Australian Government

Department of Climate Change, Energy, the Environment and Water

Use this form to nominate an ecological community for listing as threatened (or, for a change in its listed threat category) under national environment law (currently the *Environment Protection and Biodiversity Conservation Act 1999* - EPBC Act). Nominations will be considered by the Committee and the Minister for the Environment and Water for inclusion in the Finalised Priority Assessment List for the assessment period commencing 1 October 2026. Not all nominations will be prioritised.

Please read these important notes before you fill in this form:

- **Fill in this form as comprehensively as you can**. Much of the information is required under Division 7.2, sections 7.03 and 7.05 of the *EPBC Regulations 2025* which are at: https://www.legislation.gov.au/F2025L01584 and includes the statutory criteria for listing threatened ecological communities (Division 7.1, regulation 7.02).
- **Nominations which do not meet the regulated requirements (above) are not eligible for consideration**. Items required by the Regulations are marked with an asterisk (*) in this form.
- **The listing categories** for threatened ecological communities can be found in Section 182 of the EPBC Act. The statutory criteria for listing can be found in Division 7.1 of the *EPBC Regulations 2025*. These are available at: https://www.legislation.gov.au/F2025L01584
- **To be eligible for listing as threatened it must be demonstrated that an ecological community meets at least one of the six criteria for listing**. Note that ecological communities listed as endangered or critically endangered are protected as a matter of national environmental significance (MNES) and are subject to environmental impact assessments for actions that may have a significant impact under the EPBC Act. Ecological communities listed as vulnerable are not protected, but there are significant other benefits such as opportunities for funding for recovery.
- The Department and Threatened Species Scientific Committee **(the Committee) has developed Guidelines** for Nominating and Assessing Threatened Ecological Communities that should be read **in conjunction with this form**. They are available at: www.dcceew.gov.au/environment/biodiversity/threatened/nominations/forms-and-guidelines under the 'Threatened ecological communities' tab.
- **The Guidelines include important information to help you** complete particular sections and answer particular questions. This includes guidance (and indicative thresholds) on how to demonstrate that the statutory criteria for the 'critically endangered', 'endangered' or 'vulnerable' categories have been met.
- **Consider the full extent of the ecological community at a national scale**, not just its occurrence in specific areas or regions, unless it is biologically or ecologically distinct in a specific area or region. Do not exclude parts of an ecological community simply because the threats and impacts are less, or data is lacking for particular regions.
- **A clear and convincing nomination** (with supporting data, demonstrating the impacts of its threats and how it meets the listing criteria) **is needed** to fully understand how the ecological community has been defined and to judge its eligibility against each of the criteria for listing.
- The nomination form is separated into eleven sections; please **complete each section**.
- Use as much space as you need to fully answer each question as best you can; with relevant sources cited and quoted directly, or synthesised appropriately. **Where insufficient**

information is available to answer a question, or part of a question, the regulations require **you to say this** (refer to the Guidelines for further advice). **Do not leave the answer blank**.

Important notes (continued):

- **Ensure you have the most up-to-date information:** it is recommended that you contact regional Natural Resource Management organisations and/or state environment departments and First Nations where the ecological community may occur, plus other relevant experts.
- **For all facts and all information you provide: you must document your reasoning and provide supporting data**. Indicate the reliability of (and any uncertainty in) the information. For example, was it based on: a peer-reviewed research publication or expert report; observed data; an inference or extrapolation from the data; 'anecdotal' evidence; or other reasonable premise not yet supported by hard data (e.g. personal communications from experts)? You must provide references to source documents (see below for handling personal communications).
- **Personal communications:** you may cite the opinions of relevant scientific experts and First Nations (with their approval) in support of your nomination. If you do this, you should also provide: the names of the experts, their qualifications and contact details (in Section 10 of this nomination form).
- **Confidential material:** identify any confidential material and explain its sensitivity.
- **Tables:** you may include tables in or at the end of this form, or as separate electronic documents included as appendixes or attachments. **Refer to each particular table** in the relevant areas of your answers.
- **Maps: you must supply and adequately label maps**. If you are unable to supply maps electronically, please provide them in hard copy. Also, provide the map data**,** or reference sources from which data may be obtained.
- **Photographs:** you should adequately label photographs and **only use them as supporting material.** The criteria for listing need to be addressed 'in writing'.
- **Cross-referencing:** you may cross-reference relevant areas of the nomination form where you need to; e.g. to avoid unnecessary duplication (but **answer each question clearly and as thoroughly as you can**).
- The Department recognises the significant investment in time and effort required to complete a nomination for a threatened ecological community. It is suggested that you **contact us in advance to discuss your prospective nomination.** We are happy to provide independent advice and answer your questions. In the first instance, please contact the Director of the Ecological Communities Section, Department of Climate Change, Energy, the Environment and Water, via email: ecologicalcommunities@dcceew.gov.au

Please answer all the questions, citing references where applicable (also list all references in Section 10). If insufficient information exists to answer a question, in accordance with the *EPBC Regulations 2025*, you must indicate this instead of leaving the question blank.

Your answers may be provided in this form, with attachments as required; or as a separate document. It must include everything requested in this form, including a signed declaration. Please ensure that all questions are answered, with each response clearly indicating to which question it refers.

Questions required by the Regulations are marked with an asterisk (*).

Information sharing and usage

If your nomination is progressed for prioritisation and assessment, most of the information you include in this nomination will be considered by the Department, the Threatened Species Scientific Committee, the Indigenous Advisory Committee, state and territory government agencies and scientific committees, relevant external experts, and the Minister, for potential inclusion in a public-facing conservation planning document. Only three types of information will be handled differently:

- **First Nations expert knowledge:** the Department encourages the inclusion of First Nations expert knowledge and consideration of culturally significant information where appropriate when preparing a nomination.
    - If this material is included in your nomination, please identify any confidential or culturally sensitive information, describe any sensitivities you are aware of, and indicate whether it can be shared with the parties identified above, for potential inclusion in a public-facing conservation planning document.
    - Any sensitive information you identify will be held and marked as sensitive by the Department, and will not be shared with the parties identified above or included in public documentation without your consent.
- **Personal information:** your details as nominator may be provided to state and territory government agencies and scientific committees, as well as the Commonwealth's Threatened Species Scientific Committee and Indigenous Advisory Committee, as part of their collaboration on national threatened species assessments. However, your details will not be shared with external experts or the public without your express permission.
- **Other confidential information:** if you identify other confidential information in your nomination, please explain its sensitivity. It will be held and marked as sensitive by the Department, and will not be shared with external experts or the public without your express permission.

Navigation (Word and PDF versions)

This nomination is provided in both **Word** and **PDF** formats. Each version includes navigation tools that allow readers to move efficiently through the document.

Word version

To assist with navigation, the **Navigation Pane** can be enabled. Select the **View** tab in Word and tick the **Navigation Pane** checkbox. A panel will appear on the left displaying the document's headings, pages and search results.

PDF version

For the PDF version, navigation can be accessed through the **Bookmarks** panel in the left-hand sidebar. In Adobe Acrobat, select the **Bookmarks** icon to display the document's section headings. If the sidebar is not visible, it can be revealed by clicking the arrow on the far left edge of the window.

Section 1 – Nominator Details*

Note: Nominator details are subject to the provision of the *Privacy Act 1988* and will not be divulged to third parties if advice regarding the nomination is sought from such parties. If there are multiple nominators please include details below for all nominators.

Your Name(s)*	
Organisation, or Company name(s)* (if applicable)	
Postal address*	
Email* (if applicable)	
Phone*	
I declare that the information in this nomination form and any attachments is true and correct to the best of my knowledge.	
Signature (Please print or insert electronic signature)	
Date signed	29 March 2026

Section 2 - Listing Category for which the ecological community is nominated*

Is the ecological community currently listed under the EPBC Act? (Please check one box)	☐ Not currently EPBC Act listed ☐ Currently EPBC Act listed ☒ Part of it is currently EPBC Act listed
	If listed/part listed, under what name and in which category is it listed: Refer to the response to **question 14** under the sub-heading 'threatened ecological communities – existing listings'.
Proposed listing category.* (Please check one box - this should represent the highest category indicated by information provided in Section 9)	☐ Critically endangered ☒ Endangered ☐ Vulnerable

Section 3 - Conservation theme*

1. Does the nomination meet the annual conservation theme '*Nominations that support the protection and recovery of species and ecological communities at risk from the impacts of the harmful algal bloom off the coast of South Australia'* for this assessment period?* If so, please indicate how.*

Note that nominations that do not meet the conservation theme are welcome and will be assessed on their relative merits.

Answer Question **1** here. Please use as much space as you need to fully answer the question.

No, this nomination does not relate to the conservation theme for the assessment period commencing 1 October 2026, which is "nominations that support the protection and recovery of species and ecological communities at risk from the impacts of the harmful algal bloom off the

coast of South Australia." We understand that nominations outside the annual theme are welcome and will be assessed on their merits.

Section 4 – Name and Description of the ecological community*

Name*

2a. What is the proposed name of the ecological community?*

Consider the dominant species, vegetation/habitat/ecosystem structure, landscape position, IBRA bioregion/s (or other well understood region) and national extent of the ecological community you are nominating. This will help the Committee consider the ecological community's national context and its likely geographic limits.

Answer Question **2a** here. Please use as much space as you need to fully answer the question.

The proposed name of the ecological community is 'Wetlands of the Swan Coastal Plain'.

This name describes a suite of seasonally to permanently saturated to inundated wetland types that occur within the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) bioregion of south-west Western Australia. The ecological community is defined by its regionally integrated and largely groundwater-dependent hydrology, dunal landforms and wetland vegetation.

Ideally, the ecological community would encompass all wetlands across the Swan Coastal Plain in the future. At present, however, the most reliable information relates to the area between Wedge Island in the north and Dunsborough in the south, which will form the focus of this nomination. This approach excludes only a relatively small portion of the plain situated north of Wedge Island, where the ecological character of those wetlands, and the threats affecting them, are poorly understood. Historically, the key spatial dataset, guidance and research efforts have also focused on wetlands south of Wedge Island.

2b. Is the ecological community known by any other names?*

Also give any other names that have been used recently, including where different names apply in different jurisdictions, regions, or major studies.* Indicate if this information is unavailable.*

Answer Question **2b** here. Please use as much space as you need to fully answer the question.

Yes, the ecological community is also known as the 'Geomorphic wetlands of the Swan Coastal Plain'. However, the simpler term 'Wetlands of the Swan Coastal Plain' is preferred.

The name 'geomorphic wetlands' is taken primarily from the following references:

- *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* (DataWA 2021c)
- *Wetlands of the Swan Coastal Plain,* Volumes 2a and 2b (Hill *et al.* 1996a, 1996b)

The term 'geomorphic' refers to the landform-based classification of wetlands, which is essentially how they were formed and shaped by geological and hydrological processes. It is a system that classifies wetlands based on features like soil type, topography, and hydrology, rather than just vegetation or fauna.

Description*

3a. Describe the key biological components (main biological features) of the community.*

For instance, what species (or taxonomic groups) of plants and animals are dominant, characteristic of, or commonly occur together in the community; what is the typical vegetation, or other biotic structure (if relevant).

Answer Question **3a** here. Please use as much space as you need to fully answer the question.

Context for the key biological components

The wetlands of the Swan Coastal Plain have high ecological richness and support diverse flora and fauna, including many species that are endemic or threatened.

The ecological community is within the Southwest Australia global biodiversity hotspot (Beard *et al*. 2000; Brundrett 2021; Conservation International 2026a, 2026b; Hopper and Gioia 2024; Gole 2006; Myers *et al.* 2000). This hotspot approximately corresponds to the boundary of the Southwest Australian Floristic Region and is one of 35 internationally recognised biodiversity hotspots, which highlight the world's richest and most threatened centres of flora and fauna diversity.

Horwitz *et al.* (2008) notes that in Western Australia the identification of the biodiversity hotspot as a global priority has too often been one of celebrating international recognition for biodiversity rather than a prompt to reorientate activities to reverse the exceptional loss of habitat.

Within the biodiversity hotspot and Southwest Australian Floristic Region, approximately 49 to 53% of the flora species are endemic (Beard *et al.* 2000 and unpublished data in Hopper and Gioia 2004).

Twenty-nine wetlands on the Swan Coastal Plain are listed in *A directory of important wetlands in Australia* (Environment Australia 2001, p. 107). This is the highest number of listed wetlands for any bioregion in Western Australia, and the only bioregion containing more than eight sites. The directory also outlines the reasons for including these wetlands (Environment Australia 2001, pp. 11, 112)[1].

The Department of Biodiversity, Conservation and Attractions (DBCA) (2017a) says: "In a global context, the Swan Coastal Plain contains unique features due to its geology, geomorphology and climate. As such, Semeniuk and Semeniuk (2001) have proposed that the wetlands on the Swan Coastal Plain are globally distinct and unique in that their origin and features are not represented elsewhere. This global importance should be recognised when making decisions about the protection and management of wetlands on the Swan Coastal Plain."

The ecological community can be defined primarily by the hydrological attributes and landforms of the Swan Coastal Plain wetlands, rather than by floristic sub-communities. This reflects the intent of the nomination, which is to recognise the wetlands of the Swan Coastal Plain as an ecological community shaped by water regimes and landforms that support diverse biological components, with further detail on this approach provided under 'wetland types based on hydrological attributes and landform' in the response to **questions 5a and 7b**. However, the community is also characterised by flora and fauna that are consistently associated with these wetland types and advice on relevant floristic communities is provided.

Flora species and structure

Attachment A provides a detailed list of wetland flora on the Swan Coastal Plain, including threatened and priority species. It uses the vegetation structure or growth form categories in Keighery, Longman and Rye (2023) in Powell and Emberson (2023). These categories include large trees, small to medium trees, tall shrubs, medium to large shrubs, low shrubs, climbers, perennial

[1] See also the response to question 15 regarding Ramsar wetlands on the Plain.

herbs, annual herbs and aquatic flora. The latter three categories (perennial herbs, annual herbs and aquatic flora) include sedges (sedges, rushes) and grasses (grass-like plants) as both perennial and annual herbs. Typically, in vegetation structural descriptions these would be separate categories, with herbs encompassing both perennial and annual species other than grass-like plants.

Common flora were identified within the detailed flora list in **attachment A**. This information was derived from an analysis of more than 1,000 plots on the southern Swan Coastal Plain (DEC 2012o, p. 70). The analysis identified 166 commonly encountered wetland species (150 native). Species were classified as "commonly encountered" if they occurred in ten or more plots and were present in wetland floristic community types at least 75 per cent of the time (DEC 2012o, p. 70).

Information regarding Swan Coastal Plain wetland taxa is provided in Appendix 2 of DEC (2012o), while the data used to compile the figures and tables is provided in Appendix 3 (in part 1).

Appendix 3 of DEC (2012o) identifies the main biological features of the wetland flora of the Swan Coastal Plain, using a series of figures and supporting tables. The relevant tables and figures in this appendix are:

- Table 3. Data used for Figure 133: Endemism of wetland and dryland vascular plant taxa of the southern Swan Coastal Plain
- Table 4. Data used for Figure 134: Plant groups of the wetland and dryland vascular plant taxa of the southern Swan Coastal Plain
- Table 5. Data used for Figure 138: Growth forms groups of wetland and dryland vascular plants of the southern Swan Coastal Plain
- Table 6. Data used for Figure 139: Life forms of wetland and dryland vascular plants of the southern Swan Coastal Plain
- Table 7. Data used for Figure 140: Life form groups of wetland and dryland vascular plants of the southern Swan Coastal Plain
- Table 8. Data used for Figure 142: Life form of annually renewed groups of wetland and dryland plants of the southern Swan Coastal Plain
- Table 9. Data used for Figure 144: Life forms of aquatic vascular plants of the southern Swan Coastal Plain (443 total).

The following advice is taken directly from DEC (2012o, pp. 166–174). It is informed by a detailed analysis of the wetland flora of the southern Swan Coastal Plain (Moore River to Dunsborough), drawing on 1,150 quadrats, flora lists from seventy-eight reserves and bushland areas, published flora revisions and treatments, and records from FloraBase and Australia's Virtual Herbarium. Taxa were allocated to drylands and wetlands, as well as being placed in a series of other categories including life form and growth form (see Appendix 2, Part 1 in DEC 2012o). A total of 1,877 native plant taxa were recorded. This analysis highlights several interesting characteristics of the Swan Coastal Plain's wetland flora:

- Very high rate of endemism:
    - "the percentage of wetland species endemic to WA is very high at 74 per cent, as compared to 85 per cent for dryland taxa (Figure 133)… While not determined at this stage, it is expected that around 3 per cent of the Swan Coastal Plain flora will be locally endemic to wetlands on the plain (for example *Banksia squarrosa* subsp. *argillacea* (Figure 122a&b), *Darwinia whicherensis* (Figure 124b), *Calothamnus quadrifidus* subsp. *teretifolius*, Calytrix sp. Tutunup (Figure 124e&f), *Banksia nivea* subsp. *uliginosa* (Figure 123e), *Lambertia echinata* subsp. *occidentalis* (Figure 123c) and *Petrophile latericola* (Figure 123a&b))."

    - "The percentage of taxa that occur outside Australia (Figure 133) is higher for wetland species (11 per cent) than for dryland species (2 per cent). Taxa with Australia-wide distributions comprise similar percentages for both habitat types (15 per cent for wetland species and 13 per cent for dryland species)."

- Monocotyledons are more prevalent: "Plant taxa are more likely to be monocotyledons in wetlands than dryland (Figure 135, Figure 136 and Figure 137) with 46 per cent in wetlands as compared with 26 per cent for drylands (Figure 134). This is probably a reflection of the successful life and growth forms of wetland plants. The dominance of monocotyledons is reflected in the higher percentages of sedges, grasses and herbs (Figure 138)."
- Shrub-rich relative to international wetlands but not shrub-rich compared to local dryland: "shrub-rich relative to international wetlands but not shrub-rich compared to local dryland Swan Coastal Plain wetlands are not shrub-rich with 19 per cent, as compared to drylands, where 51 per cent of the flora are shrubs (Figure 138). However, they are shrub-rich when compared with wetlands in other countries."
- Herbs and sedges predominate: "herbs and sedges are the most common plant group in wetlands (48 and 29 per cent respectively) while shrubs and herbs are the most common in drylands (51 and 37 per cent respectively) (Figure 138). Examples are shown in Figure 135–137 and Figure 141."
- Underground storage organs are much more prevalent: "wetland species have a large percentage (22 per cent) renewed from underground storage organs compared with those in drylands (11 per cent) (Figure 139 and Figure 140). Examples are shown in Figure 137, Figure 141 and Figure 143."
- Annually renewed flora are much more prevalent: "wetland species have a large percentage (45 per cent) that are annually renewed (seed, underground and above ground storage organs) compared with those in drylands (21 per cent) (Figure 142)."
- Aquatic flora: a unique group: "a unique group of wetland taxa are the aquatics (Figure 143). Aquatics taxa (as defined in the southern Swan Coastal Plain study) comprise 61 per cent (271 taxa) of the wetland flora. The majority of these, 163 taxa, or 60 per cent, grow in water and flower when the sites dry (the 'post inundation' category in Figure 144). Those plants that require inundated conditions to both grow and flower form 27 per cent (73 taxa) of the wetland flora (comprising 'emergent', 'floating' and 'submerged' categories in Figure 144; see the key in Appendix 2 in part 1 for more information on these categories). These are the flora that are generally listed as aquatic taxa in the literature. The remaining 13 per cent (35 taxa) could not be allocated to either of these groups."
- Conclusion: "these data show that wetlands contribute greatly to the richness and diversity of the unique Swan Coastal Plain and Southwest flora. Features of this rich flora (illustrated from the Swan Coastal Plain flora) include:
    - wetland taxa with closely related dryland relatives (Figure 146 and Figure 147)
    - taxa endemic to wetlands of the Swan Coastal Plain (Figure 146a and Figure 147d&e)
    - rare wetland taxa (Figure 146a, Figure 147d&e, Figure 148 and Figure 149)
    - newly recognised taxa that are yet to be described (Figure 150c&d and Figure 151)
    - different wetland forms that may prove to be separate taxa (Figure 152)."

Attachment B provides a summary list of the threatened and priority wetland flora that were identified in attachment A.

Secondary information links flora species to soil types and wetland types (see **attachments C** and **D**).

Floristic communities

Several floristic communities are recognised within the wetlands of the Swan Coastal Plain. These illustrate the structural and floristic diversity present across the wetlands but they are not intended as a comprehensive list. The nominated ecological community is defined more broadly by wetland types, which are based on hydrological attributes and landforms (see the response to **question 5a**[2]). Not every species will be present in every community, and some may occur in low densities.

Gibson *et al.* (1994) is a key reference on the floristic communities of the Swan Coastal Plain. It identified Super Group 2 (seasonal wetlands) including community types 4 to 19 as seasonal wetland communities[3]. The DBCA (undated(c), undated(d)) provides further information about types 15 and 18.

One other community type from Super Group 1 was also a wetland. Later work by the former Department of Environment and Conservation (DEC) (2012o, table 2, pp. 34-35) further identified community type 2 in Gibson *et al.* (1994) as a wetland community. The DBCA (undated(e)) described the habitat requirements for community type 2 in Gibson *et al.* (1994) as: "The plant assemblage is dependent on the maintenance of local hydrological conditions. The wet flats or palusplain become waterlogged, forming small depressions and provide the community's winter-wet habitat." This confirms it is a wetland community[4].

The Department of Environmental Protection (1996) and *Bush Forever* (State of Western Australia 2000) identified additional seasonal wetland communities, S1 to S7, S17, S19 and S20.

Keighery *et al.* (2020) combined the communities in Gibson *et al.* (1994) and Department of Environmental Protection (DEP) (1996) into one dataset. The Keighery *et al.* (2020) dataset combines the results of floristic studies on flora communities of the Swan Coastal Plain IBRA Region, south of the Moore River. The main studies included are *A floristic survey of the southern Swan Coastal Plain* (Gibson *et al.* 1994) and the System 6 and Part System 1 Update Program (Department of Environmental Protection 1996).

Cresswell and Bridgewater (1985) provide information on dune vegetation communities, including wetland communities, on the Swan Coastal Plain. Semeniuk *et al.* (1990, table 2, p. 118; table 3 p. 119) compared wetland vegetation assemblages to the Cresswell and Bridgewater (1985) vegetation communities.

Bush Forever volume 2, Directory of Bush Forever sites (State of Western Australia 2000) provides a summary of vegetation information for remnant bushland, known as Bush Forever Sites, in the Perth Metropolitan Region. For each site, it records vegetation complexes, floristic community types, wetland types and wetland categories[5], with many sites containing wetlands.

Attachment E provides a summary list of threatened and priority wetland ecological communities. Some may represent additional floristic communities, particularly those that are not described in Gibson *et al.* (1994) or DEP (1996); and not already listed under the EPBC Act. For example, 'Swan Coastal Plain paluslope wetlands', 'Wooded wetlands that support colonial waterbird nesting areas', the 'Dunsborough forest swamp' and '*Casuarina obesa* association'.

The DEC (2012o, pp. 179–191) provides an example of wetland floristic communities described at a finer scale than those documented by Gibson *et al.* (1994). Within Yalgorup National Park, a range of saline and freshwater wetlands occur. The influence of salinity diminishes with increasing distance from the lakes, and freshwater seepages along the lake margins support communities

[2] Under the 'Wetland types based on hydrological attributes and landform' subheading.

[3] Gibson *et al.* (1994) identifies four major floristic groups, one of which is wetlands, demonstrating that wetlands are distinctive floristically at a very high level. In vegetation studies on the Swan Coastal Plain, the first breakdown is dry versus wet conditions.

[4] Gibson *et al.* (1994) floristic community type 2 is a threatened ecological community under the *Biodiversity Conservation Act 2016* (Western Australia) but not the EPBC Act.

[5] These parameters are described in Part A and the Bush Forever Sites are described in Part B.

dominated largely by freshwater species. Additional freshwater wetland communities are also present throughout the park. The boundaries between these communities are gradual, and in some areas the lakeside vegetation represents a combination of all the units described. This example is valuable because it illustrates the complexity of floristic communities in a wetland system (DEC 2012o, pp. 179-191).

Fauna species

Attachment F provides a list of wetland fauna on the Swan Coastal Plain, including characteristic, threatened and priority species. These fauna depend on the wetland habitat and contribute to nutrient cycling, food webs and other wetland ecological processes.

Wetland fauna species on the Swan Coastal Plain include vertebrates, such as migratory shorebirds, other waterbirds, mammals such as rakali (*Hydromys chrysogaster*), mardo (*Antechinus flavipes*), quenda (*Isoodon fusciventer*), kwoora or western brush wallaby (*Notamacropus irma*), moodit or western bush rat *(Rattus fuscipes*) and quokka (*Setonix brachyurus*), frogs, native fish, the south-western snake-necked turtle (*Chelodina oblonga*) and western swamp tortoise (*Pseudemydura umbrina*). Aquatic and semi-aquatic invertebrates include crustaceans, such as smooth marron (*Cherax cainii*), koonac (*Cherax preissii*), gilgie (*Cherax quinquecarinatus*), Dunsborough burrowing crayfish (*Engaewa reducta*), dragonflies, damselflies, mayflies, caddisflies, stoneflies, crane flies and aquatic beetles. Further details are provided in the response to **question 3b**.

These biological components demonstrate the ecological richness supported by the remaining wetlands of the Swan Coastal Plain.

3b. Describe the key species in the ecological community.*

What are the key species and why?* What information is available about each key species?* Cite relevant sources and indicate if any information is unavailable.*

Answer Question **3b** here. Please use as much space as you need to fully answer the question.

The key species of the wetlands of the Swan Coastal Plain include the characteristic, common and dominant flora that give the wetlands their structure; the endemic flora and fauna; the fauna that depend on wetland habitats; and the threatened or priority species that are especially vulnerable. These species either define how the wetlands function, or they are at risk from changes in water regimes, disturbance, or invasive species.

Key flora – sources of information

The DEC (2012o, appendix 2 in chapter 2 part 1 and part 5) and Water and Rivers Commission and Department of Conservation and Land Management (CALM) (1997a, 1997b) provide descriptions of many of the characteristic and common flora. Water and Rivers Commission (2000c) and Bell (2008) provide information on sedges, rushes and grasses.

Common wetland species are listed in the 'Common SSWA wetland species' column of Appendix 2 in DEC (2012o, pp. 70-78). From an analysis of more than 1,000 plots on the southern Swan Coastal Plain, there were 166 most commonly encountered wetland species (150 native species). Commonly encountered species were determined to be those that occurred in ten or more plots of wetland floristic community types 75 per cent or more of the time (DEC 2012o, p. 70). This category of wetland flora was developed to provide botanists with a list, based on the best available information, that defines wetland flora. The list can be used to identify wetland areas for vegetation mapping and is an important reference in environmental impact assessment when flora species are used to justify wetland mapping.

Paczkowska and Brown (2020) provides a comprehensive guide to wetland flora in the Brixton Street Wetlands. It illustrates the exceptionally high plant diversity of these wetlands, including many species that also occur in sandy wetland systems across the Swan Coastal Plain.

Keighery, Longman and Rye (2023) (Appendix B in Powell and Emberson 2023) lists wetland flora species found in the Perth Metropolitan Region. Powell (2009) provides information on wetland trees and several wetland shrubs occurring in the Perth Metropolitan Region, including their occurrence, distribution, ecology, growth habit, associated life and distinctive features.

Florabase (Western Australian Herbarium 1998–a), Brown *et al.* (1998) and recovery plans (DBCA 2025e; DCCEEW 2025g) provide descriptions of threatened flora, while *Florabase* also provides descriptions of priority flora. Lists of threatened flora on the Swan Coastal Plain are available in DBCA (2025h) and DCCEEW (2025f), while DBCA (2025h) also lists priority flora. The *Species Profile and Threats Database* (Department of Climate Change, Energy, the Environment and Water ((DCCEEW) undated(b)) provides detailed information about threatened flora listed under the EPBC Act.

Florabase (Western Australian Herbarium 1998–a) provides information about the form, height, flower colours, flowering time, soils, habitat and distribution. Brown *et al.* (1998) provides information about the distinctive features, flowering times, distribution and habitat of threatened species. The Water and Rivers Commission and CALM (1997a, 1997b) provides information about the leaves, flowers, flowering time, fruit, growth form, habitat and propagation of key wetland species on the Swan Coastal Plain.

Key flora species – including why they are key species

The examples below highlight a small number of species that play important structural or ecological roles. Although many of the key flora species are trees, this does not reflect the overall composition of the wetland flora of the Swan Coastal Plain. Floristic analyses for the southern Swan Coastal Plain show that trees comprise only a very small proportion of the common wetland flora by number of species (approximately 2%), with the majority being herbs, sedges, rushes, grasses and other ground-layer taxa (Table 5 in Appendix 3 of DEC 2012o, p. 80). Trees are included here because of their functional influence in some wetland systems, such as providing canopy structure, hollows, shading, habitat complexity and hydrological effects, rather than their proportional representation in the flora by number of species. The broader wetland flora is highly diverse and spans multiple life-form and growth-form groups, including the herbaceous species that characterise most wetland types on the Swan Coastal Plain.

Freshwater paperbark (*Melaleuca rhaphiophylla*), modong or stout paperbark (*Melaleuca preissiana*), saltwater paperbark (*Melaleuca cuticularis*), moitch or flooded gum (*Eucalyptus rudis*) and swamp banksia (*Banksia littoralis*) are, however, common species in the wetlands of the Swan Coastal Plain, as described in the response to **question 3a** and in **attachment A**. Giant sundew (*Drosera gigantea*), an annually renewed herb, is also a common species. The rushes

Some examples of key flora are provided below:

Threatened and priority flora

- Threatened and priority flora (collective): Refer to **attachment B** and the response to question 16. Their presence highlights the conservation significance of the wetlands of the Swan Coastal Plain.

Noongar bush foods and medicines

- Noongar bush foods and medicines (collective): Noongar bush foods and medicines are culturally significant flora that reflect the long-standing relationships between Noongar people and the wetlands of the Swan Coastal Plain, expressed through cultural knowledge and practices, seasonal knowledge and use of wetland resources. Many of these species are also structurally or functionally important within wetland habitats, contributing to canopy cover, shading, nutrient cycling and habitat for fauna. Some of these flora include moitch, moich, kulurda, gulurto, gooloorto, koolert, moja, colaille or gulli *(Eucalyptus rudis*); pungura, boongura, boora, boorarup, mimidi or swamp banksia (*Banksia littoralis*); bibool,

yaularung, bewel, koll, mudurda or saltwater paperbark (*Melaleuca cuticularis*); modong or stout paperbark (*Melaleuca preissiana*); yowarl, bibool, boorn, yeymbac, yiembak yawl or freshwater paperbark (*Melaleuca rhaphiophylla*); marro or swamp cypress (*Callitris pyramidalis*); banbar (*Melaleuca teretifolia*); milyu (various samphires); cara or dwarf milkmaids *(Burchardia multiflora*); cara (*Caladenia* sp.); cara or djubak (*Diuris* sp.); joobuk (*Thelymitra* sp.); tangil or pale rush (*Juncus pallidus*); Waargyl ngarnak (Waargyl's beard), kuiarch or jointed twig-rush (*Machaerina articulata*); yangeti, lirimbi, yanjidi, yunjeedie, yunjid, tanjil, yandijut, jetta (*Typha* sp.) (Hansen and Horsfall 2017, 2019). This list highlights the Noongar bush foods and medicines commonly found in the ecological community (as summarised in **attachment A**), noting that many additional culturally significant wetland flora species are documented in the literature but not listed here due to their number. Information on the cultural uses and Noongar names of these species is well documented in Hansen and Horsfall (2017, 2019), City of Joondalup (2011); Daw *et al*. (1997); Abbott (1983); Perth NRM (2015); Perth NRM (undated) and Hill (2013, pp. 514-515).

Trees

- Freshwater paperbark (*Melaleuca rhaphiophylla*): The most common paperbark, it stabilises wetland soils, influences hydrology, and supports diverse birds and invertebrates. According to Powell (2009), it typically occurs along rivers and permanent lakes, near both fresh and saline water but is less tolerant of salinity than saltwater paperbark. It grows as a small tree, usually under 10 m, or as a lower shrub in swampy alluvial soils. The species is heavily used by waterbirds: coots, dusky moorhens and various ducks (including the freckled duck) nest in its hollows, while horizontal forks provide sites for darters, cormorants, herons, egrets, ibises and spoonbills. Powell (2009) emphasises that "most importantly, freshwater paperbark is usually inundated in spring. Since waterbirds like trees standing in water, they prefer this species to modong, which grows on slightly higher ground." Powell (2009) also notes that "freshwater paperbark regenerates prolifically under the right conditions, and waterbirds also make use of the thickets of saplings." Paperbarks are also the preferred nesting sites for many terrestrial birds, especially grey fantails and willy wagtails.
- Modong or stout paperbark (*Melaleuca preissiana*): The largest paperbark on the Swan Coastal Plain, found in seasonally waterlogged wetlands where it provides canopy structure, stabilises soils, and supports diverse birds and invertebrates. According to Powell (2009), it is characterised by irregular branching, open crowns, and thick trunks in older specimens. It grows chiefly in shallow winter-wet depressions and is particularly abundant in Bassendean soils, often occurring further back from water than freshwater paperbark and commonly associating with swamp banksia (*Banksia littoralis*) or flooded gum (*Eucalyptus rudis*). In early summer, its blossoms produce copious nectar that attracts beetles, wasps, bees, and other insects, while fallen branches support wood-boring species such as jewel beetles. Waterbirds including white-faced herons, black ducks, and hardheads use modong for breeding, particularly when trees are standing in water, although it is less important to waterbirds than freshwater paperbark, which is more regularly inundated (Powell 2009).
- Saltwater paperbark (*Melaleuca cuticularis*): Characteristic of estuarine and saline wetlands, tolerating brackish conditions and providing habitat for estuarine fauna. Powell (2009) notes that the canopy of saltwater paperbark is used by waterbirds for nesting, roosting and resting.
- Moitch or flooded gum (*Eucalyptus rudis*): A key structural tree species in some Swan Coastal Plain wetlands, providing canopy cover, habitat complexity, and hollows for fauna. It is an ecologically valuable tree, as it supports abundant and diverse insects and spiders, which are food for many insectivorous birds. Its foliage, bark, and wood host a wide range of invertebrates, while mature trees develop hollows and branching structures that provide

nesting and roosting sites for ducks, herons, cormorants, ibises, parrots, owls, bats, and possums (Powell 2009). The subspecies *Eucalyptus rudis* subsp. *cratyantha* is listed as priority 4 in Western Australia[6].

- Swamp banksia (*Banksia littoralis*): Occurs in seasonally inundated sites, contributing nectar resources for birds, mammals, and invertebrates, and adding structural diversity. Powell (2009) notes that it supports a wide range of insects, including beetles, weevils, moths, and gall-wasps, which use its foliage, cones, and stems. The species flowers in winter, providing an important nectar source for honey-eating birds. Swamp banksia flowers in winter, when it is an important source of nectar for honeyeaters. The DEC (2012o, p. 140) notes that wetlands dominated by swamp banksia are "becoming rare as wetlands dry, are infested with Phytophthora and are more frequently burnt" (DEC 2012o).

Rushes, sedges and grasses

- Rushes, sedges and grasses (collective): Rushes (for example, *Juncus* sp. and *Leptocarpus* sp.), sedges (for example, *Carex* sp., *Machaerina* sp. and *Lepidosperma* sp.) and grasses form dense ground layers that define wetland structure, stabilise soils, and provide habitat (Water and Rivers Commission and CALM 1997a, 1997b; Water and Rivers Commission 2000c). The Water and Rivers Commission (2000c) notes that rushes and sedges have shallow, spreading roots that hold soil together and prevent erosion. They play a vital role in keeping wetlands healthy by slowing water flow, trapping sediment, and capturing runoff from surrounding land. This helps stop excess nutrients from entering wetlands. Many species act as natural "nutrient-strippers," storing nutrients in their stems and underground rhizomes, while also supporting bacteria that break down pollutants. Their roots release oxygen into the water and sediment, which aids nutrient cycling and creates microhabitats for small animals. Dense stands of rushes and sedges also provide shelter for native fauna, including invertebrates and birds such as Christmas spiders, Western Australian reed-warblers and little grassbirds. Their thick growth also suppresses weeds (Water and Rivers Commission 2000c). **Attachments A** and **D** highlight the common rushes, sedges and grasses; and **attachment D** lists the common and characteristic rushes, sedges and grasses on the Swan Coastal Plain by wetland type.

Aquatic flora

- Submerged aquatic flora (collective): While submerged aquatic flora (for example species of *Cycnogeton, Myriophyllum, Potamogeton, Althenia, Ruppia, Halophila, Utricularia, Azolla, Lemna* and a suite of Charophytes) are only a small percentage of the taxonomic flora, they play a critical ecological role in the wetlands. These plants are adapted to the seasonal drying of our wetlands and when flooded provide habitat and food for aquatic fauna. This habitat provides shelter from invasive species, such as eastern gambusia (*Gambusia holbrooki*) and other invasive predators, enabling native invertebrates and fish to survive when otherwise they might become locally extinct.

Other wetland flora

- Other wetland flora, including common flora (collective on the shrubs, perennial herbs, annual herbs, annually renewed herbs): These demonstrate the high diversity of wetland species in this biodiversity hotspot and encompass the main life-form and growth-form groups present in the ecological community.

[6] In Western Australia, species that are adequately known and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened species list, are placed in priority 4.

Key fauna – sources of information

DBCA (2025g) and DCCEEW (2025f) provide lists of threatened fauna, while DBCA (2025g) also includes priority fauna. Recovery plans (DBCA 2025e; DCCEEW 2025g) provide descriptions of threatened fauna. The *Species Profile and Threats Database* (DCCEEW undated(b)) contains detailed information about threatened and migratory fauna listed under the EPBC Act.

Records of wetland fauna on the Swan Coastal Plain can be confirmed using *Dandjoo* (Biodiversity Information Office 2026).

The International Union for Conservation of Nature (IUCN) (2026) search page provides information on species' range, habitat, ecology, taxonomy, population, and Red List status (that is, not evaluated, data deficient, least concern, near threatened, vulnerable, endangered, critically endangered, extinct in the wild or extinct)[7].

Storr and Johnstone (1988), Storey *et al.* (1993), Davis *et al.* (2013), Menkhorst *et al.* (2019), Geering *et al.* (2007), Birdlife Australia (2022, 2023), Lane and Burbidge (1978) and DEC (2012m) provide information about the birds that depend on the wetlands of the Swan Coastal Plain.

Storr and Johnstone (1988) give a short description of each bird species recorded on the Swan Coastal Plain. It provides information on its range, how often it is seen (for example, whether it is an occasional visitor, vagrant, common or uncommon), its breeding habitats and some of the places where it may be found. Storr and Johnstone (1988) also outline the months when migratory species are present and note seasonal movements for species that shift locally between breeding and feeding areas.

Storey *et al.* (1993) is a detailed study of how waterbirds use the wetlands of the Swan Coastal Plain. It describes the environmental features that influence waterbird use and explains the importance of these wetlands for breeding and as refuges during drought. The study lists the 20 most abundant species, identifies the species found in the greatest numbers and those seen most often, and ranks the wetlands that supported the highest diversity of species and the greatest number of breeding species during the surveys.

Menkhorst *et al.* (2019) provides comprehensive information about the bird species in Australia, including identification details, distribution and habitat. Dutson et al. (2009) identifies Important Bird Areas, many of which are on the Swan Coastal Plain.

Geering *et al.* (2007) provides information about shorebirds, many of which are migratory. It covers their distribution, evolutionary history, classification, breeding and feeding ecology, migration patterns, habitat preferences, threats, and conservation measures. Geering *et al.* (2007) and Bamford *et al.* (2008) list the sites that support internationally significant numbers of shorebirds and the species found at those sites. The relevant sites on the Swan Coastal Plain are named: Swan River Estuary, Rottnest Island, Forrestdale Lake Nature Reserve, Thomsons Lake Nature Reserve, Lake Cooloongup, Peel-Harvey system, Lake Preston and Vasse Wonnerup system Geering *et al.* (2007, p. 76) and Bamford *et al.* (2008, pp. 210-220)[8].

Further information on migratory shorebirds is available in DCCEEW (2021a, 2021b, 2025a, 2025b, 2025f), Department of the Environment (2015), DBCA (2018c, 2025b), Dutson *et al*. (2009) and Driessen *et al.* (2025). Driessen *et al.* (2025) identifies many wetlands on the Swan Coastal Plain as important migratory shorebird habitats. The relevant sites are named: Swan River, Rottnest Island, Forrestdale Lake, Bibra and Thomsons Lake Reserves, Peel and Yalgorup Lakes, Leschenault Estuary, Broadwater (Busselton) and Vasse Wonnerup Estuary. Appendix 1 of Driessen *et al.* (2025) lists the wetland habitat classifications.

[7] It also provides this information for flora. However, for flora we relied on *Florabase* (Western Australian Herbarium 1998–a) and the other references described under the 'key flora' sub-heading.

[8] References to estuaries relate to the estuary – peripheral wetland type.

Birdlife Australia (2023) provides advice about the birds found at particular wetlands; and Birdlife Australia (2026) can be used to request data from Birdata. Birdlife Australia (2022) provides up-to-date bird taxonomy advice, consistent with the Avilist, which may become the authority on bird taxonomy worldwide.

O'Connor (2010) and Collins (2011a, 2011b) identified wetlands where birds, including migratory shorebirds, are regularly recorded. In O'Connor (2010), the wetlands listed under the 'Perth suburbs' heading, and under the 'south west' sub-heading (including Coodanup, Mandurah, Harvey Peel Estuary, Lake McLarty and Lake Preston), are relevant.

Menkhorst and Knight (2011) provides descriptions, and information about the distribution and habitat of Australian mammals. Reaveley (2009), Bamford and Bamford (2003), How and Dell (1993) and How (1978) are studies of the mammal fauna on parts of the Swan Coastal Plain. Rakali (*Hydromys chrysogaster*) are dependent on wetland habitats. Reaveley (2009), Bamford and Bamford (2003), How and Dell (1993) and DEC (2012m) document associations between wetland habitats and mardo (*Antechinus flavipes*), quenda (*Isoodon fusciventer*), kwoora or western brush wallaby (*Notamacropus irma*), moodit or western bush rat *(Rattus fuscipes*) and quokka (*Setonix brachyurus*). Bamford and Bamford (2003) noted that western pygmy possum (*Cercartetus concinnus*) may favour the high density of trees and shrubs close to wetlands and damplands. Bamford and Bamford (2003) also noted that wetlands are likely to be productive feeding habitats for chuditch (*Dasyurus geoffroii*) and wambenger (*Phascogale tapoatafa wambenger*), both of which are predators. The DEC (2012m) notes that western grey kangaroos (*Macropus fuliginosus*) have large home ranges that can include wetlands.

