Bay National Park. Genevieve Wright/DCCEEW**

One of the earliest collections of narrow-leaved wilsonia was in 1852 by the famous botanist Ferdinand Von Mueller in Victoria, Port Phillip Bay, but the type is from Tasmania. In New South Wales, early records were from the Sydney area, with the first collection in 1869. In 1968, a collection was made 260 km to the south at Potato Point, a small coastal town; this population is still present today.

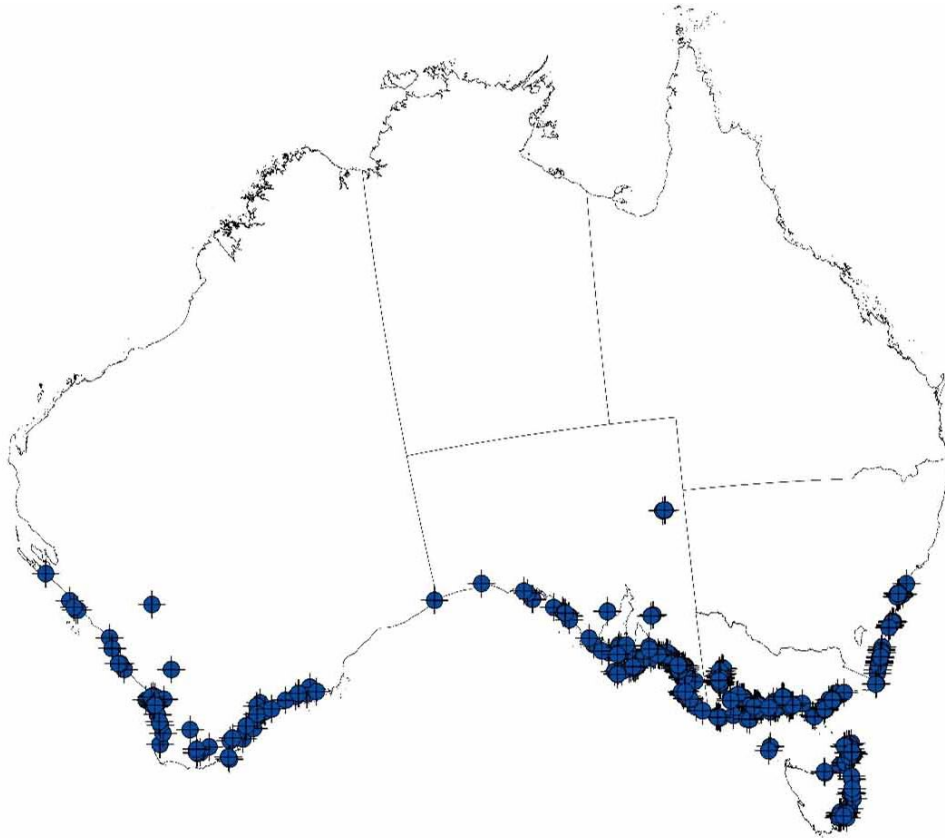
Currently, the records show the NSW distribution of *Wilsonia backhousei* to be from Wamberal Lagoon, some 50 km north of Sydney (DPIE 2000), south to the Victorian border. There are herbarium collections from 4 main localities in New South Wales: the Sydney area, Jervis Bay, Potato Point and Nelson Lagoon. Other records accessed from the Atlas of Living Australia (ALA, June 2020) indicate many additional coastal localities

in New South Wales (Map 1). Both herbarium and ALA records were targeted in the current survey, but due to time and logistical constraints not all sites were visited. The most extensive populations in New South Wales are currently thought to be those in the Jervis Bay area.



**Map 1** Narrow-leaved wilsonia in New South Wales, Herbarium and Atlas of Living Australia records

Narrow-leafed wilsonia also grows in Western Australia, South Australia, Victoria and Tasmania. The records from these states are concentrated along the coast, although recently it has also been found inland (Map 2). The locational accuracy of the records from other states was not investigated, with the exception of the inland site south of Lake Blanche (South Australia), which is a 2015 herbarium collection. *Wilsonia backhousei* growing in this inland saline environment is consistent with other saltmarsh species distributions (Saintilan 2009a). There are also herbarium collections from one location in New Zealand, at the north end of the South Island from 1994 through to 2009, in a coastal situation.



**Map 2**      **Narrow-leafed wilsonia distribution in Australia, Australian Virtual Herbarium records**



## 2. Purpose

*Wilsonia backhousei* is listed as vulnerable on the NSW *Biodiversity Conservation Act 2016* but is not listed on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. It is currently assigned to the site-managed management stream in the Saving our Species (SoS) program, which is defined as a species that can be secured in the wild for the next 100 years by conservation projects at specific sites. A review of the species' locations in New South Wales and survey of populations in part of its distribution was undertaken to assess whether it is currently assigned to the most appropriate management stream.

The objectives of the current survey were to:

- re-locate plants at sites where previously recorded
- record habitat type
- identify current or potential threats
- collect herbarium specimens if available
- collect seed if available
- record any other ecological observations.

This document reports on surveys conducted between September 2019 and June 2020 within the southern geographic range of the species in New South Wales.



**Photo 2**      **Narrow-leaved wilsonia flowering, Bermagui. Jackie Miles**

### 3. Survey method

The 2019–20 survey work was undertaken from Jervis Bay, south to Pambula Lake. Populations were surveyed in Jervis Bay, Conjola, Eurobodalla, Bournda and Ben Boyd national parks, and on Crown and private land. Surveys were conducted over a 10-month period and of the 15 sites surveyed, 13 had extant populations. The southernmost record near Boydtown and the Sydney area records, including the single record at Wamberal Lagoon, were not included in these surveys.

Prior to survey, an ArcGIS layer was developed using ALA and Australian Virtual Herbarium (AVH) records (extracted August 2019). The locational accuracy of the NSW records was checked, and this data layer used to examine the spatial distribution of the species and identify populations to survey.

For all sites surveyed with *Wilsonia backhousei* present, habitat, associated species and potential threats were recorded. The outer perimeters of the populations were georeferenced to give an indication of the population extent but cover of wilsonia within these areas varied significantly between sites. Herbarium specimens were to be collected when possible.