Smart *et al.* (2011), Trocini *et al.* (2015) and the DEC (2012a, 2012m) provide further information about rakali (*Hydromys chrysogaster*) in Swan Coastal Plain wetlands and south-western Australia. The DCCEEW (2026f) and DEC (2013) provide further information about quokkas (*Setonix brachyurus*).

Morgan *et al.* (2011) and the Department of Water and Environmental Regulation (DWER) fauna biodiversity webpage on the *Healthy rivers south-west* website (2026c) provide advice about the fish, crustaceans and mussels found in wetlands on the Swan Coastal Plain. These references include information about identifying species, distribution, habitat, biology and recommended reading.

The DEC (2008a) and DCCEEW (2026b, 2026g) provide further information about the Dunsborough burrowing crayfish (*Engaewa reducta*) and Carter's freshwater mussel (*Westralunio carteri*), respectively. The DEC (2012m) provides further information about crayfish and other crustaceans, and molluscs in wetlands. Klunzinger *et al.* (2022) provides information about a recent taxonomy update for Carter's freshwater mussel (*Westralunio carteri*).

Other sources of information on fish in Swan Coastal Plain wetlands include Sommer *et al.* (2008), Hourston *et al.* (2014), the Department of Primary Industries and Regional Development (DPIRD) (2026b) and South East Regional Centre for Urban Landcare (undated) on distribution; Morgan (undated) on ecology; and Morgan *et al.* (1996, 1998) on identification, distribution and biology. The DCCEEW (2026c, 2026d) provides further information about the western mud minnow (*Galaxiella munda*) and black-striped minnow *Galaxiella nigrostriata*), respectively.

The Western Australian Museum (undated(d)), Doughty (2009), Tyler and Knight (2020) and Pearson *et al.* (undated) provide information about the frogs found in wetlands on the Swan Coastal Plain, including descriptions, distribution maps, breeding biology and habitat.

Santoro (2017, 2022), Santoro *et al.* (2020, 2023a, 2023b, 2024a, 2024b, 2025), Sturm (2022), Gordon (2023), Whatmore (2023), Ingelbrecht *et al. (*2025), the DEC (2012m) and the DWER's fauna biodiversity page on the *Healthy rivers south-west* website (2026c) provide information about the south-western snake-necked turtle (*Chelodina oblonga*). Santoro (2017) and Santoro *et al.* (2020) highlight a lack of recruitment and link it to limited nesting habitat. Santoro (2022), Santoro

et al. (2023a) and Sturm (2022) document low hatching success likely due to increasing temperatures. Santoro (2022) and Santoro *et al.* (2023b) describe the species nesting triggers and how climate change is affecting it. Santoro (2022), Santoro *et al.* (2024a), and Whatmore (2023) provides information on the species aquatic and aestivation habitat use and how it may be changing due to climate change and invasive species. Santoro (2022) and Santoro *et al.* (2024b) report the species nesting habitat and how urbanisation has reduced it. Santoro *et al.* (2025) describes the response of the species after translocation. Gordon (2023) addresses the effects of climate change and habitat fragmentation on the species. Ingelbrecht *et al.* (2025) highlights low genetic heterozygosity and potential inbreeding.

The DCCEEW (2026e), Burbidge *et al.* (2010), the Environmental Protection Authority of Western Australia (EPA) (2026), CALM (undated), DEC (2012m) and DWER's fauna biodiversity page on the *Healthy rivers south-west* website (2026c) provide information about the western swamp tortoise (*Pseudemydura umbrina)*.

The DEC (2012m) and Wilson and Swan (2025) provide information about skinks and snakes associated with wetlands on the Swan Coastal Plain.

The DEC (2012m), Western Australian Museum (2025), Houston and Maynard (2013) and Prendergast (2020, 2021a, 2021b) provide information on native bees found in wetlands on the Swan Coastal Plain.

Horwitz *et al.* (2009), Sim *et al.* (2013), Davis and Christidis (1997), Sommer *et al.* (2008), Balla and Davis (1993), Davis *et al.* (1993), Gooderham and Tsyrlin (2002), Pennifold (2018), Hawking *et al.* (2013), Endersby (2021), Theischinger *et al.* (2021) and DEC (2012m) provide information on the aquatic and semi-aquatic invertebrates of the Swan Coastal Plain and south-western Australia. Horwitz *et al.* (2009) synthesise the aquatic invertebrate survey data for the wetlands of the Swan Coastal Plain and describe species richness and endemism. Sim *et al.* (2013) use a long-term dataset to examine temporal changes in hydroregimes and aquatic invertebrate diversity at nine seasonal wetlands. Davis and Christidis (1997), Sommer *et al.* (2008), Gooderham and Tsyrlin (2002) and Hawking *et al.* (2013) outline habitat and ecology. Pennifold (2018) examined freshwater invertebrates for potential inclusion on the Western Australian priority fauna list. Van Looij (2009) describes Australian River Assessment System (AUSRIVAS) sampling methods for Western Australia. Endersby (2021) and Theischinger *et al.* (2021) concentrate on dragonflies and damselflies: Endersby (2021) details their distribution, flight periods and records from the Swan Coastal Plain, while Theischinger *et al.* (2021) provides information on distribution, life cycles, ecology, conservation and habitat.

There is limited information on the stygofauna of the Swan Coastal Plain. However, Bennelongia Environmental Consultants (2008) and Saccò *et al.* (2022) indicate that stygofauna may be widely distributed throughout the Plain's aquifers. Stygofauna inhabit the groundwater systems that sustain wetlands, including wetlands that are seasonally waterlogged.

Key fauna species – including why they are key species

Some examples of key fauna are provided below:

- Threatened and priority fauna (collective): Refer to **attachment G** and the response to question 16. Some of these species are also described separately in this list of key fauna. Their presence highlights the conservation significance of the community.
- Migratory shorebirds (collective): The Swan Coastal Plain wetlands provide feeding and roosting habitats for migratory shorebirds during their annual migrations along the East Asian–Australasian Flyway. They are protected under bilateral agreements, international treaties and conventions and the EPBC Act, highlighting the global significance of these wetlands.

The bilateral agreements are the *Japan-Australia migratory bird agreement* (JAMBA) (Government of Australia and Government of Japan 1974), *China-Australia migratory bird agreement* (CAMBA) (Government of Australia and Government of the People's Republic of China 1986) and *Republic of Korea-Australia migratory bird agreement* (ROKAMBA) (Government of Australia and Government of the Republic of Korea 2006). The international treaties and conventions are the *Convention on the conservation of migratory species of wild animals (CMS)* (United Nations Environment Programme UNEP 1979) and the *Convention on wetlands of international importance especially as waterfowl habitat* (Ramsar convention) (Ramsar Convention Secretariat 1971). Further information about the Ramsar wetlands on the Swan Coastal Plain is provided in the response to **question 15**. The *Convention on biological diversity* (United Nations 1992) also refers to migratory shorebirds.

Geering *et al.* (2007, p. 76) lists migratory shorebirds in internationally significant numbers. For the Swan Coastal Plain wetlands, this includes sharp-tailed sandpiper and curlew sandpiper at the Vasse-Wonnerup estuary; red-necked stint at Lake Preston and the Swan River estuary; red-necked stint, sharp-tailed sandpiper and curlew sandpiper at the Peel-Harvey system; curlew sandpiper and red-necked stint at Lake Cooloongup; curlew sandpiper at Forrestdale Lake and Thomsons Lake; and ruddy turnstone at the Rottnest Island wetlands.

- Other waterbirds (collective): Waterbirds are important for the ecological character of the Swan Coastal Plain wetlands with permanent or seasonal open water because they act as both indicators and drivers of wetland health. Resident species such as ducks, swans, grebes, cormorants, herons and egrets rely on these wetlands for breeding, feeding, and shelter, and in turn shape nutrient cycling, vegetation dynamics, and food-web interactions. Their foraging activities regulate fish and invertebrate populations, while nesting and roosting contribute to habitat complexity and nutrient redistribution across wetland zones. Many species are highly sensitive to changes in water quality, hydrology, and vegetation structure, making their presence and abundance a reliable measure of ecological condition.

  In addition to their ecological functions, waterbirds hold cultural significance. They are easy to see and familiar to the community, so they help to foster community awareness and stewardship. By observing waterbirds as they feed, nest, and move across the water, people gain an understanding of how the wetland ecosystem operates.

- Raptors (collective): Wetland-dependent raptors such as the swamp harrier (*Circus approximans*), white-bellied sea eagle (*Haliaeetus leucogaster*) and eastern osprey (*Pandion haliaetus*) rely on the Swan Coastal Plain wetlands for hunting and breeding. Other raptors, including the black-shouldered kite (*Elanus axillaris*) and whistling kite (*Haliastur sphenurus*), frequently use these wetlands but are not restricted to them. Raptors function as apex predators and mesopredators (mid-level predators that hunt smaller vertebrates) within the ecological community, influencing predator–prey relationships within the wetland food web.

- Rakali (*Hydromys chrysogaster*): Rakali are predators in wetland systems, feeding on fish, crustaceans and invertebrates. They are culturally significant and may serve as indicators of aquatic ecosystem health.

- Other mammals: Mardo (*Antechinus flavipes*), quenda (*Isoodon fusciventer*), kwoora or western brush wallaby (*Notamacropus irma*), moodit or western bush rat (*Rattus fuscipes*) and quokka (*Setonix brachyurus*) all rely on the structural complexity, moisture regimes and understorey productivity provided by healthy wetlands and their buffers and foreshore areas. Through digging, foraging and movement, they contribute to soil turnover, nutrient cycling, fungal and seed dispersal, and the maintenance of understorey diversity. Their presence and

persistence are strongly linked to intact hydrology, dense vegetation cover and low levels of disturbance. See Reaveley (2009), Bamford and Bamford (2003), How and Dell (1993) and DEC (2012m).

- South-western snake-necked turtle (*Chelodina oblonga*): This endemic freshwater turtle depends on wetlands and slow-flowing rivers. It plays roles as both predator and prey and is vulnerable to habitat loss, altered hydrological regimes and predation. Recent studies by Santoro (2017, 2022),Santoro *et al.* (2020, 2023a, 2023b, 2024a, 2024b, 2025), Sturm (2022), Gordon (2023), Whatmore (2023) and Ingelbrecht *et al. (*2025) have raised concerns of declining populations, largely due to mortality of adults and limited breeding success due to habitat loss, the drying climate, high mortality of nesting females, and predation or destruction of nests by invasive predators, domestic animals and vehicles. Females must travel significant distances from wetlands to nest, during which they are vulnerable to predation, and being killed or injured by vehicles. Protection and restoration of natural habitats fringing urban wetlands (Santoro *et al.* 2023c; Sturm 2022), ensuring dry periods do not increase in frequency and/or duration (Santoro *et al.* 2024a), and invasive predator control (Santoro 2022) is important for this species.
- Western swamp tortoise (*Pseudemydura umbrina*): One of the most critically endangered reptiles in the world. It has a naturally very restricted range, in shallow, ephemeral wetlands on clay or sand-over-clay soils with nearby suitable aestivating refuges (Burbidge *et al.* 2010; DWER 2026c). This narrow ecological niche makes it highly vulnerable to climate change and habitat loss. It is listed as critically endangered under the EPBC Act and *Biodiversity Conservation Act 2016*. It represents the subfamily Pseudemydurinae monotypically and is little changed from fossils from the early Miocene[9] at Riversleigh in Queensland (Burbidge *et al.* (2010). The two remaining natural populations are at Twin Swamps Nature Reserve and Ellen Brook Nature Reserve on the Swan Coastal Plain.
- Fish (collective): Key freshwater fish species include nightfish (*Bostockia porosa*), western minnow (*Galaxias occidentalis*), western mud minnow (*Galaxiella munda*), black-stripe minnow (*Galaxiella nigrostriata*), western pygmy perch (*Nannoperca vittata*) and freshwater cobbler (*Tandanus bostocki*). Key fish species that are found in both freshwater and saline (including estuarine) wetlands include south-western goby (*Afurcagobius suppositus*), common jollytail (*Galaxias maculatus*), pouched lamprey (*Geotria australis*), western hardyhead (*Leptatherina wallacei*) and blue-spot goby (*Pseudogobius olorum*).

  Native fish can be found in permanently and seasonally inundated wetlands of the Swan Coastal Plain. They contribute to ecosystem function through roles in nutrient cycling, food web dynamics, and as prey for birds, mammals and reptiles. Fish diversity and abundance are sensitive to hydrological regimes, water quality, and connectivity, making them important indicators of wetland health. The western mud minnow (*Galaxiella munda*) is listed as vulnerable and the black-stripe minnow (*Galaxiella nigrostriata*) as endangered under both the EPBC Act and the *Biodiversity Conservation Act 2016*.
- Carter's freshwater mussel (*Westralunio carteri*): Morgan *et al.* (2011) notes this is the only reasonably large bivalve in freshwaters of the region. It occurs in greatest abundance in wetlands with stable sediments that are soft enough for burrowing; and is listed as vulnerable under the EPBC Act and *Biodiversity Conservation Act 2016*.
- Crustaceans (collective): Smooth marron (*Cherax cainii*), koonac (*Cherax preissii*), gilgie (*Cherax quinquecarinatus*), Dunsborough burrowing crayfish (*Engaewa reducta*), south-west glass shrimp (*Palaemonetes australis*) and freshwater prawns (*Palaemonidae*) recycle nutrients and provide food for fish, birds, and mammals. Their abundance reflects water

[9] A geological epoch lasting from about 4.5 to 24.6 million years ago.

quality and hydrological conditions. The Dunsborough burrowing crayfish is listed as critically endangered under the EPBC Act and endangered under the *Biodiversity Conservation Act 2016*.

- Frogs (collective): Quacking frog (*Crinia georgiana*), rattling or clicking froglet (*Crinia glauerti*), squelching or sign-bearing froglet (*Crinia insignifera*), false western froglet (*Crinia pseudinsignifera*), Lea's frog (*Geocrinia leai*), western spotted frog (*Heleioporus albopunctatus*), western marsh frog (*Heleioporus barycragus*), moaning frog (*Heleioporus eyrie*), plains frog (*Heleioporus inornatus*), sand frog (*Heleioporus psammophilus*), western banjo frog (Limnodynastes dorsalis), slender tree frog (*Litoria adelaidensis*), motorbike frog (*Litoria moorei*), kunapalari frog (*Neobatrachus kunapalari*), humming frog (*Neobatrachus pelobatoides*) and crawling toadlet (*Pseudophryne guentheri*) are frogs found in wetlands on the Swan Coastal Plain. Frogs are sensitive indicators of environmental health and play vital roles in food webs. They regulate insect populations, provide prey for birds, mammals and reptiles, and their tadpoles influence nutrient cycling and algal growth. Their distinctive calls also connect communities to wetlands, supporting citizen science and cultural engagement.
- Aquatic and semi-aquatic insects and other macroinvertebrates (collective): These species underpin ecosystem processes, contributing to decomposition, nutrient cycling, and serving as prey for higher trophic levels. Many are uniquely adapted to seasonal wetlands through dispersal or by using dormancy strategies to persist through dry periods. The more mobile invertebrates may disperse across the landscape in wetter years and retract to more reliable habitats when conditions are drier (Sim *et al.* 2013). Wetlands on the Swan Coastal Plain have high overall invertebrate richness compared to other areas surveyed in Australia (Horwitz *et al.* 2009; Sim *et al.* 2013) and tend to be dominated by taxa that actively disperse (Sims *et al.* 2013).

4. Describe the <u>key</u> interactions and functional processes in the ecological community; i.e. dependencies, ecological processes and interactions between biological and/or non-biological components (where known)**.***

Include known relevant information on functional species (e.g. ecosystem engineers, key pollinators or seed dispersers), vegetation dynamics, fire dynamics, hydrology, climate and connectivity elements, including relevant groundwater, ocean currents or key migratory species; explain why they are important. Include First Nations information on these, such as seasonal calendars, where they are published or if unpublished, permission has been granted for use. Cite relevant sources and indicate if any of this information is unavailable.*****

Answer Question **4** here. Please use as much space as you need to fully answer the question.

In the wetlands of the Swan Coastal Plain, water, flora, fauna and climate are closely interconnected. Each component (water, flora, fauna and climate) relies on the integrity of the others, creating a network of relationships that sustains the whole.

Hydrology interactions and functional processes

Seasonal rainfall patterns drive the hydrological cycles of the wetlands on the Swan Coastal Plain: winter rainfall replenishes water in the wetlands and causes flooding and rising groundwater (Balla 1994; Hill *et al.* 1996a, 1996b). This facilitates nutrient exchange and aquatic productivity. This is summarised in Davis and Froend (1999):

"Wetlands in southwestern Australia experience a strongly seasonal hydrological cycle of winter flooding and summer drawdown. This occurs as a result of the Mediterranean climate of the region that is characterized by winter rainfall and warm dry summers. Most wetlands are surface expressions of local unconfined aquifers (Townley *et al.*, 1993) and water levels vary according to

the height of the water table and the extent of influence of surface water inflows. Water levels in wetlands are usually at a maximum in spring (September and October) and a minimum in autumn (March and April).

"This strongly seasonal hydrological cycle dominates wetland processes. Nutrients enter the wetland in groundwater inflows and surface run-off during winter while evaporation, coupled with little or no rainfall, results in the concentration of nutrients and salts during summer. Increased light and temperatures during summer, together with concentrated nutrients, provide favourable conditions for algal growth and it is at this time that wetlands are most productive (Chambers and Davis, 1988). Nutrient levels in wetlands are lowest during winter and spring as a result of the dilution effect of a large amount of freshwater entering the system from winter rains, and highest during late summer and autumn, when evaporative processes dominate (Davis *et al.* 1993)."

Summer drying also exposes soils and creates different habitats for waterbirds, including migratory shorebirds, frogs and invertebrates.

In the low-lying parts of the Swan Coastal Plain, groundwater is close to the ground surface, making wetlands highly sensitive to changes in recharge and abstraction. Long-term monitoring has shown that declining groundwater levels are driven by abstraction, drainage, and reduced rainfall under climate change (Nanda *et al.* 2021).

See also the response to **question 5a** under the 'wetland hydrology' and 'wetland types based on hydrological attributes and landform' sub-headings for further information about wetland hydrology on the Swan Coastal Plain.

The wetlands as an interconnected hydrological and ecological system

Across the Swan Coastal Plain, the wetland types included in this nomination (creek, dampland, estuary – peripheral, floodplain, lake, paluslope, palusplain, river and sumpland) form an extensive, often interconnected, mosaic of wetlands. Many of these wetlands do not naturally function as isolated units; their water regimes, nutrient pathways and biotic communities are (or were) linked across the landscape. Groundwater movement, surface water flows, seasonal inundation patterns and fauna dispersal operate across multiple wetland types. This mosaic of wetland types underpins the ecological character of the wetlands of the Swan Coastal Plain and is fundamental to the persistence of wetland processes, habitats and species assemblages. This natural mosaic and connectivity also explains why fragmentation caused by clearing, draining or filling wetlands has such severe impacts.

Historically, wetlands occupied more than 25% of the Swan Coastal Plain (DBCA 2017a, 2017b; Hill *et al.* 1996a) from Wedge Island to Dunsborough. This extent is clearly illustrated in the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset, which shows how continuous and interconnected the wetland system once was, particularly when Multiple Use wetlands (severely degraded wetlands with most native vegetation removed) are included in the mapping. This extensive coverage formed a mosaic of often interconnected wetlands, with natural transitions between wetland types occurring across the landscape. Although many of these wetlands have since been lost or degraded by human activities, the hydrological and geomorphic framework that once linked them remains, even though declining groundwater levels have reduced or altered many of the natural connections.

The hydrological basis of this mosaic and connectivity is generally well understood. Groundwater is the primary hydrological driver across the wetlands of the Swan Coastal Plain. The wetlands are typically connected to the shallow unconfined aquifer, which underpins their ecological function and seasonal dynamics, although the degree of connection varies across the landscape. Surface water inundation contributes to some wetland types (such as rivers, creeks and floodplains). The *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and Department of Parks and Wildlife (DPAW) 2016, p. 17) provides further information on the interaction between groundwater and the 'river' wetland type and its tributaries. It states: "the major

rivers that cross the planning area originate east of the Darling Scarp and flow to the ocean. On the Swan Coastal Plain, surface run-off and groundwater discharge contribute to the flows within these rivers and their tributaries… A major component of the summer flows is from groundwater discharge (Davidson 1995)."

The natural wetland mosaic and interconnectedness of wetland types is clearly expressed in several well-studied wetland systems across the Swan Coastal Plain. These systems demonstrate how groundwater, surface water and ecological processes operate across multiple wetland types, each illustrating a different expression of the same underlying landscape-scale connectivity. Examples include:

- Bennett Brook wetlands (Eco Logical Australia 2019; DBCA 2019b)
- Peel–Yalgorup wetlands (Department of Water 2010a; Hall *et al.* 2010; DCCEEW undated (a); Ramsar Convention Secretariat 1998b; Peel-Harvey Catchment Council 2009, 2009–2026; Hale and Butcher 2007; DBCA 2025k)
- Brixton Street wetlands (EPA 2022; Tauss *et al.* 2019; Bourke 2017; Semeniuk and Semeniuk 2001b; State of Western Australia 2000, p. 159-161).

The Bennett Brook wetlands provide a clear example of groundwater-driven connectivity across multiple wetland types. The main water source for Bennett Brook is groundwater discharge from the Gnangara Mound, supplemented to a lesser degree by surface runoff from the surrounding floodplain and episodic flood events from the Swan River (DBCA 2019b, p. 10). Eco Logical Australia (2019, pp. 68–75) documents the hydrological and ecological linkages between the palusplain, sumpland, lake, dampland and floodplain wetland types, showing that groundwater movement, seasonal inundation and surface flows operate across these wetland types. This supports what was once a continuous (now fragmented) mosaic of wetland habitats and demonstrates that the whole system is connected by groundwater, rather than functioning as a set of discrete wetland types.

At a much larger scale, the Peel–Yalgorup wetlands demonstrate how multiple wetland types can be connected through a combination of groundwater, surface water and tidal processes.

The Peel–Yalgorup wetlands illustrate a large-scale expression of natural connectivity across multiple wetland types. The system includes the lake, estuary – peripheral and sumpland wetland types, which are influenced by groundwater gradients, surface water flows and tidal exchange (Hale and Butcher 2007). The Department of Water (2011, p. 29) noted that the Peel–Yalgorup system is the largest registered Ramsar site in the south-west "and has many interconnected wetlands, lakes, rivers, drainage features and groundwater aquifers that contribute to the area's complex hydrology". Other sections of the same plan describe the plan area as comprising interconnected wetland types that form an integrated hydrological system (Department of Water 2011, pp. ix, 39). This context demonstrates that surface water and superficial groundwater are closely linked, with drains and rivers influencing groundwater levels (Hall *et al.* 2010, p. 15).

The DEC (2012h, p. 21) describes the Brixton Street wetlands as being part of what was a "broad, interconnected chain of swamps many kilometres wide". It notes that "most areas of pasture on the eastern side of the Swan Coastal Plain either are or were wetlands that, when intact, had exceptional ecological significance. The remaining intact areas are representative of what was naturally a mosaic of an extensive area of flat, seasonally waterlogged wetlands that were interspersed with shallow, seasonally inundated basins and channels and dryland prior to European settlement." This description reflects the natural connectivity between large areas of palusplain and the interspersed sumpland, creek and floodplain wetland types within the Brixton Street wetlands and surrounding area.

Many of the wetlands of the Swan Coastal Plain are windows to the underlying groundwater where the land dips below the water table (Balla 1994, p. 11). Some wetland types, such as lakes, may

have distinct boundaries on the ground surface and are hydrologically connected to neighbouring wetlands through groundwater. Many of the lakes are flow-through systems that receive groundwater on their up-gradient side and discharge on their down-gradient side (Townley *et al.* 1993). Other wetland types, such as floodplain and palusplain wetlands, can cover large areas and include smaller areas of other wetland types within them (DBCA 2017a, p. 22).

See also the response to **question 5a** under the 'wetland hydrology' and 'wetland types based on hydrological attributes and landform' subheadings.

Vegetation dynamics

Loomes (2000) studied the influence of hydrology on the composition and structure of wetland vegetation for 19 wetlands on the Swan Coastal Plain and notes:

- There is a strong relationship "…between the distribution, growth and reproduction of wetland vegetation and the depth and duration of seasonal flooding (Mountford and Chapman, 1993; Froend and McComb, 1994; Brownlow *et al.*, 1994; Neilsen and Chick, 1997). This relationship is especially obvious where vegetation forms bands around a wetland and each successive band is less tolerant of inundation (Wheeler, 1999)."
- Altered water regimes "…also demonstrate the importance of water levels to wetland vegetation (Wheeler, 1999). As each species is adapted to a specific water level range, or hydrological envelope, any change in water levels can ultimately affect its distribution. Long-term persistent changes can cause a shift in community composition and structure as species better adapted to the new conditions become established (Harding, 1993). Lowering water tables can result in the loss of species intolerant of drying and their gradual replacement by terrestrial species with drier hydrological envelopes (Keddy and Reznicek 1986; Moore and Keddy 1988)."
- "Due to their larger size, longer life-span and more expansive root systems, wetland trees are often more tolerant and respond more slowly to changes in water levels than other species (Jenik 1990; Balla 1994)."
- "Emergent macrophytes, that is sedges and rushes with vegetative parts emerging from seasonal fresh water (Semeniuk *et al.* 1990), respond much quicker to altered water regimes than trees and many other perennial wetland species (Froend *et al.* 1993). Not only are they lost to declining water tables, like many species they are also affected by rising levels (McComb and Lake I990; ter Heerdt and Drost 1994)."

Froend *et al.* (1993) examined vegetation dynamics in eight lakes, which are one of the wetland types on the Swan Coastal Plain. Their study documented how wetland vegetation responded to changes in water levels and provided the following summary (page 2):

"Examination of changes in wetland vegetation with time, showed that emergent macrophyte communities are very dynamic, responding rapidly to both increases and decreases in water regime. The rate and magnitude of a change in flora distribution depends on the rate and magnitude of change in water regime. Emergent macrophyte vegetation is extremely dynamic, capable of responding rapidly to natural fluctuations in the environment, due to high productivity, rapid vegetative reproduction, high seed production, and tolerance of a wide range in water regimes. Wetland flora communities, in particular the emergent macrophytes, are not permanent or fixed entities, but are assemblages of species coexisting under a given set of environmental conditions.

"Therefore a given type and distribution of wetland vegetation will persist as long as a suitable environment persists. Changes in species distribution in response to water regime changes, reflect the dynamic and resilient nature of littoral communities and do not necessarily indicate degradation."

Landforms and soils/rocks

Wetlands form on all soils types on the Swan Coastal Plain. Habitat for wetland plant species is formed when groundwater is exposed at the surface, and/or where rainfall is impeded. Wetlands are mostly situated low in landscape and are present within all major landforms.

Although wetlands form on most soil types when waterlogged or inundated, the time taken for each soil type to dry determines what wetland plants can grow. The soil types include sands, peats and clays, with many wetlands occurring on combinations of these. Impermeable or impeding layers that contribute to waterlogging include clay and rocks, such as solid or clay-rich ironstone, Muchea limestones and calcareous layers.

Bush Forever volume 2, Directory of Bush Forever sites (State of Western Australia 2000, p. 18-24) provides further advice on landforms and soils.

Fire dynamics

Traditional Noongar mosaic burning historically maintained biodiversity and reduced fuel loads by creating a patchwork of habitats across the landscape. However, contemporary shifts toward more frequent and intense fires threaten wetland vegetation composition and fauna refuges, increasing the risk of canopy loss, weed invasion, and degradation of water quality and organic soils. Fire dynamics are an important influence on wetland vegetation structure, habitat availability, and the long-term function of the ecological community (Water and Rivers Commission 2000a; Horwitz and Sommer 2005; DCCEEW 2022a; Bradshaw *et al.* 2018). See further advice in the response to **question 18** (threat 9 on altered fire regimes).

Noongar six seasons

The Noongar six season calendar (Birak, Bunuru, Djeran, Makuru, Djilba and Kambarang) describes the climate of the Swan Coastal Plain and aligns closely with wetland cycles of flowering, waterbird movements and fish spawning (Yorgum Healing Services Aboriginal Corporation undated; Bureau of Meteorology 2026; Edith Cowan University 2026; Logan 2023).

These calendars highlight wetlands as sources of food, medicine and cultural practice, underscoring their ecological and cultural connectivity. Refer to the response to **question 17** for further information about the cultural significance of the wetlands of the Swan Coastal Plain for Noongar people.

Waterbird movements and interactions

Godfrey (1988) reports that waterbirds move or migrate across the wetlands of the Swan Coastal Plain in response to the filling and drying of water bodies inland and along the coastal plain. Godfrey states that:

"Many thousands of waterbirds abandon the coastal wetlands soon after the opening autumn rains. They migrate to seasonal wetlands in the agricultural and pastoral regions for winter feeding and breeding. As the inland waterbodies dry out during the summer, the birds return to the more permanent wetlands of coastal districts. Of course, many coastal wetlands also become dry in the warmer months, so that increasing numbers of waterbirds concentrate on permanent wetlands until the advent of substantial autumn rainfall.

"The Swan Coastal wetlands are also important for many transequatorial migratory birds. These incredible little waders breed in the summer of the northern hemisphere in such remote places as Siberia and Manchuria. In August, they fly to Australia to feed on tidal mudflats and shallow lakes. Large numbers can be seen at various places on the shores of the Swan and Peel/Harvey estuaries and on a number of coastal lakes of which Thomsons and Forrestdale are the most outstanding."

Seddon (1972, pp. 226-228) noted that "no species can survive unless all of its seasonal requirements are met, and the abundance of ducks, swans, coots and other waterbirds in summer on a few lakes is misleading. Yanchep, Joondalup, Monger, Claremont, North, Goollelal, Bibra and

Thomson lakes are crowded in summer, but the birds rarely breed in these waters, and the crowding comes of concentration on shrinking summer refuges. Breeding pairs of waterfowl seek nesting sites in winter. Their food requirements are high, and they generally prefer small, isolated freshwater swamps. Seasonally flooded wetlands are often especially rich in invertebrates and plant life. Hollow trees and aquatic vegetation are necessary to conceal broods from predators. When the young birds can fly they begin a slow and leisurely migration. The birds may stop and feed at seasonal winter swamps until they are forced to move on as the water dries up, and so they make their way to permanent water-summer wetlands-where they stay until the winter rains. The summer wetlands must provide food, shelter and escape from human interference.

"The breeding and migratory parts of the cycle are more vulnerable than the summer 'loafing'. The chain of seasonal swamps between the breeding grounds, mostly near the Darling Scarp, and the permanent water, mostly near the coast, is first to be drained, and this makes migration difficult for immature birds, especially when a dry season forces them prematurely from the breeding grounds. The breeding grounds are freshwater marshes, mostly in the alluvial soils of the Pinjarra Plain" (Seddon 1972, p. 228). "These winter swamps are often insignificant individually, and the loss of one or two is of no significance, but collectively they provide most of the nesting sites for the waterfowl of the coastal plain" (Seddon 1972, p. 228).

Considering whether there should be separate nominations for different groups of wetlands

On the Swan Coastal Plain, the hydrology cannot be cleanly divided into 'open' channels versus 'closed' basins. None are 'closed' wetlands and most are dependent on groundwater flow. This is described earlier in the response to **question 4**, under the sub-heading '*The wetlands as an interconnected hydrological and ecological system*'.

The wetlands of the Plain can be viewed as:

- separate wetland types or groups of wetland types (see the response to **question 5a**); or
- broad geomorphic groups, using the wetland types to illustrate the kinds of wetlands that occur within each group:
    - Quindalup Dunes
    - Spearwood Dunes
    - Bassendean Dunes
    - Pinjarra Plain
    - Plus, in some way, accounting for the river, creek and estuary – peripheral wetland types, which are also under significant threat. These wetland types intersect and intergrade with several of the broad groups, which makes it difficult to assign them neatly to any single group.

However, describing and analysing individual wetland types, groups of wetland types or broad geomorphic groups separately is not recommended. It would require a very large amount of extra work for only limited benefit. For example, each wetland type or group of wetland types would need to be investigated separately. Alternatively, each broad geomorphic group still contains several different wetland types and many local exceptions, so separate analyses would be needed for every group to explain these differences. This would add substantial complexity without improving the overall understanding of the wetlands on the Swan Coastal Plain. In addition, separate flora lists are not available for each wetland type, and developing them would require considerable effort, research and funding. It is not clear that the additional detail gained would justify the level of work required.

Dividing the wetlands of the Swan Coastal Plain into wetland types or broad groups may also imply they should be considered separately, even though they function as a mosaic of mostly groundwater-dependent wetlands across the Plain, with shared threats that call for shared and

consistent management responses. Treating them as discrete groups may obscure or complicate these shared threats and management responses rather than clarifying them.

Some context on the broader policy and governance issues that contribute to the shared threats, including the lack of a coordinated protection framework, is discussed in the response to **question 14** under the sub-heading 'No high-level coordinated protection for the wetlands of the Swan Coastal Plain'.

Listing only some wetland types or only some broad groups would leave large parts of the wetlands of the Swan Coastal Plain without protection. There are existing threatened ecological communities that occur within wetlands on the Plain (see the response to **question 15**). These listings are valuable and should be retained because they provide conservation advice specific to those communities; however, they cover only a relatively small proportion of the wetlands. Relying solely on these existing listings, or adding only selected wetland types or groups, may still leave most wetlands exposed to the same landscape-scale threats. Protecting only selected components would not address these broader threats, and the ecological community as a whole would remain at risk. A broad listing based on hydrological attributes and landforms is recommended to ensure that major parts of the wetlands of the Swan Coastal Plain are not overlooked. Further advice is provided under the sub-heading '*Wetland types based on hydrological attributes and landform'* in the response to **question 5a**.

The references cited in **attachments H** and **N** and in the nomination form demonstrate that the wetlands of the Swan Coastal Plain have long been considered as a whole by researchers, land managers and community members in Western Australia. The well-known *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset and *Wetlands of the Swan Coastal Plain,* Volumes 2a and 2b (Hill *et al.* 1996a, 1996b) reflects this shared understanding and has contributed to treating the wetlands of the Plain as a cohesive ecological community.

5a. Describe the associated non-biological components, including landscape/seascape characteristic features, of the ecological community.*

For instance, what is the typical landscape/seascape(s) in which the community occurs? Is it associated with a particular soil type or substrate? What major climatic variables drive the distribution of the ecological community (e.g. rainfall, temperature; considering maxima, minima, average, or seasonality)? Are there particular altitudes or geographic boundaries (e.g. latitudes, coordinates, continental features); or position in the landscape (e.g. in valleys, on south-facing hillsides, floodplains, or in estuaries)?

Cite relevant sources and indicate if any of this information is unavailable.*

Answer Question **5a** here. Please use as much space as you need to fully answer the question.

Wetland types based on hydrological attributes and landform

The wetlands of the Swan Coastal Plain are classified into wetland types by hydrological attributes, (such as water periodicity, i.e. permanently or seasonally inundated or waterlogged), and landform (basin, flat, channel or slope) (Hill *et al.* 1996a, 1996b; Semeniuk 1987; Semeniuk and Semeniuk 1995). Seasonally inundated wetlands are primarily sustained by rainfall but may also be connected to groundwater, for example, groundwater contributes substantially to summer flows in rivers and their tributaries (Davidson 1995 in Conservation Commission of WA and DPAW 2016, p. 17); and seasonally waterlogged wetlands are primarily sustained by groundwater (DEC 2012n). These wetland types form part of an interconnected system and are not discrete or unrelated (see the response to **question 4**).

Table 1 outlines the wetland types relevant to this nomination. These wetland types are mapped in spatial datasets, as described in the response to **question 22**.

These wetland types are variations within the geomorphic and hydrological setting of the Swan Coastal Plain, rather than separate ecological communities. If necessary, the wetland types could be treated as sub-communities within the ecological community but this is not the preferred approach. They are best understood as variants of a single ecological community that is shaped by the geomorphology, hydrology and climate across the Swan Coastal Plain.

Table 1 – the classification of wetlands (wetland types) relevant to this nomination on the Swan Coastal Plain, formed by combining hydrological attributes and landform types (adapted from Semeniuk 1987 and DBCA 2017a)

Hydrology	**Host landform**			
				
	Basin	Flat	Slope	Channel
Marine/tidal influence	Estuary – waterbody (not included in the nomination)	Estuary - peripheral		Estuary – waterbody (not included in the nomination)
Permanent inundation	Lake			River
Seasonal inundation	Sumpland	Floodplain		Creek
Seasonal waterlogging (saturation)	Dampland	Palusplain	Paluslope	

The nomination does not include the following wetland types in the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset (DataWA 2021c) (or its future updated equivalent): Artificial channel, artificial lake, artificial wetland, no longer a wetland and estuary – waterbody.

The 'estuary – waterbody' wetland type experiences significant water quality-related threats; however, its distinct ecological nature and substantial research base make it more appropriate for a standalone nomination. Some occurrences are already protected under the EPBC Act as Ramsar wetlands (i.e. the Peel–Yalgorup and Vasse–Wonnerup wetland systems).

The 'estuary – peripheral' wetland type is included because it is closely interconnected with and intergrades with the other wetland types in ways that are not readily separable, faces the same threats and requires similar management responses, and forms part of the broader ecological continuum and wetland mosaic considered in this nomination.

Hydrology on the Swan Coastal Plain

Hill *et al*. (1996, page 62-64), Balla (1994), Davidson (1995, p. 53-113) and Allen (1975, 1981) provide advice on the hydrology of the Swan Coastal Plain.

Wetland hydrology

All natural wetland functions either result from, or are closely related to, the hydrology (Carter *et al.* 1978 in Balla 1994, p. 15). The DEC (2012n, 2012h), Hill *et al*. (1996, page 62-64), Balla (1994, pp. 15-22) and Davidson (1995, pp. 6-11 and 53-58) summarise the hydrology of the wetlands of the Swan Coastal Plain.

The wetlands of the Swan Coastal Plain are mostly surface expressions of the shallow unconfined groundwater system (Froend *et al.,* 1993, p. 2; Townley *et al.*, 1993). A significant feature of these wetlands is the seasonal wet-dry cycle, with maximum water levels occurring in September to October and minimum water levels in March to April (Froend *et al.* 1993, p. 2; Davis and Froend 1999), as described in the response to **question 4**. Seasonal changes in water levels occur across the Swan Coastal Plain, reflecting the shared climatic and hydrological processes influencing all wetland types.

See also the response to **question 4** under the 'hydrology interactions and functional processes' and 'the wetlands as an interconnected hydrological and ecological system' subheadings for related information.

Geology, landscape and soils

The wetlands of the Swan Coastal Plain are found within the Perth Basin, which formed during the breakup of Gondwana when Australia separated from India (McPherson and Jones 2005). The development of this sedimentary basin created the general landscape of the Swan Coastal Plain. Over the past 2.5 million years, wind-blown and alluvial sediments produced the modern soils (Chalmers 1997 after Playford *et al.* 1976). Five main land features are recognised: the Quindalup, Spearwood and Bassendean dune systems, the Pinjarra Plain, the Ridge Hill Shelf and Dandaragan Plateau. The parallel dune systems were formed with fluctuations in sea level and they increase in age and decrease in pH with distance from the coast. The dune system soils range from alkaline, carbonate-rich sands near the coast to acidic leached quartz sands further inland (McPherson and Jones 2005; State of Western Australia 2000). Linear chains of wetlands occurring between each dune systems reflect these environmental changes, resulting in an exceptionally diverse array of habitats and suites of organisms, and are a characteristic element of this ecological community. The Pinjarra Plain comprises riverine alluvium, while the Ridge Hill Shelf forms the foothills to the Darling Scarp (McPherson and Jones 2005; State of Western Australia 2000). The Dandaragan Plateau is separated from the other landforms by the Gingin Scarp (State of Western Australia 2000).

Further information is available in McPherson and Jones (2005), McArthur and Bettenay (1960), Churchward and McArthur (1980), Davidson (1995, pp. 27-52), State of Western Australia (2000), Playford *et al.* (1976), Balla (1994), Hill *et al.* (1996, pp. 60-62) and Seddon (1972, pp. 3-19 and 88-91). McArthur and Bettenay (1960) was refined by Churchward and McArthur (1980). This information is clearly summarised in the *Approved conservation advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community* (Department of the Environment and Energy 2016).

The State of Western Australia (2000, p. 20) presents a table summarising the major geological systems (Playford *et al.* 1976), major geomorphological systems (McArthur and Bettenay 1960) and detailed geomorphological units (Churchward and McArthur 1980). Gibson *et al.* (1994, p. 2) provides a similar table covering the latter two classifications.

Attachment C lists the wetland flora species found on the soil types on the plain.

Climatic variables

The climate of the ecological community is Mediterranean, with warm to hot, dry summers and winter rainfall. Local records show that mean annual rainfall increases southwards along the coast, from about 620 mm at Lancelin to 794 mm at Dunsborough (Elders Weather 2025a, 2025b). Consistent with these figures, the DBCA (2017a) describes the region more broadly as having hot, dry summers, cool, wet winters and an annual rainfall range of 500–900 mm.

Geographic boundaries

Refer to the response to question 5b for information about the geographic boundary of the Swan Coastal Plain wetlands.

5b. Describe the location and national extent of the ecological community.

Where does the ecological community occur? If possible, indicate the bioregions or other defined areas in which the ecological community occurs (see the Guidelines).

Describe the full extent of the ecological community at a national scale, not just its occurrence in specific areas or regions. If the ecological community is biologically or ecologically distinct in a specific area, describe the features that limit its national extent to this area, and include information in Question 7 below to distinguish it from similar ecological communities in other areas. Reference the map provided at Question 22 if necessary.

Cite relevant sources and indicate if any of this information is unavailable.

Answer Question **5b** here. Please use as much space as you need to fully answer the question.

The ecological community is confined to the Swan Coastal Plain, a landform extending along the south-west coast of Western Australia. Refer to the maps in the response to **question 22**. The DBCA (2017a) provides the following summary:

"Located in the south-west of Western Australia, the Swan Coastal Plain region is a low lying plain of approximately 15,100 km2, including the city of Perth. Geographically, the Swan Coastal Plain stretches from Jurien Bay in the north to Dunsborough in the south. It is bounded by the Indian Ocean to the west and a series of scarps to the east (Gingin, Darling and Whicher Scarps). The region has a Mediterranean climate characterised by hot dry summers, cool wet winters and an annual rainfall range of 500-900 mm.

"The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into natural regions of similar geology, landform, vegetation, fauna and climate (Thackway and Cresswell 1995). The Swan Coastal Plain IBRA region is divided into two subregions – the low lying coastal plain in the west (Swan Coastal Plain subregion) and the higher plateau in the north east (Dandaragan Plateau subregion) (Figure 1).

The Swan Coastal Plain IBRA region is described in McKenzie and May (2002), McKenzie *et al.* (2002), Desmond (2001), Mitchell *et al.* (2001) and DBCA (undated(a)) under 'regional profiles', and mapped in DCCEEW (2025d, 2025e).

6. Does the ecological community show any regional or other variation across its national extent, such as characteristic differences in species composition or structure?

If so, please describe these and explain why the variants should be regarded as the same, or separate, ecological communities.

Answer Question **6** here. Please use as much space as you need to fully answer the question.

The variations linked to hydrology, landforms and soil types and floristic communities are described above in the responses to **questions 3a, 3b, 4** and **5a**. These variations occur in a mosaic across the Swan Coastal Plain.

Species richness for wetlands and drylands generally increases from west to east across the Swan Coastal Plain. The plant species richness of wetlands on the Plain relates to the soil type and period of inundation and waterlogging. Salinity is an additional factor. The floristic communities best illustrate the patterning of species richness (see part A, table 6 in *Bush Forever volume 2* (State of Western Australia 2000)) as well as flora studies on the Plain (Keighery *et al.* 2006; Webb *et al.* 2009; Freeman *et al*. 2009).

There is also some variation from north to south, due to lower rainfall in the north compared to the south of the Swan Coastal Plain.

7a. What other ecological communities intergrade with (occur near, and/or may be similar to) **the nominated ecological community?**

Answer Question **7a** here. Please use as much space as you need to fully answer the question.

The wetlands of the Swan Coastal Plain intergrade with all adjacent vegetation. These intergrades are not well described but are vital to the health of the wetlands. Many fauna species need this interconnection for food, shelter and parts of their breeding cycles.

7b. Describe the characteristic features that distinguish the nominated ecological community (including contra-indicative features) **from these intergrading, nearby or similar communities?***

These diagnostic features can be biological e.g. plant and animal taxa, including dominant species/taxa group; types of vegetation/habitat/associated ecosystems; vegetation structure, e.g. minimum or maximum tree canopy cover, shrub cover; or other biotic structure; or they can be associated non-biological landscape characteristics e.g. soil type; substrate; altitude; climate; hydrological position in the landscape (e.g. lowland floodplains); or other habitat feature.

Please limit your answer to those features that are specific to (or are contra-indicative of) the ecological community and can be used to distinguish it from other similar (or nearby) ecological communities. Indicate if any of this information is unavailable.*

Answer Question **7b** here. Please use as much space as you need to fully answer the question.

The nominated ecological community is distinguished primarily by the presence of wetlands and their associated hydrological regimes. Wetland hydrology (permanent or seasonal inundation or waterlogging) is the defining feature that separates this community from adjacent upland or non-wetland ecological communities.

The diagnostic features are:

- Presence of wetlands (creek, dampland, estuary – peripheral, floodplain, lake, paluslope, palusplain, river or sumpland).
- Permanent or seasonal waterlogging or inundation.
- Wetland vegetation adapted to periodic inundation or waterlogging.
- Associated fauna reliant on wetland conditions.

The contra-indicative features are:

- Absence of wetlands or wetland hydrology (for example, well-drained upland soils or dryland vegetation).
- Vegetation communities dominated by xeric shrublands or woodlands not subject to seasonal waterlogging.
- Landscapes lacking hydrological connectivity (e.g. elevated ridges, plateaus).

In summary, the defining characteristic is the presence of wetlands and their hydrological regimes, which underpin the vegetation structure and fauna assemblages. This definition encompasses variation among floristic sub-communities but distinguishes the nominated ecological community from nearby non-wetland systems.

8. Describe any other known considerations to help identify the ecological community, including when to conduct surveys to determine its presence at a particular place and time.

For example: season; time of day; weather conditions; length of time since certain disturbances (such as grazing, fire, or drought); length, intensity and pattern of search effort; and any other recommended survey considerations. Include relevant references.

Answer Question **8** here. Please use as much space as you need to fully answer the question.

Information on wetland delineation, evaluation and flora surveys is available in *Propose a change to a wetland dataset* (DBCA 2025d; <www.dbca.wa.gov.au/management/wetlands/propose-change-wetland-dataset>), *Technical guidance flora and vegetation surveys for environmental impact assessment* (EPA 2016), *A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia* (DBCA 2017a) and *Wetland identification and delineation: information for mapping and land use planning on the Swan Coastal Plain* (DBCA 2017b).

Seasonal timing

- Survey timing and conditions should align with periods when wetland hydrology and vegetation are most evident.
- Surveys are best conducted in late winter to early spring, when seasonal inundation and waterlogging are apparent and wetland vegetation is actively growing.
- Summer surveys are less reliable, as many wetlands dry and diagnostic hydrological and vegetation features are obscured.

The DBCA (2017a) maintains the wetlands spatial datasets, including those on the Swan Coastal Plain. It advises that: "Wetland conditions usually vary during the year. The collection of certain information (such as vegetation condition, flora surveys, photographs and hydrology) should be undertaken after the main period of rainfall. In some circumstances, a request may not be able to be processed until the appropriate season if there is inadequate information based on a poorly timed field evaluation. Evaluators should be mindful of seasonal variation when assessing and describing the condition of wetlands."

Weather and hydrological conditions

- Recent rainfall enhances visibility of inundation and waterlogged soils.
- Extended drought may mask wetland features, requiring careful interpretation of vegetation and soil indicators.

Disturbance history

- Fire, grazing, and clearing can temporarily alter vegetation structure. Surveys should consider the time elapsed since disturbance, as recovery may influence detectability of diagnostic features.

Survey effort and methods

- Standard quadrats (10 metres x 10 metres) suitable for comparison with Swan Coastal Plain flora datasets, sampled a number of times to record changes in flora over the drying period.
- Transects across wetland margins are recommended to capture transitions between wetland and upland vegetation.
- Observations should include hydrological position in the landscape, soil moisture, and vegetation structure.
- Fauna indicators (e.g. waterbirds, frogs) may provide supporting evidence of wetland conditions.

Contra-indicative cues

- Absence of permanent or seasonal waterlogging or inundation.
- Dominance of xeric shrublands or woodlands on well-drained soils.

Condition classes/thresholds – a key approach for national ecological communities

The Threatened Species Scientific Committee (the Committee) recognises that due to various threats causing loss and modification in recent centuries, Australian ecological communities typically now exist in various condition states (e.g. high, moderate and low quality condition).

National listing focuses legal protection on patches of the ecological community that are most functional, relatively natural and in comparatively moderate or higher condition. For vegetation communities, condition thresholds assist in distinguishing between patches of different quality. See the examples in the table of condition classes below (and see the Guidelines for further details).

For most ecological communities the Committee also applies a combination of minimum patch or area size together with minimum (at least moderate) condition indicators (such as minimum native plant cover and diversity, landscape connectivity, water quality/salinity, presence of large trees/other habitat features and/or evidence of key species recruitment) in order to distinguish areas of the ecological community to be protected as a Matter of National Environmental Significance (MNES) under the EPBC Act.

Examples of condition classes		
Condition class	**Explanation**	**Example indicators**
High quality condition	Likely to persist into the long-term with minimal management and hence should be protected under national environmental law.	Threshold between high and moderate quality condition (as per Q.11); e.g. at least 70% of perennial vegetative cover in each layer present is native **AND** the entire patch contains at least 20 native understorey species.
Moderate quality condition	Likely to persist into the long-term future with some management and hence should be protected under national environmental law. A good target for restoration programs.	Threshold between moderate and low quality condition (as per Q.11); e.g. at least 50% of perennial understorey vegetative cover is native **AND** the entire patch contains at least 12 native understorey species **OR** there are at least 5 canopy trees with hollows.
Low quality condition	Not protected as the ecological community under the EPBC Act.	
Note: Although very degraded or modified patches/areas (i.e. low quality) are not protected as the ecological community listed under the EPBC Act, it is recognised that patches that do not meet the moderate quality condition thresholds may still retain important natural values and may be protected through state and local laws, or schemes, and could be considered as buffers for adjacent higher quality areas of the ecological community. These patches will not be excluded from recovery and other management actions, including Australian Government funding programs. Suitable actions may improve these patches to the point where they may be regarded as part of the ecological community and hence fully protected under the EPBC Act.		

9. Should condition classes/thresholds be applied to this ecological community? If not, give reasons.

Please cite references to any quality/condition assessments that have been applied to, or carried out on the ecological community?

Answer Question **9** here. Please use as much space as you need to fully answer the question.

Yes. Condition classes (evaluation categories) should be applied to the ecological community. The approach is described in *A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia* (DBCA 2017a). Templates are available via *Propose a change to a wetland dataset* (DBCA 2025d; <www.dbca.wa.gov.au/management/wetlands/propose-change-wetland-dataset>).

The ecological community includes the Conservation and Resource Enhancement wetland evaluation categories in the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset (DataWA 2021c) (or its future updated equivalent). It does not include the Multiple Use evaluation category. A relatively small number of wetlands in the spatial dataset are in the Not Assessed category; these may fall within the Conservation or Resource Enhancement categories and should be regarded as part of the ecological community unless determined otherwise.

Conservation category wetlands are in the best condition. Resource Enhancement category wetlands are partly or somewhat degraded, typically through loss of some of the understorey flora; and Multiple Use wetlands have had most or all of their native flora removed by land clearing or other disturbances.

Table 2 provides further information about the wetland evaluation categories.

Table 2 – Wetland evaluation categories applied to the Swan Coastal Plain (EPA 2008)

Wetland evaluation category	**General description**	**Objectives**
Conservation	Wetlands that support a high level of attributes and functions	To preserve and protect their existing conservation values through various mechanisms, including: • Reservation in national parks, Crown reserves and state-owned land • Wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement	Wetlands that may have been modified or degraded but still support substantial attributes and functions	To manage, restore and protect towards improving their conservation value and hydrological/hydrogeological regime. These wetlands have the potential to be restored or rehabilitated to Conservation category, focussing on wetland functions, structure and biodiversity value.
Multiple Use	Wetlands with few remaining attributes and functions	The use, development and management of these wetlands should be considered in the context of ecologically sustainable development and best management practice catchment planning. Their role in managing the natural hydrological and hydrogeological regime of the general area should be maintained.

10. If condition classes/thresholds should be applied, what features of the community would best define condition classes/categories and why?

E.g. native species diversity; percentage of native (or weed) cover; mature trees; density of trees, shrubs or grass tussocks; proximity to other native vegetation; or water quality.

Answer Question **10** here. Please use as much space as you need to fully answer the question.

Vegetation condition is a key component of the wetland evaluation approach in *A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia* (DBCA 2017a). This is because it directly reflects the ecological integrity, attributes, functions and values of wetlands. The structure, diversity and health of native vegetation indicate whether natural hydrological regimes are intact, whether characteristic species and their habitats are present, and whether ecological processes such as nutrient cycling are maintained. Degradation of native vegetation, often through clearing, filling, draining or weed invasion, is one of the clearest signs that a wetland has lost its ecological integrity, attributes, functions and values.

11. If condition classes/thresholds should be applied, what threshold values for the above features of the ecological community should define high, medium and low quality condition classes (or another set of applicable condition states)**, noting that low quality condition occurrences will be excluded from direct regulatory protection?**

Answer Question **11** here. Please use as much space as you need to fully answer the question.

High, medium and low condition for this ecological community aligns with the established wetland evaluation categories in the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset (DataWA 2021d) and *A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia* (DBCA 2017a).

High condition corresponds to Conservation category wetlands, which retain intact hydrological regimes, native vegetation structure and diversity, and minimal weed invasion. These wetlands represent the best examples of the ecological community and are the primary focus for protection.

Medium condition corresponds to Resource Enhancement category wetlands, which remain ecologically functional but show partial degradation, typically through loss of some understorey flora or altered vegetation density. These wetlands retain potential for recovery and continue to support significant ecological values.

Low condition corresponds to Multiple Use category wetlands, which have been severely degraded by clearing or other disturbance, resulting in the removal of most or all native flora. These wetlands no longer support the ecological functions characteristic of the community and are excluded from the nomination.

12. If condition classes/thresholds have been/should be applied, what relative proportion (e.g. percentage area) of the ecological community would be/is classed as being of high, medium and low condition (or other set of applicable condition states)**?**

Answer Question **12** here. Please use as much space as you need to fully answer the question.

Based on the recalculated values in Table 3b (response to Question 23a), the wetlands of the Swan Coastal Plain are estimated to comprise approximately **15.4% in high condition** (Conservation category), **5.6% in medium condition** (Resource Enhancement category) and **79.1% in low condition** (Multiple Use category). These proportions represent the relative area of the ecological community falling within each condition class once sites not assessed for condition are excluded.

For context, DBCA (2017a, p. 16) reported similar condition proportions using an earlier, unmodified version of the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* dataset

(DataWA 2021d). That assessment estimated that approximately 21% of wetlands on the Swan Coastal Plain were in high condition (Conservation category), 6% in medium condition (Resource Enhancement) and 73% in low condition (Multiple Use). These figures provide a broad indication of condition at the time; however, they do not incorporate the refinements applied for this nomination, including clipping to the Swan Coastal Plain IBRA region and selecting only the relevant wetland types (as described in the response to **question 22**).

See also tables 3a and 3b in the response to **question 23a**, which present comparable results using the modified spatial dataset provided in **attachment L** and described in the response to **question 22**.

Refer to the 'habitat loss (clearing, draining and filling wetlands)' subheading in the response to **question 18** and to **attachment H** for information on the extensive area of wetlands on the Swan Coastal Plain lost due to clearing, draining and filling.

Section 5 - Existing protection

13a. If known, what proportion of the current extent (%, km^2, ha, and/or other measure of amount) **of the ecological community is protected within reserves set aside primarily for conservation purposes?**

This may already have been provided by you, within the data for Question 3; if so, please indicate how it is recorded within the data; or alternatively provide from records of reserves etc.

Answer Question **13a** here. Please use as much space as you need to fully answer the question.

The proportion of the current extent of the ecological community that is protected within reserves set aside primarily for conservation purposes is not currently known. This may be partially determined by overlaying the Conservation and Resource Enhancement category wetlands from the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset (DataWA 2021d) with the *DBCA – Legislated lands and waters (DBCA-011)* dataset (DataWA 2025b). The latter dataset includes State Government conservation reserves but does not cover reserves managed by local government.

Some historical information is available in Singleton (1988), Majer (1979a, 1979b, 1979c, 1979d[10]) and EPA (1993[11]).

13b. Give details of the protection offered by the reserves.

Include: the name of the reserves and if it is known: the extent of the ecological community protected within each reserve; and whether the reserves are permanent and effective in terms of the protection they offer.

Answer Question **13b** here. Please use as much space as you need to fully answer the question.

This information is not currently known. Refer to the response to **question 13a**. In principle, State Government conservation reserves listed in the *DBCA – Legislated lands and waters dataset (DBCA-011)* dataset (DataWA 2025c) are permanent under legislation and provide formal protection. However, the extent of the ecological community within each reserve and the effectiveness of the protection they provide against ongoing significant threats (e.g. hydrological change, invasive species, changing fire regimes and climate change) has not been quantified.

[10] Singleton (1988) referred to Majer (1979a, 1979b, 1979c, 1979d) as "Bulletins 59 to 62 by the former Department of Conservation and Environment (1979)".

[11] The reserves in system 6 and part of system 1 are relevant to the Swan Coastal Plain.

13c. Which if any, reserves have management plans that cover the ecological community and are they being implemented?* Indicate if any of this information is unavailable.*

Answer Question **13c** here. Please use as much space as you need to fully answer the question.

The ecological community is subject to a range of management plans prepared by the DBCA, the Conservation Commission, and their predecessor agencies (the departments of Environment and Conservation, Parks and Wildlife, and Conservation and Land Management), local governments and other authorities, such as the DWER and Peel-Harvey Catchment Council. Current DBCA management plans are listed on the agency's webpage, *Management plans* (DBCA 2025a; <www.dbca.wa.gov.au/management/plans>), and although some have passed their original timeframes, they are treated as valid and in effect if still listed. The *Forest management plan 2024–2033* has its own dedicated webpage (Conservation and Parks Commission and DBCA 2023; <www.dbca.wa.gov.au/management/forests/forest-management-plan>). Management plans for nature reserves and national parks are required under the *Conservation and Land Management Act 1984* and are likely to closely guide their management, while management plans for regional parks are enabled under that Act.

Water quality improvement plans are actively implemented through the *Healthy Estuaries* program (DWER and DPIRD 2026; <https://estuaries.dwer.wa.gov.au>)[12] and associated State Government commitments. Similarly, the *Forest management plan 2024–2033* (Conservation and Parks Commission and DBCA 2023), *Swan Canning river protection strategy* (DPAW and Swan River Trust 2015), and *Bindjareb Djilba (Peel–Harvey Estuary) protection plan* (DWER 2020) represent long-term commitments by the State Government.

Examples of relevant plans include:

- Nature reserve and national park management plans:
    - *Forrestdale Lake Nature Reserve management plan 53* (Conservation Commission of WA and CALM 2005a)
    - *Lake McLarty Nature Reserve management plan 60* (Conservation Commission of WA and DEC 2008)
    - *Nambung National Park, Wanagarren, Nilgen and Southern Beekeepers Nature Reserves management plan 1998–2008* (CALM and National Parks and Nature Conservation Authority 1998)
    - *Parks and reserves of Yanchep and Neerabup management plan 76* (DEC 2012b)
    - *Swan Coastal Plain South management plan 85* (Conservation Commission of WA and DPAW 2016)
    - *Swan Estuary Marine Park and adjacent nature reserves management plan 1999–2009* (CALM and National Parks and Nature Conservation Authority and Marine Parks and Reserves Authority 1999)
    - *Thomsons Lake Nature Reserve management plan 54* (Conservation Commission of WA and CALM 2005b)
    - *Tuart Forest National Park management plan 2014* (DPAW 2014b)

[12] The exception is the *Swan Canning water quality improvement plan* (Swan River Trust 2009), which is implemented by the Department of Biodiversity, Conservation and Attractions.

- Regional park management plans:
    - *Beeliar Regional Park management plan 2006* (Conservation Commission of WA and CALM 2005)
    - *Herdsman Lake Regional Park management plan 2004–2013* (Conservation Commission of WA, CALM, Water Corporation and City of Stirling 2004)
    - *Jandakot Regional Park management plan 2010* (Conservation Commission of WA, DEC , City of Cockburn, City of Armadale and Town of Kwinana 2010)
    - *Kalgulup Regional Park management plan 96* (DBCA 2021)
    - *Rockingham Lakes Regional Park management plan 2010* (Conservation Commission of WA, DEC , City of Rockingham 2010)
    - *Woodman Point Regional Park management plan 64* (Conservation Commission of WA, DEC , City of Cockburn, Department of Transport and Department of Sport and Recreation 2010)
    - *Yellagonga integrated catchment management plan 2021–2026* (City of Joondalup and City of Wanneroo 2021)
    - *Yellagonga Regional Park management plan 2003–2013* (Conservation Commission of WA, CALM, City of Joondalup and City of Wanneroo 2003)
- Water quality improvement plans:
    - *Gabi Warlang Bidi: Water quality improvement plan for the Peel-Harvey Estuary system* (DWER 2025b)
    - *Leschenault Estuary water quality improvement plan* (Department of Water 2012a)
    - *Vasse Wonnerup wetlands and Geographe Bay water quality improvement plan* (Department of Water 2010a)
    - *Swan Canning water quality improvement plan* (Swan River Trust 2009) and associated local water quality improvement plans for the Bannister Creek, Baywater, Bennett Brook, Bickley Brook, Bull Creek, Canning plain, Ellen Brook, Mount Bay, Southern River and St Leonards Creek catchments (DBCA 2026).
- Other plans:
    - *Bindjareb Djilba (Peel-Harvey Estuary) protection plan* (DWER 2020)
    - *Peel-Yalgorup Ramsar site management plan* (Peel-Harvey Catchment Council 2009)
    - *Forest management plan 2024–2033* (Conservation and Parks Commission and DBCA 2023)
    - *Swan Canning river protection strategy* (DPAW and Swan River Trust 2015)
    - *Knowing and managing the Brixton Street Wetlands* (Keighery 1995)
    - *The Greater Brixton St Wetlands management guidelines, natural history and research* (Marshal 2000).

Long timeframes for water quality improvement

While water quality improvement plans and related environmental protection policies[13] and strategies are being implemented, they require long-term commitment, and measurable improvements may not appear for decades. This delay occurs because excessive nutrients infiltrate catchment soils and enter wetlands, where they are stored in sediments. These legacy nutrients take decades to deplete and discharge, so improvements in water quality will only be realised over similarly extended timeframes (DWER 2025b, pp. 94, 225). Achieving water quality objectives may also be difficult if changes cannot be made to existing land uses and activities in the catchments. Despite these constraints, targeted nutrient-reduction programs have demonstrated localised improvements, suggesting that broader catchment-scale action would benefit the wetlands.

14. What is the ecological community's current level of protection under Australian state/territory legislation?

Record whether there is an existing state listing for all or part of the nominated ecological community, its listing category (e.g. critically endangered, vulnerable) and its title. If not listed as threatened, is there any other form of protection under state/territory legislation? Consider the effectiveness of state/territory environment approvals and vegetation clearance laws.

Answer Question **14** here. Please use as much space as you need to fully answer the question.

Threatened ecological communities – existing listings

Small components of the ecological community correspond to existing wetland threatened ecological communities that are listed under both or either of the EPBC Act and BC Act (DBCA 2025i), as summarised in Table E1 in **attachment E**. These listed threatened ecological communities represent localised or specific elements of the broader ecological community, but they do not provide comprehensive statutory protection for the whole ecological community.

Using the name listed under the EPBC Act, the threatened ecological communities protected under both the EPBC Act and BC Act include:

- Aquatic root mat community in caves of the Swan Coastal Plain (endangered)
- Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain (endangered)
- Clay pans of the Swan Coastal Plain (critically endangered)
- Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (endangered)
- Shrublands and woodlands on Muchea limestone of the Swan Coastal Plain (endangered)
- Shrublands and woodlands on Perth to Gingin ironstone (Perth to Gingin ironstone association) of the Swan Coastal Plain (endangered)
- Shrublands on southern Swan Coastal Plain ironstones (endangered)
- Thrombolite (microbialite) community of a coastal brackish lake (Lake Clifton) (critically endangered)
- Thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond) (endangered).

The threatened ecological communities protected only under the EPBC Act:

[13] Refer to response to question 14 for information about environmental protection policies under the *Environmental Protection Act 1986*.

- Empodisma peatlands of southwestern Australia (endangered)
- Subtropical and temperate coastal saltmarsh (vulnerable).

While the 'Empodisma peatlands of southwestern Australia' and 'Subtropical and temperate coastal saltmarsh' ecological communities are large and widespread elsewhere, their representation on the Swan Coastal Plain is limited, with relatively small portions present locally. The mapping for 'Empodisma peatlands of southwestern Australia' also mostly indicates that the community 'may occur' on the Swan Coastal Plain, rather than 'is likely to occur', indicating a lower level of confidence in its local extent.

The existing ecological community listings should remain in place because they address values, threats and management requirements that are distinct from, and in one case more severe than, those considered in this broader nomination. For example, the claypans of the Swan Coastal Plain are listed as critically endangered, whereas the broader wetland ecological community is proposed as endangered; the microbialite communities at Lake Clifton and Lake Richmond have unique conservation priorities and reasons for listing; and the Empodisma peatlands of southwestern Australia are particularly susceptible to fire under a drying climate, with fires that can smoulder for extended periods. Each of these threatened ecological communities includes specific guidance on protection and threat management that should continue to be considered by proponents during environmental impact assessments, in addition to the broader requirements associated with this nomination.

The saltmarsh ecological community is currently listed as vulnerable over a much broader geographic extent; however, within the Swan Coastal Plain it would meet the criteria for listing as endangered under this nomination. This higher level of protection is warranted given the severity and extent of threats affecting saltmarshes on the Swan Coastal Plain (as outlined in the response to **question 18**), as well as the additional pressures associated with several canal estates.

Within the nominated area, the wetland threatened ecological communities protected solely under the BC Act in Western Australia, all of which are listed as critically endangered, include:

- Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (floristic community type 15 as originally described in Gibson *et al.* 1994)
- Shrublands on calcareous silts of the Swan Coastal Plain (floristic community type 18 as originally described in Gibson *et al.* 1994)
- Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson *et al.* 1994).

The stromatolite community of the stratified hypersaline coastal lakes (Lake Thetis) lies on the Swan Coastal Plain north of Wedge Island, around 30 kilometres north of the nominated area, and is listed as Critically Endangered under the BC Act.

The terrestrial (non-wetland) threatened ecological communities of the Swan Coastal Plain are listed in Table E3 of **attachment E**. These may be useful to note for their proximity or mapping overlaps but they are not part of the wetlands of the Swan Coastal Plain.

Threatened ecological communities – effectiveness of existing protection under the BC Act

The Office of the Auditor General (2025) audited the effectiveness of the DBCA management of threatened ecological communities under the BC Act. The key findings were:

- Listing Western Australia's 65 threatened ecological communities gave those communities legislative protections, but the listing process was complex and lengthy.
- The DBCA is not using all its powers under the BC Act, leaving some threatened ecological communities more vulnerable than others. This particularly applies to the 72% of threatened

ecological communities that are outside DBCA-managed land (for example, national parks and nature reserves).

- The DBCA does not have a threatened ecological community strategy, and it is not clear if threatened ecological community activities align to long-term conservation goals.
- Progress to maintain and protect threatened ecological communities is not clear, because it is not adequately monitored and reported.

Priority ecological communities

Small components of the ecological community are recognised as priority ecological communities in Western Australia (Table E2 in **attachment E**). Priority ecological communities are not protected under legislation, and their recognition does not confer statutory controls or regulatory obligations.

Priorities 1 to 3 include ecological communities that may be threatened but require further survey or definition. Priority 4 includes ecological communities that are sufficiently well known and are considered rare but not currently threatened, that meet the criteria for near-threatened status, or that have recently been removed from the threatened list. Priority 5 includes conservation-dependent communities.

The Office of the Auditor General (2025) found that with a priority ecological community list of 390 communities, it is estimated it would take over 100 years with the current level of departmental resourcing allocated to the task to write the nominations for priority ecological communities that may meet the necessary criteria for threatened ecological community listing under the BC Act. This delays the legislative protections that come with attaining threatened ecological community status. However, the DBCA advised that almost half of the priority ecological communities cannot be listed as a threatened ecological community because it needs to assess the condition before it can support a nomination, and it lacks the resources to do so (Office of the Auditor General 2025).

No high-level coordinated protection for the wetlands of the Swan Coastal Plain

There is currently no high-level, coordinated mechanism for conserving, protecting or managing the wetlands of the Swan Coastal Plain. Although various policies and guidance documents exist[14], they do not provide overarching protection, resulting in a fragmented and currently poorly funded approach to wetland conservation, protection and management. Evidence of continued wetland loss and degradation, together with unclear roles and responsibilities, further highlights the limitations of the current framework. A listing under the EPBC Act would help establish a coordinated approach by bringing together multiple wetland types and the full range of threats they face within a single, integrated framework, providing some of the structure needed to unify protection efforts and enable more strategic, landscape-scale conservation across the Swan Coastal Plain.

In 2015, the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* was repealed. This policy applied to the lakes wetland type and had the force of law under sections 33(1) and 35(2) of the *Environmental Protection Act 1986* (WA).

A 1999 review of the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* recommended updating the policy so it would apply to all wetland types in the Conservation evaluation category (EPA 1999). The *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004* (EPA 2004a) was subsequently released in July 2004; however it was not finalised and was repealed in 2006.

Partial protection under clearing legislation in Western Australia

Outside of threatened ecological community listings, the ecological community receives partial protection through the *Environmental Protection Act 1986*, which governs clearing of native vegetation, and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004

[14] For example, see the response to **question 18** (threat 2).

(the Clearing Regulations). The effectiveness of the Act and Regulations varies and is influenced by exemptions, and the scale and context of proposed clearing.

The Auditor General for Western Australia (2007) assessed the effectiveness of native vegetation clearing legislation. The findings indicate that the clearing permit system is generally robust, but compliance has not been meaningfully tested, the extent of illegal clearing remains unknown, areas identified through satellite imagery as potential illegal-clearing 'hotspots' are rarely investigated, and follow-up of serious complaints is inconsistent and often inadequate.

Intended protection through the clearing principles and continue loss of wetlands through clearing:

Under section 51O of the *Environmental Protection Act 1986*, the DWER considers the ten clearing principles set out in Schedule 5 when determining whether to grant or refuse a native vegetation clearing permit. For example, native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland (principle f), and native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water (principle i). This appears to provide strong protection; however, wetlands have continued to be lost, largely through clearing, since section 51O of the Act and the Clearing Regulations came into effect in 2004. Further detail on the continued loss of wetlands is provided in the response to **question 18** (threat 1, wetland loss and fragmentation).

Schedule 6 exemptions:

One factor that may be contributing to ongoing wetland loss is the broad set of Schedule 6 exemptions, which remove the requirement for a clearing permit where clearing is authorised under other statutory processes. These exemptions apply state-wide and can allow clearing to proceed without assessment against the clearing principles and a clearing permit. The exemptions are outlined in *A guide to the exemptions and regulations for clearing native vegetation* (DWER 2019).

Clearing regulation exemptions with a narrower scope:

In contrast, the Clearing Regulations provide exemptions for the generally low-impact and routine maintenance activities listed in regulation 5. These exemptions are narrower in scope and do not apply within environmentally sensitive areas.

Environmentally sensitive areas afford some limited protection:

Under the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, the exemptions for low-impact and routine maintenance clearing listed in regulation 5 of the Clearing Regulations do not apply within environmentally sensitive areas. Relevant to the wetlands of the Swan Coastal Plain, these areas include Conservation category wetlands (but not Resource Enhancement category wetlands), Ramsar wetlands, wetlands listed in the *Directory of important wetlands in Australia* (Environment Australia 2001), wetlands mapped in *A Systematic overview of environmental values of the wetlands, rivers and estuaries of the Busselton-Walpole region* (Pen 1997)[15] and the *Environmental Protection (Western Swamp Tortoise) Policy 2002*, which has since been replaced by a 2011 version[16], and several repealed environmental protection policies[17]. This means that those exemptions do not apply and a clearing permit is still required for the low-impact and routine maintenance clearing activities listed in regulation 5. Within these areas, a clearing permit is still required for activities that would otherwise be exempt, providing some limited additional protection.

[15] Pen (1997) applies to a small portion of the Swan Coastal Plain near Busselton and Dunsborough.

[16] The *Environmental Protection (Western Swamp Tortoise Habitat) Policy 2011.*

[17] The repealed environmental protection policies include the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*, *Environmental Protection (Swan and Canning Rivers) Policy 1998*. The *Environmental Protection (South West Agricultural Zone Wetlands) Policy 1998* did not apply to the Swan Coastal Plain.

Further information:

Further information about native vegetation clearing permits is available via the Government of Western Australia (2024a, (<www.wa.gov.au/service/environment/environment-information-services/native-vegetation-clearing-permits>). The Act and Clearing Regulations were amended recently, and some of the published guidance may not yet be updated.

Swan and Canning Rivers Management Act 2006

The *Swan and Canning Rivers Management Act 2006* applies to a relatively small portion of the Swan Coastal Plain wetlands. It establishes the legal framework for protecting, managing, and enhancing the Swan and Canning rivers, with a focus on improving water quality. It creates the Swan Canning Riverpark and a Development Control Area, within which activities and development are regulated. As per the response to **question 13c**, water quality improvements require long-term commitment and measurable improvements may not appear for decades.

The Swan Canning Development Control Area is established under Schedule 3 of the Act. This area covers the Riverpark and private land reserved for Parks and Recreation under the Metropolitan Region Scheme. The Riverpark sits within the Development Control Area and is described in Schedule 2 of the Act. It consists solely of land that is held in public ownership.

The River Reserve forms part of the Riverpark. It comprises the land and waters placed under the authority of the Swan River Trust for their management, care and control, as outlined in Schedule 4 of the Act.

Maps of the Swan Canning Development Control Area and Riverpark are available from the DBCA (2025f, (<www.dbca.wa.gov.au/licences-and-permits/riverpark-development-and-planning/swan-canning-development-control-area-and-maps>) and DataWA (2021e, 2021f).

The *Swan Canning river protection strategy* (DPAW and Swan River Trust 2015) is made under the Act. It aims to coordinate the complex management arrangements necessary to protect and enhance the ecological and community benefits and amenity of the Development Control Area and Riverpark. Refer to the 'long timeframes for water quality improvement' sub-heading in the response to question 13c.

Environmental protection policies under the Environmental Protection Act 1986 (WA)

The *Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992* (Government of Western Australia 1992)[18]; and *Environmental Protection (Western Swamp Tortoise Habitat) Policy 2011*[19] and associated references (Government of Western Australia 2011; EPA 2026) are also relevant. However these cover only a small portion of the wetlands on the Swan Coastal Plain.

These environmental protection policies have the force of law under sections 33(1) and 35(2) of the *Environmental Protection Act 1986*.

Refer to the 'long timeframes for water quality improvement' sub-heading in the response to **question 13c**, as it relates to the *Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992* (Government of Western Australia 1992).

[18] The estuary – waterbody wetland type is not included in this nomination; however, the policy area encompasses other wetland types that are included.

[19] The *Environmental protection (western swamp tortoise habitat) policy 2011* is currently being reviewed, as per Government of Western Australia (2025).

15. Do areas of the ecological community overlap with other landscape level matters of national environmental significance (MNES)?

Examples include: Ramsar wetland sites; and national/world Heritage listed areas. How much of the ecological community is protected by these other MNES and how effective is protection that extends to the ecological community?

Answer Question **15** here. Please use as much space as you need to fully answer the question.

Yes. Portions of the ecological community overlap with several Ramsar-listed wetlands on the Swan Coastal Plain, including Forrestdale and Thomsons Lakes, Becher Point wetlands, Peel–Yalgorup system and Vasse–Wonnerup system[20]. These sites represent only a small proportion of the total extent of the ecological community, however they provide important examples of its values and functions.

Across all Ramsar wetlands on the Swan Coastal Plain, the key references consistently identify hydrological alteration, declining water quality (particularly nutrient enrichment), invasive species, loss of fringing wetland vegetation and wetland buffers, recreational disturbance (vegetation trampling and erosion), and drying due to climate change as major threats. Many of these pressures originate from land use changes in surrounding catchments and urbanised landscapes, meaning they continue to affect the ecological community even where parts of it occur within protected areas and despite their listing as Ramsar wetlands.

The Conservation and Parks Commission (2017) found that Forrestdale Lake and Thomsons Lake have likely exceeded the limits of acceptable change under the Ramsar criteria. This exceedance is attributed to altered hydrological conditions that ordinarily support populations of more than 5000 birds. The lakes are now experiencing lower maximum water levels, earlier seasonal drying and shorter inundation periods. Additional contributing factors include the spread of flora adapted to drier conditions and the resulting loss of wader habitat. Evidence from across Australia indicates that, if more favourable hydrological conditions can be restored and maintained, waterbird populations are likely to respond positively. The Conservation and Parks Commission (2017) and DBCA (undated(f)) therefore support further investigation into water supplementation, given the success of previous programs at Thomsons Lake. However, the DBCA has noted that the scale at which such management actions can be implemented is unlikely to prevent exceedance of the hydrological limits for Thomsons Lake in the medium to long term, as climate change remains the most significant driver of continued wetland drying in the southwest of Western Australia (Conservation and Parks Commission 2017). Refer to the response to **question 18** (threat 10, climate change).

At Forrestdale and Thomsons Lakes, key threats include altered hydrology and declining water levels due to drainage, groundwater abstraction and climate change, nutrient enrichment, invasive weeds and fauna, and disturbance from recreation and adjacent urban development. The drying climate and reduced groundwater inflows are leaving the lakes drier for longer periods, with consequent impacts on wetland vegetation and fauna habitat (Ramsar Convention Secretariat 1998a; Conservation Commission of WA and CALM 2005a, 2005b). Forrestdale Lake is treated with pesticides to control midges (chironomids). Midges are naturally occurring, however nutrient enrichment increases their numbers and the problem is worsened because there is only a narrow buffer between the wetland and residential areas (Ramsar Convention Secretariat 1998a; Conservation Commission of WA and CALM 2005a).

The Becher Point wetlands are threatened by altered hydrology, potential salt water intrusion from groundwater abstraction, invasive weeds and fauna, altered fire regimes (most fires are deliberately lit by arsonists), recreational pressure (vegetation trampling and erosion) and fragmentation from

[20] While the estuary – waterbody wetland type is excluded from this nomination, other wetland types within the Peel–Yalgorup and Vasse–Wonnerup systems are included. Management practices within the catchments influence all wetlands in these systems.

surrounding urban development (Ramsar Convention Secretariat 2025; Conservation Commission of WA, DEC and City of Rockingham 2010).

Within the Peel–Yalgorup system, major threats include nutrient enrichment, algal blooms, altered hydrology, invasive weeds and fauna, recreational pressure (vegetation trampling and erosion), and loss of fringing wetland vegetation and wetland buffers and foreshore areas (Ramsar Convention Secretariat 1998b; DWER 2020, 2025; Conservation Commission of WA and DEC 2008, Peel-Harvey Catchment Council 2009).

The Vasse–Wonnerup wetlands are threatened by nutrient enrichment, algal blooms, altered hydrology, invasive weeds and fauna and loss of fringing wetland vegetation and wetland buffers and foreshore areas (Ramsar Convention Secretariat 2014; DPAW 2014b, Department of Water 2010a).

Ramsar listing and reserve tenure provide important recognition and management frameworks, however they do not fully protect the ecological community from threats such as altered hydrology, eutrophication and algal blooms due to nutrient inputs from land uses in the catchment, climate change, invasive weeds and fauna. There are catchment-scale pressures, such as clearing of native vegetation, groundwater abstraction, intensive and non-intensive agriculture and urban development in the catchments, which adversely impact on water quality and hydrology. Many threats originate outside reserve boundaries and continue to affect wetland condition despite existing protections.

Further information about these Ramsar wetlands is available from the DBCA (2025k, (<www.dbca.wa.gov.au/management/wetlands/wetlands-national-and-international-importance>). It lists the relevant Ramsar Site Information Service webpages and relevant management plans. In addition, further information about the Peel-Yalgorup Ramsar wetland is available from *Bindjareb Djilba (Peel–Harvey Estuary) protection plan* (DWER 2020), *Gabi Warlang Bidi: Water quality improvement plan for the Peel-Harvey Estuary system* (DWER 2025b) and *Ecological character Description of the Peel-Yalgorup Ramsar site* (Hale and Butcher 2007); further information about the Vasse-Wonnerup wetlands is available from the *Vasse Wonnerup wetlands and Geographe Bay water quality improvement plan* (Department of Water 2010a) and *Ecological character description for the Vasse-Wonnerup Wetlands Ramsar site in south-west Western Australia* (Wetland Research and Management 2007); and further information about Thomsons Lake and Forrestdale Lake is available in *Ecological character description for the Forrestdale and Thomsons lakes Ramsar site* (Maher and Davis 2009). The *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and DPAW 2016, pp. 84-89) provides summary information on the Peel-Yalgorup and Vasse-Wonnerup Ramsar wetlands.

Section 6 – Other Ecological and Cultural Values

16. Does the ecological community provide habitat for any listed threatened or migratory species and/or endemic species?

If so, note each species and whether it is listed on state/territory and/or national lists and the nature of its dependence on the ecological community.

Answer Question **16** here. Please use as much space as you need to fully answer the question.

Yes. The wetlands of the Swan Coastal Plain provide habitat for threatened flora and fauna, and migratory and endemic fauna. This includes threatened flora; migratory and threatened shorebirds; threatened waterbirds, mammals, fish, reptiles, crustaceans and native bees; and endemic fauna. Threatened and migratory fauna species vary in their degree of dependence on the ecological community, from strong and seasonal reliance to occasional or infrequent use.

Threatened flora

Attachment B lists the threatened wetland flora of the Swan Coastal Plain that are recognised under the EPBC Act and the *Biodiversity Conservation Act 2016* (Western Australia). It also lists the priority wetland flora of the Swan Coastal Plain identified under Western Australian policy.

The threatened and priority flora of the Swan Coastal Plain typically rely on the ecological community for suitable hydrology, soil moisture and soil types. For wetland flora, including threatened flora, the most important components of the water regime are the depth and duration of inundation (referred to as the "duration of the flood event") (Froend *et al.* 2004, p. 16) and the length of the dry period.

Migratory and threatened fauna

Attachment G lists the threatened fauna and migratory shorebirds of the Swan Coastal Plain that are recognised under the EPBC Act and the *Biodiversity Conservation Act 2016* (Western Australia). It also lists the priority fauna of the Swan Coastal Plain identified under Western Australian policy.

Migratory shorebirds, several of which are threatened species, use some of the wetlands, especially the saltmarshes, for foraging, roosting, resting and refuge during the non-breeding season (Department of the Environment 2015). They rely on shallow water, exposed mudflats and sandflats that support predictable food resources. Their dependence is generally seasonal, with many species occurring regularly each summer (spring to autumn) when wetlands are drying, while others appear only occasionally or infrequently depending on hydrological conditions and broader migratory patterns (Department of the Environment 2015; DBCA 2025b). Refer to the response to question 3b for further information about the wetlands that support migratory shorebirds.