A number of ecological observations were made, which are documented in the site descriptions in the following section.

## 4. Sites

### 4.1 Wowly Gully, Jervis Bay National Park



**Photo 3**      **Narrow-leaved wilsonia at Wowly Gully, Jervis Bay National Park. Genevieve Wright/DCCEEW**

**Survey date:** 5 September 2019

**Species present:** *Gahnia* (*Gahnia filum*), glasswort (*Sarcocornia quinqueflora*), swamp weed (*Selliera radicans*), streaked arrowgrass (*Triglochin striata*), bare twig-rush (*Machaerina juncea* [Syn. *Baumea juncea*]), sea rush (*Juncus kraussii*)

**Ecological notes:** The Wowly Gully site of *Wilsonia backhousei* is adjacent to the endangered ecological community Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

This survey was completed in spring 2019, following a below average rainfall winter (Phil Craven pers. comm. September 2019). The population at this site is quite extensive and it is possible the species' extent may be able to be mapped from aerial photographs. The plants at this site had recently produced new growth, possibly in response to a recent rainfall event (Photo 4).



It was observed that a few patches of *Wilsonia backhousei* were yellowing, presumably in response to local microclimate variation, possibly in response to the dry conditions (Photo 5). No plants were found in bud or flower.

The full extent of the population here was not surveyed, but this site is extensive and there is potential habitat downstream. There is a 2006 BioNet record (J Miles) 600 m downstream of the area surveyed in this work, which was not surveyed but indicates a larger population at this site. This site has a single 20 m x 20 m full-floristic plot established for the 2006 Saltmarsh EEC validation project (P Craven 2020). An herbarium specimen was collected from this area by P Adams (8 Oct 1983, NSW 427810), and the collection notes indicated that wilsonia was widespread on saltmarshes in the Jervis Bay area.



**Photo 4**      **Narrow-leaved wilsonia with new growth. Genevieve Wright/DCCEEW**





**Photo 5**      **Narrow-leaved wilsonia yellowing patches. Genevieve Wright/DCCEEW**

**Threats:** The Wowly Gully population in Jervis Bay National Park is close to the township of Callala Bay and adjacent to a powerline easement. The access track along this easement has impacted the narrow-leaved wilsonia population and use of the area by 4WD vehicles and motorbikes has denuded the site of vegetation.

Vehicle impacts are mainly confined to the easement and adjacent private land; the current fence line excludes most traffic, but occasional illegal vehicle impacts are evident in the park (Photo 6).

Recovery of a continuous area of narrow-leaved wilsonia from soil and root compaction after vehicle impacts may take up to 5 years without further disturbances (Phil Craven pers. comm. September 2019).

A series of images taken at Wowly Gully between 2002 and 2019 show the extent of vehicle impacts and recovery trajectories (Appendix A).



**Photo 6**      **Vehicle impacts in Jervis Bay National Park. Genevieve Wright/DCCEEW**



## 4.2 Callala Creek



**Photo 7**      **Narrow-leafed wilsonia at Callala Creek. Genevieve Wright/DCCEEW**

**Survey date:** 5 September 2019

**Species present:** *Gahnia* (*Gahnia filum*), glasswort (*Sarcocornia quinqueflora*), swamp weed (*Selliera radicans*), saltwater couch (*Sporobolus virginicus*), bare twig-rush (*Machaerina juncea* [Syn. *Baumea juncea*]), sea rush (*Juncus kraussii*), grey mangrove (*Avicennia marina*)

**Ecological notes:** The Callala Creek site of *Wilsonia backhousei* found during this survey was situated in the lower marsh on the western edge of an intertidal area. It was adjacent to a patch of recently burnt endangered ecological community Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

The wilsonia at this site occurred in a discrete patch some 20 m x 30 m, but also extended 40 m south of this area. At this site wilsonia occurred as a more or less continuous patch in one part of the site (Photo 7), but in other areas occurred as a scattering of plants.

This survey was completed in spring 2019, following a below average rainfall winter (Phil Craven pers. comm. September 2019). No plants were found in bud or flower.

The full extent of the population here was not surveyed, but the saltmarsh at Callala Creek extends some 1.5 km west of our survey point.



The saltmarsh area has 2 BioNet records, which were not surveyed in this work, a record from 2009 (A Stratton), and a 2015 record (J Bryant). These are 630 m and 850 m upstream, respectively, of the area surveyed in this work, indicating *Wilsonia backhousei* is more widespread. There is no herbarium collection for this site.

**Threats:** There were no obvious threats at this site (i.e. vehicle impacts), but the site is close to Callala Bay. The fire that burnt the casuarina forest did not appear to extend into the marsh and had not appeared to affect saltmarsh plants.

### 4.3 Carama Inlet, Jervis Bay National Park



**Photo 8**      **Narrow-leaved wilsonia, upper Carama Creek, Jervis Bay National Park.**  
**Genevieve Wright/DCCEEW**

**Survey date:** 5 September 2019

**Species present:** *Gahnia* (*Gahnia filum*), glasswort (*Sarcocornia quinqueflora*), saltwater couch (*Sporobolus virginicus*), bare twig-rush (*Machaerina juncea* [Syn. *Baumea juncea*]), sea rush (*Juncus kraussii*), streaked arrowgrass (*Triglochin striata*), glasswort (*Tecticornia arbuscula*), rat's tail orchid (*Dendrobium teretifolium*)

**Ecological notes:** The upper Carama Inlet site of *Wilsonia backhousei* found during this survey was approximately 1 km west of the 2006 BioNet record (J Miles). It is adjacent to the endangered ecological community Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions. There is no herbarium collection for this site.

The population at this site is extensive, occurring as dense mats similar to those found at Wowly Gully. It is possible the species' potential habitat may be mapped from aerial photographs. Patches of the sea rush (*Juncus kraussii*) at this site appeared to have died; the cause of this is unknown (Photo 9) but may be related to the below average rainfall in the district over the past 2 years and an elevated accumulation of salt in the soil profile.



While the stems have died and some smaller plants were clearly dead, the rootstock of many large tussock plants may still be alive and may respond favourably to an episodic rainfall event.

*Wilsonia backhousei* was observed to be preferentially growing in the raised areas around old, long dead swamp oak (*Casuarina glauca*) (Photo 10). These old stumps are evidence of the historical changes in the ecological boundary between the Swamp Oak Floodplain Forest and salt marsh. No *Wilsonia backhousei* plants were found in bud or flower at this site.



**Photo 9** Narrow-leaved wilsonia in foreground with dead patches of sea rush evident behind, upper Carama Creek, Jervis Bay National Park. Genevieve Wright/DCCEEW





**Photo 10**      **Narrow-leaved wilsonia patches, upper Carama Inlet, Jervis Bay National Park.**  
**Genevieve Wright/DCCEEW**

**Threats:** Recent vehicle impacts were recorded during this survey (Photo 11). This activity has the potential to have an adverse impact on the wilsonia population at this site if it continues.





**Photo 11** Motorbike track impacts to intact narrow-leaved wilsonia patch, upper Carama Inlet, Jervis Bay National Park. Genevieve Wright/DCCEEW



## 4.4 St Georges Basin



**Photo 12** Main patch of *Wilsonia backhousei* on shoreline of St Georges Basin. Phil Craven

**Survey date:** 3 September 2019

**Ecological notes:** This is a very small population of *Wilsonia backhousei* found on the northern shore of St Georges Basin. It occurs in a 5 m x 15 m area and is growing in siltstone fissures at the upper high tide zone; there are 7 distinct clumps (Photo 12).

No plants were found in bud or flower. No other plants were found in similar habitat within 250 m of this population. At this site wilsonia is associated with *Sporobolus virginicus*.

This population was first recorded in 2009 (P Craven). There are 2 BioNet records, 2002 (D Young) and 2009 (M Stables), from the same locality on the southern shore of St Georges Basin near Suncrest Avenue, Sussex Inlet. These were not surveyed during this work.

**Threats:** Close proximity to St Georges Basin foreshore walking track. Subject to accidental trampling by people walking along the foreshore. Future sea level rise will possibly force plants to grow in rock fissures higher on the shoreline.



**Photo 13**      **Narrow-leaved wilsonia and rock fissure habitat, St Georges Basin. Phil Craven**



**Photo 14**      **Narrow-leaved wilsonia and rock fissure habitat, St Georges Basin. Phil Craven**



## 4.5 Monument Beach, Conjola National Park



Photo 15 Main population of *Wilsonia backhousei* at Monument Beach. Phil Craven

**Survey date:** 26 September 2019

**Species present:** Narrow-leafed wilsonia (*Wilsonia backhousei*), saltwater couch (*Sporobolus virginicus*), coastal rosemary (*Westringia fruticosa*), NZ spinach or Warrigal greens (*Tetragonia tetragonioides*)

**Ecological notes:** *Wilsonia backhousei* is located on the coastline immediately below the Monument Beach car park picnic shelter. Here, it grows in longitudinal sandstone rock cracks orientated east–west.

There are 2 distinct groups of plants, the main one having 4 extensive clumps (within an extent of 11 m x 2 m) and the minor site some 10 m away to the north-west had 2 distinct clumps (within an extent of 2 m x 1.5 m). The area occupied by plants is much less than the extents noted above.

The population at this site is very restricted (Photo 15). Most stems appeared healthy with new growth but were not flowering or fruiting. The eastern-most stem had some dieback but was alive; its location closest to the ocean may make it more prone to salt effects. This population was first recorded by Kevin Mills in 1998 (Mills 1998).



**Photo 16**      *Wilsonia backhousei* growing in crack in sandstone in association with *Westringia fruticose*. Phil Craven

**Threats:** No immediate threats to the viability of this population are apparent.

People walk through the main group over a small saddle to traverse the rocks (Photo 17, to left of drum), however, scuffing of plants is minimal. Predicted sea level rise in future decades may cause this population to grow into cracks further shoreward, however, there is a limit to how far this growth can extend before reaching the cliff base.

The very small number of plants and restricted locality make this site very vulnerable to stochastic events that may cause its local extinction.





**Photo 17** Monument Rocks, showing small saddle through which walkers pass; *Wilsonia backhousei* is in crack below blue drum on either side of saddle. Phil Craven

## 4.6 Bingie Bingie Point



**Photo 18** Bingie Bingie Point. Genevieve Wright/DCCEEW

**Survey date:** 18 June 2020

**Notes:** There is a 2017 record from ALA from Bingie Bingie Point, a human observation (anon.); there is no herbarium collection. The locality was surveyed, but no *Wilsonia backhousei* was found. There are saltmarsh species often associated with wilsonia present at the locality given, further survey may re-locate this population, but it is likely to be small.



## 4.7 Potato Point



**Photo 19**      **Narrow-leaved wilsonia, Potato Point. Genevieve Wright/DCCEEW**

**Survey date:** 6 September 2019

**Ecological notes:** This is a very small population of *Wilsonia backhousei*; it occurs in an area approximately 20 m x 50 m. Here *Wilsonia backhousei* is growing on the edge of a rock platform in rock fissures (Photo 20). No plants were found in bud or flower.

**Threats:** Being close to Potato Point boat ramp, there are possible impacts from summer tourism and competition from other coastal species (Photo 21). This site was first recorded in January 1968, and there was an herbarium collection made at that time (J Wrigley). There is also a 2004 BioNet record from the same locality (J Miles).





**Photo 20**      **Narrow-leaved wilsonia, growing in rock fissures, Potato Point.**  
**Genevieve Wright/DCCEEW**





**Photo 21**      **Narrow-leaved wilsonia, competing for resources with couch grass, Potato Point. Genevieve Wright/DCCEEW**



## 4.8 Lake Mummuga, Eurobodalla National Park



Photo 22      Narrow-leaved wilsonia, Lake Mummuga. Genevieve Wright/DCCEW

**Survey date:** 18 June 2020

**Species present:** Gahnia (*Gahnia filum*), sea rush (*Juncus kraussii*), glasswort (*Sarcocornia quinqueflora*), swamp weed (*Selliera radicans*), swamp oak (*Casuarina glauca*)

**Ecological notes:** At this site *Wilsonia backhousei* was found in 2 patches on the north-eastern and southern edge of an unnamed island about 500 m from the lake mouth. One area is 60 m x 35 m, the other 45 m x 16 m.