The Australasian bittern (*Botaurus poiciloptilus*) relies on dense vegetation in shallow freshwater wetlands for foraging and cover (DCCEEW 2022b; DBCA 2018a). Specifically, its preferred habitat comprises "wetlands with dense vegetation from 0.5–3.5 metres in height, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways [rivers or creeks], or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds" (DCCEEW 2022b). On the Swan Coastal Plain, it has been known since the 1980s only from Forrestdale Lake, Thomsons Lake in the southern Perth metropolitan area, and Benger Swamp near Harvey (DBCA 2018a). The Vasse–Wonnerup system near Busselton may provide seasonal feeding habitat, with recent surveys recording at least one Australasian bittern. It was historically known in the Peel–Yalgorup system around Mandurah, and conservation management at Lake Mealup and natural regeneration at Lake McLarty may create habitat suitable for its return (DBCA 2018a).

The Australian fairy tern (*Sternula nereis nereis*) relies on estuaries and coastal wetlands with concentrations of small fish for foraging, and nests where there are suitable sandy substrates with low and sparse vegetation (Commonwealth of Australia 2020; Dunlop 2021). The Australian Painted Snipe (*Rostratula australis*) is an infrequent visitor that uses shallow, freshwater (occasionally brackish) wetlands with emergent tussocks of grasses, sedges, rushes, samphire and sometimes *Melaleuca* sp. (DCCEEW 2022c).

Carnaby's (*Zanda latirostris*), Baudin's (*Zanda baudinii*) and Forest red-tailed (*Calyptorhynchus banksii naso*) black-cockatoos are known to rely on wetlands as a drinking water source (DPAW 2013; DEC 2008b). They are dependent on water being available in the vicinity of roosting sites and drink before returning to their roost at dusk (DPAW 2013; DEC 2008b). The three black cockatoo species are also likely to use wetlands and wetland buffers on the Swan Coastal Plain for foraging and roosting when suitable flora species and vegetation structure is present.

Threatened mammals associated with the wetlands of the Swan Coastal Plain show varying levels of ecological dependence, ranging from strong reliance on wetland habitats to more opportunistic

use of wetlands, fringing wetland vegetation and wetland buffers. The quokka (*Setonix brachyurus*) demonstrates strong dependence on wetlands, using dense wetland vegetation for refuge and foraging. There is a known population on the Swan Coastal Plain at Muddy Lakes, south of Bunbury, with unconfirmed reports from Thomsons Lake, and in the Yallingup area of the southern Swan Coastal Plain (Reaveley 2009). The chuditch (*Dasyurus geoffroii*) is not wetland-dependent but may use wetlands for foraging and movement; its use of the ecological community is intermittent and limited. Bamford and Bamford (2003) noted that chuditch are likely surviving at low population densities; and wetlands and their margins may be particularly productive habitats for it. On the Swan Coastal Plain, the ngwayir or western ringtail possum (*Pseudocheirus occidentalis*) primarily occupies peppermint (*Agonis flexuosa*) and tuart (*Eucalyptus gomphocephala*) woodlands (DPAW 2017c). However, it may use wetland and wetland buffer vegetation where suitable canopy and understorey occur, with dependence varying from occasional to regular use depending on local vegetation structure.

Threatened wetland dependent fish-, including the western mud minnow (*Galaxiella munda*) and black-striped minnow (*Galaxiella nigrostriata*), rely on relatively undisturbed stream habitats. The western mud minnow (*Galaxiella munda*) prefers permanent stream habitats and the black-striped minnow (*Galaxiella nigrostriata*) prefers ephemeral, near-coastal wetlands (DWER 2026c; Morgan *et al.* 2011). The loss of these species from large areas of their former range is assumed to be due to land degradation (salinisation, eutrophication and land development), dewatering of their habitats and invasive fish (Morgan *et al.* 2011).

On the Swan Coastal Plain, black striped minnow (*Galaxiella nigrostriata*) may now be found only in disjunct populations at Bunbury and Gingin (Morgan *et al.* 1996, 1998); and western mud minnow (*Galaxiella munda*) only at Gingin (Morgan *et al.* 1998).

Balston's pygmy perch (*Nannatherina balstoni*) may now be locally extinct on the Swan Coastal Plain. The *Healthy rivers south-west* website (DWER 2026c) notes that "the original range probably included other systems through the Swan Coastal Plain, based on museum records from north of Perth (Gingin Brook). The absence north of Margaret River may be in response to habitat degradation, changes to water regimes (extraction and drying climate), secondary salinisation and competition with introduced fish". Hourston *et al.* (2014) and Morgan *et al.* (2011) likewise reported that the species' range has contracted further south. It is listed as vulnerable under both the EPBC Act and the BC Act.

The western swamp tortoise (*Pseudemydura umbrina*) has a naturally very restricted range, in shallow, ephemeral wetlands on clay or sand-over-clay soils with nearby suitable aestivating refuges (Burbidge *et al.* 2010; DWER 2026c). Most original habitat has been lost within its very small former range due to clearing and drainage; and the increasingly dry climate has caused the permanent drying of much of this habitat type (Burbidge *et al.* 2010; DWER 2026c).

The Dunsborough burrowing crayfish (*Engaewa reducta*) is known from several wetlands and drainages between Dunsborough on the Swan Coastal Plain and the inland locality of Warner Glen, which lies outside the Plain but is relatively nearby (Morgan *et al.* 2011).

Carter's freshwater mussel (*Westralunio carteri*) requires coastal freshwater rivers and lakes with suitable substrates and has dramatically declined in salinised systems (Morgan *et al.* 2011).

The short-tongued bee (*Leioproctus douglasiellus*) and *Neopasiphae simplicior* are threatened native bee species that depend on wetlands and have been collected on wetland flora, including *Anthotium junciforme* and *Angianthus preissianus*, respectively (DEC 2012m). Both species have

also been collected on *Goodenia filiformis* (DEC 2012m; DEWHA 2009a; Department of Sustainability, Environment, Water, Population and Communities 2013a)[21].

Endemic fauna

The Western Swamp Tortoise (*Pseudemydura umbrina*) is found naturally only within two wetlands on the Swan Coastal Plain (Burbidge *et al.* 2010).

Neopasiphae simplicior has only been found in two Perth locations, Cannington and Forrestdale Lake Nature Reserve, which are both on the Swan Coastal Plain (DEC 2012m; DEWHA 2009a). It is presumed extinct at Cannington (DEWHA 2009a).

Leioproctus douglasiellus has only been found in three Perth locations from Cannington to Forrestdale on the Swan Coastal Plain (Department of Sustainability, Environment, Water, Population and Communities 2013a).

Horwitz *et al.* (2009a) and Sommer *et al.* (2008) provide information on endemic aquatic invertebrates on the Swan Coastal Plain. Three species could be readily designated as locally endemic to the Swan Coastal Plain. One amphipod, *Hurleya* sp., appears restricted to root mat communities of the Yanchep Caves, and two water mites, *Thryptaturus* sp. nov. and *Anisitsiellides* sp. nov., are known only from tumulus mound springs in the eastern Gnangara region (M. Harvey, pers. comm. in Horwitz *et al.* (2009a). *Westrapyrgus slacksmithae* is a locally endemic aquatic snail, only known from the footslopes of the Darling Scarp north of Perth and from the Moore River on the Swan Coastal Plain (Horwitz *et al.* 2009a). Thirty-eight aquatic invertebrate taxa (15.6%) are endemic to south-western Australia (Horwitz *et al.* 2009a).

Endemic flora

The Southwest has a high degree of endemism as does the Swan Coastal Plain and its wetlands. For example, table 10 in Tauss *et al.* (2019) lists 18 taxa that are Swan Coastal Plain wetland endemics of the Greater Brixton Street Wetlands. Some other examples include the wet Busselton ironstone endemics, *Darwinia whicherensis, Calytrix reversifolia*, *Grevillea maccutcheonii, Grevillea elongata, Lambertia echinata* subsp. *occidentalis, Petrophile latericola, Gastrolobium papilio* and *Chamelaucium roycei.* There are other endemics, for example *Banksia squarrosa* subsp. *argillacea*, *Calothamnus quadrifidus* subsp. *teretifolius*, *Calytrix* sp. Tutunup, *Banksia nivea* subsp. *uliginosa* (Keighery and Keighery 2013, p. 167); *Jacksonia gracillima* (Keighery and Keighery 2013, p. 175), *Eremophila glabra* subsp. *chlorella* (Keighery and Keighery 2013, p. 174) and *Boronia juncea* subsp. *juncea* (Keighery and Keighery 2013, p. 143) and *Samolus* sp. Clay Flats. Many of the endemic species are yet to be described (Keighery and Keighery 2013).

The south-west of Western Australia is an important region globally for high diversity and endemicity of *Tecticornia*, *Triglochin* (samphires) and *Samolus* (G. Keighery pers. comm in Department of Sustainability, Environment, Water, Population and Communities 2013b).

See also the 'Context for the key biological components' and 'Flora species and structure' sub-sections of the response to **question 3a**.

[21] Both *Neopasiphae simplicior* and *Leioproctus douglasiellus* are endemic to the Swan Coastal Plain. However, *Florabase* (Western Australian Herbarium 1998–a) and other references do not show *Goodenia filiformis* occurring on the Swan Coastal Plain. The cause of this discrepancy is unknown.

17. Identify parts, areas, key species or other features of the ecological community and its associated ecosystem(s) that are known to have particular cultural significance to First Nations people.

Provide additional information on which First Nations groups they are significant to, and the nature of the significance, if publicly available. Please cite relevant sources and note any material that needs to remain confidential.

Answer Question **17** here. Please use as much space as you need to fully answer the question.

The wetlands of the Swan Coastal Plain hold deep cultural significance for Noongar people, who are the Traditional Owners of this land. Many wetlands, including lakes, rivers and creeks, and groundwater are associated with the Waugal (also Wagyl, Waugul or Waargyl), a powerful ancestral being central to Noongar creation stories, lore and spirituality. The Waugal is a water-forming and water-protecting spirit whose movements shaped the wetlands of the Swan Coastal Plain, and who continues to act as a guardian of these places. These values are reflected in *Spirituality* (South West Aboriginal Land and Sea Council 2026c), the *Wagoorjup animation* (Community Arts Network 2026), the *Walk with the Waugal* videos (Water Corporation 2026c), the *Walking on water: Spirit of the Swan Coastal Plain* project (State Library of Western Australia 2021) and the Western Australian Museum's *Reimagining Perth's lost wetlands: Aboriginal context* (Western Australian Museum, undated(a)). Although located outside the Swan Coastal Plain, the Noongar Kaartdijin Aboriginal Corporation (2025) provides additional information titled *Wagyl - Spirit Snake / Creator* and *Bilya Kaartdijin (waterways knowledge)*.

Wetlands are also significant as places associated with the *Carers of Everything*, a concept described by Noongar Elder Dr Noel Nannup to express the cultural responsibilities and ancestral beings that guide the care of Country (Nannup 2003). This emphasises the interconnectedness of people, water, plants, animals and spiritual wellbeing. Marie Taylor's reflections in *The ripples we made: Wisdom of Country* (The Wetlands Centre Cockburn 2024), further highlight the continuing cultural importance of wetlands as places of teaching, ceremony, identity and custodianship. Wooltorton *et al.* (2019) describe groundwater and wetlands in Gnangara as "living water" central to Noongar boodjar (Country).

Information from the South West Aboriginal Land and Sea Council, including the *Noongar of Beeliar*, *Spirituality*, other cultural resources and the interactive map of the Noongar Land Estate (South West Land and Sea Council 2026a, 2026b, 2026c, undated) highlight the importance of water places as part of Noongar identity, cultural continuity and ongoing cultural practice. Additional cultural context is provided in *Aboriginal Perth and Bibbulmun biographies and legends* (Bates 1992), *The Nyoongar legacy: the naming of the land and the language of its people* (Rooney 2011), *Indigenous history of the Swan and Canning rivers* (Hughes-Hallet 2010) and *Sharing sweet water: Culture and the wise use of wetlands in Western Australia* (Hill 2013).

The cultural significance of specific wetlands on the Swan Coastal Plain has been documented in numerous studies. Wetlands in the Perth–Bunbury region (O'Connor *et al.* 1989) and the Busselton–Walpole region (O'Connor *et al.* 1995) are recognised as important cultural landscapes, serving as mythological sites, camping places, resource areas and ceremonial locations. Polglaze (1986) documents the Aboriginal heritage significance of the Coolbellup/Walliabup wetlands (North Lake – Bibra Lake), while McDonald *et al.* (2005) and the *Walk with the Waugal* videos (Water Corporation 2026c) describe groundwater-related cultural values on the Gnangara groundwater system, emphasising the spiritual and practical importance of water places. Brady and Murray (2018), Garlett and Abraham (2017), *Beyond the waters: The spirit and science of Walliabup Bibra Lake* (The Wetlands Centre Cockburn 2023a, 2023b, 2023c) and *The ripples we made: Wisdom of Country* (The Wetlands Centre Cockburn 2024) highlight the cultural, historical and contemporary significance of wetlands including the Beeliar wetlands, and the impacts of wetland loss on Noongar cultural landscapes. The *Walk with the Waugal* videos (Water Corporation

2026c) also describe the significance of Lake Joondalup and Bennett Brook to Noongar people. *The Djarlgarro Bilya waterways project* (Ramalho *et al.* 2021; National Environmental Science Programme undated; Government of Western Australia 2024c) and the soon-to-be-released *Kep Wirrin, the Spirit of Water: Nyoongar cultural stories of the Djarlgarro Bilya* (Stainton *et al*. 2026) describe the significance of the *Djarlgarro Bilya* (Canning River and associated wetlands). *Traditional ecological knowledge of Forrestdale Lake* (Perth NRM undated) describes the significance of Forrestdale Lake.

Noongar plant knowledge associated with wetland species is documented in *Plants and people in Mooro Country* (City of Joondalup 2011), *Bush tucker plants of the south-west* (Daw *et al.* 1997), *Noongar bush medicine: Medicinal plants of the south-west of Western Australia* (Hansen and Horsfall 2017), *Noongar bush tucker: Bush food plants and fungi of the south-west of Western Australia* (Hansen and Horsfall 2019), *Aboriginal names for plant species in south west Western Australia* (Abbott 1983)*, Traditional ecological knowledge* (Perth NRM 2015), *Traditional ecological knowledge of Forrestdale Lake* (Perth NRM undated) and *Sharing sweet water: Culture and the wise use of wetlands in Western Australia* (Hill 2013, pp. 514-515). These record Noongar names for wetland plants; and traditional uses of wetland plants for food, medicine, tools and cultural practices. The Noongar names for mammals, birds and other fauna are documented in *Traditional ecological knowledge* (Perth NRM 2015), *Traditional ecological knowledge of Forrestdale Lake* (Perth NRM undated), 'Aboriginal names of mammal species in south west Western Australia' in *CALM Science* (Abbott 2001), *Sharing sweet water: Culture and the wise use of wetlands in Western Australia* (Hill 2013, pp. 514-515) and 'Aboriginal names of bird species in south-west Western Australia, with suggestions for their adoption into common usage' in *Conservation Science Western Australia* (Abbott 2009).

Many wetlands on the Swan Coastal Plain are recognised as Aboriginal heritage places under the *Aboriginal Heritage Act 1972* (WA), including registered and lodged sites associated with mythological, ceremonial, archaeological and historical values. The Act protects all Aboriginal sites in Western Australia, whether they are registered or not. Publicly available information on Aboriginal heritage sites is maintained by the Government of Western Australia (Government of Western Australia 2017–2026a, 2017–2026b). These sites demonstrate the long-standing cultural, spiritual and practical relationships between Noongar peoples and wetland ecosystems.

The South West Native Title Settlement recognises the Noongar people as the Traditional Owners of the south-west of Western Australia (Government of Western Australia 2017–2026c; National Native Title Tribunal undated). The Settlement includes six Indigenous Land Use Agreements (ILUAs), each associated with a Noongar Native Title Agreement Group represented by a Regional Corporation. The South West Aboriginal Land and Sea Council supported the establishment of the Regional Corporations under the Settlement; and continues to provide cultural, heritage and Settlement-wide support.

The wetlands of the Swan Coastal Plain are within the areas of the following four Regional Corporations (with the relevant ILUA shown in brackets):

- Yued Aboriginal Corporation (Yued ILUA)
- Whadjuk Aboriginal Corporation (Whadjuk ILUA)
- Gnaala Karla Booja Aboriginal Corporation (Gnaala Karla Booja ILUA)
- Karri Karrak Aboriginal Corporation (South West Boojarah #2 ILUA).

Further information about each region is available from the South West Aboriginal Land and Sea Council (<www.noongarculture.org.au>, select 'country').

The Bibbul Ngarma Aboriginal Association is working to protect and restore the Mandoon Bilya (Helena River) and associated wetlands. See further information in the response to **question 21**.

The Conservation Council of Western Australia (CCWA) Indigenous Advisory Board provides advice on increasing Indigenous participation and representation in addressing environmental and conservation issues in Western Australia, and guides CCWA decision-making, working practices and cultural competency.

See also information about the Noongar six seasons in the response to **question 4**.

Some cultural knowledge relating to specific wetlands, stories and practices is confidential or restricted and is not reproduced here.

We contacted the South West Aboriginal Land and Sea Council in January, February and March; the Yued Aboriginal Corporation, Whadjuk Aboriginal Corporation, Gnaala Karla Booja Aboriginal Corporation and Karri Karrak Aboriginal Corporation in February and early March; and the Bibbul Ngarma Aboriginal Association in early March to seek guidance on cultural perspectives relevant to the nomination. We shared the draft sections on cultural significance (**question 17**) and support networks (**question 21**), along with the full draft nomination (excluding attachments), and invited advice on the appropriate people to speak with, how best to reflect Noongar knowledge respectfully, and whether they wished to receive the attachments. Although we did not receive direct advice, we hope to establish ongoing connections and continue seeking their guidance. We were advised to contact the CCWA and the members of their Indigenous Advisory Board shortly before the nomination was due and intend to follow this up after submitting the nomination.

Section 7 – Threats and Threat Abatement*

Threats*

18. Identify threats to the ecological community, indicating whether they**:**

- occurred in the past only
- occur in the present and/or
- are likely to occur in the future (potential).*

For each threat identified, describe:

the specific impacts on this ecological community and how and where they occur

whether the impacts are actual, suspected, or potential in the future (if an impact is suspected or potential, explain the likelihood and expected timeframe over which the threat is/will impact on the ecological community)

whether the threat impacts the entire ecological community or only certain areas (specify known areas) and why

any ongoing effects; e.g. legacy impacts of fragmentation and/or loss of key biota; or impacts of ongoing activities or development projects (again, with ongoing effects, give details, where possible, of the expected timeframe over which the threat impacts on the ecological community).

how the threats interact; e.g. vegetation clearance also causing hydrology, salinity and/or eutrophication impacts; weeds that may exacerbate fire problems.*

Additionally:

which demonstrable threats, if any, could cause the ecological community to be lost in the immediate, near, or medium-term future? Over what timescale could the impacts of these threats cause the ecological community to be lost? See the Guidelines for further details, particularly the section on geographic and temporal variation within ecological communities and the guidance for Criterion 2 [Small geographic distribution coupled with demonstrable threat].

Where possible provide supporting information, including quantitative data, as recommended above and indicate if information is unavailable (refer to dealing with uncertainty in the Guidelines).*

If you plan to identify climate change as a threat to the ecological community, refer to Appendix 2 of the Guidelines for information on how this should be addressed.

Also, identify and explain any additional biological characteristics, particular to the ecological community (or to important species within it), which exacerbate threats to the ecological community's survival (e.g. low genetic diversity; susceptibility to disease and/or dieback).

Answer Question **18** here. Please use as much space as you need to fully answer the question.

The response to question 18 outlines the major threats affecting the wetlands of the Swan Coastal Plain. It addresses wetland loss and fragmentation due to clearing, draining and filling (threat 1); loss of fringing wetland vegetation and loss or inadequacy of wetland buffers and foreshore areas (threat 2); altered hydrological regimes (threat 3); water quality degradation (threat 4); invasive weeds (threat 5); invasive fauna (threat 6); farmed animal grazing and trampling (threat 7); pathogens and disease (threat 8); altered fire regimes (threat 9); climate change (threat 10); cumulative impacts (threat 11); and dams, crossings and other barriers to aquatic fauna movement (threat 12). These threats could cause the ecological community to be lost in the ***near future***.

Water quality degradation includes nutrient enrichment, algal blooms and deoxygenation (threat 4.1); acidification due to exposure of acid sulfate soils (threat 4.2); other pollutants such as pesticides, metals, hydrocarbons and excessive pathogens (threat 4.3); sedimentation and increased turbidity (threat 4.5); and salinisation (threat 4.6).

Pathogens and disease include Phytophthora dieback (*Phytophthora cinnamomi*) (threat 8.1); frog chytrid fungus (threat 8.2); myrtle rust (threat 8.3); and highly pathogenic avian influenza H5N1 (threat 8.4).

The following legend outlines the terms used in the introduction to each threat:

- Timing – the threat occurs in the **past** only, is **ongoing** or is a **future** threat.
- Status of impacts – **actual** or **potential impacts**.
- Severity and consequences – the threat causes, or has the potential to cause, impacts that are:
    - **extreme** (leading to loss or transformation of affected patches or occurrences), and in some cases labelled as **potentially extreme**)
    - **major** (leading to degradation of affected patches or occurrences), and in some cases labelled as **potentially major**)
    - **minor** (impacting some components of affected patches or occurrences)
    - **unknown**.
- Scope or extent – the threat is affecting the following amounts of the ecological community: **whole** (estimated >90%), **majority** (>50%), **minority** (<50%), **unknown**.
- Trend – the severity of the threat and its consequences are likely to be **decreasing**, **increasing**, **stable/static** or **unknown**.

1. Wetland loss and fragmentation (clearing, draining and filling wetlands)

(ongoing; actual impacts; extreme – a system-level driver of ecological decline; majority (likely over 80% lost); increasing)

Extent of wetland loss through clearing draining and filling

Historical and ongoing clearing, draining and filling have caused substantial loss of the wetlands on the Swan Coastal Plain and are among the most significant threats to this ecological community. The wetlands that remain are increasingly fragmented and subject to physical disturbance from infrastructure, recreation and vehicle access, further reducing habitat extent, connectivity and resilience.

Various accounts describe extensive historical clearing, drainage and filling for agriculture, sanitation, mosquito control and urban development, resulting in the permanent loss of extensive areas of wetlands on the Swan Coastal Plain (Riggert 1966; Bekle 1981; Singleton 1988; Bekle and Gentilli 1993; Naturelink Perth 2022; Wikipedia undated; Western Australian Museum undated(b)).

Attachment H summarises different estimates of wetland loss across the Swan Coastal Plain. One commonly cited figure is that around 80% of the wetland area on the Plain has been lost or heavily altered. This estimate appears in many references, although its original source and method of calculation are unclear. Despite this uncertainty, assessments undertaken since the mid-1990s consistently indicate very high levels of loss. The *State of the environment report: Western Australia 2007* (EPA 2007a, p. 93) estimated that 70 to 80% of the area of wetlands had been lost to clearing, draining and filling and noted that the actual figure may be higher due to continued losses, as well as the significant decline in the condition of remaining wetlands.

In addition to wetland loss and fragmentation, the whole Swan Coastal Plain is subject to ongoing threats from land clearing and fragmentation, which has contributed to the decline of multiple ecological communities. This is evident in the listing of other threatened ecological communities on the plain, including the Banksia woodlands and Tuart woodlands. By 2024, only 38% of the Swan Coastal Plain IBRA region remained covered by native vegetation (DataWA 2025a[22], 2025c). The ongoing threats from land clearing on the Swan Coastal Plain are also evident in the biodiversity chapter of the *State of the environment report: Western Australia 2007* (EPA 2007b).

Limitations of the Geomorphic wetlands, Swan Coastal Plain (DBCA-019) spatial dataset for wetland loss estimates

The DBCA (2017a) derived its estimate of 73% loss of wetland area from the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset (DataWA 2021d). This dataset was created in 1996, capturing the data in Hill *et al.* 1996b) and has undergone only limited and ad hoc revision. As a result, it does not reflect the full extent of wetland losses that have occurred since it was created. It also excludes many historically filled or drained wetlands, such as those documented by Riggert (1966), Bekle (1981), Singleton (1988), Bekle and Gentilli (1993), Naturelink Perth (2022), Wikipedia (undated) and Western Australian Museum (undated(b)). This indicates that actual wetland losses are greater than estimates derived solely from this dataset. For example, many wetlands shown in the maps in **attachment H** are not included in the dataset, nor are the 607 hectares of reclaimed wetlands along the Swan and Canning estuaries described by Seddon (1972).

Many of the historical wetland losses known to be absent from the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset relate to clearing, draining and filling around Perth. For other parts of the Swan Coastal Plain, documentation of historical wetland loss is limited, except for Riggert (1966). That report provides broad estimates, including a 1965 annual report that mentions 494,739 acres (200,216 hectares) of wetlands being drained. However, it does not include maps, so it is not possible to compare those figures with current wetland mapping. Riggert (1966) also noted that it was difficult to identify and map reclaimed wetlands using aerial photographs.

See also the response to **question 23a**.

Wetland loss and fragmentation is continuing

The EPA (2007a, p. 93) found that:

- wetland vegetation on the Swan Coastal Plain continues to be cleared or degraded at a rate equivalent to about two football ovals per day between 1996 and 2004 (about 1500 hectares or 750 football ovals per year); and
- about 6% of wetlands of high conservation value on the Swan Coastal Plain were lost or degraded between 1996 and 2004.

The method used to derive this calculation was not documented.

Analysis of Landsat satellite imagery from 1992 to 2012 produced consistent findings. This demonstrated that about four hectares of perennial vegetation each day were being lost from the wetlands of the Swan Coastal Plain (DBCA 2017a, p. 10). This equates to roughly 1460 hectares, or about 750 football ovals, being cleared each year. Importantly, this level of wetland clearing has continued despite the introduction of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (the Clearing Regulations). Further details on the Clearing Regulations is provided in the response to **question 14**.

Population growth and urban expansion is placing increasing pressure on the Swan Coastal Plain. For example, it took approximately 180 years for the population of Perth and Peel to grow to just over 2 million people, yet current projections indicate that more than 3.5 million people will live in

[22] Refer to the 'IBRA region veg associations' worksheet.

the region by 2050 (Department of Planning, Lands and Heritage (DPLH) and Western Australian Planning Commission (WAPC) 2018). Most readily developable land has already been developed, and the remaining areas are frequently constrained by high groundwater levels (Thompson *et al.* 2021b). As a result, further population growth is likely to increase pressures on wetlands from land clearing and changes to natural hydrological regimes.

Without stronger planning and environmental legislation controls, wetland loss through clearing, draining and filling is expected to continue at the rates documented above.

Ecological consequences of wetland loss and fragmentation through clearing, draining and filling

The *State of the environment report: Western Australia 2007* (EPA 2007b, p. 139) describes some of the impacts and implications of native vegetation loss: "In some parts of WA (especially the Wheatbelt and parts of the Swan Coastal Plain) native vegetation has been cleared beyond safe ecological limits. Continued clearing will result in loss of biodiversity and extinctions, with fragmented habitats becoming more susceptible to climate change, disease, and weed and introduced animal invasion. Salinisation of land and inland waters, altered water regimes, soil erosion, eutrophication and increased greenhouse gas emissions are all direct consequences of clearing native vegetation."

Davis and Froend (1999) summarised that removal of wetland vegetation "causes the direct loss of floral diversity, reduced potential for plant population recruitment, reduction in primary production, the subsequent loss of fauna diversity through the loss of habitat and food, decreased aeration of sediments, and increased nutrient levels as a consequence of the decrease in plant uptake. Elevated water temperatures and light levels in the littoral zone promote algal blooms and a subsequent deterioration in water quality". The DEC (2012i, p. 10) provides similar advice.

Loss of wetlands due to clearing, draining and filling reduces breeding, foraging and refuge habitat for fauna, including waterbirds, frogs, turtles and aquatic invertebrates (Riggert 1966; Davis *et al.* 2013). Fauna dependent on wetlands, such as the south-western snake-necked turtle (*Chelodina oblonga*), exhibit reduced nesting success, altered movement patterns and population declines in cleared or urbanised landscapes (Santoro 2017, 2022; Santoro *et al.* 2020; Santoro *et al.* 2023c). Similar population declines have been documented for waterbirds, and for frogs that require moist, vegetated microhabitats for breeding and dispersal. Wetland birds have been particularly affected by the large-scale loss of wetlands on the Plain (How and Dell 1993; Horwitz *et al.* 2009c; Wilson *et al.* 2009). As wetlands are lost, terrestrial birds that rely on them for water, breeding, foraging and refuge habitat, and mammals that depend on them for water, foraging and refuge, also experience reduced habitat availability.

The increasing need for fauna to move across cleared or urbanised landscapes and roads also heightens their exposure to road mortality, with south-western snake-necked turtles frequently killed or injured on roads that now intersect former wetland linkages (Santoro 2017, 2022). Other wetland-dependent fauna, such as frogs, mammals and waterbirds are also frequently killed or injured on roads in these circumstances.

The cumulative loss of wetland area, fringing vegetation and geomorphic features has progressively reduced landscape connectivity across the south west region, including the Swan Coastal Plain (Wilson *et al.* 2009; Semeniuk and Semeniuk 2001; Nanda *et al.* 2021). Clearing (threats 1 and 2), drainage, dams, flow-control structures and wetland crossings (threats 3 and 12) have left many wetlands smaller and increasingly isolated from their former ecological and hydrological linkages (Wilson *et al.* 2009; Horwitz *et al.* 2009c). As these linkages diminish, habitat continuity is disrupted, fauna movement and dispersal are constrained, and opportunities for genetic exchange and recolonisation following disturbance are reduced. These changes also interrupt surface water

and groundwater pathways, alter natural flow regimes and undermine the ecological integrity and functioning of wetland systems.

As connectivity declines further, wetlands lose the capacity to operate as components of a broader landscape mosaic and instead function as isolated units with reduced resilience. This isolation increases the vulnerability of small populations to local extinction, limits the ability of species to track suitable habitat conditions across the landscape and reduces the availability of refugia during extreme climatic events (Nanda *et al.* 2021). Collectively, these processes diminish the adaptive capacity of wetland communities and heighten their susceptibility to localised disturbances and environmental change.

A soon-to-be-released study by Sonja Sprenger investigates how wetland connectivity is changing across the Swan Coastal Plain and what that means for species with varying dispersal abilities. It may soon be published on the Naturelink Perth website (<https://naturelinkperth.org>). This study also relates to altered hydrological regimes (threat 3), as it includes consideration of connectivity through drainage networks, although this is not the primary focus of the work.

Indirectly related information on managing wetland vegetation is provided by the DEC (2012i, pp. 3-10). It summarises the main types of vegetation change or degradation in wetlands (composition, structure and density) and the impacts on wetlands, including the wetlands of the Swan Coastal Plain.

Variation in wetland loss and fragmentation due to clearing, filling and draining across wetland types

Ephemeral wetlands with shallow basins (for example, damplands) or flat landforms (for example, the palusplain, floodplain and estuary – peripheral wetland types) are particularly vulnerable to clearing, draining and filling (Semeniuk and Semeniuk 2001). In contrast, wetlands with deeper basins and permanent open water (such as lakes and rivers), or with flowing water (such as rivers and creeks), are less vulnerable to these activities. This is because removing or significantly modifying deeper, permanent open-water systems would require large quantities of fill and substantial earthworks, whereas shallow or flat wetlands can be removed or modified more readily through comparatively minor earthworks, drainage or infill. However, even permanent open water wetlands remain vulnerable to the clearing or degradation of their fringing vegetation and terrestrial native vegetation in their wetland buffers or waterway foreshore areas (refer to threat 2), in addition to other threats.

Seddon (1972, p. 226) noted that the "lakes and waterways [the river and creek wetland types] that have survived in the metropolitan region are now not likely to be drained because they are in reserves, because they are too deep to drain, or because they are salt lakes near the coast, and not worth draining for agriculture. This does not mean that such wildlife as is left is secure, for many reasons. Clearing around the lakes is common, and this deprives birds of a supplementary food supply" (Seddon 1972, p. 226) (refer to threat 2).

Hill *et al.* (1996, p. 12) found that only 17% of all basin and flat wetlands in the Wedge Island to Mandurah area remained fully vegetated with mainly native species at that time. Only 48% of rivers and 33% of creeks retained more than half of their original vegetation. Hill *et al.* (1996, p. 17) also concluded that rivers and creeks required urgent attention to reverse the decline in their condition. Rivers and creeks are often bordered by palusplain or floodplain, the vast majority of which had already been cleared. Only 6% of palusplain and 22% of floodplain between Gingin and Mandurah remained vegetated (Hill *et al.* 1996, p. 17).

Interaction with other threats

Wetland loss interacts strongly with other threats. For example, clearing of wetland vegetation and native vegetation in the catchment:

- permanently alters hydrology (threat 3) by reducing evapotranspiration and root water uptake, causing groundwater levels to rise and altering natural inundation patterns (DEC 2012h, p. 11-12; EPA 2007a, p. 88), though these effects are influenced by declines in rainfall and groundwater levels due to climate change and groundwater abstraction (DEC 2012h, p. 8-12; Yesertener 2008; Dawes *et al.* 2012) (threat 10)
- increases turbidity and sediment inputs into wetlands by exposing sandy soils and increasing overland flow across cleared surfaces, mobilising sediments that would otherwise be retained by intact vegetation (DEC 2012l, p. 131) (threats 4.1 and 4.5)
- facilitates weed invasion by removing shade and competition, exposing soils and introducing weed seeds through soil movement and machinery (DEC 2012p, p. 4 and 68) (threat 5)
- favours invasive predators (cats and foxes) (threat 6) by removing vegetation structure and creating open, disturbed areas that increase hunting efficiency (Doherty *et al.* 2015)
- increases the spread of Phytophthora dieback (*Phytophthora cinnamomi*) (threat 8.1) through soil movement, machinery, fill material and modified drainage pathways (DEC 2012j, p. 5; Wilson *et al.* 2009).

Fragmentation of native wetland vegetation and nearby upland vegetation through clearing:

- reduces fauna movement by breaking continuous habitat into smaller, isolated patches that limit the ability of fauna to move, disperse and access resources (Saunders *et al.* 1991) (threat 11)
- compounds the impacts of cats and foxes (threat 6) by increasing the amount of exposed habitat along fragment boundaries and creating narrow, open remnants that heighten the visibility and vulnerability of fauna to invasive predators (Doherty *et al.* 2015)
- reduces flora and fauna resilience to altered fire regimes (threat 9) by creating smaller, isolated habitat patches with reduced structural diversity and limited refuges, which diminishes the capacity of flora and fauna to withstand and recover from altered fire regimes. Fragmentation and the drying climate (threat 10) also increases the likelihood that a single fire event may burn an entire wetland or reserve (threat 9), reducing the opportunity for wetland-dependent fauna to escape or survive.

Drainage alters wetland hydrology (threat 3) by lowering water levels through the removal of surface water and groundwater, which disrupts natural hydroperiods and shortens the duration of inundation (DEC 2012h, p. 20-24)[23]. Many wetlands are also affected by pollution (threat 4.3) delivered through drainage infrastructure (threat 3), as urban and rural drains often empty directly into wetlands and carry nutrients, sediments and other pollutants in stormwater.

Infill alters wetland hydrology (threat 3) by reducing wetland storage capacity and obstructing natural flow paths, which prevents wetlands from holding water and disrupts natural hydroperiods. Drainage also increases susceptibility to acidification by exposing acid sulfate soils (DEC 2012h, p. 35; DWER 2015) (threat 4.2).

Knowledge gaps

Although the significant extent of historical wetland loss on the Swan Coastal Plain is well recognised, there are large gaps in understanding the full scale, distribution and ecological consequences of clearing, draining and filling the wetlands of the Swan Coastal Plain.

[23] Disposing of stormwater into urban wetlands is covered separately in threat 3.

The mapping of pre-European wetland extent on the Plain is incomplete, and records of historical clearing, drainage and infilling of wetlands are often poorly documented or unavailable.

The current mapping of the wetlands on the Swan Coastal Plain requires a substantial review. It was first compiled in the mid-1990s and has undergone only limited and ad hoc revision since then.

There is limited long-term monitoring of how either cumulative or incremental wetland habitat loss affects wetland vegetation structure, wetland fauna, hydrological function or ecological connectivity. There is almost no information on the thresholds at which cumulative loss leads to irreversible ecosystem decline.

The effectiveness of restoration is not well quantified. This limits the ability to assess the potential for wetland recovery and to prioritise wetlands for restoration.

Additional references

Refer to **attachment H** for additional references.

2. Loss of fringing wetland vegetation and loss or inadequacy of wetland buffers and foreshore areas

(ongoing; actual impacts; potentially extreme – a driver of ecological decline; majority, close to whole; increasing)

For historical and practical reasons, different methods have been used to identify wetland buffers and waterway foreshore areas in Western Australia. These terms are explained in the context sub-section below.

Extensive clearing on the Swan Coastal Plain (threat 1) has caused widespread loss of fringing wetland vegetation and the natural wetland buffers and foreshore areas of native terrestrial vegetation that once surrounded these wetlands. The removal or narrowing of these protective areas is recognised as a distinct threat to wetland condition because fringing vegetation, wetland buffers and waterway foreshore areas perform essential ecological functions. These are described below.

Seddon (1972, p. 226) noted that the clearing of fringing vegetation was historically common on the Swan Coastal Plain. This is also evident from aerial imagery which, when considered alongside mapped wetland boundaries in **attachment L**, is considered highly likely to demonstrate that most remaining Conservation and Resource Enhancement evaluation category wetlands do not retain adequate wetland buffers or waterway foreshore areas.

Clearing of native vegetation in areas that should function as wetland buffers or waterway foreshore areas continues. This ongoing loss occurs in part because these buffers and foreshore areas have not always been formally delineated and therefore have not been reserved or otherwise secured for protection. Until formal delineation occurs, the native vegetation within these intended buffers and foreshore areas is not recognised for its protective role and remains more vulnerable to clearing.

Clearing and degradation of intended wetland buffers, waterway foreshore areas and fringing wetland vegetation continues on the Swan Coastal Plain, even though policies and guidance have long emphasised the need for adequate buffer and foreshore widths. For example, the *State of the environment report: Western Australia 2007* (EPA 2007a, pp. 97–100) reported ongoing loss and degradation of fringing vegetation of waterways (and waterway foreshore areas, as it considered a 50-metre "buffer") throughout the south-west region, and noted net declines in fringing vegetation in many coastal catchments between Bunbury and Geraldton due to land development, drought and rural activities. This is also occurring for other wetlands but is poorly documented, other than total wetland loss.

In addition to loss of fringing vegetation and intended wetland buffers and foreshore areas, a related threat is inadequate buffers and foreshore areas. This occurs when buffers and foreshore areas are applied but their width does not provide adequate protection. This is discussed further below.

Context for wetland buffers, waterway foreshore areas and fringing wetland vegetation

Wetland buffers and waterway foreshore areas allow for **future restoration** where degradation has occurred (for example, realignment of straightened channels, controlling erosion and restoration of endemic native vegetation) (WAPC 2025b, p. 24)

Healthy **native vegetation** of sufficient width is essential for foreshore areas and wetland buffers to perform their protective functions, and the ecological linkages and land required to support it should be identified as early as possible in the planning process (WAPC 2025b, p. 24). This also applies to other decision-making processes where land uses and activities may change near all wetland types.

A **wetland buffer** is "an area of terrestrial land immediately surrounding a wetland that provides spatial separation between the wetland and adjacent land use(s)" (WAPC 2025a, p. 10; DEC 2012i, p. 41). It includes terrestrial vegetation and applies to the following wetland types: **dampland, lake, paluslope, palusplain and sumpland**.

The relevant policies and guidance for wetland buffers are chapter 'B4 Wetlands' in *Environmental guidance for planning and development – Guidance statement* 33 (EPA 2008), *Draft guideline for the determination of wetland buffer requirements* (WAPC 2005); and for land planning decisions under the *Planning and Development Act 2005*, *State planning policy 2.9 water* (WAPC 2025a) and *Planning for water guidelines, for the implementation of State planning policy 2.9 water* (WAPC 2025b). *State planning policy 2.9 water* and its guidelines apply only to land planning under the *Planning and Development Act 2005* (WA), not other approval processes.

The *Draft guideline for the determination of wetland buffer requirements* (WAPC 2005) is now more than 20 years old and has not been finalised. Although it remains available for use, it is usually set aside in favour of a standard 50-metre buffer, which is unlikely to be adequate in many circumstances. The draft policy also contains several limitations, one of which is not clarifying the difference between, and different purposes of, a wetland buffer of native vegetation versus an additional separation distance to protect water quality from potentially polluting land uses, as outlined below. A final wetland buffer policy or guideline was recommended in the *Wetlands conservation policy for Western Australia* (Government of Western Australia 1997, p. 10), which is outdated and appears to no longer be in use; *Perth and Peel @ 3.5 million environmental impacts, risks and remedies* (EPA 2015, p. 6 and 36-37); and *Bindjareb Djilba (Peel–Harvey Estuary) protection plan* (DWER 2020, p. 6 and 46). Any updated wetland buffer policy or guideline should recommend an appropriate minimum wetland buffer width; assessment on a case-by-case basis, not a standard width; appropriate protection for Resource Enhancement evaluation category wetlands, not only Conservation category wetlands; clear, consistent guidance on how buffers are to be measured; and resolve the limitations of the current draft.

Wetland buffer widths are determined on a **case-by-case basis** and consider the physical characteristics relevant to the wetland, including the wetland values, attributes and the surrounding land use. Based on the physical characteristics of a wetland, a negotiation buffer can be achieved (WAPC 2025b, p. 26, 2005; EPA 2008).

Wetland buffers should be measured from the outer edge of the mapped wetland boundary. If accurate, the mapped wetland boundary encompasses all wetland vegetation and hydric soils. This is important because imprecise mapping or unclear guidance can result in buffers being measured from the wrong point, leading to inadequate protection of the wetland. In practice, this may have contributed to wetlands being cleared up to the edge of paperbarks and other wetland vegetation, as the true extent of wetland vegetation and soils was not fully captured or understood; or the buffer was not applied from the outer edge of the mapped boundary. Clear, accurate mapping and

consistent measurement methods are essential to ensure that buffers function as intended and provide effective protection.

A **waterway** is the collective term for the following wetland types: **river, creek, floodplain or estuary – peripheral**[24].

A **waterway foreshore area** is "the land that adjoins or directly influences a waterway. It is the area of transition between the edge of the waterway channel and the farthest extent of riparian vegetation, the floodplain and riverine landforms; or a negotiated area endorsed by the DWER (and on the advice of the Department of Biodiversity, Conservation and Attractions where it relates to the Swan Canning Development Control Area)" (WAPC 2025a, p. 8; Department of Water 2012b, p. 2). It includes terrestrial and wetland (riparian) vegetation.