The larger patch is a dense carpet of *Wilsonia backhousei*, which extended through the adjacent *Gahnia filum* and *Juncus kraussii* and continued under the canopy of *Casuarina glauca* stands for up to 2 m.

The other patch had a similar distribution on the island edge but occurred as scattered plants among other saltmarsh species.

No plants were found in bud or flower. There is a 2016 BioNet record (B Gooden) from this locality, which was unknown at the time of survey. This record has been confirmed. There is also another record approximately 300 m south-east of this site from 2006 (J Miles). This area was searched but no plants were found. The record from that time indicated only a few plants, recently established.

Grass cover in the area is now very dense and the plants could not be found. This survey was not extensive; there are other areas of potential habitat around the lake's edge that may have additional populations.

**Threats:** Close proximity to the coastal township of Dalmeny, possible impacts from summer tourism situated at the end of a fishing track.

## 4.9 Nangudga Lake



**Photo 23**      **Narrow-leaved wilsonia, Nangudga Lake. Genevieve Wright/DCCEEW**

**Survey date:** 18 June 2020

**Species present:** *Gahnia* (*Gahnia filum*), sea rush (*Juncus kraussii*), glasswort (*Sarcocornia quinqueflora*), swamp weed (*Selliera radicans*), swamp oak (*Casuarina glauca*)

**Ecological notes:** At this site *Wilsonia backhousei* occurs on the southern shore of Nangudga Lake, 60 m from the bridge on the Princes Highway. One patch 90 m long x 20 m wide (at the widest point) was found. Survey was conducted to the end of the saltmarsh vegetation towards the lake mouth, but no more plants were found. The patch had both dense carpets of *Wilsonia backhousei*, and areas of scattered plants among other saltmarsh species. This site was originally found in December 2009 (J Miles).

No plants were found in bud or flower. There is another BioNet record at this site from the same time, location about 300 m inland from the mouth of Nangudga Lake on the western shore, in Eurobodalla National Park. This could not be accessed during this survey due to high water levels, but it is assumed that the population still exists.

**Threats:** No obvious threats, access is limited and the land adjacent to the site is privately owned but falls within Crown land boundaries. The lake edge here is fenced and stock have no access.



## 4.10 Bermagui River estuary

### 4.10.1 South River Road



Photo 24 Narrow-leaved wilsonia, Bermagui River estuary. Genevieve Wright/DCCEEW

**Survey date:** 11 June 2020

**Species present:** Grey mangrove (*Avicennia marina*), river mangrove (*Aegiceras corniculatum*), glasswort (*Sarcocornia quinqueflora*), creeping brookweed (*Samolus repens*), austral seablite (*Suaeda australis*), sea lavender (*Limonium australe*), sea rush (*Juncus kraussii*), saltmarsh Gahnia (*Gahnia filum*), salt couch (*Sporobolus virginicus*), coastal speargrass (*Austrostipa stipoides*)

**Ecological notes:** *Wilsonia backhousei* has populations in 2 areas in this part of the estuary. The most extensive occurrence is on the southern shore at the end of South River Road, starting just beyond the gate from the car parking area. There are 3 patches in this location in an area approx. 215 m x 75 m.

The other location for the species is 400 m upstream, in an area 90 m x 90 m. Vegetation that *Wilsonia backhousei* is associated with varies within the site. It occurs in the lowest part of the saltmarsh and extends into the lower edge of the *Juncus kraussii* zone, but it mainly grows with *Sarcocornia*.

In the *Juncus kraussii* zone it extends a few metres in as an understorey plant. More elevated areas carry the large tussock grass *Austrostipa stipoides*, and the wilsonia here does not extend into this zone.

This site contains the largest collective area of wilsonia found during these surveys, with the exception of Jervis Bay.



**Photo 25**      **Narrow-leafed wilsonia, Bermagui River estuary, western population.**  
**Genevieve Wright/DCCEEW**





**Photo 26**      **Narrow-leaved wilsonia, Bermagui River estuary, western population showing old access trail. Genevieve Wright/DCCEEW**

Two records from 1992, associated with a saltmarsh survey by P Clarke, were close to the populations found in this survey in the Bermagui River estuary. It is assumed that these are the same populations. These same areas were visited between 2002 and 2005 and there are a number of BioNet records from that time (J Miles, Stuart Cameron). One more 1992 saltmarsh survey record (P Clarke) indicated a population of wilsonia 2 km upstream of the Bermagui River estuary sites. This area was surveyed, but no plants were found. There are no herbarium records for any of these populations.

**Threats:** On a tidal estuary, mangrove invasion could represent a threat to saltmarsh species. Abundant regeneration of grey mangrove is present in many areas of the Bermagui River estuary. No weeds or evidence of herbivore activity.

Vehicle access was a threat to saltmarsh vegetation at this site, but access has now been blocked by fencing established by Bega Valley Shire Council, and some rehabilitation of old tracks has been completed. Recovery and recolonisation by wilsonia along the track edges was evident (Photo 26). Signage explaining the significance of saltmarsh has also been installed. The area is still popular with local walkers but given the relatively small population of Bermagui, trampling impacts should be minimal.



## 4.10.2 Bermagui Harbour



**Photo 27**      **Narrow-leafed wilsonia, Bermagui Harbour. Genevieve Wright/DCCEEW**

**Survey date:** 11 June 2020

**Species present:** Glasswort (*Sarcocornia quinqueflora*), sea rush (*Juncus kraussii*), salt couch (*Sporobolus virginicus*)

**Ecological notes:** There are 2 small occurrences of *Wilsonia backhousei* on the northern shore east from the bridge at the corner of Wapengo Street and Wallaga Lake Road in Bermagui Harbour. There is a 1 m x 10 m patch and a smaller patch 50 m downstream. The first is in a more elevated situation among *Sporobolus virginicus* on a mound of accumulated sediment. The second is on the lower edge of the *Juncus kraussii* zone. A spit that would be an island at high tide about 200 m east of this population was also checked and the species is not present on it.

**Threats:** Despite being close to roads, the site appears to be under no immediate threat. The built-up nature of the immediate environs may mean the population has nowhere to retreat to in the event of sea level rise making their current habitat unsuitable. There were no weeds or evidence of herbivore activity.



### 4.10.3 Bermagui Harbour, Bermagui Point



**Photo 28**      **Narrow-leafed wilsonia, Bermagui Harbour, Bermagui Point. Genevieve Wright/DCCEEW**

**Survey date:** 11 June 2020

**Species present:** Glasswort (*Sarcocornia quinqueflora*), sea rush (*Juncus kraussii*), salt couch (*Sporobolus virginicus*)

**Ecological notes:** There are a few plants in crevices of vertically bedded siltstone rock along the eastern shore of the Bruce Steer pool close to the harbour mouth. They extend over an area of 80 m x 3 m but are only sparsely scattered.

There is an ALA record for this site from 2019 (J Miles), when it was first found.

**Threats:** Despite being close to a carpark and recreation area, the site appears to be under no immediate threat. The built-up nature of the immediate environs may mean the population has nowhere to retreat to and sea level rise would impact the population. There were no weeds or evidence of herbivore activity at this site.



#### 4.10.4 Bermagui Harbour, Country Club



**Photo 29**      **Narrow-leaved wilsonia, Bermagui Harbour, Country Club. Genevieve Wright/DCCEEW**

**Survey date:** 11 June 2020

**Species present:** Glasswort (*Sarcocornia quinqueflora*), austral seablite (*Suaeda australis*), sea rush (*Juncus kraussii*)

**Ecological notes:** This population occurs in the mouth of a small drainage line that runs out of the golf course to the harbour just east of the Country Club car park. It extends over an area of about 37 m x 20 m, with a narrow tail running upstream along the western edge below a stand of *Casuarina glauca*. Further upstream on this drainage line has been checked previously and the species was not found to extend beyond this area.

**Threats:** Despite being close to a car park, the site appears to be under no immediate threat. The regeneration of grey mangrove adjacent to the wilsonia at this site is present in many areas of the Bermagui River estuary and may have future impact. The built-up nature of the immediate environs may mean the population has nowhere to retreat to, making sea level rise a threat to the population. There were no weeds or evidence of herbivore activity at this site.

This site was first recorded in 2005 (J Miles), and there is another record from 2017 (J Miles). There is no herbarium specimen for this site.



## 4.11 Baragoot Lake

### 4.11.1 Baragoot Lake, north shore



**Photo 30**      **Narrow-leafed wilsonia, Baragoot Lake, north shore. Genevieve Wright/DCCEEW**

**Survey date:** 11 June 2020

**Species present:** Glasswort (*Sarcocornia quinqueflora*), creeping brookweed (*Samolus repens*), giant honey myrtle (*Melaleuca armillaris*), sea rush (*Juncus kraussii*), salt couch (*Sporobolus virginicus*)

**Ecological notes:** There was a single 2005 BioNet record (S Cameron) from the northern shore of Baragoot Lake, growing in rock crevices over an area of about 25 m in length. This site was re-located but found to be only 14 m x 4 m in size. The entire northern shore was checked to Mangans Creek inlet, and no other occurrences were found. No plants were found in bud or flower. There is no herbarium collection for this site.



#### 4.11.2 Baragoot Lake, south shore



**Photo 31**      **Narrow-leafed wilsonia, Baragoot Lake, south shore. Genevieve Wright/DCCEEW**

**Survey date:** 11 June 2020

**Species present:** Glasswort (*Sarcocornia quinqueflora*), creeping brookweed (*Samolus repens*), giant honey myrtle (*Melaleuca armillaris*), sea rush (*Juncus kraussii*), salt couch (*Sporobolus virginicus*)

**Ecological notes:** The eastern half of the southern shoreline was also traversed and another very small population of *Wilsonia backhousei* was located. The species was growing on rocks at the lower edge of the *Melaleuca armillaris* belt. This is a new site. No plants were found in bud or flower. There is no herbarium collection for this site.

Baragoot Lake has quite a small catchment and is a coastal lagoon with an intermittently closed and open direct connection to the sea (ICOLL), which in recent decades has frequently been closed for very long periods, sometimes for years at a time.

The water level was quite low at the time of the survey, with a beach a few metres wide around most of the shore except where rock outcrops occurred.



**Threats:** The small size of the 2 populations on this lake may leave them vulnerable to stochastic events such as protracted droughts or periods of high stand. However, periods of low water level may provide an opportunity for this species to extend its range into parts of the lake that are normally under water.

Observations indicate the population on the northern shore of the lake has not moved out of the rock outcrop and into the adjacent sediment despite a drought of over 2 years in length.

Climate change and associated sea level rise may increase the frequency of the lake being open to the sea. Becoming a tidal lake would reduce the variability in water depth and thereby the area potentially available for *Wilsonia backhousei* to occupy.

The water salinity and seasonal variability in lake water depth would also be changed, conditions in which saltmarsh species have an adaptive advantage over other coastal plants.

Baragoot Lake is a Crown waterway; the land adjoining the entire lake is privately owned. There is no evidence of livestock accessing the lake margins and no weeds present.

## 4.12 Cuttagee Lake



**Photo 32**      **Narrow-leafed wilsonia, Cuttagee Lake, Snake Island. Genevieve Wright/DCCEEW**

**Survey date:** 11 June 2020

**Species present:** Glasswort (*Sarcocornia quinqueflora*), water buttons (*Cotula coronopifolia*), austral seablite (*Suaeda australis*), native sowthistle (*Sonchus hydrophilus*), saltbush species (*Atriplex* spp., *Chenopodium glaucum*), native *Senecio* species (*Senecio glomeratus*, *S. linearifolius*), sea rush (*Juncus kraussii*), salt couch (*Sporobolus virginicus*), mostly recently established on a newly extended spit



**Ecological notes:** There are 3 previous 2005 records (S Cameron) from Cuttagee Lake, 2 in the vicinity of Snake Island located just upstream of the Tathra–Bermagui Road at the lake mouth. This location was checked and a population occupying the north-west corner of a sand spit on the upstream end of the island was located.