The relevant policies and guidance for waterway foreshore areas are *Operational policy: Identifying and establishing waterways foreshore areas* (Department of Water 2012b); and for land planning decisions under the *Planning and Development Act 2005*, *State planning policy 2.9 water* (WAPC 2025a) and *Planning for water guidelines, for the implementation of State planning policy 2.9 water* (WAPC 2025b).

A foreshore area is measured separately for each bank outwards from either the outer edge of riparian vegetation or the high-water mark (bankfull) level, whichever is the greatest (WAPC 2025b, p. 25; Department of Water 2012b). As for wetland buffers, consistent measurement methods are essential to ensure that foreshore areas function as intended and provide effective protection.

The dimensions of foreshore areas are **site-specific** and based on the defined floodway, climate, hydrology, ecological, social and cultural values, biological and physical features of the waterway, including erosion and other channel formation processes that may change its shape and direction (morphology). They are also based on features such as embankments, consideration of disease vector and nuisance insects (such as mosquitoes and midges), provision of suitable public access, and the existing and proposed adjacent land uses (WAPC 2025b, p. 25; Department of Water 2012b). Foreshores are often variable in width along a section of waterway according to its the size or body of water and the condition of its banks or shore (WAPC 2025b, p. 25).

Fringing wetland vegetation is the wetland vegetation that occur around the margins of wetlands. This term applies to all wetland types. Its variations are described briefly by the DEC (2012i, figure 17, p. 17).

Waterway foreshore areas and wetland buffers assist with protecting water quality. However, they are not designed to protect water quality from potentially polluting land uses. Where these land uses are proposed near a waterway or wetland an **additional separation distance** may be required. The additional separation distance should consider the values, features and functions of the wetland or waterway, the water quality risk and vulnerability of the wetland or waterway, topography, stormwater velocities and the effectiveness of measures designed to minimise nutrient and non-nutrient contaminant export (WAPC 2025b, pp. 24-25; Department of Water 2012b, p. 28-29). Further information is available from the WAPC (2025b, pp. 29-32, particularly point 4(b)(i) on page 32) and DEC (2012l, pp. 30-31). See also degradation of water quality (threat 4).

Inadequate wetland buffer and waterway foreshore area widths

In addition to loss of fringing vegetation and intended wetland buffers and foreshore areas, a related threat is inadequate buffers and foreshore areas. This occurs when buffers and foreshore areas are applied but their width does not provide adequate protection.

[24] The term 'waterway' is generally not used in other parts of the nomination form, except when referring to 'waterway foreshore areas'.

The following *minimum* widths apply in current policy and guidance:

- The EPA (2008) states that "wetlands that are to be protected require a minimum 50 metre buffer distance".
- The WAPC (2025b, p. 25) states that "foreshore widths of less than 30m for waterways or a development setback of 50m for estuaries are generally not considered to provide adequate protection for the ecosystem" The Department of Water (2012b, p. 27) provides similar advice and clarifies the circumstances when the minimum may be appropriate (for example, heavily degraded waterways, where restoration is not proposed and the proposed adjacent land use is not likely to cause additional degradation downstream). It also notes that use of the minimum buffer would not adequately protect waterways functions and services, or enable future restoration.

Site-specific assessment is needed to determine the *appropriate* wetland buffer or waterway foreshore area, and the *minimum* width should not be applied by default, even though it is commonly used for wetland buffers. **Attachment I** summarises recommended wetland buffer widths. It also demonstrates that many significant threats to wetlands (and waterways) are not adequately managed by these minimum buffer widths.

The *Draft guideline for the determination of wetland buffer requirements* (WAPC 2005) *recommends* a 100-metre separation distance[25] to protect against habitat modification for Conservation Category wetlands, and 50 metres for Resource Enhancement category wetlands.

A 100-metre buffer width/separation to protect against habitat modification is applied in the *Approved conservation advice for the Empodisma peatlands of southwestern Australia* (DCCEEW 2023b, p. 34-35), *Approved conservation advice for the assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain* (DCCEEW 2023a, p. 13-14) and *Approved conservation advice for the sedgelands in Holocene dune swales of the southern Swan Coastal Plain* (DCCEEW 2023c, p. 19-20).

Appendices 3 and 4 of *the Draft guideline for the determination of wetland buffer requirements* (WAPC 2005) provide case studies demonstrating site-specific assessments for a Conservation and Resource Enhancement category wetland, respectively. Step 6 is particularly relevant.

Where native vegetation is no longer present within areas that should function as the wetland buffer or waterway foreshore, further consideration is required. This includes assessing whether restoration should be undertaken, whether space should be retained to allow future restoration if resources become available, and whether any justified exceptions to the minimum buffer may be appropriate in highly constrained locations.

Ecological consequences of inadequate wetland buffers and waterway foreshore areas and clearing of fringing wetland vegetation

The ecological functions of wetland buffers, foreshore areas and fringing vegetation (as described above) highlight why their loss has significant consequences.

The WAPC (2025b, p. 24) summarises that wetland buffers and waterway foreshore areas "function by separating a waterway or wetland from the adjacent land use(s) and related activities that pose risks to their values, including habitat modification and loss, changes to hydrology, declining water quality, weed incursion and damage by people, vehicles and animals; reducing the chance a waterway or wetland may adversely affect the surrounding land use(s) (for example, through flooding, hydrological change or midges and mosquitoes); maintaining the ecological processes and

[25] Clear wording is recommended. A "separation distance" is the distance between a particular land use and a wetland. It does not necessarily preclude other land uses within that area, in contrast to a "wetland buffer", which should contain native vegetation and does preclude incompatible land uses.

functions of the waterway or wetland; and providing habitat important for many native flora and fauna species".

Wetland buffers, waterway foreshore areas and fringing wetland vegetation supply coarse woody debris and leaf litter that support diverse assemblages of aquatic invertebrates, which underpin wetland food webs and the species that depend on them. This vegetation also provides movement corridors and refuge habitat for fauna, contributes organic material that fuels primary and secondary productivity, and plays a critical role in maintaining the ecological connectivity and resilience of wetland ecosystems For open water wetlands (the lake, sumpland, river and creek wetland types), this vegetation also protects wetlands from wind and wave erosion.

As noted in Seddon (1972, p. 226), the clearing of fringing vegetation deprives waterbirds of an important supplementary food source. Some smaller wading birds rely more on insects and spiders than on marine worms and shellfish, so even if the shallows remain undisturbed, their food supply is reduced when fringing vegetation is cleared. Terrestrial birds that rely on fringing vegetation for breeding, foraging and refuge habitat, and mammals that depend on them for foraging and refuge, also experience reduced habitat availability.

Variation across wetland types

Policies and guidance for wetland buffers are generally less developed and less clearly defined than those for waterway foreshore areas. The roles and responsibilities for wetland buffers are also less clearly defined. This is likely to impact on the implementation of these policies and may result in poorer outcomes for wetland buffers compared to waterway foreshore areas.

Resource Enhancement category wetlands may be somewhat more likely than Conservation category wetlands to have no wetland buffers or fringing vegetation, or to have wetland buffers that are too narrow. This may reflect the current lack of clarity in policy expectations for these wetlands compared with the generally clearer requirements that apply to Conservation category wetlands. Refer to WAPC (2005) and EPA (2008) for further advice. However, most Conservation category wetlands also do not have adequate wetland buffers.

Interaction with other threats

Removal of wetland buffers, waterway foreshore areas and fringing wetland vegetation:

- reduces shading and accelerates evaporation, exacerbating drying trends associated with altered hydrology (threat 3) and climate change (threat 10)
- increases exposure to weeds by creating disturbed edges and increasing light availability (threat 5)
- increases vulnerability to predation by cats and foxes (threat 6) by reducing refuge habitat
- reduces the capacity of wetlands to intercept nutrients, sediments and other pollutants (threats 4.1, 4.3 and 4.5).

Other threat interactions are like those for wetland loss and fragmentation due to clearing, draining and filling (threat 1) and altered fire regimes (threat 9).

Knowledge gaps

Other than Davies and Lane (1995), which is referenced in **attachment I**, there is limited Western Australian or Swan Coastal Plain-specific research on the minimum or most appropriate widths of wetland buffers and waterway foreshore areas needed to maintain hydrological function, protect water quality, support fauna movement and sustain vegetation communities under current and future climate conditions.

There are also no case studies that track wetland buffer or waterway foreshore decisions across all stages of land-use planning (regional, district, local, subdivision and development) or other approval processes. These case studies would help assess the effectiveness of existing policies and

guidance and identify where decision makers and technical advisors could learn from previous decisions and outcomes. Similarly, a desktop study examining the proportion of wetlands and waterways with adequate buffers and foreshore areas would help to formally document that few buffers and foreshore areas are of adequate width, and would provide additional insight into how effectively existing policies and guidance are being applied.

State government agency roles and responsibilities for providing advice on wetland buffers when land uses change near them are not clearly defined; and there are broader uncertainties regarding responsibilities for wetland conservation, protection and management outside the conservation estate.

There is a lack of clarity about how the term "separation distance" relates to a wetland buffer, including in *Draft guideline for the determination of wetland buffer requirements* (WAPC 2005). In many cases, the intended meaning is not defined. It is therefore unclear whether a separation distance refers to an additional distance required to protect wetlands from potentially polluting land uses, or to the distances used to determine an appropriate wetland buffer. This distinction is important because a separation distance may simply describe the space between a land use and a wetland and does not necessarily exclude other land uses within that area, including cleared parkland, high-maintenance irrigated turf ovals with substantial nutrient inputs, other recreation facilities, firebreaks and parking areas. In contrast, a wetland buffer is intended to contain native vegetation and exclude incompatible land uses.

Additional references

Refer to **attachment I** and **attachment N** for additional references.

3. Altered hydrological regimes

(ongoing; actual impacts; extreme – a system-level driver of ecological decline; whole; increasing)

All natural wetland functions arise from, or are closely linked to, the hydrological regime (Carter *et al.* 1978 in Balla 1994, p. 15). The Department of Environment and Heritage (NSW 2002) provides a concise summary of the ways hydrological regimes can be altered. It notes that: "Alteration to natural flow regimes can occur through reducing or increasing flows, altering seasonality of flows, changing the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels (Walker 1985; Cadwallader and Lawrence 1990; Gehrke *et al.* 1995; Kingsford 1995; Maheshwari *et al.* 1995; Poff *et al.* 1997; Boulton and Brock 1999; Robertson *et al*. 1999, 2001)." Although framed around flowing systems, this description applies equally well to the wetlands of the Swan Coastal Plain when extended to include changes to inundation and waterlogging.

The EPA (2007a, p. 86) identifies altered hydrology as a major driver of biodiversity loss and reduced ecological function in both aquatic and terrestrial systems. On the Swan Coastal Plain, changes to the timing, duration, depth and connectivity of wetting and drying cycles have disrupted the hydrological processes that support wetland function, species composition and ecological dynamics.

Major alterations to water regimes for surface water and groundwater are evident across most of the south west of Western Australia (EPA 2007a, p. 86), which includes the wetlands of the Swan Coastal Plain. The EPA (2007a, p. 86) also reported that "moderate to major levels of change can be largely attributed to widespread land clearing, damming of major waterways, high levels of water extraction and replacement of perennial native vegetation with low water using pastures and crops" (EPA 2007a, p. 86). Impacts vary locally, but no part of the ecological community is insulated from hydrological change due to the interconnected nature of its hydrological regimes; and because climate change is affecting rainfall and recharge (see threat 10 climate change).

The DEC provides further information on wetland hydrology (2012n) and altered hydrological regimes (2012h), including the causes and effects.

Without substantial reductions in groundwater abstraction, improved stormwater management and climate-adapted water planning, altered hydrological regimes will continue to drive long-term declines in the condition and extent of the wetlands on the Swan Coastal Plain.

Drying and groundwater level decline due to groundwater abstraction and climate change

The DEC (2012h) notes the risk of wetlands drying due to groundwater abstraction is particularly prevalent on the Swan Coastal Plain.

For example, the EPA reports watertable declines of up to 6 metres near the crest of the Gnangara mound (EPA 2007a, p. 87), while more recent assessments indicate groundwater levels across the Gnangara Mound have fallen by up to 10 metres, representing a 1000 gigalitre loss of aquifer storage (Government of Western Australia 2024b). Hu *et al.* (2019) confirm that the current decline and abstractions are not sustainable, i.e., natural recharge is not keeping pace with human abstraction.

The EPA (2007a, p. 87) noted that 19% of groundwater management units in the Gnangara Mound exceed their allocation limit and "this means in some areas groundwater extraction is exceeding that required to maintain the environment, and the water resource is being mined". See related advice in the *Gnangara groundwater allocation plan* (DWER 2022b, pp. 7–8).

The *Gnangara groundwater allocation plan* (DWER 2022b) identified a need to reduce annual groundwater abstraction by 54 gigalitres over the next decade, equivalent to about a 19% reduction across the Gnangara groundwater system.

There are currently high levels of non-compliance with Ministerial statement 819, which sets water-level criteria at 30 sites across the Gnangara Mound (DWER 2025a). In 2023–24, 16 of these sites did not meet their absolute minimum or minimum peak water-level criteria (DWER 2025a). The Government of Western Australia (2024b) similarly reports that "over half of the 30 sites used to gauge the health of the groundwater-dependent ecosystems on the Gnangara mound are breaching minimum water levels," indicating that thresholds critical to ecological persistence are already being exceeded.

Similarly, Ministerial Statement 688 sets water level criteria at 23 sites across the Jandakot Mound. In 2023–24, 8 of these sites did not meet their absolute minimum water level or other criteria set by the Ministerial statement (DWER 2026a).

DEC (2012o, p. 141) notes that declining rainfall and increasing groundwater abstraction have caused many lake and sumpland wetland types, which are surface expressions of the groundwater, to become disconnected from the aquifer, with some now receiving surface water from drains instead. This change in water regime has led to the loss of native annual species such as *Fimbristylis velata* and their replacement by weedy perennial grasses and garden escapes.

The consequences of wetland drying due to groundwater abstraction and climate change include reduced inundation periods and prolonged dry phases; loss and alteration of wetland flora species and communities; reduced recruitment and shifts in species composition; loss of fauna habitat; and increased acidity in wetlands such as Mariginiup, Gnangara, Joondalup and Goollelal. Horwitz *et al.* (2008, p. 7) similarly note that periods of inundation will decrease, and periods during which sediments will be exposed to drying will increase, with drying of acid sulphate soils leading to acidification posing serious threats to aquatic biodiversity.

Earlier and faster drying of Forrestdale Lake and wetlands near Busselton almost annually leaves black swan (*Cygnus atratus*) cygnets stranded before they can fly, making rescue necessary (Dee 2024; Leaver 2022; Landry and Lynch 2026; Honeybone 2023). At Forrestdale Lake, this has resulted in the DBCA-managed Cygnet Muster operating in most years since 2009. Wetland loss and fragmentation compound the problem by preventing cygnets from walking to nearby wetlands,

including in Busselton where unfledged cygnets increasingly disperse into unsuitable habitats such as the ocean (Landry and Lynch 2026; Honeybone 2023). Earlier drying also heightens predation risk, as cygnets and other wetland fauna, including the south-western snake-necked turtle (*Chelodina oblonga*), become more exposed to foxes and feral cats (see threat 6.4).

There are also increasing risks to water quality from saltwater intrusion, due to groundwater abstraction in coastal areas and declines in groundwater levels due to climate change. This includes areas such as the *Peel coastal groundwater allocation plan* area (Department of Water 2015, p. 29).

Extensive drainage on the Swan Coastal Plain

Extensive surface and deep drainage in both urban and agricultural areas has exported water from wetlands and caused wetland loss. The EPA notes that "in urban areas the excessive use of drains has contributed to mass depletion of water from landscapes and prevented wetland and groundwater recharge, even during high rainfall. Some wetlands are being drowned by excess water from drains and some groundwater aquifers are not being adequately recharged. Drains also rapidly transport nutrients and other pollutants from the catchment to waterways and wetlands, with little opportunity for filtering by natural ecosystems. It has been estimated that in the Perth metropolitan area alone, there are approximately 830 km of drains managed by the Water Corporation and 3000 km managed by local governments (together, about the distance from Perth to Brisbane)" (EPA 2007a, p. 90). Drainage in agricultural areas has also severely altered water regimes in receiving wetlands (EPA 2007a, p. 90).

The DEC (2012h, p. 20-21) similarly notes that much of the urban, agricultural and industrial landscapes present today across the southwestern coastal areas of WA were made possible through extensive draining, clearing and infilling of wetlands. Much of Perth was built on drained wetlands (for example, the northern Perth area, known as the 'Great Lakes District' (a map is provided on p. 21 or refer to **attachment H**). The large extent of drainage and its contribution to wetland loss is documented in further detail under threat 1 (wetland loss and fragmentation (clearing, draining and filling).

In one case example, the *Murray hydrological studies: surface water, groundwater and environmental water* (Hall *et al.* 2010) documented drains flowing into and out of eight key wetlands in the study area (Barragup Swamp, Airfield wetland, Greyhound Road wetland, Lakes Road wetland, Phillips Road wetland, Scott Road wetland, Benden Road wetland and Elliot Road wetland). Only one of these wetlands lacked a connection to the drainage network.

In addition to causing wetland loss, drainage rapidly transports water away from the landscape, reducing the recharge of rainfall to shallow unconfined aquifers and increasing the volume of water conveyed to downstream receiving surface water bodies (DEC 2012h, p. 21). Drainage away from wetlands can also cause acidification by exposing acid sulfate soils. Refer to threat 4.2.

Drainage into wetlands – wetlands as compensating basins in the drainage network

While stormwater policy and guidance (DWER 2022c, 2017) now aims for stormwater management to mimic natural hydrology, traditional, piped drainage was used for most of the urban stormwater network on the Swan Coastal Plain; and new urban developments can still alter the natural hydrology of wetlands. Where traditional piped drainage into wetlands is used, these wetlands now function as compensating basins within stormwater networks. Davis and Froend (1999, p. 15) note that natural seasonal changes in water regimes have been severely disrupted and some wetlands that previously dried during summer are now permanently flooded.

Yangebup Lake, for example, functions as a 'compensating basin' for the South Jandakot Drainage Scheme, which drains about 200 square kilometres and helps maintain water levels in the Ramsar-listed Thomsons Lake. The scheme allows stormwater to flow into Yangebup, the Kogolup lakes and Thomsons Lake, with pumps used to control maximum water levels; when Yangebup reaches its designated height, water is pumped to Cockburn Sound. Similar drainage schemes affect

many wetlands in urban areas of the Swan Coastal Plain. Davis and Froend (1999, p.15) noted that at Yangebup Lake annual maximum water depths have increased by approximately three meters since the early 1980s and the lake is now permanent, where it was naturally ephemeral.

The DEC (2012h, p. 25) also notes that stormwater in Perth and other urbanised parts of the Swan Coastal Plain commonly enters drainage networks designed to lower groundwater levels, meaning stormwater and groundwater management are closely linked.

Although the information above relates to drainage into wetlands in urban areas, drainage into wetlands in rural areas results in comparable impacts. Drainage into wetlands also introduces nutrients, litter and pollutants, such as pesticides and hydrocarbons, with receiving wetlands usually exhibiting water quality problems, such as algal blooms, odours and nuisance midges (Davis and Froend 1999, p. 15). Refer to threats 4.1 and 4.3.

Excessive inundation and rising water levels

In some areas, land clearing and increased surface runoff have caused rising watertables and excessive inundation. Davis and Froend (1999) note that water levels in many wetlands have risen due to land clearing resulting in local rises in the watertable and increased surface runoff. Excessive amounts of water in wetlands can be just as detrimental as not enough water to ecological systems, through drowning wetland associated vegetation (EPA 2007a, p. 88).

Urbanisation generally increases surface runoff compared to natural landscapes due to the removal of vegetation and increase in impervious surface area (Schirmer *et al.* 2013 in Thompson *et al.* 2021b). In Perth, this runoff is often infiltrated via soakwells, sumps, or bio-filtration basins. Combined with higher regional groundwater during winter, infiltration of urban stormwater can contribute to large increases in groundwater levels after rain (Thompson *et al.* 2021b).

Excessive inundation drowns fringing vegetation, alters flora community structure and reduces habitat diversity.

Dams, other flow control structures and wetland crossings

Dams have captured large proportions of natural flows, altering downstream hydrology. For example, damming of the Canning River has captured about 95% of its flow, turning downstream reaches into a trickling stream (EPA 2007a, p. 88). Refer to threat 12 for further information on how dams, other flow control structures and wetland crossings affect hydrology, the movement of aquatic fauna and affect water quality downstream.

Loss of floodplain connectivity

The EPA (2007a, p. 115-116) notes that floodplain isolation occurs when rivers and creeks are heavily modified to reduce flooding risk, protect agriculture and infrastructure, and prevent loss of life. Measures such as drain diversions, channel straightening and dredging accelerate water flow and disconnect waterways from their floodplains. Both Perth and Mandurah have extended urban development on the floodplains of the Swan and Murray rivers respectively. These residential developments have contributed to the loss of connectivity between the rivers, their floodplains and associated wetlands. Figures are provided on page 116 of EPA (2007a).

The EPA (2007a, p. 115) also states that “no waterway should be isolated from its floodplain: connectivity is the key to maintaining terrestrial and aquatic biodiversity, and land and water productivity. Removing the hydrological connection of floodplain aquatic ecosystems may eventually result in them becoming terrestrial ecosystems. Floodplain isolation also impacts on river ecosystem health. Lack of organic material and debris washed from floodplains decreases the available food and habitat for fish and aquatic organisms, thereby reducing fish stocks and productivity. Studies show that river production following one day of floodplain inundation was equivalent to 82 years of production under normal conditions (Davies, Bunn & Mosisch, 2001).”

Dams and other flow control structures also disrupt floodplain connectivity. Refer to threat 12. See also threat 1, wetland loss and fragmentation.

Other ecological consequences of altered hydrological regimes on the wetlands of the Swan Coastal Plain

In addition to the consequences noted above, the DEC (2012h, p. 32) summarised that "altered hydrology can affect wetland water quality, the species and communities present in individual wetlands, the physical and chemical processes in wetlands, regional populations of wetland species, and in the case of drying, it may ultimately result in the loss of wetlands. In practice, it can be difficult to separate out the effects of altered hydrology, because water has such a fundamental effect on wetland species, and physical and chemical conditions in wetlands."

A decline in condition of flora and fauna often occurs with altered water regime (DEC 2012h, p. 37). Wetland flora establish under the conditions that suit their anatomy and physiology, and when the conditions change, their condition can decline, in very rapid (days) to very long-term (decades) timeframes, depending on the change and their ability to adapt to it. The degree of response depends on the magnitude, rate and duration of water level increase or decrease, the historic changes in water levels, the specific site conditions (soil stratigraphy, etc.), habitat type and species in question, the influence of disturbance impacts (fire, etc.), and finally the condition of the vegetation (Horwitz *et al.* 2009c in DEC 2012h, p. 37).

The DEC (2012h, pp. 32–47) provides additional information on the impacts of altered hydrological regimes on wetlands, including those of the Swan Coastal Plain. It offers a general overview of the effects of altered hydrology and outlines its consequences for water chemistry and quality; wetland populations, communities and species; the condition of vegetation; species distribution and abundance; the loss of species and changes in species composition; local species extinctions; impacts on wetland soils and ecosystems; and the loss of wetlands through drying. Altered hydrological regimes combined with fragmentation of wetland habitats can interrupting ecological processes, including movement and dispersal, reproduction, recruitment and regeneration.

Declines in the condition of aquatic invertebrates due to altered hydrological regimes are described in Sim *et al* (2013).

Interaction with other threats

Hydrological alteration interacts strongly with multiple threats by intensifying the underlying pressures that drive ecological decline. Drainage and groundwater decline accelerate wetland loss and fragmentation (threat 1) and weaken fringing vegetation, buffers and foreshore areas (threat 2) through soil drying and reduced flora resilience. Lower water levels concentrate nutrients and increase algal bloom risk (threat 4.1), while stormwater inflows transport nutrients and pollutants, and altered flow paths can mobilise sediments and pollutants (threats 4.3 and 4.5).

These interactions are further amplified by climate change (threat 10), which is projected to reduce rainfall, increase temperatures and intensify drying of wetlands. Reduced inundation and drying also increases acidification risk in wetlands with acid sulfate soils (threat 4.2), limits dilution of nutrients and pollutants (threats 4.1 and 4.3), and raises fire susceptibility (threat 9). As wetlands contract and vegetation cover declines, opportunities for weed invasion expand (threat 5), and fauna may become more exposed to predators (threat 6).

Knowledge gaps

Although broad-scale hydrological decline on the Swan Coastal Plain is relatively well documented, key uncertainties remain regarding the ecological consequences of altered groundwater and surface-water regimes.

Data on wetland flora and fauna responses to reduced water levels, shortened inundation periods and increased intermittency are limited, constraining the ability to identify particularly vulnerable wetlands or species, or to assess cumulative impacts.

The thresholds for irreversible flora, fauna and ecosystem stress, canopy collapse and loss of wetland function due to altered hydrological regimes are poorly quantified. This includes how these thresholds shift under cumulative impacts, such as fire, disease, nutrient enrichment, drying due to climate change.

The environmental effects of using wetlands as stormwater basins are "poorly quantified but urgently need to be addressed" (Davis and Froend 1999, p. 15). Davis and Froend (1999) also reported that the number and location of minor drains is often not well documented. This is not likely to have changed to date.

The number and location of dams, other flow control structures and wetland crossings is not well documented. This limits the understanding of their individual and cumulative impacts on hydrology and aquatic fauna movements.

Recharge responses under future climate remain uncertain. Gelsinari *et al.* (2024) highlight the need for long-term, consistent datasets to resolve interpretation challenges.

Most wetlands lack fine-scale hydrological models capable of predicting thresholds for wetland flora loss or decline or ecological collapse.

Additional references

Additional references are available in **attachment N**, if required.

4. Water quality degradation

Water quality degradation in the wetlands of the Swan Coastal Plain is due to nutrient enrichment and eutrophication (threat 4.1), which can lead to algal blooms and deoxygenation; acidification associated with acid sulfate soils (threat 4.2); other pollutants from urban, industrial and agricultural sources (threat 4.3); loss of colour due to less tannin inputs (threat 4.4), sedimentation due to disturbed or cleared native vegetation (threat 4.5) and salinisation (threat 4.6). Together, these threats represent a major driver of ecological decline across the ecological community.

The DEC (2012l) provides detailed information on the causes and impacts of water quality degradation on wetlands, including wetlands on the Swan Coastal Plain, and offers guidance on the management of wetland water quality.

Additional references

Additional references are available in **attachment N**, if required.

4.1 Nutrient enrichment, eutrophication, algal blooms and deoxygenation

(ongoing; actual impacts; major; majority (nutrient enrichment) and unknown (algal blooms and deoxygenation); increasing)

Nutrient enrichment and the resulting eutrophication, algal blooms and deoxygenation are long-recognised and widespread water quality threats to wetlands on the Swan Coastal Plain. Water quality improvement plans and related plans consistently identify these as significant threats to water quality in the wetlands of the Plain (DWER 2020, 2025b; Department of Water 2010a, 2012a; Swan River Trust 2009; DBCA 2026). Similarly, the *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and DPAW 2016, p. 3) identified nutrient run-off into wetlands from surrounding rural and residential land uses as a key management issue; and Kemp and John (2006) noted that potentially toxic cyanobacterial blooms are becoming common in the wetlands of the Plain.

The low nutrient-holding capacity of the soils on the Swan Coastal Plain are a particular concern. Most of the Swan Coastal Plain has soils with a low soil Phosphorus retention index (PRI) (<7) (DWER 2025b, p. 31). PRI is a measure of the capacity of the soil to retain Phosphorus. Soils with a low PRI leach Phosphorus easily with the passage of water through the soil profile and across the soil surface. The lower the PRI, the easier it is for Phosphorus to move through the sandy soils (DWER 2025b, p. 31). Studies of the Peel–Harvey estuary catchment show that up to 80 per cent of phosphorus in superphosphate leaches through soil and is lost with winter rain (DEC 2012l, p. 38).

Surface and groundwater transport nitrogen and phosphorus from multiple sources, either dissolved or attached to sediments. Nutrients can leach into wetlands through groundwater where rainfall infiltrates the soil, or be washed in as stormwater carrying dissolved nutrients and soil-bound particulates (DEC 2012l).

In urban and peri-urban areas, nutrient inputs arise from fertilisers applied to lawns, gardens, parks and sports fields (DEC 2012l). Inflowing drains deliver large volumes of water, and nutrients, from surface catchments during the winter months (Davis and Froend 1999). Nutrient inputs from peri-urban areas include on-site wastewater systems. Additional inputs come from landfills, industrial sites and sewerage treatment works. In rural areas, nutrient sources include horticulture, turf farms, viticulture, broadacre agriculture and animal-keeping businesses (DEC 2012l).

Water quality improvement plans, such as *Gabi Warlang Bidi: Water quality improvement plan for the Peel-Harvey Estuary system* (DWER 2025b), provide detailed advice on nutrient inputs. For example, in the Peel-Harvey catchment, grazing for beef contributes 393 tonnes (62 per cent) of the nitrogen (N) and 40 tonnes (67 per cent) of the phosphorus (P) load even though it only occupies 11 per cent of the catchment area (DWER 2025b). Cropping (12 per cent), dairy farming (7.8 per cent), intensive animal industries (3.8 per cent) and septic tanks (3.7 per cent) are the next largest contributors to the N load. Intensive animal uses export the largest N loads per unit area. After beef grazing, the main contributors to the P load are dairy farming (8.1 per cent), horticulture (7.3 per cent), horses (5.5 per cent) and septic tanks (2.6 per cent). In-ground horticulture is by far the largest exporter of P per unit area (DWER 2025b). Additional information on nutrient inputs is provided in Kelsey *et al.* (2010, 2011) and Ovens *et al.* (2008).

Kilminster *et al.* (2011) assessed water quality at 30 sites in the Swan–Canning catchment, 31 in the Peel–Harvey and 28 in the Leschenault, among other sites; most of the catchment sites were rivers, creeks or drains. Nutrient concentrations and dissolved oxygen levels were compared with the ANZECC and ARMCANZ (2000)[26] trigger values for lowland river ecosystem stress. Guideline

[26] These guidelines have since been superseded by the *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG 2018).

values were frequently exceeded for nutrient concentrations across all catchments. In the Peel–Harvey, approximately 70% of samples exceeded total nitrogen (TN) and total phosphorus (TP) guidelines. In the Swan–Canning, around 75% of sites exceeded the nitrate–nitrite (NOx) guideline, whereas only 3% of Peel–Harvey sites did so; however, a higher proportion of Peel–Harvey sites exceeded the ammonium (NH_4^+) guideline (Kilminster *et al.* 2011, p. 31). Dissolved oxygen was often outside guideline ranges, with depletion (<80% saturation) more common than supersaturation (>120%). The Peel–Harvey catchment had the highest proportion of depleted samples, with 45% below 80% saturation (Kilminster *et al.* 2011, p. 31-32).

Kemp and John (2006) and Kemp (2009) studied toxic algal blooms in wetlands on the Swan Coastal Plain. Nutrient enrichment has driven recurrent cyanobacterial blooms across wetlands of the Swan Coastal Plain for many decades, with high nutrient inputs strongly associated with toxin-producing species (Kemp & John 2006). During summer the dominant bloom-causing speciesbelong to the genera *Microcystis* and *Anabaena* and to a lesser extent *Aphanizomenon* and *Nodularia* (Kemp and John (2006). In Kemp and John (2006), 32 natural bloom samples representing 13 lakes were analysed for microcystin. Twenty-eight samples were found to be toxic. The highest total microcystin concentration ranged from 1645 to 8428.6 $\mu g/L^{-1}$, and the lowest concentrations were less than 10 $\mu g/L^{-1}$ with some below the detection limit (< 0.05 $\mu g/L^{-1}$).

Wetlands formerly used for agricultural production can receive substantial nutrient inputs. For example, an estimated 12,000 tonnes of superphosphate was applied to the dry bed of Benger Swamp over forty years (DEC 2012l, p. 37). It is now a nature reserve that supports the endangered Australasian bittern (*Botaurus poiciloptilus*) (refer to the response to **question 16**) and is identified as an Important Bird Area (Dutson *et al.* 2009).

In one example, Lake Gwelup was described as oligotrophic (naturally low in nutrients) in 1993 (Davis *et al*. 1993, p. 194), but it is now experiencing severe and potentially toxic algal blooms (City of Stirling 2026; Murphy 2026), representing a substantial change from its natural low-nutrient condition.

The DEC (2012l) provides further information on the causes and effects of nutrient enrichment and the resulting eutrophication, algal blooms and deoxygenation, particularly pages 36 to 82.

Variation across wetland types

Nutrient enrichment affects all wetland types on the Swan Coastal Plain. For example, nutrient enrichment can adversely affect wetland flora in damplands, which do not contain open water. In open-water wetlands (i.e. the lake, sumpland, river and creek wetland types), nutrient enrichment can result in eutrophication, algal blooms and deoxygenation.

Ecological consequences of nutrients enrichment and the resulting eutrophication, algal blooms and deoxygenation in wetlands on the Swan Coastal Plain

The ecological consequences of nutrient enrichment and the resulting eutrophication, algal blooms and deoxygenation are substantial. Davis and Froend (1999) noted the "consequences of nutrient enrichment are well documented (McComb and Davis 1994) and include the development of nuisance blooms of blue-green algae, odours and anoxic conditions. Waterfowl, fish and large invertebrates may suffer direct lethal effects due to both algal toxicity and periods of reduced oxygen availability. Waterfowl deaths may also occur as a result of outbreaks of botulism, caused by the bacterium, *Clostridium botulinum*, and promoted by anoxic conditions (McRoberts 1989). Outbreaks of nuisance midges at Perth wetlands are also a direct consequence of the development, and subsequent decay, of large algal blooms (Davis et al. 1988, 1989, 1990; Pinder *et al.* 1991, 1992)."

The DEC (2012l, p. 3) provides similar advice and notes the consequences may include less nutrient-sensitive species and more nutrient-tolerant species and reduced biodiversity. The DEC

2012l, p. 47) notes that outbreaks of the bacteria *Clostridium botulinum* are almost always associated with decomposing algal blooms and anoxic conditions in nutrient enriched wetlands.

Fish kills on the Swan Coastal Plain can be attributed to toxic algal blooms and low oxygen levels following an algal bloom collapse. In 2003, more than 110 000 fish died in the lower Serpentine River near Mandurah and more than 100 000 died in the Swan Estuary[27] following dinoflagellate blooms (*Karlodinium* sp.) toxic to fish (EPA 2007a, p. 112). In 2004 more than 50 000 fish died in the lower parts of the Serpentine and Collie rivers (EPA 2007a, p. 112).

As noted in the response to **question 13c**, excessive nutrients infiltrate catchment soils and enter wetlands, where they are stored in sediments. These legacy nutrients take decades to deplete and discharge, so improvements in water quality can only be realised over similarly extended timeframes (DWER 2025b, pp. 94, 225). This means that key wetland functions and communities can remain degraded for decades, even after external nutrient inputs decline. Despite these constraints, targeted nutrient-reduction programs have demonstrated localised improvements, suggesting that broader catchment-scale action would benefit the wetlands.

The DEC (2012l, p. 43-49) and water quality improvement plans provide further information about the ecological consequences of nutrient enrichment and the resulting eutrophication, algal blooms and deoxygenation.

Interaction with other threats

Nutrient enrichment, and the resulting eutrophication, algal blooms and deoxygenation interact strongly with other threats. For example:

- sedimentation (threat 4.5) can transport nutrient-rich particles into wetlands by mobilising fine sediments during erosion, runoff or channel disturbance, which then settle in wetlands and contribute to internal nutrient stores.
- other pollutants (threat 4.3) can compound eutrophication impacts by stressing aquatic biota, reducing their tolerance to low oxygen, and altering microbial processes that regulate nutrient cycling
- weeds (threat 5) proliferate in nutrient-enriched conditions, outcompeting native vegetation. The EPA (2007a, p. 113) notes that eutrophic conditions can drastically alter biodiversity in wetlands, rapidly turning them into weed-dominated systems.
- poor water quality increases flora and fauna susceptibility to disease (threat 8) and reduces habitat quality for native wetland fauna, increasing vulnerability to predation (threat 6) by degrading submerged vegetation[28] that provides refuge, forcing aquatic fauna into more exposed areas during low-oxygen conditions, and causing behavioural stress that reduces their ability to detect or evade predators
- climate change (threat 10) is expected to intensify eutrophication by increasing water temperatures (which accelerate algal growth and reduce oxygen solubility), reducing dilution capacity during dry periods, and altering rainfall patterns that influence nutrient mobilisation and flushing
- A combination of flocculant sediment (from organic enrichment of decomposing algal blooms, turbidity from algal blooms and suspended sediment can cause an ecological regime shift where macrophytes are lost for the system and may not be able to recolonise due to the

[27] The Swan Estuary is not included in this nomination; however, this example is relevant because nutrient inputs and associated algal-bloom events operate at a catchment-wide scale. It is reasonable to infer that the processes leading to this fish kill also pose comparable risks to other wetlands within the same catchment.

[28] For example, due to poor light penetration.

changed conditions. This can result in consistent algal blooms and significant loss of biodiversity (Davis *et al.* 2010).

Knowledge gaps

The thresholds at which nutrient concentrations trigger algal blooms, oxygen depletion or shifts in vegetation communities are not well defined, particularly under changing hydrological and climatic conditions. There is also limited information on the effectiveness of different management interventions. These gaps constrain the ability to predict ecological responses and to design targeted nutrient-reduction strategies.

4.2 Acidification due to exposure of acid sulfate soils

(ongoing; actual impacts; potentially major; unknown scope, however mapping indicates large areas are susceptible; increasing)

Acidification due to exposure of acid sulfate soils is a significant threat to the wetlands of the Swan Coastal Plain. The EPA (2007a, p. 101) notes this typically arises when the lowered watertable exposes acid sulfate soils or iron-rich groundwater to oxygen, triggering chemical and microbial reactions that generate sulfuric acid. Acid sulfate soils are benign when saturated below the watertable but become acidic when drained, excavated or otherwise exposed to air. This acidity mobilises metals, and potentially also nutrients, in the soil. The DEC (2012l), Department of Environmental Regulation (2015) and Environmental Protection and Heritage Council and Natural Resource Management Ministerial Council (2011) provide similar information. Acid sulfate soils are commonly located around wetlands but can also occur beneath the watertable in the areas between wetlands (DWER 2022b, p. 66).

The EPA (2007a, p. 102) notes that coastal groundwater acidity emerged as a major issue in Perth in the early 2000s, when acidic groundwater (as low as pH 1.9) contaminated with aluminium and arsenic was detected in Stirling[29] household bores and nearby wetlands. The acidification was linked to heavy groundwater abstraction and dewatering, which exposed acid sulfate soils. Subsequent investigations showed widespread shallow-groundwater acidification on the Gnangara and Jandakot mounds, with pH values down to 2.4 and elevated aluminium and arsenic. High aluminium concentrations are toxic to wetland flora and aquatic fauna, while arsenic poses long-term ecological and human-health risks. Several Gnangara wetlands are now permanently acidified (for example, Lake Gnangara), and others have experienced episodic events (for example, Lake Mariginiup and Lake Jandabup). Wetland acidification due to exposing acid sulfate soils occurs widely across coastal parts of the Swan Coastal Plain, including the coastal parts of the Swan–Canning, Peel–Harvey, Leschenault and Vasse–Wonnerup catchments (EPA 2007a, p. 102).

Kilminster *et al.* (2011) studied the impact of acid sulfate soils on water quality at 30 sites in the Swan–Canning catchment, 31 in the Peel–Harvey and 28 in the Leschenault; most sites were rivers, creeks or drains. The study compared water quality with the ANZECC and ARMCANZ (2000) [30] trigger values for lowland river ecosystem stress. Around 30% of samples from the Swan Coastal Plain were below pH 6.5 (Kilminster *et al.* 2011, p. 31-32).

The *Gnangara groundwater allocation plan* (2022b, p. 66) notes that "Lakes Gnangara and Mariginiup have become acidic, and Lake Jandabup has experienced intermittent acidification (Sommer and Horwitz 2009) – although it has since recovered after supplementation improved water levels at the lake. Acidity is also affecting Mussel Pool in Whiteman Park. Decline in the watertable between wetlands has exposed acid sulfate soils in upper parts of the Superficial aquifer, causing acidification of over 380 km2 of the shallow aquifer (Degens and Thornton 2018). If this continues, it will eventually limit the use of shallow groundwater in these areas. While pumping

[29] A suburb of Perth.

[30] These guidelines have since been superseded by the *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG 2018).

from greater depth may avoid drawing acidified groundwater, it can also draw the acidic shallow water deeper into the aquifer – which occurred in the Mirrabooka borefield (Appleyard and Cook 2008)."

The DEC (2012l, pp. 82-110) provides further information about the causes and effects of acidification of wetlands, including wetlands on the Swan Coastal Plain.

Variation in the impacts of acidification on wetlands of the Swan Coastal Plain

The *Acid sulfate soil risk map, Swan Coastal Plain (DWER-055)* spatial dataset (DataWA 2017) identifies areas where acid sulfate soils are likely to occur. Wetlands are at increased risk of acidification where excavation, drainage or dewatering takes place on acid sulfate soils in or near wetland areas (for example, during land or infrastructure development), or where groundwater levels are declining in landscapes that contain acid sulfate soils (threat 3).

Ecological consequences of the acidification of wetlands on the Swan Coastal Plain

The ecological consequences of acidification can be severe. The DEC (2012l, p. 92) notes that "wetland acidification affects wetland organisms both directly and indirectly. In addition to increased acidity, the key impacts of acidification are deoxygenation, the release of metals and metalloids and increased turbidity and smothering. Changes in bioavailability of nutrients can also occur. Each of these processes can have serious detrimental effects on organisms, and can be compounded when more than one occurs. The overall effect on wetlands is typically to alter their ecological characteristics and to reduce their biological diversity. Fish, crustaceans and molluscs are typically particularly sensitive to the direct and indirect effects of acidification. Changes in pH can also accelerate or retard the degradation of pesticides in wetlands."

In addition to the advice above, the DEC (2012l, p. 3) notes that the consequences may include a shift toward less acid-sensitive and more acid-tolerant species, increased numbers of acid-tolerant mosquitoes, impaired health or death of flora and fauna and altered species composition.