Stuart Cameron is of the opinion that this is a relatively recently established population, and much of the vegetation with which it is growing appeared to be newly colonising this spit. The species occurs patchily over an area of 55 m x 10 m, with some plants submerged on the northern edge.

A single plant was found on the lake shore to the east of Snake Island.

The other record on the northern shore of the lake was not surveyed on the advice of local resident, Stuart Cameron, who indicated that following heavy rain in February 2020 the lake rose to its highest level, and although it had dropped a little, he was of the opinion that populations would currently be submerged.

Cuttagee Lake is an ICOLL, which in recent decades has frequently been closed for very long periods, sometimes for years at a time. It has a larger catchment than Baragoot Lake, which is located only 3 km to its north, with Cuttagee Creek entering its upstream end and several small unnamed creeks around its northern and southern sides. This likely explains why its level is still high following rain in February, while Baragoot Lake has continued to drop.

**Threats:** The population on this lake has persisted through a couple of decades of protracted droughts and consequent periods of high stand when the lake mouth remains closed for months or years at a time.

Stuart Cameron reports that despite lengthy periods of complete, often quite deep immersion, the species has recovered after each drought. This indicates rhizomes are resistant to long immersion and capable of resprouting when water levels drop.

Rising sea level might eventually mean that the lake is open more frequently than it has been in the last couple of decades, becoming more tidal again. This would reduce the variability in water depth and salinity and reduce the area potentially available for saltmarsh species.

The entire lake margin is private property, and it is likely that livestock access the lake margin at some points, but no evidence of any impact from this is known to occur.

No significant weeds were seen in the small area checked, but fireweed (*Senecio madagascariensis*) and African lovegrass (*Eragrostis curvula*), which are exotic species, occur in the vicinity of Cuttagee and Baragoot lakes and can tolerate saline conditions.

## 4.13 Wapengo Lake



**Photo 33**      **Narrow-leaved wilsonia, Wapengo Lake. Genevieve Wright/DCCEEW**

**Survey date:** 10 June 2020

**Species present:** Grey mangrove (*Avicennia marina*), shrubby glasswort (*Tecticornia arbuscula*), glasswort (*Sarcocornia quinqueflora*), creeping brookweed (*Samolus repens*), austral seablite (*Suaeda australis*), sea lavender (*Limonium australe*), salt couch (*Sporobolus virginicus*), sea rush (*Juncus kraussii*), saltmarsh Gahnia (*Gahnia filum*)

**Ecological notes:** There are 2 records of *Wilsonia backhousei* at Wapengo Lake from the 1992 saltmarsh survey (P Clarke), one on the northern shore of the lake the other on the southern, towards Bithry Inlet. The record at the northern end of the lake was not checked as this area was filled with swamp paperbark (*Melaleuca ericifolia*) scrub and appeared to be unlikely habitat and difficult to access.

The other record located at the landward end of a large bay on the western side of the lake, near Bithry Inlet, was not checked in this survey. The accuracy of these older locations, pre-GPS, is likely to be low, and no written details are available to check them. These records do indicate that wilsonia has been present at this site for at least 30 years.

During this survey 3 occurrences were found along the eastern shore of Wapengo Lake, all adjacent to private property.



The most extensive population (Photo 33) is the location of a BioNet record from 2011 (J Miles). It is adjacent to an access track to the lake shore where a gate has been installed in the private property boundary fence. The population starts on the track and extends to the lake shore. It covers an area of about 130 m x 75 m.



**Photo 34**      **Narrow-leaved wilsonia, Wapengo Lake. Genevieve Wright/DCCEEW**

A small population occurs about 400 m to the south along the eastern shore (Photo 34), on the upper edge of a slightly wider section of sandy beach, below the *Juncus kraussii* zone. This population covers an area of 28 m x 5 m.





**Photo 35**      **Narrow-leaved wilsonia, Wapengo Lake. Genevieve Wright/DCCEEW**

A very small patch was found in the north-east corner of the lake (Photo 35). It is about 8 m x 8 m in extent, on an elevated berm between the lake shore and a *Sarcocornia quinqueflora* filled small bay.

Wapengo Lake is permanently open and tidal.

**Threats:** On a tidal lake, mangrove invasion could represent a threat to saltmarsh species. Abundant regeneration of grey mangrove is present at the upper end of Wapengo Lake and at the site halfway along the eastern shore.

A walking track runs through the largest population, and walkers may stray off it at times when the tide creates puddles along it that they wish to avoid. However, given the size of the population, and the current visitation levels, this is currently not a significant threat.

Bank erosion was observed near the population furthest downstream. Flooding would contribute to this, and floods may become more extreme with climate change. Wapengo Lake is used for oyster farming, and frequent use of boats with outboard motors to service the oyster racks probably contributes to bank erosion to some extent. No immediate threat from this factor was seen.



## 4.14 Nelson Lagoon



**Photo 36**      **Narrow-leaved wilsonia, Nelson Lagoon. Genevieve Wright/DCCEEW**

**Survey date:** 19 June 2020

**Species present:** Grey mangrove (*Avicennia marina*), shrubby glasswort (*Tecticornia arbuscula*), glasswort (*Sarcocornia quinqueflora*), creeping brookweed (*Samolus repens*), swampweed (*Selliera radicans*), austral seablite (*Suaeda australis*), sea lavender (*Limonium australe*), ruby saltbush (*Enchylaena tomentosa*), salt couch (*Sporobolus virginicus*), sea rush (*Juncus kraussii*), saltmarsh Gahnia (*Gahnia filum*)

**Ecological notes:** *Wilsonia backhousei* had previously been recorded at 2 locations on Nelson Lagoon, one a 2006 BioNet record (J Miles) from the southern edge of a large saltmarsh located on the western side of the lagoon.

At the other location, on the southern edge of the lagoon, near Baronda Head, there is an herbarium collection from 1995 (S Donaldson) and a BioNet record from the same area in 2000 (K McDougall). It was not possible to revisit this site due to temporary closure of Cowdroys Road, but a section of lake shore further upstream on the northern arm was checked instead.

No wilsonia and no likely habitat was found in this area, which consisted of a narrow band of *Gahnia filum* between mangroves and *Melaleuca armillaris* scrub.

The area of the 2006 BioNet record was surveyed. The population at the western end of the lake is extensive and mostly occupies the middle elevation of the saltmarsh, between mangrove/samphire zones and the *Juncus kraussii*/*Gahnia filum* zone. It occasionally occurs as an understorey among *Gahnia filum* or the shrub *Tecticornia arbuscula*.

There were 3 main patches of plants in this area, only the perimeter of the westerly patch was recorded, which covered an area 115 m x c. 25 m (1,983 m<sup>2</sup>). The total length of the area that the 3 patches of wilsonia occurred in was 250 m.

Nelson Lagoon is permanently open and tidal.

**Threats:** On a tidal lake, mangrove invasion could represent a threat to saltmarsh species. Abundant regeneration of grey mangrove is present at numerous points around Nelson Lagoon.

The largest population is on or adjacent to private property but is fenced off from livestock. There have been some plantings around the upper edge of the saltmarsh, including the exotic small tree, Norfolk Island Hibiscus (*Lagunaria patersonia*), but this is unlikely to represent a threat to the wilsonia population.



## 4.15 Pambula Lake



Photo 37 Pambula Lake. Genevieve Wright/DCCEEW

**Survey date:** 12 June 2020

**Species present:** Grey mangrove (*Avicennia marina*), shrubby glasswort (*Tecticornia arbuscula*), glasswort (*Sarcocornia quinqueflora*), creeping brookweed (*Samolus repens*), austral seablite (*Suaeda australis*), swampweed (*Selliera radicans*), rounded noon-flower (*Disphyma crassifolium* subsp. *clavellatum*), salt couch (*Sporobolus virginicus*), sea rush (*Juncus kraussii*), saltmarsh Gahnia (*Gahnia filum*), coastal speargrass (*Austrostipa stipoides*)

**Ecological notes:** There is one record of *Wilsonia backhousei* from Pambula Lake recorded in the 1992 saltmarsh survey (P Clarke), located on the eastern shore 400 m west of Long Point. The accuracy of this old record, pre-GPS, is likely to be low, and no written details are available.

The survey was conducted by boat. The approximate vicinity of the single old record was checked for a distance of about 1 km. No plants were found, and the habitat appeared mostly unsuitable, with a narrow oyster-covered beach below a steep rocky shore, with very occasional patches of *Sarcocornia* and almost no other vegetation. Where rock outcrops occurred along the shore the rock fissure niche often utilised by wilsonia was occupied by *Samolus repens*.

A few hundred metres were checked around the tip of Tea Tree Point. In this area there is a narrow beach with scattered mature grey mangrove, then a steep bank with *Austrostipa stipoides* above it, and occasional patches of *Sarcocornia* along the upper edge of the beach. The tip of this point is entirely composed of sediment, with no rock outcrops.

A small area of flat land at the confluence of the Yowaka and Pambula rivers about 1 km upstream of Tea Tree Point was checked. It has marginal potential habitat for wilsonia, but no population is present.

The shores upstream along the Pambula River arm of the lake as far as the lower end of the mangroves below the old racecourse were checked and no suitable habitat was seen, with predominantly steep rocky shores and occasional small mangrove stands.

The eastern end of the lake has not been checked and it appears to have much less steep shorelines, so there may be more development of saltmarsh in this area. It has poor land access and would have to be searched by boat at high tide.

Pambula Lake is permanently open and tidal.

## 4.16 Boydtown

There is a 2004 BioNet record (J Peppers) from Boydtown. This location was not part of these surveys as one of the authors has previously visited the area and deemed the habitat unsuitable.



## 5. Discussion

The purpose of this work was to survey populations of narrow-leafed wilsonia on the south coast of New South Wales to ascertain whether plants remained at specific sites, rather than to undertake a comprehensive search of all known sites and/or conduct searches for new populations based on habitat suitability. Recorded populations between Jervis Bay and the Victorian border were surveyed; those in the Sydney area were excluded from this work.

Fifteen sites were surveyed, 13 of which had current populations of the species. Site location, threats, vegetation association, area covered by plants and any other ecological observations were recorded where possible.

Narrow-leafed wilsonia is mainly an Australian species with its distribution confined to southern latitudes in Western Australia and South Australia, Victoria, New South Wales and Tasmania. It occurs in a range of saline aquatic habitats and has a high tolerance to ranges of salinity and soil water content (Saintilan 2009a). It is strongly associated with saltmarsh communities and most records are coastal, but it is not exclusively in this vegetation type (Table 1).

There are records from inland environments in both South Australia and Western Australia, and it also occurs in rock fissures on coastal shorelines and on the foreshores of intermittently closing and opening lakes and lagoons (ICOLLs). This suggests wilsonia distribution is determined by the presence of saline aquatic environments, rather than being associated with a particular plant community. It appears to be an opportunistic coloniser in saline environments.

The populations of *Wilsonia backhousei* in New South Wales vary considerably in size. Jervis Bay had the most extensive cover of wilsonia but its full extent here was not determined (Photo 1 and Photo 8). Bermagui River estuary was the second largest site with 6 areas of *Wilsonia backhousei*.

Other significant locations for wilsonia, in order of size were Wapengo Lake, Lake Mummuga, Nelson Lagoon and Nangudga Lake. The populations at the other sites were relatively small.

Studies have found that a single *Wilsonia backhousei* plant can cover up to 225 m<sup>2</sup>, with apparently large populations having few individuals (Sommerville et al. 2013). Many of the sites surveyed supported large dense mats of plants, but area covered cannot be used as an indicator of plant number. Further, very few individual plants were seen in the field (Photo 38, this being the exception rather than the rule).