Kilminster et al. (2011, p. 2) also notes "acidic discharge has been implicated in fish kills (Brown et al. 1983; Hart et al. 1987). Damage to fish gills and skin from acid exposure increases the susceptibility of fish to fungal infections such as 'red spot' (Sammut et al. 1996; Kiryu et al. 2003)."

The DEC (2012l, pp. 92-95) provides further information about the ecological consequences of acidification of wetlands, including wetlands on the Swan Coastal Plain.

Interaction with other threats

Acidification interacts with other threats in the following ways:

- groundwater decline (threat 3) increases the likelihood of exposing acid sulfate soils by lowering the watertable, allowing previously saturated acid sulfate soils to oxidise and generate sulfuric acid when they dry
- sediments can release additional pollutants (threat 4.3) under acidic conditions because low pH mobilises metals bound to sediments, increasing their bioavailability and ecological toxicity. Changes in the bioavailability of nutrients can also occur (threat 4.1).
- climate change (threat 10) is expected to intensify acidification risk by further lowering groundwater levels during prolonged dry periods, increasing evaporation that concentrates acidity, and altering rainfall patterns that reduce natural flushing and buffering processes.

4.3 Other pollutants, such as pesticides, metals, hydrocarbons and excessive pathogens

(ongoing; actual impacts; widely present but somewhat unknown severity, scope and trend)

Many of the wetlands of the Swan Coastal Plain have been contaminated with metals; pesticides, including organochlorine pesticides; hydrocarbons, including polycyclic aromatic hydrocarbons (PAHs); perfluoroalkyl and polyfluoroalkyl substances (PFAS); excessive pathogens; and other pollutants. However, the scope and severity of the problem is often not well documented.

Davis and Froend (1999) note that few wetlands within Perth remain completely free of contamination with either pesticides or heavy metals. Organochlorine pesticides detected in wetland sediments, such as DDT, dieldrin, chlordane and heptachlor, are attributed to a state government program to control Argentine ants (undertaken from the mid-1950s to 1986) and to treatments for termite control within urban areas (Davis and Froend 1999; Davis *et al.* 1993). Davis *et al.* (1993) provides historical data from a study conducted in the 1990s. These pesticides, along with many metals, are highly persistent in soils and sediments and can bioaccumulate in wetland food webs, remaining in wetlands for many decades after their application or release has ceased.

PFAS were found in all surface waters sampled in a study in the Perth metropolitan region by the DWER (Richmond 2022). The Heads of Environmental Protection Authorities Australia and New Zealand (HEPA) (2025) identified the following as sensitive receptors for PFAS: areas identified with any of the nine Matters of National Environmental Significance (MNES) protected under the EPBC Act, and areas of environmental significance as identified in specific jurisdictions; protected areas, such as parks and other reserves; aquatic and terrestrial ecosystems, such as Ramsar sites; ecological receptors; wetlands; dams, bores, stockwater and irrigation water; biota, such as aquatic flora and fauna, waterbirds, and those species at the top of affected food chains; groundwater-dependent ecosystems; and predators of PFAS-affected aquatic fauna. Many of these are relevant to the wetlands of the Swan Coastal Plain. Receptors are defined as "living organisms (including humans), the habitat which supports such organisms, or natural resources that could be adversely affected by environmental contamination resulting from a release at, or migration from, a site" (HEPA 2025).

Lettoof *et al.* (2020) studied sediments and western tiger snake (*Notechis scutatus occidentalis*) livers from four Perth wetlands along an urban gradient. All 17 metals and trace elements sampled were detected in the sediments of wetlands as well as 16 in the livers of tiger snakes. Arsenic, copper, mercury, lead, selenium and zinc were at concentrations exceeding government trigger values in at least one sediment sample. Two organochlorine pesticides and six of seven PAHs were detected in the sediments of a single wetland, all exceeding government trigger values, but were not detected in tiger snakes. Metals and trace elements were generally in higher concentration in sediments and snake livers from more heavily urbanised wetlands. These patterns indicate that tiger snakes can reflect contaminant loads in their wetland habitats and support their use as bioindicators of wetland contamination.

Past and ongoing pollution sources have also contributed to pollutant loads in wetlands. A survey of 522 light industries adjacent to the Swan–Canning rivers, undertaken before the Environmental Protection (Unauthorised Discharges) Regulations 2004 (WA), showed that wastewater containing chemicals and pesticides was disposed of through soakage into soil (19%), stormwater drains (16%), septic tanks (13%) and sewers (Swan River Trust 1999, cited in EPA 2007a, p. 114). About 50% of industrial premises did not undertake wastewater treatment and less than 5% conducted periodical testing and maintenance of their treatment facilities. Many light industries did not understand the potential contamination risk or best practices for industrial wastewater management. These past practices are likely to have contributed to persistent contaminant issues that continue to affect water quality and ecological health.

Several wetlands on the Swan Coastal Plain were also historically used as landfill sites (Hirschberg 1993; Western Australian Museum undated(c); Seddon 1972, p. 231). While many of these areas

have since been filled and are no longer recognisable as wetlands, the waste remains hydraulically connected to groundwater, resulting in ongoing contamination that affects water quality in connected wetlands. Evans (2009) studied pollutants in groundwater at three historical landfill sites in the Swan Canning catchment.

Contemporary studies further demonstrate the range and extent of pollutants in the catchment. PFAS were found in all surface waters sampled in a study in the Perth metropolitan region by DWER (Richmond 2022). HEPA (2025) identified numerous sensitive receptors for PFAS, including Matters of National Environmental Significance under the EPBC Act, protected areas, aquatic and terrestrial ecosystems such as Ramsar sites, ecological receptors, wetlands, dams, bores, stockwater and irrigation water, aquatic flora and fauna, waterbirds, species at the top of affected food chains, groundwater-dependent ecosystems and predators of PFAS-affected aquatic fauna. Many of these receptors are relevant to the wetlands of the Swan Coastal Plain. Receptors are defined as "living organisms (including humans), the habitat which supports such organisms, or natural resources that could be adversely affected by environmental contamination resulting from a release at, or migration from, a site" (HEPA 2025).

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Foulsham (2009) undertook a snapshot assessment of water quality and sediments at six sites across four industrial drains in Perth. All four drains, Herdsman Lake, Bayswater, Bibra Lake and Bickley Brook, were affected by contamination from industrial activities and other anthropogenic sources. The extent and nature of contamination differed between sites and varied across the three sampling periods. Contaminants detected in either sediments or water included hormones, in particular the synthetic hormone ethinylestradiol; polychlorinated biphenyls (PCBs); metals, including aluminium, arsenic, lead, chromium, copper, nickel and zinc; PAHs; total petroleum hydrocarbons (TPHs); surfactants, both anionic and non-ionic forms; phenolic compounds, in particular phenol and creosol; and nutrients, primarily total oxidised nitrogen, organic nitrogen and particulate phosphorus.

Kilminster *et al.* (2011) sampled for metals and metalloids in a study on the impacts of acid sulfate soils on water quality at 30 sites in the Swan–Canning catchment, 31 in the Peel–Harvey and 28 in the Leschenault, among other sites; most catchment sites were rivers, creeks or drains. Metals and metalloids were assessed against the ANZECC and ARMCANZ (2000)[31] trigger values for 95% freshwater species protection (high reliability), with hardness-modified trigger values (HMTVs) applied for cadmium, chromium, copper, nickel, lead and zinc. Aluminium, iron, copper, cobalt, zinc and chromium most frequently exceeded trigger values, with exceedance rates for each catchment provided in Appendix D of the report (Kilminster *et al.* 2011). Aluminium exceeded its trigger value in most samples across all catchments, with higher exceedance rates for total (77–100%) than soluble fractions (45–89%). Iron commonly exceeded trigger values in all catchments (Kilminster *et al.* 2011). Kilminster *et al.* (2011, p. 67) noted that multiple sources are likely to have

[31] These guidelines have since been superseded by the *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG 2018).

contributed to the metals detected, including urban, agricultural and industrial inputs, as well as disturbed acid sulfate soil materials.

Nice *et al.* (2009) assessed 77 drain sites across 27 Swan–Canning sub-catchments for the Non-Nutrient Contaminants Program, analysing surface water and surficial sediments for a broad suite of stormwater-associated pollutants. These included PAHs, total petroleum hydrocarbons (TPHs), polychlorinated biphenyls (PCBs), organochlorine and organophosphorus pesticides, herbicides, anionic surfactants, metals, microbial pathogen indicators (faecal coliforms and enterococci), major ions and physical parameters. These pollutants were found at many drain sites and the resulting data were used to prioritise sub-catchments and contaminants for further assessment.

Foulsham *et al.* (2009) sampled ten Swan and Canning catchment drainage systems four times over a one year period and reported that "twenty five pesticides (including insectides and herbicides) were detected in total, of which simazine, diuron and atrazine were the most prevalent, being detected in every drain during almost every sampling event. Diazinon, trifluralin and metachlor were also detected in several drains. The herbicides simazine, diuron and metolachlor were measured above freshwater ecosystem trigger values (ANZECC & ARMCANZ 2000[32]), as were the insecticides diazinon, chlorpyrifos and dieldrin. Two metabolites of atrazine were also detected. Atrazine has been linked to hermaphroditism in male frogs, mutagenicity and carcinogenicity (Hayes *et al.* 2002; Cox 2002). Simazine is a suspected endocrine disrupting chemical (Cox 2002). The highest herbicide concentrations were detected in Southern River, Belmont South and Bennett Brook during the wetter April and July months." Foulsham *et al.* (2009) also reported regular detection of banned organochlorine pesticides chlordane, dieldrin and heptachlor, or the metabolites of these compounds in this study and noted "a number of these are suspected endocrine disrupting compounds, having oestrogenic properties that are able to interfere with reproductive system function, inducing reproductive organ abnormalities and fertility problems (Ulrich *et al.* 2000). These compounds are also carcinogenic, mutagenic and teratogenic (Fox 1995). They are also environmentally persistent and most likely to be a legacy of historic use as they have been banned for many years (Department of the Environment, Water, Heritage and the Arts 1997)." A wide variety of PAHs were detected in all sub-catchments but did not exceed trigger values. Phenanthrene, fluoranthene, pyrene and chrysene were the most commonly detected PAHs.

Other studies undertaken for the Non-Nutrient Contaminants Program focused on the Swan–Canning Estuary, which is not included in the nomination, but their findings, together with other investigations, indicate that similar pollutants are likely to occur in wetlands elsewhere in the catchment. These studies include Nice (2009) and Novak and Hoeksema (2022a, 2022b). Nice (2009) found metals, organochlorine pesticides and PAHs in surficial sediments (top 3 cm) at all 20 Swan–Canning catchment sites examined. These sites were mostly downstream of stormwater drains or near disused landfills identified as contamination priorities in earlier studies. Novak and Hoeksema (2022a) compared results from the same 20 sites assessed in the 2009 baseline study and expanded the analyte suite to include PCBs and glyphosate. At an estuary-wide scale, Novak and Hoeksema (2022a) found that contamination patterns in the Swan–Canning Estuary were generally consistent with those reported by Nice (2009). Hoeksema (2022b) detected PFAS in surface water at every site.

DEC (2012l, pp. 111–130) provides additional detail on the sources of contamination by pesticides, metals and hydrocarbons, and excessive pathogens from animal waste. DEC (2012g, p. 20) provides brief information on excessive pathogens caused by farmed animal faeces and dead farmed animals.

Ecological consequences of pollutants such as pesticides, metals, hydrocarbons, including PAHs, PFAS and excessive pathogens for the wetlands of the Swan Coastal Plain

[32] These guidelines have since been superseded by the *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG 2018).

Pollutants such as pesticides and heavy metals reduce the diversity of aquatic fauna through both direct lethal effects and chronic or sub-lethal impacts (Davis and Froend 1999). These include impaired breeding success in waterbirds and increased susceptibility to disease, and the loss of grazing organisms such as Daphnia can contribute to nuisance algal blooms (Davis and Froend 1999). PFAS, as highly persistent "forever chemicals", also affect aquatic flora and fauna and are currently being investigated in relation to turtle shell deformities (A. Sturm pers. comm. 2026). In line with this broader understanding, DEC (2012l, pp. 3, 94, 111–130) notes that pesticides, metals and hydrocarbons commonly impair the health of flora and fauna, disrupt physiological processes such as photosynthesis, growth and reproduction, and can lead to disease or death. These pollutants may favour tolerant species over sensitive species, resulting in shifts in species composition and reduced biodiversity. Excess pathogens from animal waste can also cause illness, behavioural distress and mortality in fauna, and reduce the abundance and diversity of sensitive species.

Organochlorine pesticides, metals, PAHs and PFAS are persistent pollutants that can bioaccumulate in wetland food webs (Australian and New Zealand Governments (ANZG) 2018; HEPA 2025; DEC 2012l).

The *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG 2018), together with the technical publications linked within them, provide advice on the aquatic toxicology of metals; pesticides, including organochlorine pesticides; hydrocarbons, including PAHs; PFAS; and other pollutants in aquatic environments. The ANZG (2018) also provides advice on factors that affect bioavailability and toxicity for some pollutants.

The DEC (2012l) also provides further information on the ecological consequences of various pollutants on wetlands, including pesticides (pp. 111–113), metals (pp. 94 and 120–121) and hydrocarbons (p. 124).

Knowledge gaps

There is very limited monitoring of pesticides, metals, hydrocarbons, PFAS and other pollutants in the wetlands of the Swan Coastal Plain.

The fate of heavy metals and pesticides within wetland ecosystems and the extent of bio-magnification and bio-accumulation within wetland food chains, in southwestern Australia, remains poorly known.

4.4 Loss of colour due to less tannin inputs

(ongoing; actual impacts; unknown severity; unknown scope; unknown trend)

Many wetlands on the Swan Coastal Plain are tannin stained, having some of the darkest colouration in the world (Wrigley *et al.* 1988). Tannins are complex organic compounds (polyphenols) occurring in various flora (DEC 2012e, p. 95). Tannins in wetlands are derived from the leaves, bark and roots of fringing vegetation; the breakdown of submerged, emergent and floating wetland flora; leaf litter and soil organic matter from the catchment; and organic-rich inflows of leaf litter and soil organic matter from the surrounding catchment and groundwater. In wetlands connected to organic-rich aquifers, groundwater can also carry dissolved organic carbon, including tannins and humic substances[33]. Tannin staining reduces the likelihood of algal blooms (through light limitation and alleopathy) and has significant impact on wetland biodiversity ecological character. Sommer *et al*. (2008) found these wetlands had the highest invertebrate species richness and endemism on the Swan Coastal Plain.

When fringing wetland vegetation and terrestrial vegetation in the catchment is lost or degraded (threats 2 and 1), the sources of tannin input are reduced, contributing to a decline in the natural

[33] Humic substances are complex organic compounds derived from plant materials, formed from the decomposition products of polyphenols such as tannins (DEC 2012e, p. 14).

tea-coloured water typical of many Swan Coastal Plain wetlands. Clearing of fringing vegetation also reduces shading and ultraviolet light breaks down the complex hydrocarbons removing the colour.

Variation across wetland types

Loss of colour due to less tannin inputs is relevant to the open-water wetlands (i.e. the lake, sumpland, river and creek wetland types).

Ecological consequences of loss of colour due to less tannin inputs

Reduced tannin levels have important ecological consequences because the loss of natural water colour alters light penetration, nutrient dynamics, temperature regulation, ecological processes, and the functioning of organisms that depend on these conditions, leading to broader changes in wetland condition.

The DEC (2012e, p. 12) summarises that the "presence of wetland vegetation… moderates light and temperature. Some wetlands naturally have tea-coloured water due to staining with tannin, a dark-coloured chemical produced by plants. This tannin staining limits the amount of light that penetrates the water column, which in turn limits the activity of organisms in the water that need light in order to photosynthesise (such as submerged plants, cyanobacteria and algae) or to fix nitrogen (such as cyanobacteria). In this way, tannin staining is thought to play a role in keeping harmful algal and cyanobacterial blooms at bay, and in turn, moderating the populations of organisms that consume algae, such as midges and mosquitoes. Shading from vegetation also keeps wetland waters cool, and may contribute to controlling the populations of species which proliferate in warmer waters, such as some species of nuisance midges".

4.5 Sedimentation and increased turbidity

(ongoing; actual impacts; unknown severity; unknown scope; unknown trend)

Erosion within catchments and disturbed buffers increases sediment loads, leading to infilling, turbidity and smothering of wetland habitats. These changes reduce habitat complexity and affect species reliant on clear, shallow water.

The EPA (2007a, pp. 105-107) and Government of Western Australia (2023b) provide information on the causes and impacts of sedimentation on wetlands, including the wetlands of the Swan Coastal Plain. This threat intuitively applies to the creek, river and floodplain wetland types but can also apply to other wetland types, where it can contribute to the gradual filling of wetlands over time.

The EPA (2007a, p. 105) summarises that eroded soil is gradually deposited into wetlands by wind and water erosion, or via mass collapse of soil structures (such as land slides, bank collapse and slumping). When eroded soil is deposited into wetlands it becomes sediment. Fine sediments (e.g. silt) can be suspended in water and carried quickly downstream. Coarser sediments (e.g. sand, pebbles and rocks) slowly roll along the riverbed and deposit in pools, river channels and other wetland types. During low flows, sediments begin to settle out of the water in a process termed 'sedimentation'. In contrast, during large flows and floods, sediments are scoured from the riverbed or banks of rivers and creeks and transported downstream or out to sea. Over time this dynamic process of sediment deposition and scouring contributes to the reshaping of rivers and creeks. In other wetlands types, sedimentation is more problematic, contributing to the gradual filling of wetlands over time (EPA 2007a, p. 105).

The DEC (2012l, pp. 130-137) provides information on the causes and impacts of increased turbidity on wetlands.

Ecological consequences of sedimentation and turbidity on the wetlands of the Swan Coastal Plain

Mobilised coarse sandy sediment tends to accumulate in areas of slow waterflow and may smother bottom-dwelling organisms and their habitats (Government of Western Australia (2023b). Increased sediment loads can smother benthic (bottom-dwelling) habitats, reduce light penetration and inhibit photosynthesis, leading to declines in submerged and emergent vegetation. Loss of vegetation structure reduces habitat availability for invertebrates, fish and waterbirds, and can disrupt feeding, breeding and refuge functions. Elevated turbidity also interferes with visual feeding, impairs respiration in aquatic fauna through gill clogging, and can reduce the survival of eggs and larvae. Over time, these impacts diminish ecological function, reduce biodiversity and compromise the resilience of wetland ecological communities.

Further information on the ecological consequences of sedimentation and increased turbidity is available from the DEC (2012l, pp. 130-137) and Government of Western Australia (2023b).

4.6 Salinisation

(ongoing; actual impacts; unknown severity; unknown scope; unknown trend)

Changes to hydrology, including reduced freshwater inputs, altered groundwater levels and increased evaporation, can elevate salinity within wetland systems. In some areas, irrigation practices also contribute to salinisation by raising local groundwater levels and mobilising salts, increasing the risk of saline groundwater or surface flows entering wetlands.

The DEC (2012k, p.1) summarises that there are two main types of secondary salinisation in Australia; dryland salinisation and irrigation salinisation. Dryland salinisation occurs on non-irrigated land (including wetlands) and usually results from broadscale clearing of native vegetation and its replacement with crops and pastures that use less water, while irrigation salinity occurs through the addition of irrigation water to a landscape. In both cases, a change to the water balance leads to accelerated land and water salinisation.

The EPA (2007a, p. 83) notes that irrigation salinity is already a problem in some irrigated areas with poorly drained soils and shallow, naturally saline groundwater. About 20% of the southern Swan Coastal Plain, from Gingin to Dunsborough, is at risk of irrigation salinity. Salt scalds are already evident in some areas of the Harvey River catchment.

As noted under threat 3 (altered hydrological regimes), there is also an increasing risks to water quality from saltwater intrusion, driven by groundwater abstraction in coastal areas and further exacerbated by declines in groundwater levels due to climate change. This includes areas such as the *Peel coastal groundwater allocation plan* area (Department of Water 2015, p. 29).

Ecological consequences of salinisation of the wetlands of the Swan Coastal Plain

As salinity accumulates, wetland vegetation and dependent fauna become stressed or displaced, and ecological processes are progressively impaired, reducing the resilience and long-term condition of the ecological community. The DEC (2012k, pp. 3, 7–13) summarises the impacts of salinisation on wetlands, including impaired health or death of flora and fauna, shifts from salt-sensitive to more salt-tolerant species, altered species composition and reduced biodiversity. Further detail is provided in DEC (2012k, pp. 7–13).

5. Invasive weeds

(ongoing; actual impacts; potentially extreme – a driver of ecological decline; whole; increasing)

Invasive weeds pose a major and ongoing threat to the wetlands of the Swan Coastal Plain. Weed invasion is ongoing and widespread, and aggressive weeds, such as *Watsonia* spp., arum lily (*Zantedeschia aethiopica*), couch (*Cynodon dactylon*), kikuyu grass (*Cenchrus clandestinus*), spiny rush (*Juncus acutus*), divided sedge (*Carex divisa*), *Isolepis hystrix* and *Sparaxis bulbifera* displace

native sedges, rushes and other wetland understorey flora. This reduces habitat quality and floristic diversity, alters fire regimes and undermines resilience to other threats.

The DEC (2012p, pp. 4) found that weeds have invaded almost every wetland in the south-west of Western Australia, which includes the Swan Coastal Plain. The EPA (2007b, p. 150-151) noted that the Swan Coastal Plain and the Jarrah Forest IBRA bioregions have the highest number of weeds in the State, with 700-800 identified species. Similarly, the *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and DPAW 2016, p. 3) identifies weed invasion as a key management issue.

According to the EPA (2007b, p. 153), the most serious aquatic or wetland environmental weeds in the south-west of WA are spiny rush (*Juncus acutus*), divided sedge (*Carex divisa*), *Isolepis hystrix*, *Sparaxis bulbifera* and couch (*Cynodon dactylon*). The EPA (2007b, p. 152) also identified watsonia (*Watsonia* spp.) and arum lily (*Zantedeschia aethiopica*) among the worst terrestrial environmental weeds in the region, both of which are also major invaders of wetland habitats.

Wetlands are particularly vulnerable to weed invasion where soil or native vegetation is disturbed, exposing bare ground that provides ideal germination sites, especially along wetland edges adjoining highly modified landscapes such as housing areas, parklands, paddocks, road verges and tracks (DEC 2012p, pp. 4-6). Disturbance increases space and light availability, creating favourable conditions for weed growth. These disturbances may be natural, such as drying and wetting cycles, drought or fire, or arise from human activities including altered hydrology, vegetation clearing, garden-waste dumping, farmed animal access and vehicle movement. Frequent fires and the spread of Phytophthora dieback in wetlands further promote weed invasion and establishment (DEC 2012p, pp. 4-6.

The EPA (2007a, p. 98) found that surveys on the Swan–Canning estuary and its major tributaries (the river and creek wetland types) indicate minimal retention of native vegetation and a significant weed presence. Most of the estuary foreshore has been found to have more than 70% weed cover, indicating a substantial shift of fringing vegetation from its natural state.

The DEC (2012p) provides further information on invasive weeds and their management and impacts on wetlands, including the wetlands of the Swan Coastal Plain. The (DEC 2012p, pp. 10-35) lists wetland weed species, most of which occur on the Swan Coastal Plain.

Ecological consequences of weeds on the wetlands of the Swan Coastal Plain

The EPA (2007b, p. 150) summarised that "weeds can rapidly invade natural sites where the soil has been disturbed, where there has been clearing, or where fire regimes have changed. Weeds also thrive in nutrient rich soils or where fertilizers have been added. Weeds threaten the survival of many native flora and fauna because they grow faster and out-compete native plants for available nutrients, water, space and sunlight. They can smother and replace native plants including those used by animals for habitat and are commonly resilient to pests or diseases. Consequently, weeds have the potential to dominate and simplify natural ecosystems. They may also lead to significant changes to ecosystems and fire regimes." In addition to displacing native flora and reducing habitat quality, weeds can also diminish the availability of food resources relied on by native herbivores and invertebrates.

The DEC (2012p, p. 9) similarly summarised that "weed invasion poses a serious threat to the biodiversity and conservation values of wetlands and can disrupt key ecosystem functions. The development of native seedlings can be hindered by the competition created by weeds for light, nutrients and moisture. This can lead to displacement of native plants and loss of biodiversity due to degradation and simplification of the wetland plant community. Weeds can also increase fire risk by increasing fuel loads in summer, contribute to soil erosion problems, reduce native fauna habitat and reduce overall ecosystem resilience."

Weeds can also contribute to reduction in wetland water quality, which can lead to midge problems, algal blooms, loss of natural invertebrate communities, displacement of native species (DEC 2012p, p. 9).

How to find the wetland weed species of the Swan Coastal Plain in Florabase

Florabase (Western Australian Herbarium 1998–a, <https://florabase.dbca.wa.gov.au>) supports weed identification through several pathways. The 'advanced search' tool allows filtering by 'status origin', with 'alien' used to isolate weeds. This can be combined with the 'features' under 'distribution' set to the 'Swan Coastal Plain' IBRA bioregion to focus results on weeds occurring within the nomination area. This search can be further refined to include the following 'habitat' types, which correspond to wetlands (although some weeds may not have searchable habitat types): swamps, fresh water, winter-wet, seepage areas, drainage lines, floodplains, watercourses, creeks, flowing water, claypans and salt lakes[34]. Known or suspected weed species can also be checked individually using the main search function, where each profile lists origin, habitat information and distribution maps. Florabase also hosts the *Swan Weeds Database* (Western Australian Herbarium 1998–b, <https://florabase.dbca.wa.gov.au/projects/swanweeds/list>), which provides supplementary biological and management information for the most problematic environmental weeds of the Perth NRM Region, including part of the Swan Coastal Plain.

Most of the wetland weeds listed by DEC (2012p, pp. 10–35) occur on the Swan Coastal Plain. Each species can be verified individually in Florabase using the main search function to confirm its presence in wetlands on the Plain.

Interactions with other threats

Invasive weeds interact strongly with other threats. For example:

- habitat loss and fragmentation (threat 1) create exposed wetland edges and disturbed soils that provide ideal establishment sites for invasive weeds. Once established, weeds inhibit native vegetation recovery, creates long-term habitat degradation, and reduce structural diversity and habitat quality for native wetland fauna
- loss of wetland buffers, foreshore areas and fringing vegetation (threat 2) removes overhanging and fringing vegetation that normally regulates light and temperature, suppresses weed growth and algal blooms, and filters nutrients, pollutants and sediments while stabilising banks (EPA 2007a, p. 97). This creates conditions that favour invasive weeds
- altered hydrological regimes (threat 3) may favour weeds if inundation periods are reduced and bare soils are exposed
- nutrient enrichment (threat 4.1) promotes rapid weed growth, enabling nutrient-responsive weeds to outcompete native wetland vegetation. The EPA (2007a, p. 113) notes that eutrophic conditions can drastically alter biodiversity in wetlands, rapidly turning them into weed-dominated systems.
- acidification and other water-quality changes (threats 4.2 and 4.3) stress or kill native vegetation, creating canopy and understorey gaps that weeds rapidly occupy, preventing natural regeneration and altering vegetation structure
- sedimentation (threat 4.5) infills shallow wetlands and smothers native vegetation, producing bare or disturbed soils that weeds may colonise more readily than native species
- invasive fauna (threat 6) such as pigs and rabbits disturb soils, uproot vegetation and create open niches that facilitate weed establishment and spread

[34] Other relevant habitat types include seasonally - wet areas and waterholes, however there are no weeds listed for these habitat types on the Swan Coastal Plain.

- farmed animal grazing and trampling (threat 7) damages native vegetation and compacts soils, or create areas of bare soil that can be colonised by weeds
- pathogens and disease (threat 8) such as *Phytophthora dieback* (*Phytophthora cinnamomi*) cause dieback in susceptible native species, opening structural gaps that weeds fill, altering fuel loads and vegetation composition
- altered fire regimes (threat 9) are reinforced by many weeds that increase fire intensity, promoting more severe fires that may suppress native wetland species and favour fire-adapted weeds
- climate change (threat 10) stresses native wetland flora through drying and heat extremes, while weeds may tolerate or exploit these conditions, enabling them to expand into new areas.

Knowledge gaps

Although the impacts of invasive weeds on wetland ecosystems are well recognised, significant gaps remain in understanding their distribution, rates of spread and long-term ecological consequences for the wetlands of the Swan Coastal Plain.

Many wetlands lack systematic weed surveys.

There is limited documented evidence on how invasive weeds interact with altered hydrology, nutrient enrichment, fire regimes and the drying climate to accelerate ecosystem decline.

Thresholds at which invasive species outcompete native vegetation or trigger irreversible shifts in community structure are not well defined, and the effectiveness of control measures under changing environmental conditions is uncertain.

These gaps constrain the ability to prioritise management actions, assess cumulative impacts and develop strategies that prevent further degradation of wetland vegetation communities.

Additional references

Additional references are available in **attachment N**, if required.

6. Invasive fauna

(ongoing; actual impacts; major – a major driver of fauna decline; whole; increasing)

Invasive fauna are widespread and include emerging species. The invasive polyphagous shot-hole borer–fungus complex (*Euwallacea fornicatus* and its symbiotic fungi) has recently been detected and poses a substantial emerging threat to wetland canopy species as many native wetland tree species are reproductive hosts. It can kill susceptible canopy species, resulting in the loss of mature trees and structural changes to affected ecosystems (see threat 6.1). Invasive fish and crustaceans prey on small freshwater fish, eggs, tadpoles and aquatic invertebrates, disrupting food webs; and carp increase turbidity by disturbing wetland sediments while foraging (see threat 6.2). Invasive pigs are particularly attracted to wetland habitats, where they churn soils and destroy native vegetation (see threat 6.3); foxes and cats prey on turtles, frogs, reptiles, small mammals and ground-nesting waterbirds, driving population declines (see threat 6.4). Rabbits damage vegetation and increase predation pressure by attracting foxes and cats (see threat 6.5).

Many of the world's most harmful invasive fauna, as identified in the Global Invasive Species Database list of 100 of the worst invasive species, are present in the wetlands of the Swan Coastal Plain. The EPA (2007b, p. 143) notes the list is compiled to recognise species that have shown very high invasive ability. Other invasive fauna are declared pests under the *Biosecurity and Agriculture*

Management Act 2007 (DPIRD 2026a); or classified as noxious fish or otherwise restricted under the Fish Resources Management Regulations 1995 (EPA 2007b, p. 145).

Attachment J lists many of the invasive fauna recorded in the wetlands of the Swan Coastal Plain, their impacts on native species and wetland ecosystems, and whether each species is listed among the 100 worst invasive species or under Western Australian legislation.

The DEC (2012f) and Reaveley *et al.* (2009) provide further information on invasive fauna and their impacts on wetlands, including wetlands on the Swan Coastal Plain.

Interaction of invasive fauna with other threats (collective for all invasive fauna)

Invasive fauna influence, and are influenced by, other threats. For example:

- habitat loss, clearing and fragmentation (threat 1) increase the vulnerability of native fauna to predation by foxes and cats by reducing vegetation cover. Disturbed areas may also attract invasive pigs, which further degrade habitat
- loss of wetland buffers, foreshore areas and fringing vegetation (threat 2) removes protective vegetation that provides shelter, nesting sites and movement corridors for native fauna, making them more susceptible to predation and disturbance by invasive fauna
- altered hydrological regimes (threat 3) and climate change (threat 10) can reduce water availability and concentrate native fauna into shrinking or isolated refuges during dry periods. This increases exposure to predators such as foxes, cats and introduced fish, intensifying predation pressure where waterbodies become fewer, smaller and more fragmented
- nutrient enrichment (threat 4.1) can increase populations of invasive fish and crustaceans by boosting algal and detrital food resources. This can intensify predation on native fish, tadpoles and aquatic invertebrates
- sedimentation (threat 4.5) smothers submerged vegetation and reduces habitat complexity, removing or reducing drought refuges for small fish, frogs and invertebrates and increasing their exposure to predation by invasive fish and crustaceans
- invasive weeds (threat 5) can simplify vegetation structure, reducing concealment for native fauna and making them more vulnerable to predation by foxes and cats
- native fauna that are stressed due to illness caused by pathogens and disease (threat 8) may be more susceptible to predation from cats and foxes
- altered fire regimes (threat 9) can reduce ground-layer vegetation and leaf litter, exposing small mammals, reptiles and ground-nesting birds to predation by foxes and cats. Post-fire environments may also be more accessible to invasive pigs
- climate change (threat 10) increases disturbance frequency (e.g., drought, heatwaves), creating conditions that may favour disturbance-tolerant invasive fauna over native species
- cumulative landscape-scale impacts (threat 11) such as roads, tracks and urban edges facilitate the movement of foxes, cats and pigs across the landscape, increasing their access to wetlands and compounding predation and disturbance pressures
- dams, crossings and other barriers to aquatic fauna movement (threat 12) can trap native fish, tadpoles and invertebrates in isolated pools where they are more vulnerable to predation by introduced fish and crustaceans.

The declining canopy condition and death of wetland flora caused by the PSHB–fungus complex contributes to habitat loss and reduces the structural complexity of wetland vegetation (threats 1 and 2).

Knowledge gaps (collective for all invasive fauna)

Gaps remain in understanding the distribution, population dynamics and ecological effects of invasive fauna on the wetlands of the Swan Coastal Plain.

Many wetlands lack systematic monitoring for key invasive species, particularly in fragmented landscapes or on private land, outside national parks and nature reserves.

Thresholds at which invasive species cause irreversible declines in native wetland fauna or disrupt ecological processes are poorly defined, and the long-term effectiveness of control programs under changing environmental conditions is uncertain. These gaps constrain the ability to assess cumulative impacts, prioritise management actions and develop strategies that effectively reduce invasive-fauna pressures on wetland ecosystems.

Improved monitoring is required to establish the distribution and abundance of invasive fauna in Western Australia (EPA 2007b, p. 140). For example, Duffy *et al.* (2017) emphasise that ongoing monitoring is essential for the early detection and eradication of introduced fish. As many introduced fish originate from the ornamental aquarium trade, they also note the need for continued investment in public education to reduce the risk of new species being released.

The recent introduction of PSHB presents additional knowledge gaps, as its host range, the susceptibility of local wetland flora, and the severity of potential impacts are not yet well understood. There is limited documented evidence on how invasive fauna interact with altered hydrology, declining water quality, habitat fragmentation and the drying climate to exacerbate predation pressure, competition and disturbance.

Banks and Hughes (2012) observed that although black rats are believed to have severe impacts on native fauna, their impact remains largely overlooked. They highlighted a major knowledge gap in understanding this species' ecological role and the conservation threat it poses in Australia.

Additional references

Additional references are available in **attachment N**, if required.

6.1 A significant emerging threat: the polyphagous shot-hole borer–fungus complex (*Euwallacea fornicatus* and its symbiotic fungi)

(ongoing; actual impacts; emerging as a potentially major or extreme threat in the future; the current scope is within the Perth Metropolitan Region, although the specific wetlands affected is unknown and the future scope is unknown; increasing)

The polyphagous shot-hole borer–fungus complex (*Euwallacea fornicatus* and its symbiotic fungi) was detected in Perth in 2021 and is currently confined to the Perth and Peel region of the Swan Coastal Plain. The eradication program was not successful, meaning the complex is now established in Western Australia. As PSHB uses several wetland plant species as reproductive hosts, its establishment represents a significant and rapidly emerging threat to wetland canopy vegetation. According to DPIRD (2025c), the susceptibility ratings for known wetland reproductive host species include:

- Freshwater or swamp paperbark (*Melaleuca rhaphiophylla*) – very high
- Modong or stout paperbark (*Melaleuca preissiana*) – high
- Swamp banksia (*Banksia littoralis*) – high
- Moitch or flooded gum (*Eucalyptus rudis*) – moderate
- Cooli or salt sheoak (*Casuarina obesa*) – moderate
- Banbar (*Melaleuca teretifolia*) – moderate

- Basket bush (*Spyridium globulosum*) – moderate.

Many are key wetland species on the Swan Coastal Plain, as per the response to **question 3b**.

Mohan (*Melaleuca viminalis*) is a reproductive host but its susceptibility has not been determined (DPIRD 2025a). Other flora species that occur in wetlands, including coojong or orange wattle (*Acacia saligna*), wonnich (*Callistachys lanceolata*) and peppermint (*Agonis flexuosa*) are non-reproductive hosts and have low or negligible susceptibility (DPIRD 2025c).

The DPIRD has been leading a nationally funded and coordinated biosecurity response. It is now transitioning from an eradication strategy to a long-term management approach after the National Management Group determined it was no longer technically feasible to eradicate PSHB (DPIRD 2026c; Department of Agriculture, Fisheries and Forestry 2025). PSHB spreads through the movement of infested plant material, and females can fly to 400 metres (Department of Agriculture, Fisheries and Forestry 2025).

The associated fungi also represent a pathogen threat (threat 8). However, the complex is addressed only under invasive fauna to avoid duplication.

Ecological consequences of the PSHB–fungus complex on the wetlands of the Swan Coastal Plain

The PSHB introduces both physical damage and fungal infection to susceptible trees. Adult females tunnel into stems and branches and inoculate the wood with a symbiotic *Fusarium fungus*, which colonises the tissue and, together with the beetle, causes branch dieback and tree decline. Symptoms typically include wilting and canopy dieback, often beginning in the upper crown.

This beetle–fungus complex can kill susceptible canopy species, leading to the loss of mature trees and structural changes in affected wetlands; and loss of fauna habitat, including wetland and terrestrial bird habitat for nesting and foraging. The full ecological consequences for wetland vegetation communities remain uncertain, but the presence of highly susceptible native hosts suggests the potential for significant impacts.

6.2 Invasive fish and crustaceans

(ongoing; actual impacts; potentially extreme in relevant wetland types – drivers of aquatic fauna decline; whole; increasing)

Hourston *et al.* (2014) reported numerous non-native freshwater fish on the Swan Coastal Plain, with eastern gambusia (*Gambusia holbrooki*) being the most widespread (Morgan *et al.* 2004 in Hourston *et al.* 2014). Other recorded species include convict cichlid (*Amatitlania nigrofasciata*), silver perch (*Bidyanus bidyanus*), goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), pearl cichlid (*Geophagus brasiliensis*), golden perch (*Macquaria ambigua*), rainbow trout (*Oncorhynchus mykiss*), European or redfin perch (*Perca fluviatilis*), *Phalloceros harpagos*, rosy barb (*Puntius conchonius*), spangled perch (*Leiopotherapon unicolor*), brown trout (*Salmo trutta*) and freshwater catfish (*Tandanus tandanus*) (Beatty and Morgan 2013 in Hourston 2014; Duffy *et al.* 2013 in Hourston 2014).

Duffy *et al.* (2017) later identified three new introduced fish species previously not recorded in Western Australia: long-finned eel (*Anguilla reinhardtii*), jaguar cichlid (*Parachromis managuensis*) and southern platy (*Xiphophorus maculatus*). Of these, southern platy (*Xiphophorus maculatus*) has established a self-sustaining population. The DWER (2026c) noted that green swordtail (*Xiphophorus helleri*) is also now established in Perth.

The yabby (*Cherax destructor*) and indistinct river shrimp (*Caridina indistincta*) are invasive crustaceans found in the wetlands of the Swan Coastal Plain (DWER 2026c).

Although rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) are known to harm wetland fauna, they continue to be deliberately released by the Department of Primary Industries

and Regional Development for recreational fishing purposes (Government of Western Australia 2025b; DPIRD 2025b).

The number of species of introduced freshwater fishes exceeds the number of native species in south-western Australia and there has been a sharp increase in introductions (Beatty & Morgan 2013 in Beatty *et al.* 2014b, Duffy *et al.* 2013 in Beatty *et al.* 2014b).

The introduction of additional invasive fish and crustaceans is a significant concern for the future. Duffy *et al.* (2017) noted that introductions correlate with human population growth, as many introduced species originate from the ornamental aquarium trade and are released by hobbyists. This is also a concern because new introductions are rarely detected before the population becomes too large to eradicate (Myers *et al.* 2000 in Duffy *et al.* 2017). The DWER (2026c) similarly noted that the yabby (*Cherax destructor*) is "almost impossible to eradicate" once established in wetlands; and that public education to prevent continued spread is the main strategy to avoid the spread of this species into additional wetlands.

Variation across wetland types

Invasive fish adversely affect the open-water wetlands (i.e. the lake, sumpland, river and creek wetland types).

Ecological consequences of invasive fish in the wetlands of the Swan Coastal Plain

Invasive fish species now dominate most wetlands on the Swan Coastal Plain, with only a small fraction still supporting exclusively native fish communities. Hourston *et al.* (2014, p. 1) found that "of 113 wetlands visited that contained water, 76% also housed fish. Of those inhabited wetlands, few contained only native species (12%), while the many contained either both native and non-native fishes (45%) or non-native fishes only (42%). Only seven wetlands out of the 113 contained only obligate freshwater fishes native to the region. Overall, numbers of fish were dominated by the non-native species eastern gambusia (*Gambusia holbrooki*) (78.6%)." Wetlands with higher salinity typically contained fewer eastern gambusia (*Gambusia holbrooki*). Overall, the study demonstrates that very few lentic (non-flowing) systems on the southern Swan Coastal Plain still support native fish populations without non-native competitors (Hourston *et al.* 2014, p. 1).

Invasive fish and crustaceans compete with native species for food and habitat, prey on eggs and juveniles, and disrupt ecosystem processes such as nutrient cycling. Many also exhibit aggressive behaviours that further disadvantage native fauna. Details for most invasive fish and crustaceans are provided in DWER (2026c) and DEC (2012f, pp. 8-9).

For example, the DWER (2026c) stated that eastern gambusia (*Gambusia holbrooki*) is "an aggressive species that compete with native species. They are known to fin-nip and can completely remove the tail fin of several species, and will predate on fish and frog eggs, fish larvae and insects. Co-existence with native fish is enhanced when the natural environment isn't too disturbed. However, in disturbed systems, where native animals are subjected to additional stress, this species is known to quickly dominate the fish fauna."

Common carp (*Cyprinus carpio*) increase water turbidity and siltation, decrease macrophyte biomass and diversity, increased water nutrient loads, increase algal concentrations, reduce native fish numbers and diversity and decrease macro-invertebrate numbers and diversity (Bomford and Tilzey (1996).