Only genetic testing would provide detail on the number of plants in a particular site, which may assist with assessing the relative importance of sites within New South Wales and in determining appropriate population management.

**Table 1**      ***Wilsonia backhousei* habitat in NSW sites**

Location	Habitat
Wowly Gully	Saltmarsh
Callala Creek	Saltmarsh
Carama Inlet	Saltmarsh
St Georges Basin	Coastal lake, growing in rocks on shoreline
Monument Beach	Coastal shoreline, growing in rocks
Potato Point	Coastal shoreline, growing in rocks
Lake Mummuga	Coastal lake, saltmarsh
Nangudga Lake	Coastal lake, saltmarsh
Bermagui River	River estuary, saltmarsh and coastal shoreline, growing in rocks
Baragoot Lake	Coastal lake, growing in rocks on shoreline
Cuttagee Lake	Coastal lake, saltmarsh
Wapengo Lake	Coastal lake, saltmarsh
Nelson Lagoon	Coastal lake, saltmarsh





**Photo 38**      **Single *Wilsonia backhousei* plant at Cuttagee Lake. Genevieve Wright/DCCEEW**

None of the plants in the NSW populations surveyed were in flower or fruit. However, studies on the reproductive biology of narrow-leaved wilsonia recorded flowering from mid to late October and seed set between December and February (Sommerville et al. 2012).

*Wilsonia* is wind-pollinated and seed production is positively affected by increased soil moisture content and by the number genetically distinct individuals growing in close proximity (Sommerville et al. 2013).

The fruits float, so can be dispersed on outgoing or incoming tides, and the seeds are physically dormant and long-lived so can potentially form a viable soil seedbank following dispersal (Sommerville et al. 2012).

Pollination occurs mainly within sites, but gene flow is evident within estuaries (as a result of seed dispersal) and appears to occur occasionally between estuaries (Sommerville et al. 2013).

There is little seed of this species held in the NSW Seedbank at the Australian Botanic Garden, Mount Annan.

Narrow-leafed wilsonia grows in environments that are periodically inundated and has adapted to long periods of submersion. At Nangudga Lake the wilsonia population was under water for 2 years and has recovered, presumably from rhizomes.

Similarly, at Cuttagee Lake a local resident has reported that despite lengthy periods of complete, often quite deep immersion, the species has recovered after each flooding event (S Cameron pers. comm. 2020). Again, this suggests that rhizomes are resistant to long immersion periods and are capable of resprouting when the water levels drop, however, submersion for very long periods may be a threat to local populations. The species also tolerates daily tidal immersion.

Wilsonia is tolerant of a wide range of environmental conditions including exposure to salt spray on the coastline and to long periods of either constant exposure or constant immersion at ICOLLs. Its occurrence on ICOLLs indicates that it is tolerant to a range of salinities, with ICOLLs varying from hypersaline to brackish depending on the period of closure to the sea and the amount of inflow and evaporation. However, as populations in tidal situations are the largest, daily tidal inundation appears to be its optimal ecological setting.

Potential threats to narrow-leafed wilsonia populations include climate change impacts through sea level rise, weed invasion, grazing by domestic stock, vehicle damage and mangrove invasion of coastal areas. Increasing sea levels associated with climate change are a threat to tidal communities where there is limited ability for the community to move inland (Saintilan 2009b).

Climate change induced rainfall impacts may also affect local hydrology and subsequently water levels in ICOLLs, with potential to impact local wilsonia populations occurring on foreshores.

Weed invasion presents little or no threat currently as only a very limited number of exotic species are known to invade coastal saline habitats in southern New South Wales, but in other parts of Australia weeds have impacted narrow-leafed wilsonia habitat (G Carr pers. comm. September 2020).

Although narrow-leafed wilsonia populations occur on secure tenure in national parks, some of these sites have been damaged by illegal vehicle access.

It is considered that narrow-leafed wilsonia is currently assigned to the most appropriate management stream, a change from this to either the keep watch, or partnership species management stream would require survey of all known sites in New South Wales and an indication of the proportion of plants that occur in this state compared to the other states.

The sites should be re-surveyed in 5 years, in 2025–26, to ensure the populations remain stable and the long-term survival of this species is assured.



## 6. Recommendations

The following recommendations are made in response to the survey findings:

- Seed collection be completed for the NSW sites as little seed of this species is held in the NSW Seedbank at the Australian Botanic Garden, Mount Annan.
- Herbarium collections are made at any unvouchered distribution records in New South Wales.
- The NSW National Parks and Wildlife Service to maintain and improve the existing fenced boundary of Jervis Bay National Park at Wowly Gully to exclude motorised vehicles.
- Search identified potential habitat at Lake Mummuga not surveyed in 2019–20.
- If funds are available unsurveyed suitable habitat could be surveyed to find new populations in New South Wales, in addition, older population records included in this survey that could not be found because of inaccurate location details could be included in future survey work.

## 7. References

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# Appendix A: Photo series of Wowly Gully, Jervis Bay National Park

A series of images were taken of Wowly Gully over time. The initial image was taken in July 2002 (Photo 39). The next image, taken in July 2003, shows the same area with seasonal water inundation (Photo 40).

In March 2011, the saltmarsh area at Wowly Gully was being impacted by vehicles, with extensive use heavily impacting the vegetation at the site (Photo 41). The Jervis Bay National Park boundary fence had been compromised and was no longer keeping vehicles out.

The image taken in September 2019, during this survey, shows some recovery of the saltmarsh vegetation and much reduced vehicle impacts due to the improved boundary fence (Photo 42). This fence currently has very recently been breached and requires maintenance to be able to continue to protect this site (Photo 43).



**Photo 39**      **Wowly Gully, 11 July 2002**





Photo 40 Wowly Gully, 8 July 2003



Photo 41 Wowly Gully, 7 March 2011





**Photo 42**      **Wowly Gully, recent vehicle impacts, September 2019.**  
**Genevieve Wright/DCCEEW**





**Photo 43**      **Wowly Gully, 5 September 2019**