Further information on the ecological consequences of invasive fish is provided by DWER (2026c), DEC (2012f, pp. 8-9), Corfield *et al*. (2008), Arthington and Blühdorn (1995), Arthrington and McKenzie (1997) and DCCEEW (2026a, p. 201). Further information on the ecological consequences of eastern gambusia (*Gambusia holbrooki*) is provided in Gill *et al.* (1997) and Rowe *et al.* (2008); on European or redfin perch (*Perca fluviatilis*) in Rowe *et al.* (2008) and Morgan *et al.* (2003); on common carp (*Cyprinus carpio*) in Koehn (2004) and Koehn *et al.* (2000); and on rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) in Cadwallader (1996).

6.3 Invasive pigs

(ongoing; actual impacts; major; unknown scope but centred around rural and conservation areas; unknown trend)

Invasive pigs (*Sus scrofa*) occur in wetlands within rural and conservation areas, particularly in the southern parts of the Swan Coastal Plain. They are widespread and abundant across the south-west of Western Australia (DPIRD 2019, p. 2) and are particularly associated with wetland habitats (Commonwealth of Australia 2017).

The *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and DPAW 2016) stated that illegal release of pigs for hunting occurs in parts of the planning area. Genetic evidence confirms that invasive pigs have been illegally moved (translocated) in the south west of WA (DPIRD 2019, p. 7).

Ecological consequences of invasive pigs in the wetlands of the Swan Coastal Plain

Invasive pigs are omnivorous and consume a wide range of native flora and fauna, including small mammals, birds, reptiles, frogs, crayfish, eggs, soil-dwelling invertebrates and underground fungi (DEC 2012f; Commonwealth of Australia 2017) and all parts of plants, including the fruit, seeds, roots, tubers, bulbs and foliage (Commonwealth of Australia 2017). They are also significant disease vectors, capable of transmitting pathogens such as tuberculosis and hydatids (DEC 2012f). Pigs can spread Phytophthora dieback (*Phytophthora cinnamomi*) through soil disturbance, damage to vegetation, and the ingestion and excretion of infected plant material, providing multiple pathways for pathogen transmission (DEC 2012f; Commonwealth of Australia 2017).

The soil-disturbing behaviour of pigs is particularly damaging in wetlands, where wallowing and foraging removes and degrades wetland flora, creates turbidity and sedimentation that reduces light penetration, smothers benthic fauna and infills wetland habitats (DEC 2012f). Pigs and other invasive fauna also tend to congregate around wetlands. They degrade water quality by defecating and urinating in or near wetlands, contributing to nutrient enrichment, eutrophication and algal blooms (DEC 2012f).

Similarly, the Commonwealth of Australia (2017) summarises that "habitat changes due to feral pigs include: destruction of plants, sometimes threatening the survival of specific plant species through reduced or failed recruitment of new plants; changing the composition of plant communities; alteration of soil structure through digging and rooting; increased invasion and spread of weeds through spreading seeds via faeces or in fur, or creating suitable habitat through soil enrichment with urine and faeces or ground disturbance; reduced water quality through disturbance of riparian zones and bodily wastes; and creation of habitat suitable for plant disease vectors."

The *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and DPAW 2016) noted that invasive pigs "can cause substantial damage to wetlands, where their diggings disturb populations of rare flora and affect water quality".

6.4 Invasive foxes and cats

(ongoing; actual impacts; major – driver of fauna decline; whole; unknown trend)

Invasive foxes and cats are found in wetlands throughout the Swan Coastal Plain, including urban, rural and conservation areas. They are widespread and abundant. For example, the *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and DPAW 2016, p. 29) notes that the small to medium sized ground mammals that now dominate fauna species on the Swan Coastal Plain include cats and foxes.

Ecological consequences of foxes and cats in the wetlands of the Swan Coastal Plain

Invasive foxes (*Vulpes vulpes*) and cats (*Felis catus*) are major predators of native birds, mammals and reptiles, with cats implicated in the extinction of 23 native species and foxes responsible for the decline or disappearance of many others (DEC 2012f).

Both predators are attracted to wetlands due to high concentrations of fauna, particularly during waterbird breeding and turtle nesting seasons. Cats also transmit *Toxoplasma gondii*, causing toxoplasmosis in more than twenty native mammal species, and both cats and foxes carry parasites such as *Spirometra erinacei* and diseases including sarcosporidiosis, which can cause serious illness or death in native fauna (DEC 2012f).

Beyond direct predation, the presence of these predators can alter the behaviour of native fauna, affecting feeding, activity patterns and mating, which can reduce access to optimal habitat, increase energy expenditure and ultimately diminish health, reproduction and survival (DEC 2012f).

Foxes are a major predator of freshwater turtles in Australia and have been identified as a significant contributor to turtle population declines through predation on both nests and adults (Thompson 1983; Spencer and Thompson 2005; Dawson *et al.* 2016 in Santoro 2022). In Perth's urban wetlands, foxes have been implicated in the suggested population declines, and the lack of and reduced recruitment of south-western snake-necked turtle (*Chelodina oblonga*) in most urban wetlands (DEC 2012f, p. 8; Santoro *et al.* 2025). Nesting females and hatchlings are vulnerable to fox predation during overland movements (Dawson *et al.* 2014; Santoro *et al.* 2025). Increased mortality of adult turtles greatly increases the chance of local extinctions due to turtle life histories. Foxes are also known to dig up and eat turtle eggs, and likely destroy most nests (Santoro *et al.* 2025). The effects of foxes on turtle populations are predicted to increase as wetlands continue to dry, as evidenced by the killing of over 100 aestivating turtles at Bibra Lake during the 2024 drought (Ingelbrecht *et al.* 2025).

Impacts of cats may be direct (for example, cats substantially reduce a population via predation or disease), or indirect (for example, cats disrupt ecosystems by reducing the abundance of ecologically significant species) (DCCEEW 2024). This is also likely to apply to foxes.

6.5 Invasive rabbits, rats and mice

(ongoing; actual impacts; major – drivers of flora and fauna decline; whole; unknown trend)

Invasive rabbits (*Oryctolagus cuniculus*), black rats (*Rattus rattus*), brown rats (*Rattus norvegicus*) and house mice (*Mus musculus*) are found in wetlands throughout the Swan Coastal Plain. They are widespread and abundant. For example, the *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and DPAW 2016, p. 29) notes that the small to medium sized ground mammals that now dominate fauna species on the Swan Coastal Plain include invasive rats and mice; and significant invasive fauna include rabbits.

Ecological consequences of rabbits, rats and mice in the wetlands of the Swan Coastal Plain

Rabbits cause extensive damage to wetlands by overgrazing native wetland vegetation, preventing flora regeneration and altering natural flora succession. Their grazing and burrowing activities modify soil structure and nutrient cycling, often leading to significant erosion and degradation of sensitive landforms and habitats (Commonwealth of Australia 2016a). Rabbits also compete with native fauna for food and shelter and can remove critical vegetation used by arboreal mammals and birds, increasing their exposure to predators and reducing reproductive success (Commonwealth of Australia 2016a).

Invasive rats and mice prey on eggs, hatchlings and small vertebrates, including ground-nesting birds, frogs and reptiles, and can significantly reduce recruitment of native fauna. They also compete with native fauna for food and shelter and carry diseases that may affect native fauna.

Banks and Hughes (2012) provide detailed information on rat predation on native fauna, their competition with native fauna, and their role as carriers of diseases. Exotic rodents also eat the seeds and fruit of native plants and potentially limit regeneration of some species (Caughley *et al.* 1998 in DEWHA 2009b).

Large populations of rabbits, rats or mice may attract cats and foxes to wetlands, putting native species at risk (DEC 2012f). Rabbits, rats and mice are a major component of the diet for both cats and foxes (DEC 2012f).

7. Farmed animal grazing and trampling

(ongoing; actual impacts; unknown severity; unknown scope, except it is limited to rural areas; potentially decreasing due to some fencing and restoration programs but potential changes to the abundance and stocking density of farmed animals is unknown)

Farmed animal grazing and trampling historically occurred in wetlands across the Swan Coastal Plain and currently occurs in rural areas. Its severity is strongly influenced by whether wetlands are fenced to exclude farmed animals. However, the extent of rural land used for farmed animal grazing, and the extent of fencing that protects wetlands from grazing, may be poorly documented and mapped, making it difficult to determine how much of the wetlands of the Swan Coastal Plain are currently protected from this threat.

The level of impact also varies with stocking density, soil moisture, seasonality and day-to-day management practices ((DEC 2012g; Morris and Reich 2013; Staton and O'Sullivan 2019). Soil moisture and seasonality are important because wet soils are more easily compacted and pugged, and farmed animals tend to concentrate around wetlands during dry periods, increasing pressure on vegetation and soils.

The placement and design of yards, waste ponds, roads and storage facilities can further influence the degree of impact on wetlands (Staton and O'Sullivan 2019). For example, by altering access patterns, concentrating use in either sensitive or resilient areas, or changing drainage and runoff pathways. The DEC (2012g, p. 4) similarly notes that "impacts can be compounded by certain management activities such as clearing of native vegetation for pastures, leaching of farm chemicals, fertilisers and other treatments into water supplies. Other poorly planned activities like carcass burial and inappropriate placement of infrastructure can impact on wetland condition."

Wetlands are preferentially used by farmed animals because they provide valuable resources, including water for drinking and cooling off, trees for shade and shelter and flora that may be highly palatable (DEC 2012g, p. 1). As a result, "wetlands are often used more intensively by farmed animals than other areas of the landscape, especially when it is dry and during drought" (DEC 2012g, p. 1). This concentrated use has resulted in significant degradation of wetlands in many cases (DEC 2012g, p. 1).

Ecological consequences of farmed animal grazing

The DEC (20212g, p. 4) summarises that farmed animal access "can cause severe degradation of wetlands." Farmed animals "can compact and erode the soil, increase runoff and levels of sediments, nutrients and contaminants in wetlands, change the vegetation and degrade the habitats of native animals. These changes can cause serious damage to wetland ecosystems."

Morris and Reich (2013, p. 6) describe that farmed animals "treading in the wetland physically damages plants, causes soil disturbance, increases turbidity, compacts the soil, and creates bare ground. These changes can alter water clarity, microclimate, the infiltration of water and air into the soil, soil strength and carbon stores. This adversely affects plant growth, results in compositional changes in vegetation, and can affect soil organisms and nutrient processing. Reduced vegetation cover, soil disturbance and compaction in the wetland buffer or in the wetland catchment can also

reduce water quality as they increase surface runoff and erosion, reduce sediment trapping and increase the delivery of soil particles, nutrients, salts, and/or pollutants to the wetland."

Trampling damages or kills flora, reducing biomass and leaf litter and creating bare ground, which increases soil erosion and accelerates water runoff and increases the entry of soil particles, nutrients or other pollutants into wetlands (Morris and Reich 2013, p. 6). Loss of vegetation and leaf litter and exposure of bare soil alters the microclimate, causing increased temperature and light, increasing opportunities for weeds to establish and contributing to changes to vegetation structure and composition (Morris & Reich 2013, p. 6).

Pugging can dislodge flora and damage or disrupt soil seed and egg banks (Morris & Reich 2013, p. 6). This degraded soil structure, prevents native vegetation from growing and promotes weed invasion.

Staton and O'Sullivan (2019) describe extensive impacts on riparian vegetation, including the destruction of riparian grasses, trees and shrubs through grazing and trampling, which reduces biodiversity by removing food sources and habitat. The loss of vegetation also leads to erosion because plant roots can no longer stabilise the soil, resulting in unstable banks and loose, unprotected soil that is easily dislodged by farmed animals when they trample or wade through wetland margins. This increases turbidity and sedimentation. The removal of overhanging vegetation can also raise water temperatures in wetlands. Increased turbidity and sedimentation can, in turn, cause declines in aquatic fauna due to reduced oxygen levels and restricted movement (Staton and O'Sullivan 2019)

Farmed animal urine and dung contributes to nutrient enrichment, eutrophication, algal blooms and deoxygenation (threat 4.1) and the spread of disease and parasites (threat 8).

Unmanaged grazing and trampling have historically contributed to the loss of some wetlands on the Swan Coastal Plain and is likely to continue doing so where it remains severe and ongoing.

The DEC (2012g) provides further information on the adverse impacts of farmed animals on wetlands, including the wetlands of the Swan Coastal Plain.

Interaction with other threats

Farmed animal grazing and trampling interact with several other threats. For example:

- habitat loss, clearing and fragmentation (threat 1) increase farmed-animal access to wetlands, exposing soils and vegetation to grazing pressure and trampling that further degrade already-disturbed areas.
- loss of wetland buffers, foreshore areas and fringing vegetation (threat 2) allows farmed animals to enter wetland margins more easily, accelerating vegetation loss, bank erosion and soil compaction.
- altered hydrological regimes (threat 3) can concentrate farmed animals around shrinking waterbodies during dry periods, intensifying trampling, pugging and vegetation damage.
- Water quality degradation (threats 4.1–4.4) is exacerbated by inputs of nutrients, sediments and pathogens (threat 8) from farmed animals, compounding eutrophication, turbidity and contamination pressures.
- invasive weeds (threat 5) benefit from grazing-induced disturbance, as farmed animals selectively remove native vegetation and create bare, compacted soils that weeds colonise rapidly.
- pathogens and disease (threat 8) spread more readily where farmed animals disturb soils, damage roots and transport contaminated material between wetlands.

- altered fire regimes (threat 9) can be reinforced by grazing-driven changes to vegetation structure, including reduced native understorey and increased weed dominance, which may influence fuel loads.
- climate change (threat 10) increases drought stress, drawing farmed animals to remaining wetland refuges and intensifying trampling impacts on margins and shallow zones.
- cumulative landscape-scale impacts (threat 11) are amplified where grazing occurs across multiple properties, progressively degrading wetland buffers and foreshore areas, hydrology and vegetation condition.

Knowledge gaps

Although the impacts of grazing and trampling on wetland vegetation, soils and fauna are well recognised, significant gaps remain in understanding the current extent and severity of these pressures across the Swan Coastal Plain. Systematic monitoring of grazing impacts is limited. The interactions between grazing, altered hydrology, nutrient enrichment, invasive species and drying due to climate change are also poorly understood, making it difficult to determine thresholds at which grazing leads to irreversible degradation.

Additional references

Additional references are available in **attachment N**, if required.

8. Pathogens and disease

Pathogens pose a significant and growing threat to the wetlands of the Swan Coastal Plain, affecting native flora, fauna and ecological processes. This threat category includes four well-documented pathogens of major concern: the soil-borne water mould Phytophthora dieback (*Phytophthora cinnamomi*), which causes root rot and dieback in a wide range of native flora species; the frog chytrid fungus (*Batrachochytrium dendrobatidis*), which is present but is not currently considered a major threat to local frog populations; myrtle rust (*Austropuccinia psidii*), a wind-borne fungal pathogen that infects Myrtaceae and threatens key wetland species; and highly pathogenic avian influenza (H5N1). Phytophthora dieback remains a current and significant threat, while myrtle rust and H5N1 are recognised as potential future threats to wetland flora and wetland-dependent bird species.

The invasive polyphagous shot-hole borer–fungus complex (*Euwallacea fornicatus* and its symbiotic fungi) is addressed under invasive fauna (threat 6) but the associated fungi also represent a pathogen threat.

8.1 Phytophthora dieback (*Phytophthora cinnamomi*)

(ongoing; actual impacts; major – a driver of ecological decline; majority; increasing)

Phytophthora dieback (*Phytophthora cinnamomi*) is a significant pathogen threat to the wetlands of the Swan Coastal Plain, and is irreversible once introduced. This water mould causes canopy loss and mortality in key wetland flora, leading to structural decline and potentially ecosystem collapse in affected areas.

The DEC (2012, p. 1) notes that the arrival and spread of Phytophthora dieback in Western Australia has been "catastrophic" for many south-western ecosystems, including wetlands, with as many as 2,300 of the estimated 5,700 native plant species susceptible. The EPA (2007b, p. 159) similarly reported that 14% of south-west flora are highly susceptible and 40% are susceptible, equating to 2,284 plant taxa, including 800 highly susceptible species. Of the State's threatened flora, 49% are susceptible (Shearer *et al.* 2004 in EPA 2007b, p. 159).

The *Swan Coastal Plain South management plan 2016* (Conservation Commission of WA and DPAW 2016, p. 3) identifies the continuing spread of Phytophthora dieback as a key management issue.

The DEC (2012j) provides further information about the management and impact of Phytophthora dieback on wetlands, including wetlands of the Swan Coastal Plain.

Susceptible and resistant wetland flora on the Swan Coastal Plain

Despite the severity of the threat, very little research has examined the effects of Phytophthora dieback on the wetlands or wetland flora of the Swan Coastal Plain (DEC 2012j, p. 6). A review of the wetland flora listed in **attachment A** shows that 88%–86.5% had no information on susceptibility or resistance, based on Groves *et al.* (undated(a)–(d)) alone, and on Groves *et al.* combined with recovery plans, respectively.

Some wetland flora species are known to be resistant, including flooded gum (*Eucalyptus rudis*), moonah (*Melaleuca lanceolata*), modong (*Melaleuca preissiana*), saltwater paperbark (*Melaleuca cuticularis*) and white myrtle (*Hypocalymma angustifolium*) (Groves *et al.* undated(a), undated(c)). Field observations also suggest that many wetland species may be resistant (C. Dunne 2008, pers. comm. in DEC 2012j, p. 6). However, susceptibility varies and knowledge remains incomplete.

Groves *et al.* (undated(b), undated(d)) identified several wetland species on the Swan Coastal Plain as susceptible to Phytophthora dieback, including basket flower (*Adenanthos meisneri*), swamp banksia (*Banksia littoralis*), pingle (*Banksia squarrosa*), Whicher Range dryandra (*Banksia squarrosa* subsp. *argillacea*), swamp fox banksia (*Banksia telmatiaea*), royce's waxflower (*Chamelaucium roycei*), *Evandra aristata*, orange stars (*Hibbertia stellaris*), *Isopogon formosus* subsp. *dasylepis*, grey stinkwood (*Jacksonia furcellata*), western prickly honeysuckle (*Lambertia echinata* subsp. *occidentalis*), *Loxocarya cinerea*, rough honeymyrtle (*Melaleuca scabra*), *Melaleuca thymoides*, dog weed (*Opercularia vaginata*), swamp purple flag (*Patersonia occidentalis* var. *angustifolia*), swamp tea-tree (*Pericalymma ellipticum*), *Petrophile seminuda,* blueboy (*Stirlingia latifolia*), brook peppermint (*Taxandria linearifolia*), compacted featherflower (*Verticordia densiflora*), long-stalked featherflower (*Verticordia densiflora* var. *pedunculata*), variegated featherflower (*Verticordia huegelii*) and balga (*Xanthorrhoea preissii*).

Recovery plans identified additional susceptible species, including slender andersonia (*Andersonia gracilis*), abba bell (*Darwinia whicherensis*), *McCutcheon's grevillea* (*Grevillea maccutcheonii*), *ironstone grevillea (Grevillea elongata*) and tufted plumed featherflower *(Verticordia plumosa* var. *ananeotes*) (DEC 2006b; Stack and English 2003a; Stack *et al.* 2003; Stack and English 2003b; Taylor *et al.* 2005).

The recovery plans of glossy-leafed hammer orchid (*Drakaea elastica*), curved-leaf grevillea (*Grevillea curviloba* subsp. *curviloba*); pyramid mulla-mulla (*Ptilotus pyramidatus*); club-leafed Synaphea (*Synaphea* sp. Pinjarra); and Dwellingup synaphea (*Synaphea stenoloba*) found them to be indirectly susceptible due to habitat changes (DEC 2009; English and Phillimore 2000; DPAW 2016b; Stack *et al.* 2002; DBCA 2018b). Laterite petrophile (*Petrophile latericola*) [35] and tarbush (*Eremophila glabra* subsp. *chlorella*)[36] are regarded as potentially susceptible, however testing has either been inconclusive or has not yet been undertaken. Phytophthora dieback is present in the habitat of *Gastrolobium papilio*; however, laboratory testing indicates the species has some resistance with 18% of 11 inoculated plants dying (DPAW 2014a)[37].

[35] Endangered under the EPBC Act and critically endangered under the BC Act.

[36] Endangered under both Acts.

[37] Endangered under the EPBC Act and critically endangered under the BC Act.

Threatened and priority wetland flora species affected by Phytophthora dieback on the Swan Coastal Plain

Of the threatened and priority species susceptible to Phytophthora dieback:

- western prickly honeysuckle (*Lambertia echinata* subsp. *occidentalis*), abba bell (*Darwinia whicherensis*), *McCutcheon's grevillea* (*Grevillea maccutcheonii*) and tufted plumed featherflower (*Verticordia plumosa* var. *ananeotes*) are endangered under the EPBC Act and critically endangered under the BC Act
- long-stalked featherflower (*Verticordia densiflora* var. *pedunculata*) is endangered under the EPBC Act and BC Act
- slender andersonia (*Andersonia gracilis*) is endangered under the EPBC Act and vulnerable under the BC Act
- *ironstone grevillea (Grevillea elongata*) is vulnerable under the EPBC Act and endangered under the BC Act
- Whicher Range dryandra (*Banksia squarrosa* subsp. *argillacea*) and royce's waxflower (*Chamelaucium roycei*) are vulnerable under the EPBC Act and BC Act
- *Isopogon formosus* subsp. *dasylepis* is listed as priority 3 in Western Australia

Most of these species are endemic to the Swan Coastal Plain (see the 'endemic flora' sub-heading in the response to **question 16**).

Of the indirectly susceptible species, glossy-leafed hammer orchid (*Drakaea elastica*) is endangered under the EPBC Act and critically endangered under the BC Act; curved-leaf grevillea (*Grevillea curviloba* subsp. *curviloba*) and Dwellingup synaphea (*Synaphea stenoloba*) are endangered under both Acts; pyramid mulla-mulla (*Ptilotus pyramidatus*) and club-leafed Synaphea (*Synaphea* sp. Pinjarra) are critically endangered under both Acts.

Findings from recovery plans

The flora species recovery plans summarised the threat from Phytophthora dieback:

- Slender andersonia (*Andersonia gracilis*) is highly susceptible, ranking 8 on a scale of 1 to 10 where 7 is considered a significant risk (Keighery 1988 in DEC 2006b, p.7).
- abba bell (*Darwinia whicherensis*) occurs near known infestations and is presumed susceptible, as this is a characteristic of many Myrtaceous species; phosphite treatment has been ongoing since 1996 (Stack and English 2003a)
- glossy-leafed hammer orchid (*Drakaea elastica*) is not thought to be directly susceptible, but habitat changes caused by dieback (for example, canopy opening) may affect the orchid, its fungus and its pollinator (DEC 2009)
- the habitat of all populations of curved-leaf grevillea (*Grevillea curviloba* subsp. *curviloba*) (English and Phillimore 2000) is under threat. Although initial testing suggests it may not be directly susceptible (C. Crane, personal communication in English and Phillimore 2000), other flora in the habitat may be affected, creating the potential for indirect impacts
- *McCutcheon's grevillea* (*Grevillea maccutcheonii*) (Stack *et al.* 2003) is moderately susceptible, and disease is a serious threat to all populations (Stack et al. 2003)
- *ironstone grevillea* (*Grevillea elongata*) may be susceptible when stressed; most habitat is already severely affected (Stack and English 2003b)

- western prickly honeysuckle (*Lambertia echinata* subsp. *occidentalis*) is highly susceptible and its only known population is affected; despite phosphite treatment, four plants died in 2001 and all tested positive. Phosphite concentrations were up to ten times higher than in other Proteaceae, raising concerns about potential toxicity (Stack and Brown 2003)
- Phytophthora dieback is a threat to tufted plumed featherflower (*Verticordia plumosa* var. *ananeotes*), as preliminary studies indicate that it is susceptible to the disease (Taylor *et al.* 2005).

The recovery plans for threatened wetland ecological communities and fauna on the Swan Coastal Plain are also likely to provide advice on the risk of Phytophthora dieback to these ecological communities and species. These recovery plans are listed in the response to **question 19**.

Mechanisms of spread, vulnerability of wetlands and sources of further information

Phytophthora dieback is readily dispersed in water or in moist soil, making wetlands particularly vulnerable to rapid spread and infection. The DEC (2012j, p. 157) notes that *Phytophthora cinnamomi* is transported by two main mechanisms: movement of spores through free water (including groundwater in coarse-textured soils and water-filled root channels) or by root-to-root contact, and the movement of infected soil or plant material around the landscape. The latter has driven the large-scale spread and devastating impacts of Phytophthora dieback in the south-west of WA. The pathogen spreads quickly downslope when infected water moves freely, but much more slowly upslope and on flat ground (around one metre per year), where movement is generally restricted to root-to-root contact. Any action or process that transports soil can move the pathogen to new sites, and wetlands in low-lying parts of the landscape are at high risk because they receive water from across the catchment (DEC 2012j, p. 57).

Activities that occur frequently in or near wetlands on the Swan Coastal Plain carry a high risk of transporting Phytophthora dieback. These include removing groundwater or surface water from potentially contaminated wetlands (for dewatering, irrigation or fire-fighting); transporting soil to or from wetlands that may contain the pathogen; constructing firebreaks, which can move soil within and between properties; undertaking revegetation where contaminated potting mix or soil may introduce the pathogen; and moving equipment and vehicles, including during the construction and maintenance of linear corridors such as roads, railways, gas pipelines and powerlines (DEC 2012j, p. 5).

Ecological consequences of Phytophthora dieback in the wetlands of the Swan Coastal Plain

The loss of native vegetation due to Phytophthora dieback (both within and surrounding a wetland) can cause increased erosion and sedimentation, reduced water quality and loss of biodiversity, both directly and through loss of habitat for flora and fauna and food for native fauna (DEC 2012j, p. 9).

Changes in the composition and structure of wetland flora communities caused by Phytophthora dieback may adversely affect native fauna and soil biota by altering the availability of food resources and habitat (DEC 2012j, p. 10). Smaller fauna, such as quenda and frogs, may be particularly affected by the loss of refuge, as the resulting more open vegetation provides less protection from predators (DEC 2012j, p. 10).

Vegetation loss caused by Phytophthora dieback can have wide-ranging impacts on wetland-dependent fauna by reducing food availability, shelter, and habitat quality (DEC 2012j, p. 10). The loss of susceptible understorey and mid-storey flora leads to a decline in seeds, nectar, pollen, and invertebrates that many species rely on for food. Reduced flora species richness and diversity further limits food sources for fauna that prefer floristically rich environments. As vegetation cover decreases and bare ground increases, habitat is lost for species dependent on dense ground cover, and predation risk rises. Declines in canopy cover alter microclimates and reduce food for tree-dwelling fauna, while reduced litter fall diminishes invertebrate populations and food for

insectivores. Post-infection increases in resistant flora species may also disrupt food webs (DEC 2012j, p. 10).

Interaction with other threats

The effects of Phytophthora dieback are amplified by its interactions with other threats. For example:

- habitat loss, clearing and fragmentation (threat 1) disturb soils and expose root zones, increasing opportunities for Phytophthora dieback to establish and spread, while reducing the capacity of native vegetation to recover once infected
- altered hydrological regimes (threat 3) may influence Phytophthora dieback dispersal, as it spreads readily through water and saturated soils
- invasive weeds (threat 5) can occupy canopy and understorey gaps created by Phytophthora dieback, altering fuel loads, shading and soil moisture in ways that further disadvantage susceptible native species
- invasive pigs (threat 6) disturb soils, damage roots and transport infested soil, facilitating the spread of Phytophthora dieback between wetlands
- farmed animal grazing and trampling (threat 7) damage vegetation and move contaminated soil, increasing the likelihood of Phytophthora dieback introduction and spread
- climate change (threat 10) increases drought stress and alters soil moisture regimes, reducing flora resilience and expanding the environmental conditions under which Phytophthora dieback can persist and spread
- cumulative landscape-scale impacts (threat 11) such as roads, tracks and drainage lines create multiple pathways for soil movement and disturbance, increasing the risk of Phytophthora dieback introduction to wetlands.

Knowledge gaps

The susceptibility of many wetland flora communities to Phytophthora dieback remains poorly understood, with considerable variation among and within families making taxonomic classification an unreliable predictor of vulnerability (Shearer *et al.* 2007).

Direct impacts of Phytophthora dieback on wetland flora and ecological processes in the South-west Botanical Province are poorly documented, and indirect impacts arising from habitat loss are even less well understood (Shearer *et al.* 2007).

Secondary effects on wetland fauna and soil biota remain largely unquantified, leading to underestimation of the pathogen's true ecological impact (Shearer *et al.* 2007).

Limited data exist on pathogen behaviour in seasonally waterlogged soils and how hydrological variation influences its spread and persistence.

Long-term ecosystem responses following infestation, including changes in flora composition, fauna habitat availability, and food-web structure, are insufficiently monitored.

There are several other species of Phytophthora present in native vegetation in the southwest of WA, including *P. cryptogea, P. multivora* and *P. nicotianae*, but their extent and impact on native vegetation is unclear (DEC 2012j, p. 1).

Additional references

Additional references are available in **attachment N**, if required.

8.2 Frog chytrid fungus (*Batrachochytrium dendrobatidis*)

(ongoing (occurs but presently poses a relatively low threat) and future (the risk to frogs could change); potential impacts; unknown severity in the future; unknown scope; unknown trend)

Although current evidence indicates that the frog chytrid fungus (*Batrachochytrium dendrobatidis* (Bd)) poses a low level of threat to frog populations in wetlands of the Swan Coastal Plain, this situation could change in future. Bd is a major pathogen affecting frog populations across Australia and remains a potential threat to frogs in the wetlands of the Swan Coastal Plain.

Riley *et al.* (2013) reported that "predicted and realised high environmental suitability for B. dendrobatidis is not correlated with frog decline in south-western Australia. Innate or acquired immunity, chytrid strain type and limited opportunities for chytrid growth may all explain absence of chytrid impacts. Occurrence of Batrachochytrium dendrobatidis is not a current critical management issue for conservation managers in south-western Australia despite a known presence since 1985."

The *Threat abatement plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis* (Commonwealth of Australia 2016b) similarly notes: "Of note, the situation in Western Australia is quite different to the eastern states; although chytrid fungus is present in the majority of south-western Australian frog species, the impacts on these species have been non-catastrophic and stable populations persist. At present, it is not known why this difference between eastern and western Australia exists, but several theories including environmental differences and B. dendrobatidis strain variations have been suggested (Riley *et al*., 2013)."

Despite these findings, Bd is present on the Swan Coastal Plain, and its impact could increase if conditions change, for example, through the introduction of a new strain that is more pathogenic.

Additional references

Additional references are available in **attachment N**, if required.

8.3 Myrtle rust (Austropuccinia psidii)

(future; potential impacts; unknown severity in the future but potentially extreme; potentially whole in future; currently not present (static/stable))

Myrtle rust is a nationally significant plant disease caused by the invasive fungal pathogen *Austropuccinia psidii*. It infects and can kill many flora species within the Myrtaceae family. The pathogen has not yet been detected in the wetlands of the Swan Coastal Plain. However, it entered Western Australia in 2022, with the first confirmed detection in the east Kimberley (Government of Western Australia 2023c), and it has spread rapidly and extensively across eastern Australia since its introduction to New South Wales in 2010 (Invasive Species Council undated(a), undated(b); Campos and Tobe 2022, p. 6). This rapid spread and the recent breach of Western Australia's biosecurity barrier indicates a high likelihood of myrtle rust being introduced into the wetlands of the Swan Coastal Plain.

Given the high likelihood of myrtle rust being introduced, it is particularly significant that many of the flora species of the wetlands of the Swan Coastal Plain belong to the Myrtaceae family (see **attachment A**). This includes moitch or flooded gum (*Eucalyptus rudis*), freshwater paperbark (*Melaleuca rhaphiophylla*), modong or stout paperbark (*Melaleuca preissiana*) and saltwater paperbark (*Melaleuca cuticularis*), which are identified as key wetland flora species in the response to **question 3b**. As Myrtaceae species contribute substantially to the structure, shading, nutrient cycling and habitat of these wetlands, any pathogen that affects them poses a direct risk to the ecological function and long-term viability of these wetlands.

The spores of the myrtle rust pathogen are spread very easily by wind, by a variety of animals, and by human movement and activity (Makinson *et al.* 2020, p. 2). Once established in a climatically suitable area the disease is very hard, usually impossible, to eradicate (Makinson *et al.* 2020, p. 2).

Myrtle rust in Australia – a national action plan (Makinson *et al.* 2020, p. 2) identifies the south-west of Western Australia as having potential for very serious impacts due to its exceptionally rich Myrtaceae flora. It also notes that ecological communities with high proportions of susceptible Myrtaceae have the greatest potential for loss of ecological function as a result of myrtle rust impacts (Makinson et al. 2020, p. 6). The plan provides examples of the severity of impacts already observed in eastern Australia, noting that "among the species undergoing the most drastic declines due to myrtle rust, we know that several are no longer producing seed due to foliage and stem damage and stress. For these species, we have missed the window for seed collection, and we must capture and grow vegetative material from which protected seed production areas can be established later" (Makinson et al. 2020, p. 7). This illustrates the scale of ecological disruption the pathogen can cause and the vulnerability of Myrtaceae-dominated wetlands on the Swan Coastal Plain.

Campos and Tobe (2022) stated that "myrtle rust is a known risk to biodiversity, bringing species to near extinction (Fensham *et al.* 2020). The risk to Western Australia should be considered in the context of the already existing threats of habitat destruction and fragmentation, *Phytophthora cinnamomi* dieback and climate change. Further, Myrtaceae species are key in the tree/canopy component of vegetations over the entire state (DPIRD 2021). Canopy decline could lead to landscape-scale ecosystem changes, such as an impact on trophic webs, changes in depth of water table and subsequent soil quality, and even changes to rainfall patterns." This highlights the potential for significant ecological consequences if myrtle rust becomes established in Myrtaceae-dominated wetlands on the Swan Coastal Plain.

Campos and Tobe (2022) noted that "despite the lack of records in Western Australia to date, models have shown that the State is susceptible to myrtle rust both in the tropical north (Singh *et al*. 2016, Narouei-Khandan *et al.* 2020) and the temperate southwest (Kriticos *et al.* 2013, Singh *et al.* 2016, Narouei-Khandan *et al.* 2020)." Makinson *et al.* (2020, p. 2) similarly noted that multiple risk-projection models have consistently shown a high likelihood of establishment in the south-west of Western Australia. However, one study (Berthon *et al.* 2018) projected lower climatic suitability, highlighting variation among modelling approaches.

The DBCA (2025c), Invasive Species Council (undated(b)) and Plant Biosecurity Science Foundation (2020) have all expressed significant concern about the pathogen's continued movement into Western Australia. The Invasive Species Council (undated(b)) states that "climatic modelling suggests it will spread further, with south-western Australia at grave risk," and describes myrtle rust as "one of the worst biosecurity threats Australia has faced, putting already endangered species at further risk."

Knowledge gaps

Myrtle rust in Australia – a national action plan (Makinson *et al.* 2020, p. 2) identifies substantial knowledge gaps and the potential for severe ecological consequences.

There are significant uncertainties regarding the potential impacts of myrtle rust on the wetlands of the Swan Coastal Plain. The susceptibility of many local Myrtaceae species is unknown, and there is limited information on how infection affects growth, reproduction, canopy structure and long-term survival.

The rate of spread under local climatic conditions, and the potential for interactions with other threats**,** such as drought, fire, altered hydrology, invasive species and other pathogens including Phytophthora dieback (*Phytophthora cinnamomi*), are poorly understood.

Most studies indicate that the south-west of Western Australia has a suitable climate for myrtle rust; however, at least one study reached a different conclusion. This may highlight a need for further

investigation, including an examination of the assumptions and parameters that led to the differing result.

There is also little documented evidence on how myrtle rust may alter habitat quality for wetland-dependent fauna through changes in shading, litter inputs and vegetation structure.

Additional references

Additional references are available in **attachment N**, if required.

8.4 Highly pathogenic avian influenza H5N1

(future; potential impacts; unknown severity in the future but potentially extreme; potentially whole in future; currently not present (stable/static))

Highly pathogenic avian influenza (H5N1), also known as H5 bird flu and H5 avian influenza, is a serious and contagious global wildlife virus that poses significant risks to native fauna and ecosystems, including those of the wetlands of the Swan Coastal Plain if it is introduced to south-west Western Australia.

H5N1 bird flu has spread to all continents except Australia (BirdLife Australia 2025a; Biodiversity Council *et al.* 2024). The annual spring migration of shorebirds from the northern hemisphere is the most likely pathway for its arrival (Wildlife Health Australia 2025; BirdLife Australia 2025a). It may also enter via waterbirds from regions north of Australia or seabirds travelling from Antarctic and sub-Antarctic areas (Wildlife Health Australia 2025; BirdLife Australia 2025a; Biodiversity Council *et al.* 2024). These wild bird movements can occur year-round (Wildlife Health Australia 2025).

Once in Australia, H5N1 could be transmitted between birds or to other fauna through direct contact with respiratory secretions and faecal material, predation or scavenging, or indirect exposure to contaminated environments or objects such as clothing, boots and equipment (Wildlife Health Australia 2026).

In October 2025, H5N1 was confirmed on Heard Island. This is the first recorded detection of the virus in an Australian territory (BirdLife Australia 2025b; Wildlife Health Australia 2025).

Potential ecological consequences if H5N1 is introduced to the wetlands of the Swan Coastal Plain

Overseas, this strain has killed millions of wild birds and tens of thousands of wild mammals (DCCEEW 2025c; BirdLife Australia 2025a; Biodiversity Council et al. 2024). BirdLife Australia (2025a) stated that “an outbreak of H5 bird flu in Australian birds could be catastrophic. It can be expected to cause large numbers of birds becoming infected and dying.” It noted particular concerns for threatened species and emphasised that impacts can be especially severe in species with small populations or those restricted to a few locations. In some overseas populations, outbreaks have caused more than 50% mortality, including in the sandwich tern in Europe and the Peruvian pelican in South America (BirdLife Australia 2025a).

The most frequently affected native birds overseas include waterbirds (for example, ducks and swans), shorebirds, seabirds (for example, gulls and terns) and predatory or scavenging birds (for example, eagles and other raptors) (Wildlife Health Australia 2026). Based on mammal cases overseas, infections are most likely in predatory or scavenging mammals and marine mammals that have close contact with seabirds, such as seals and sealions (Wildlife Health Australia 2026).

BirdLife Australia (2025a) states that all bird species are potentially susceptible. Species that gather in high densities or share habitats with many others, such as shorebirds and waterbirds, have an increased likelihood of contracting and spreading the virus. Birds that nest in colonies, particularly those restricted to a few sites, are at greatest risk because close contact facilitates transmission and any outbreak can affect a large proportion of the population. Godfrey (1988) noted the large

congregations of waterbirds on open-water wetlands during summer (see 'waterbird movements and interactions' in the response to **question 4**). Drying due to climate change, altered hydrology and reduced water quality may further concentrate waterbirds into fewer refuges, increasing the likelihood of high-density outbreaks of H5N1.

There are significant concerns for black swans (*Cygnus atratus*), which Karawita *et al.* (2023) found to be "extremely sensitive to highly pathogenic avian influenza." They stated that black swans would be in "significant peril" if avian viral infections become established in their habitat. Kaur (2023) similarly noted that "for years, scientists have known bird flu kills every black swan it infects."

The Biodiversity Council *et al.* (2024) noted that other Australian fauna are also likely to be highly susceptible, given Australia's isolation and their lack of evolutionary exposure to the H5N1 virus.

Additional references

Additional references are available in **attachment N**, if required.

9. Altered fire regimes

(*ongoing; actual impacts; potentially extreme – a system-level driver of ecological decline; whole; increasing*)

The EPA (2007b, p. 129) identifies Swan Coastal Plain communities among ecosystems "at serious risk from too much fire". Blake (2013) similarly states that the wetlands of the Swan Coastal Plain have been subject to increasing fire frequency and intensity. This trend reflects a combination of drying due to climate change, declining groundwater levels, and the increasing exposure of wetlands to fires originating in adjacent urban and peri-urban areas.

Multiple studies emphasise that wetland soils and sediments on the Swan Coastal Plain are now more vulnerable to fire than historically. Bleby *et al.* (2009, p. 28) state that "wetland soils and sediments are becoming more vulnerable to fire on the Swan Coastal Plain due to summer drying of surface sediments, which is affected by recent changes in climate, declining rainfall, increased use of groundwater by an increasing urban population… [and] urban development." The EPA (2007b, p. 127) similarly notes that native vegetation within urban areas is subject to frequent fires due to arson, accidental ignition, and invasion by grassy weeds that increase fuel loads.

Fire is now occurring in wetland areas that historically remained too wet to burn. Horwitz and Sommer (2005, p. 122) describe that "in recent years… over-extraction of groundwater, exacerbated by declining rainfall, has lowered groundwater tables… [and] some wetland systems… have in the recent past become so dry in summer that nearby fires have passed through the wetland areas, either severely cracking the organic soils or actually burning them."

Broader regional assessments also recognise inappropriate fire regimes as a major threat to biodiversity in wetland habitats. For example, the *Swan Coastal Plain South management plan* (Conservation Commission of WA and DPAW 2016, p. 33) states that "inappropriate fire regimes are a major threat to the diversity, viability and long-term conservation of communities, habitats and populations of many species."

Ecological consequences of altered fire regimes on the wetlands of the Swan Coastal Plain

Altered fire regimes affect the wetlands of the Swan Coastal Plain through direct impacts on wetland vegetation and habitat structure, fauna, soils, and water quality.

Vegetation and habitat structure

The EPA (2007b, p. 129) notes that "changed fire regimes have radically changed the environment by threatening fire-sensitive species and altering floristic patterns and vegetation structure, and hence affecting the fauna that depends on that vegetation… In addition, many species that are not

necessarily fire-sensitive can be burnt too frequently and not effectively recover between fires." Fires that occur too frequently across large areas or at an inappropriate time of year cause loss of habitat and food supply for native species (EPA 2007b, p. 131).

The Conservation Commission of WA and DPAW (2016, p. 33) note that "inappropriate fire regimes are particularly damaging to threatened species and ecological communities that have specific fire regime requirements or that are found in geographically or temporally restricted habitats. For example, overly frequent fires may reduce the availability of nesting material or sites for the Australasian bittern and [wetland] vegetation often needs near total exclusion of fire to persist."

Impacts on fauna

Fire-sensitive fauna are particularly vulnerable. The EPA (2007b) states that "fire-sensitive animals are those that have limited capacity to escape, or to find alternative food sources and shelter if fire temporarily removes habitat." Wetland fauna, including fledgeling birds, frogs, turtles and invertebrates, are exposed to these risks when fires penetrate wetland margins or basins during dry periods, when escape options are limited.

The richness and diversity of fauna are also affected by the loss of habitat diversity. As noted by Bamford and Roberts (2003) in Conservation Commission of WA and DPAW (2016, p. 33), "the richness and diversity of fauna taxa is generally maximised by avoiding widespread intense bushfires and by maintaining a diversity of post-fire vegetation successional stages." High-intensity or frequent fires reduce this diversity.

Soil and sediment impacts

Fire can cause substantial physical and chemical changes to wetland soils and sediments. Bleby *et al.* (2009) and Horwitz and Sommer (2005) report that wetlands exposed to fire can experience loss of organic matter and a range of chemical and physical changes.

Water quality impacts

Fire can alter water quality through multiple pathways, including ash inputs, nutrient pulses, increased alkalinity, and changes associated with rehydration of burnt or overheated soils. Horwitz and Sommer (2005) summarise that "water quality responses may occur due to catchment effects (increased runoff and erosion, explainable by removal of canopy cover and changes in soil water repellency, resulting in nutrient and sediment fluxes into the wetland, elevated cation concentration and a shift to alkalinity)… On the Swan Coastal Plain the over-riding catchment influences are the ways in which the wetlands interact with the shallow unconfined aquifers and how a fire and a changed fire regime might affect this relationship."

Horwitz and Sommer (2005) also note that "profound changes to water quality are possible upon rehydration of burnt or overheated (organic) soils. Cracking and erosion caused by fire can expose acid sulphate soils to oxidizing conditions, resulting in lower pH and mobilization of heavy metals."

These changes can affect aquatic fauna directly. For example, altered pH and metal concentrations can reduce the abundance of sensitive macroinvertebrates.

Fire-sensitive and fragmented wetland ecosystems

Multiple sources emphasise that wetlands are among the most fire-sensitive ecosystems. The Conservation Commission of WA and DPAW (2016, p. 33) highlight that "fire-sensitive species and ecosystems are most typically associated with the less flammable parts of the landscape… for example wetlands and riparian vegetation."

As discussed in threat 1, wetlands on the Swan Coastal Plain are now highly fragmented. In this fragmented landscape, many wetland remnants are small and isolated, making them particularly sensitive to fire. The Conservation Commission of WA and DPAW (2016, p. 34) notes that a high-intensity fire that affects an entire fragment may result in the loss of whole populations of threatened and endemic flora. Small remnants may also experience significant impediments to

post-fire recovery. For example, their high proportion of exposed margins makes them more susceptible to weed invasion.

Interactions with other threats

Altered fire regimes interact strongly with other threats. For example:

- altered hydrological regimes (threat 3) dry wetland soils and reduce groundwater levels, increasing the likelihood of fire entering wetlands and intensifying fire severity
- water-quality degradation (threats 4.1–4.4) can follow fire events through nutrient pulses, ash inputs and erosion, compounding eutrophication and turbidity pressures; and in some wetlands, cracking and erosion caused by fire can also expose acid sulphate soils
- invasive weeds (threat 5) often increase flammability, promoting more frequent or intense fires that further suppress native vegetation and reinforce weed dominance
- invasive fauna (threat 6) such as foxes and cats exploit post-fire environments where ground cover is reduced, increasing predation pressure on native fauna
- climate change (threat 10) increases fire frequency and intensity through hotter, drier conditions and more extreme weather, amplifying the impacts of altered fire regimes on wetland ecosystems
- farmed animal grazing and trampling (threat 7) can suppress post-fire regeneration because regenerating vegetation may be more sensitive, palatable and accessible
- pathogens (threat 8) may be promoted by fire, with fire–disease interactions increasing the impact of *Phytophthora cinnamomi* (Department of Agriculture, Water and the Environment 2022, pp. 1, 24).

Knowledge gaps

Although the impacts of fire on wetland ecosystems are increasingly recognised, substantial gaps remain in understanding how different fire regimes affect the structure, function and long-term resilience of wetlands on the Swan Coastal Plain. Key knowledge gaps include how climate change and altered hydrology have shifted the natural frequency, intensity and seasonality of fire; the levels of fire frequency, intensity and seasonality that wetland flora, fauna and organic-rich soils can tolerate before experiencing irreversible change; the long-term effects of frequent burns on hydrology, water quality, wetland flora and wetland fauna; and the cumulative impacts of fire interacting with the drying climate, invasive weeds, invasive fauna, pathogens, such as Phytophthora dieback, and altered hydrological regimes.

Anecdotal evidence suggests that arson, accidental ignition and prescribed burning are major contributors to altered fire regimes in wetlands on the Swan Coastal Plain; however, their relative contribution has not been quantified. Improving this understanding would help identify where direct management, such as reducing arson and accidental ignition risk and avoiding overly frequent prescribed burning, can protect wetlands from altered fire regimes. This recognises that climate change and altered hydrology have also altered fire regimes but may be less readily managed at the local scale.

Additional references

Additional references are available in **attachment N**, if required.

10. Climate change

(ongoing; actual impacts; extreme – a system-level driver of ecological decline; whole; increasing)

Wetlands across the South West Land Division (SWLD), including those on the Swan Coastal Plain, are highly sensitive to climate change because they rely on cool-season rainfall, surface runoff and groundwater recharge. The region has undergone sustained climatic change, marked by declining winter rainfall, reduced catchment runoff and groundwater recharge, and rising temperatures, sea levels and fire weather severity.

Declining rainfall

The BoM (2025, p. 8) reported that "rainfall decline in south-west WA has been greater than anywhere else in Australia. Almost all climate projections indicate a warmer and drier future for the region, marking it as a global hotspot for reduced rain because of climate change". In the south-west, April–October (cool-season) rainfall has declined by approximately 16% since 1970 (BoM and CSIRO 2024). May–July rainfall has experienced the greatest reduction, decreasing by around 20% since 1970, or 24% since 1994 (BoM and CSIRO 2024). Gelsinari *et al.* (2024) similarly noted a 20% decline in total rainfall since the 1960s

These changes represent a substantial shift in the climatic conditions that underpin wetland hydrology (refer to threat 3 and the response to question 4 under 'Hydrology interactions and functional processes'). Earlier analyses by the Indian Ocean Climate Initiative (IOCI 2005a, 2005c), which focus specifically on the south-west, may also provide relevant context.

Climate change is also increasing the frequency, duration and severity of drought conditions (Ukkola *et al.* 2020).

Substantially declining catchment runoff

Catchment runoff in the south west has declined substantially due to reduced winter rainfall. The DWER (2024) reported that, since the mid-1970s, lower rainfall has caused an average reduction of approximately 80% in streamflow runoff. Before 1975, the average annual streamflow into Perth's drinking water reservoirs was approximately 420 gigalitres (GL); it is now only about 25 GL per year (DWER 2024). See also the graph by the Water Corporation (2026b). These reservoirs are located on the Darling Plateau, above the Swan Coastal Plain. Historical information specific to the south-west is also available from the Indian Ocean Climate Initiative (IOCI 2005e).

Substantially declining groundwater recharge

Most wetlands on the Swan Coastal Plain are connected to groundwater, and the groundwater recharge that supports these wetlands has also declined. Recharge on the Gnangara Mound has decreased by 50–70% since the 1960s in response to a 20% decline in rainfall (Gelsinari *et al.* 2024). BoM (2025, p. 8) similarly reported up to 70% less groundwater recharge in the South West Land Division. These trends align with reductions in the extent and duration of wetland inundation and diminished hydrological connectivity at the landscape scale (see threat 3).

Gelsinari *et al.* (2024) identified shorter winters and fewer winter storms are the primary drivers of reduced groundwater recharge. Their findings also indicate that recharge in Mediterranean-climate groundwater systems is likely to decline more rapidly than rainfall.

The DWER (2024) reported the combined impacts of climate change and increasing groundwater use have shifted groundwater systems out of balance. Since 1980, groundwater levels across the Gnangara Mound have fallen by up to 10 metres in some areas, representing a loss of approximately 1,000 GL of aquifer storage. This is equivalent to 1,000 very large sports stadiums filled with water (DWER 2024).

Priestly *et al.* (2023) and CSIRO (2023) reported that cave-based analyses indicate rainfall is no longer reliably recharging groundwater in southwest Australia. Their examination of records shows that this pattern is unprecedented over the past 800 years.

Unconfined groundwater resources under native vegetation are projected to be most affected by the impact of climate change and the associated increase in water demand for production and consumption (McFarlane *et al.* 2012; McFarlane *et al.* 2020 in DCCEEW 2023b).

For further detail on declining groundwater levels and recharge, refer to threat 3 and Ali *et al.* (2012). Historical information from the Indian Ocean Climate Initiative (IOCI 2005b) may also be relevant.

Rising temperatures and increasing fire weather

Australia has warmed by an average of 1.51 ± 0.23 °C since national records began in 1910, with most warming occurring since 1950 (BoM and CSIRO 2024). Each decade since 1950 has been warmer than the one before it, and the national warming trend is consistent with global patterns (BoM and CSIRO 2024). Australia's warmest year on record was 2019, and eight of the nine warmest years have occurred since 2013 (BoM and CSIRO 2024). According to BoM and CSIRO (2024), the long-term warming trend means that most years are now warmer than almost any observed during the 20th century. Warming is observed across Australia in all months, accompanied by an increased number of extreme heat events across all months, including a greater frequency of very hot days in summer (BoM and CSIRO 2024). Historical information specific to the south-west is available in IOCI (2005f).

Extreme fire weather and the length of the fire season have increased across large parts of Australia since the 1950s (BoM and CSIRO 2024). These changes have contributed to larger and more frequent fires, particularly in southern Australia (BoM and CSIRO 2024). There is high confidence that climate change will continue to increase the frequency of weather conditions associated with high fire danger in the south-west (Son *et al.* 2021; Dowdy 2018). Dowdy (2018) reported "a clear trend toward more dangerous conditions during spring and summer in southern Australia, including increased frequency and magnitude of extremes, as well as indicating an earlier start to the fire season."

Sea level rise

Global mean sea level has risen by over 22 centimetres since 1900 (BoM and CSIRO 2024). Half of this rise has occurred since 1970. Global mean sea level rise is accelerating. BoM and CSIRO (2024) stated that "tide gauge and satellite altimetry observations show that the rate of global mean sea level rise increased from 1.5 cm (± 0.2 cm) per decade from 1901 to 2000, and is now approaching 4 cm (± 0.4 cm) per decade from 1993 to 2023. The dominant cause of global mean sea level rise since 1970 is anthropogenic climate change." See also IOCI (2005d).

Climate change projections and summaries

Climate projections indicate that these trends are likely to continue. Expected changes include ongoing increases in air temperature, with more frequent heat extremes and fewer cold extremes; a continued decline, on average, in cool-season rainfall across many parts of southern Australia, leading to longer periods in drought; more intense short-duration heavy rainfall events, even in regions where average rainfall decreases or remains stable; a continued rise in the number of dangerous fire-weather days and a longer fire season across much of southern Australia; and further sea-level rise (BoM and CSIRO 2024).

The projections reported by BoM and CSIRO (2024) are broadly consistent with global climate change assessments by the Intergovernmental Panel on Climate Change (IPCC), including Parmesan *et al.* (2024), IPCC (2022a, 2022b, 2022c), and earlier predictions for the south-west by the Indian Ocean Climate Initiative (IOCI 2005b). The IPCC (2022a) noted that the south-west has experienced a "significant rainfall decrease in 1910–2019, attributable to human influence, increase in agricultural and ecological drought (high confidence), rainfall very likely to continue decreasing under all future scenarios".

Ecological consequences of climate change on the wetlands of the Swan Coastal Plain; and interactions with other threats

Climate is causing significant ecological impacts on the wetlands of the Swan Coastal Plain. For example (adapted from WAPC 2025b):

- Reduced rainfall has:
    - altered wetland hydrology (threat 3), including reductions in groundwater recharge and rainfall that result in shorter hydroperiods, reduced inundation and more frequent complete drying
    - affected water quality through changes in the quantity and quality of inflows, and through exposure of acid sulfate soils caused by declining groundwater levels (threats 4.1–4.3). Water-quality degradation intensifies under hotter, drier conditions, as elevated water temperatures promote algal blooms, reduce oxygen solubility and concentrate pollutants during dry or low-flow periods, which can also cause fish kills
    - impacted on water-dependent fauna, flora and ecosystems, for example, causing death or declines in condition as wetlands dry; and increasing the importance of dry season refuges for aquatic fauna or shifting their location
    - increased the barriers for migration and movement of aquatic fauna.
- Increased frequency of heatwaves and associated temperatures, which may cause death or harm to wetland flora and fauna, and contribute to hydrological changes (threat 3)
- Rising sea levels, which may elevate coastal wetland flood levels, raise groundwater levels and increase the risk of saltwater intrusion into wetlands via groundwater and surface water.
- Changes in the frequency and magnitude of extreme weather events, which may alter the frequency and extent of flooding and droughts; and mobilise larger volumes of sediment, which may negatively impact on water quality (threat 4.5).
- Increased bushfire risk, frequency and intensity, which threaten the extent and condition of wetland vegetation and aquatic ecosystems important for protection of wetlands (threat 9).

Climate change is also influencing the severity and extent of other threats. For example:

- habitat loss, clearing and fragmentation (threat 1) reduce the ability of wetlands to buffer the effects of a changing climate, making remaining patches more vulnerable to heat stress, reduced water availability and extreme events
- loss of wetland buffers, foreshore areas and fringing vegetation (threat 2) removes shading and moisture-retaining vegetation that would otherwise moderate temperature extremes and protect wetland margins under a drying climate
- invasive flora (threat 5) often tolerate heat and moisture stress better than native species, enabling weeds to expand into areas affected by climate-related shifts towards drier conditions
- invasive fauna (threat 6) benefit when native fauna are concentrated in shrinking refuges during periods of reduced water availability, increasing predation pressure and disturbance
- farmed animal grazing and trampling (threat 7) intensify during dry periods, as farmed animals seek remaining water sources, compounding climate-related stress on wetland margins and shallow zones

- pathogens and disease (threat 8) can become more severe as vegetation and fauna are weakened by climate-related moisture deficits, reducing resistance to infection and slowing recovery
- altered fire regimes (threat 9) are amplified by a drying climate, increasing the likelihood of intense fires that damage wetland vegetation and peat soils
- cumulative landscape-scale impacts (threat 11) reduce ecological resilience, making wetlands less able to absorb or recover from climate-related hydrological and ecological change.

Chambers *et al.* (2013) and Kauhanen (2011) provide further information on the ecological consequences of climate change on wetlands.

Knowledge gaps

Despite extensive research on climate trends and hydrological impacts in south-west Western Australia, significant uncertainties remain regarding how climate change will affect wetlands. While exposure to warming and drying is well established, the thresholds at which dominant wetland species experience irreversible decline are not fully understood, nor are the interactions between hydrological change due to the drying climate, fire, disease, invasive species and nutrient enrichment. Predicting ecological outcomes is further complicated by non-linear responses and time lags. There is limited monitoring of long-term wetland vegetation change, fauna responses, groundwater–surface water interactions and the loss of ecological and hydrological connectivity under drying climates.

The Climate Science Initiative will fill some gaps by producing the most detailed and comprehensive Western Australian climate change projections to date, extending to the year 2100 (Government of Western Australia 2025a).

Additional references

Additional references are available in **attachment N**, if required.

11. Cumulative impacts of threats on wetlands

(ongoing; actual impacts; extreme – a system-level driver of ecological decline; whole; increasing)

The wetlands of the Swan Coastal Plain are increasingly affected by cumulative impacts. Although individual threats each pose significant risks, their combined effects can be far more severe than any single pressure acting alone. The WAPC (2025b, p. 4) noted that cumulative impacts are the interactions or compounding effects of one or more impacts, including past, present and (reasonably) foreseeable future pressures; and that the assessment of cumulative impacts considers the compounding effects of direct, indirect and consequential impacts over time.

The following cumulative impacts on wetlands are adapted from Beanlands *et al.* (1986) and Runge (1998):

- *Time crowding* – repeated or ongoing pressures on the same wetland, such as continual stormwater inflows or recurring groundwater drawdown.
- *Space crowding* – multiple small or incremental impacts occurring in close proximity, including clustered developments, numerous abstraction bores, or cumulative loss of surrounding native vegetation.
- *Compounding or synergistic effects* – interacting stressors that intensify ecological change, such as nutrient enrichment combined with altered hydrology or multiple contaminant sources affecting water quality.

- *Time lags* – delayed ecological responses, including gradual loss of wetland flora or long-term declines in wetland fauna from chronic low-level contamination or incremental hydrological change.
- *Extended boundaries* – impacts originating at a distance or transmitted through connected wetland systems, such as regional groundwater extraction, upstream land-use change or dams, or catchment-scale drainage infrastructure altering wetland hydrology.
- *Triggers and thresholds* – pressures that push wetlands beyond critical ecological limits, for example water quality deterioration or groundwater decline reaching levels that key wetland species cannot tolerate.
- *Indirect effects* – secondary impacts arising from enabling infrastructure, such as new transport or service corridors facilitating further development and increased stormwater or clearing pressure.
- *Patchiness effects (fragmentation)* – clearing, drainage, dams and other flow control structures, poorly constructed wetland crossings, development or linear infrastructure breaking up wetlands, wetland buffers or foreshore areas, reducing ecological function, connectivity and resilience.

The cumulative impacts also reflect the combined and interacting effects of the threats outlined in threats 1–10 and 12 of this nomination.

In one example, the *Gabi Warlang Bidi: Water quality improvement plan for the Peel-Harvey Estuary system* (DWER 2025b, p. xii) states that "the Peel-Harvey estuary suffered ecosystem collapse in the 1970s. This was characterised by prolific blooms of macroalgae (which had to be physically removed with marine harvesters), loss of seagrass, fish kills and toxic cyanobacteria (*Nodularia spumigena*) coverage visible from space. The collapse was undeniably a result of massive modifications to the catchment and its hydrology. Extensive draining of wetlands and seasonally inundated lowlands, along with the widespread clearing of native vegetation for agriculture on poor-nutrient-retaining soils, led to very high nutrient loads going into the estuary." Given the catchment-wide scale of these threats, it is reasonable to infer that wetlands throughout the Peel–Harvey catchment were also, and continue to be, subject to cumulative impacts.

Another example is the cumulative impact of climatic drying and barriers on endemic freshwater fishes in the 'river' and 'creek' wetland types. Freshwater fish in southwestern Australia, including species occurring on the Swan Coastal Plain, migrate upstream to spawn during winter and spring, and these movements have been shown to increase with higher river flows (Beatty *et al.* 2014a). Ongoing climatic drying and the associated loss of wetland habitat are therefore expected to reduce these spawning migrations and subsequent recruitment into native fish populations (Beatty *et al.* 2014a). Consequently, climatic drying is believed to be compounding the impacts of existing instream barriers on these already vulnerable fish communities (Beatty *et al.* 2014a).

The EPA (2007a, p. 95) strongly summarised that wetlands on the Swan Coastal Plain "are being lost or degraded at an alarming rate by altered catchment water balances, drainage, development, salinity, acidity, pollutant discharge, dieback, weed encroachment and insensitive fire management. Climate change is also an ominous threat for remaining wetlands, particularly in the south west".

The DEC (2012h, p. 3) notes some of the complexities in wetland management and highlights the need to understand, consider and manage cumulative impacts.

Knowledge gaps

While individual threats are relatively well studied in isolation, far less is known about their cumulative effects.

The extent to which fragmentation, falling groundwater levels and drying associated with climate change combine to restrict flora and fauna dispersal and reduce habitat availability remains uncertain.

Additional references

Additional references are available in **attachment N**, if required.

12. Dams, crossings and other barriers to aquatic fauna movement

(ongoing; actual impacts; major; majority of the most relevant wetland types and minor for other wetland types; increasing)

Constructed barriers within wetlands often obstruct the natural movement of fish, crustaceans and other aquatic fauna. These barriers include in-steam or in-wetland dams, weirs, gauging stations and other flow-control structures; and poorly designed wetland crossings for road vehicles, rail, pedestrians or farmed animals. Barriers of this kind have been introduced across the Swan Coastal Plain over many decades and continue to be installed or upgraded.

Ecological consequences of barriers to aquatic fauna movement

Major dams on the Darling Plateau, including Mundaring, Lower Helena, Victoria, Churchman Brook, Canning, Wungong, Serpentine, Serpentine Pipehead, North and South Dandalup, Lower South Dandalup, Conjurunup, Samson Brook, Samson Brook Pipehead, Harvey and Stirling dams (Water Corporation 2026a),and Wellington dam in the Collie Basin, have substantially regulated the rivers that flow onto the Swan Coastal Plain and altered the hydrology of their connected wetlands. For example, damming of the Canning River has captured about 95% of its flow (EPA 2007a, p. 88). These dams reduce the frequency and magnitude of flows reaching downstream wetlands (Kingsford 2000, 2011; Kreibich 2025; Kreibich *et al.* 2024). This suppresses natural winter peak flows, reduces summer baseflows and delays the onset of seasonal inundation, contributing to shortened hydroperiods. Their cumulative effects interact with declining rainfall, rising temperatures and groundwater abstraction to accelerate the drying of seasonal wetlands, reduce hydrological connectivity, sometimes changing wetlands to terrestrial ecosystems (Kingsford 2000, 2011; Kreibich 2025; Kreibich *et al.* 2024). See also threat 3 under the ‘loss of floodplain connectivity’ sub-heading.

Even small or low-lying structures relative to the wetland bed, such as piped culverts, low-flow pipes, causeways and gauging stations, which are common on the Plain, can block the movement of small native fish that cannot swim against high velocities, tolerate turbulence, or jump more than a few centimetres. Beatty *et al.* (2014b) provides further information about considering fish swimming ability when designing fishways.

This is significant because fish may undertake a range of movements for different ecological purposes, including local movements to access food, avoid predators and seek shelter during daylight; daily movements to reach habitat, food and shelter, defend territory and avoid predators; and seasonal movements associated with breeding cycles triggered by rising water levels or temperatures (Fairfull and Witheridge 2003). They also move upstream to access new habitats or established spawning areas, downstream following spawning or to avoid predators, and laterally onto floodplains or adjacent habitats to access food, complete breeding cycles and support juvenile recruitment (Fairfull and Witheridge 2003; Beatty *et al.* 2014a).

These barriers have the following ecological consequences:

- fragmenting aquatic populations, reducing genetic diversity and resilience (Fairfull and Witheridge 2003; Government of Western Australia 2023a; Coleman *et al.* 2018 in Lucas 2019; Pavlova *et al.* 2017 in Lucas 2019; Beatty *et al.* 2014b)
- restricting access to breeding, spawning, feeding, nursery and refuge habitats, interrupting daily and seasonal, lateral and longitudinal movements (Fairfull and Witheridge 2003; Lintermans and Osborne 2002 in Lucas 2019; Beatty *et al.* 2014b)
- causing local extinctions (Fairfull and Witheridge 2003; DPI NSW 2023; WAPC 2025b)
- reducing population size and distribution, with cumulative barriers recognised as a major threat to native fish persistence (Fairfull and Witheridge 2003; Arthur Rylah Institute 2026)
- increasing predation and competition, as aquatic fauna are forced into smaller habitat fragments (DPI NSW 2023)
- creating favourable conditions for invasive fish, including carp and mosquito fish, by forming still-water pools upstream of barriers (Fairfull and Witheridge 2003; Government of Western Australia 2023a) (threat 6)
- altering water quality, including increased nutrients, reduced dissolved oxygen, warmer shallow water downstream of barriers, and stagnant water upstream (Government of Western Australia 2023a) (threat 4)
- increase the flooding of wetland vegetation upstream of barriers and decreasing the water available to vegetation downstream from the barrier (Government of Western Australia 2023a)
- disrupting floodplain connectivity, reducing the frequency, duration and extent of inundation required for fish and other aquatic fauna movement and recruitment, nutrient exchange and productivity booms (EPA 2007a; Kingsford 2000; Kreibich 2025) (threat 3).

As stated in threat 11 (cumulative impacts), climatic drying in southwestern Australia, including on the Swan Coastal Plain, is reported to act cumulatively with instream barriers to adversely affect fish populations (Beatty *et al.* 2014a).

Fairfull and Witheridge (2003) describe how various types of waterway crossings (such as bridges, culverts, wetland flow-control structures and causeways) can impede the movement of fish. For example, poorly designed culverts that convey water beneath roads can significantly modify flow conditions within and adjacent to the structure, reducing opportunities for fish passage across a wide range of flows and, in some cases, completely preventing movement. Common issues include excessive flow velocities, inadequate flow depth, high turbulence, debris blockages, long culvert lengths without habitat or resting areas, limited lighting that creates shaded zones some species avoid, and abrupt drops in water level at the outlet that create a waterfall effect (Fairfull and Witheridge 2003).

Variation in extent across the different wetland types

Barriers to aquatic fauna movement primarily affect the river, creek and floodplain wetland types, where aquatic fauna depend on longitudinal and lateral connectivity for feeding, dispersal, refuge and reproduction (Lucas 2019). These connections are readily disrupted by structures such as dams, culverts and road crossings.

These impacts are generally less relevant to wetland types such as lakes, palusplains, sumplands and damplands, which do not rely on channel-based connectivity and typically do not support fauna requiring upstream–downstream movement. However, they can still occur in these wetlands where

they are hydrologically connected to rivers, creeks or floodplains, although the effects are usually less pronounced.

Wetland crossings are found in all parts of the Swan Coastal Plain, including rural, urban and conservation areas. In urban or proposed urban areas, more wetland crossings are likely to be constructed in future as urban development and associated infrastructure expands due to population growth. Dams, weirs and other flow control structures are more common in rural areas; and sometimes in areas managed for conservation.

The threat is greatest where multiple barriers occur along a single river, creek or floodplain system (Fairfull and Witheridge 2003; Government of Western Australia 2023a).

Interactions with other threats

Barriers to aquatic fauna movement interact strongly with:

- altered hydrology, including reduced flows and loss of floodplain connectivity (EPA 2007a; Kingsford 2000; Beatty *et al.* 2014a) (threat 3)
- water quality degradation, including eutrophication, low dissolved oxygen and thermal stress (Government of Western Australia 2023a) (threat 4)
- invasive fauna, which may proliferate in still-water pools created by barriers (Fairfull and Witheridge 2003) (threat 6)
- habitat loss and degradation, which reduce shading, increase sedimentation and alter vegetation structure (Fairfull and Witheridge 2003) (threats 1 and 2)
- drying due to climate change, which reduces natural flow events that would otherwise allow passage over barriers (threat 10).

Knowledge gaps

The number and location of dams, other flow-control structures and wetland crossings is not well documented, limiting understanding of their individual and cumulative impacts on hydrology and aquatic fauna movement.

Limited information exists on the swimming, jumping and endurance capacities of small native fish, particularly under different flow, temperature and lighting conditions, constraining assessments of barrier severity.

Barrier characteristics (such as culvert dimensions, outlet drops, flow velocities, turbulence, lighting conditions and maintenance status) are poorly mapped, reducing the ability to evaluate passability.

Few people are aware that wetland crossings can be a significant barrier to aquatic fauna movement. This means aquatic fauna are rarely considered when planning, designing and constructing crossings.

The cumulative effects of multiple small barriers across catchments are not well understood, limiting predictions of long-term impacts on population viability.

Species-specific behavioural responses to non-physical barriers, including shading, noise, vibration and abrupt transitions between light and dark environments, remain poorly studied.

Seasonal hydrological conditions at barriers, including low-flow periods, drying events and backwatering, are not consistently monitored, making it difficult to determine when structures are passable.

The use of floodplains, wetlands and off-channel habitats by different life stages of aquatic fauna is not well documented, limiting understanding of how barriers disrupt lateral connectivity.

Barrier performance over time is poorly monitored, including how sedimentation, debris accumulation and structural deterioration affect passability.

Additional references

Additional references are available in **attachment N**, if required.

Biological characteristics that exacerbate threats

Several biological characteristics of the wetlands of the Swan Coastal Plain make them particularly vulnerable to the threats described above. Many are groundwater-dependent systems with vegetation adapted to shallow groundwater, stable hydroperiods and saturated soils. Flora species may have limited tolerance to changes in groundwater depth, soil moisture and inundation patterns. When hydrological conditions change, these species experience stress, canopy decline and reduced recruitment, which in turn reduces shading, alters microclimates and accelerates drying; and amplifies the impacts of altered hydrological and fire regimes, disease and nutrient enrichment.

Organic-rich soils and dense root mats are also highly sensitive to drying and disturbance. Once exposed, these substrates can oxidise, become hydrophobic or acidic, release nutrients or become readily combustible, leading to long-term changes in wetland structure and function.

Fauna communities further contribute to vulnerability. Aquatic and semi-aquatic fauna species rely on permanent or seasonal wetlands for breeding and refuge, and some have limited mobility. Loss of refugia, increased intermittency and warming water temperatures can rapidly shift species composition and disrupt ecological processes. These biological characteristics (dependence on stable hydrology, sensitivity of organic soils, limited dispersal and strong interdependencies among species) collectively reduce resilience and increase the susceptibility of Swan Coastal Plain wetlands to multiple interacting threats.

Threat abatement and Recovery*

19. Identify <u>key</u> management documentation that may assist with recovery of the community.*

Examples include national and state/territory recovery plans, conservation advices, other conservation plans, threat abatement plans, or local/regional or site specific management plans; including plans for other ecological communities and species that may benefit recovery of the nominated ecological community.* Management plans for reserves (already mentioned at Question **13c**) need not be documented in full again; but please reference your previous answer. Indicate if any of this information is unavailable.*

Answer Question **19** here. Please use as much space as you need to fully answer the question.

The response to **question 13c** lists the relevant nature reserve and national park management plans, regional park management plans, water quality improvement plans and other plans. The response to **question 15** refers to plans and other documents relevant to managing the Ramsar wetlands.

The relevant threat abatement plans include:

- *Threat abatement plan for competition and land degradation by rabbits* (Commonwealth of Australia 2016a)
- *Threat abatement plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis* (Commonwealth of Australia 2016b)
- *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa) (2017)* (Commonwealth of Australia 2017)

- *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi* (Commonwealth of Australia 2018)
- *Threat abatement plan for predation by feral cats 2024* (DCCEEW 2024b)
- *Threat abatement plan for predation by the European red fox* (DEWHA 2008b)

The relevant recovery plans for threatened ecological communities include:

- *National recovery plan for the clay pans of the Swan Coastal Plain ecological community* (DBCA 2019a)
- *Interim recovery plan 2015-2020 for clay pans of the Swan Coastal Plain (Swan Coastal Plain community types 7, 8, 9 and 10a) and Clay pans with mid dense shrublands of Melaleuca lateritia over herbs* (DPAW 2015a)[38]
- *Interim recovery plan aquatic root mat community of caves of the Swan Coastal Plain 2000-2003* (CALM 2000)
- *Community of tumulus (organic mound) springs of the Swan Coastal Plain interim recovery plan no. 198* (CALM 2006)
- *Interim recovery plan 2011-2016 for sedgelands in Holocene dune swales* (DEC 2011)
- *Shrubland and woodlands on Muchea limestone interim recovery plan 2000-2003* (English and Blyth 2000b)
- *Interim recovery plan no. 197 shrublands and woodlands on Perth to Gingin ironstone recovery plan* (Meissner and English 2005a)
- *Shrubland association on southern Swan Coastal Plain ironstone (Busselton area) (southern ironstone association) recovery plan* (Meissner and English 2005b)
- *Eastern shrublands and woodlands (swan coastal plain community 20c) interim recovery plan 2000-2003* (English and Blyth 2000a).
- *Interim recovery plan 2006-2011 for the shrublands and woodlands of the eastern side of the Swan Coastal Plain (community type 20c)* (DEC 2006a) [39]
- *Thrombolite community of coastal freshwater lakes (Lake Richmond), interim recovery plan (Coastal freshwater lakes thrombolitic aragonite community formed by biologically influenced precipitation of a mineral phase) 2003-2008* (English *et al.* 2003)[40]
- *Thrombolite (stromatolite-like Microbialite) community of a coastal Brackish lake (Lake Clifton) interim recovery plan 2004-2009* (Luu *et al.* 2004)[41].

The relevant recovery plans for flora species include:

- *Slender andersonia (Andersonia gracilis) interim recovery plan 2006-2011* (DEC 2006b)
- *Austrostipa bronwenae interim recovery plan 2017–2022* (DPAW 2017a)[42]
- *Whicher Range dryandra (Dryandra squarrosa subsp. argillacea) interim recovery plan 2004-2009* (Luu and English 2004)[43]

[38] This is the Western Australian interim recovery plan.

[39] This is the Western Australian interim recovery plan. The plan on the DCCEEW recovery plan webpage is an older version.

[40] This is the Western Australian interim recovery plan.

[41] This is the Western Australian interim recovery plan.

[42] This is the Western Australian interim recovery plan. Listed as *Austrostipa bronwenae* under the EPBC Act. However, the accepted scientific name is *Austrostipa bronweniae*, as per Florabase (Western Australian Herbarium 1998–).

[43] This is the Western Australian interim recovery plan. Currently named *Banksia squarrosa* subsp. *argillacea.*

- *Bussell's spider orchid (Caladenia busselliana) recovery plan* (DEC 2005)
- *Swamp starflower Calytrix breviseta subsp. breviseta interim recovery plan 2015–2020* (DPAW 2015b)[44]
- *Abba bell (Darwinia sp. Williamson[45]) interim recovery plan 2008-2008* (Stack and English 2003a)
- *Glossy-leafed hammer orchid (Drakaea elastica) recovery plan* (DEC 2009)
- *Eremophila glabra subsp. chlorella interim recovery plan 2016–2021* (DPAW 2016a)[46]
- *Butterfly-leaved gastrolobium, Gastrolobium papilio interim recovery plan 2014−2019* (DPAW 2014a)[47]
- *Curved-leaf grevillea (Grevillea curviloba subsp. curviloba) interim recovery plan 2000-2003* (English and Phillimore 2000)
- *Ironstone grevillea (Grevillea elongata) interim recovery plan 2003-2008* (Stack and English 2003b)
- *McCutcheon's grevillea (Grevillea maccutcheonii) interim recovery plan 2003-2008* (Stack *et al.* 2003)
- *Western prickly honeysuckle (Lambertia echinata subsp. occidentalis) interim recovery plan 2003-2008* (Stack and Brown 2003)
- *Ironstone petrophile (Petrophile latericola ms) interim recovery plan 2001-2004* (Phillimore *et al*. 2001)[48]
- *Pyramid mulla-mulla (Ptilotus pyramidatus) interim recovery plan 2016–2021* (DPAW 2016b)[49]
- *Club-leafed synaphea (Synaphea sp. Pinjarra) interim recovery plan 2002-2007* (Stack *et al*. 2002)[50]
- *Synaphea sp. Pinjarra Plain (A.S. George 17182) interim recovery plan 2016–2021* (DPAW 2016c)[51]
- *Serpentine Synaphea (Synaphea sp. Serpentine (G.R. Brand 103)) interim recovery plan 2017–2022* (DPAW 2017b)[52]
- *Dwellingup Synaphea (Synaphea stenoloba) interim recovery plan* (DBCA 2018b) [53]
- *Tufted plumed Featherflower (Verticordia plumosa var. ananeotes) recovery plan* (Taylor *et al.* 2005).

The relevant recovery plans for fauna species include:

[44] This is the Western Australian interim recovery plan.
[45] Currently named *Darwinia whicherensis.*
[46] This is the Western Australian interim recovery plan.
[47] This is the Western Australian interim recovery plan.
[48] This is the Western Australian interim recovery plan.
[49] This is the Western Australian interim recovery plan.
[50] This is the Western Australian interim recovery plan.
[51] This is the Western Australian interim recovery plan.
[52] This is the Western Australian interim recovery plan.
[53] This is the Western Australian interim recovery plan.

- *Dunsborough burrowing crayfish (Engaewa reducta), Margaret River burrowing crayfish (Engaewa pseudoreducta) and Walpole burrowing crayfish (Engaewa walpolea) recovery plan 2007-2016* (DEC 2008a)[54]
- *Western swamp tortoise (Pseudemydura umbrina) recovery plan* (Burbidge *et al.* 2010)
- *Wildlife conservation plan for migratory shorebirds Commonwealth of Australia 2015 adopted as an interim recovery plan for the threatened migratory shorebirds visiting Western Australia* (DBCA 2018c)[55]
- *National recovery plan for the Australian fairy tern (Sternula nereis nereis)* (Commonwealth of Australia 2020)
- *National recovery plan for the Australasian bittern Botaurus poiciloptilus* (DCCEEW 2022b)
- *Australasian bittern (Botaurus poiciloptilus) Western Australian recovery plan* (DBCA 2018a)[56]
- *National recovery plan for the Australian painted snipe Rostratula australi* (DCCEEW 2022c)
- *Carnaby's cockatoo (Calyptorhynchus latirostris) recovery plan* (DPAW 2013)
- *Forest black cockatoo (Baudin's cockatoo Calyptorhynchus baudinii and forest red tailed black cockatoo Calyptorhynchus banksii naso) recovery plan* (DEC 2008b)
- *Quokka Setonix brachyurus recovery plan* (DEC 2013)
- *Western ringtail possum (Pseudocheirus occidentalis) recovery plan* (DPAW 2017c)
- *Chuditch (Dasyurus geoffroii) recovery plan* (DEC 2012d).

See also the *Wildlife conservation plan for migratory shorebirds* (Department of the Environment 2015).

The relevant conservation advice for threatened ecological communities includes:

- *Approved conservation advice for the assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain* (DCCEEW 2023a)
- *Approved conservation advice for the Empodisma peatlands of southwestern Australia* (DCCEEW 2023b)
- *Approved conservation advice for the sedgelands in Holocene dune swales of the southern Swan Coastal Plain* (DCCEEW 2023c)
- *Approved conservation advice for shrublands and woodlands on Perth to Gingin ironstone (Perth to Gingin ironstone association) of the Swan Coastal Plain* (DCCEEW 2023d)
- *Approved conservation advice for shrublands on southern Swan Coastal Plain ironstones* (DCCEEW 2023e)
- *Approved conservation advice for clay pans of the Swan Coastal Plain* (Department of Sustainability, Environment, Water, Population and Communities 2012)
- *Conservation advice for subtropical and temperate coastal saltmarsh* (Department of Sustainability, Environment, Water, Population and Communities 2012)

[54] This is the Western Australian recovery plan.

[55] This is the Western Australian recovery plan.

[56] This is the Western Australian recovery plan.

- *Approved conservation advice for aquatic root mat community in caves of the Swan Coastal Plain* (Department of the Environment and Energy 2017a)
- *Approved conservation advice for shrublands and woodlands on Muchea limestone of the Swan Coastal Plain* (Department of the Environment and Energy 2017b)
- *Approved conservation advice for thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond)* (DEWHA 2008a)
- *Approved conservation advice for thrombolite (microbialite) community of a coastal brackish lake (Lake Clifton)* (DEWHA 2010).

For the approved conservation advice on threatened flora and fauna, refer to the Species Profile and Threats Database (undated(b)). The threatened species and ecological communities relevant to this nomination are provided in **attachments B and G**. They are not listed separately in this response, given the number of species involved.

A guide to managing and restoring wetlands in Western Australia (DEC 2012c) and *River restoration manual: A guide to the nature, protection, rehabilitation and long-term management of waterways in Western Australia* (Water and Rivers Commission 1999–2003) are also relevant to wetland recovery.

For the recovery plans and conservation advice of threatened ecological communities, see also the response to **question 14** and **attachment E**.

20. Give an overview of how threats are being abated, or could be abated, and other recovery actions underway or proposed.*

Identify who is undertaking these activities and how successful the activities have been to date. Indicate if any of this information is unavailable.*Provide details of any ongoing monitoring programs.

Answer Question **20** here. Please use as much space as you need to fully answer the question.

State government agencies, local governments, community groups, research institutions and private landholders undertake management activities relevant to the wetlands of the Swan Coastal Plain. These actions address individual threats to varying degrees. However, they are generally localised, inconsistently applied, and not delivered at a scale capable of counteracting the extent of the threats and the cumulative impacts affecting the ecological community. The following overview summarises the types of actions underway or proposed, their effectiveness to date, and key information gaps. These efforts, while fragmented, demonstrate there is local expertise and community commitment that could be scaled up under a coordinated framework.

As discussed in the response to **question 14** under the sub-heading ‘no high-level coordinated protection for the wetlands of the Swan Coastal Plain’, there is currently no high-level, coordinated mechanism for conserving, protecting or managing the wetlands of the Swan Coastal Plain. Although various policies and guidance documents exist, they do not provide overarching protection, resulting in a fragmented and currently poorly funded approach to wetland conservation, protection and management. Evidence of continued wetland loss and degradation, together with unclear roles and responsibilities, further highlights the limitations of the current framework. A listing under the EPBC Act would help establish a coordinated approach by bringing together multiple wetland types and the full range of threats they face within a single, integrated framework, providing the structure needed to unify protection efforts and enable more strategic, landscape-scale conservation across the Swan Coastal Plain.

Management responses to wetland loss and fragmentation occur through statutory clearing and environmental impact assessments and restoration. While clearing and environmental impact assessments prevent some losses, wetland loss and fragmentation is continuing, and wetland buffers and foreshore areas remain inadequate or absent for many wetlands on the Swan Coastal Plain. (Refer to **threats 1 and 2** in the response to **question 18** and 'partial protection under clearing legislation in Western Australia' in the response to **question 14**.) As a result, habitat loss and fragmentation remain ongoing and widespread. Where appropriate wetland buffers and foreshore areas have been applied, they have been effective, demonstrating that a strong wetland buffer policy and consistent implementation would substantially improve wetland protection as land uses change or intensify near wetlands.

Restoration efforts, while valuable at local scales, are costly, slow, and limited in their capacity to address the magnitude of wetland loss, fragmentation and altered hydrology, or the extent of invasive weeds, water quality degradation and other ongoing threats to the wetlands of the Swan Coastal Plain (refer to the response to **question 18**). As a result, restoration cannot meaningfully compensate for the extent of historical and ongoing habitat loss and degradation, nor can it re-establish the landscape connectivity and ecological processes of the wetlands of the Swan Coastal Plain. Similarly, efforts to address loss of, or inadequate, wetland buffers and foreshore areas through restoration are limited. These measures provide localised benefits but many wetlands remain constrained by adjacent urban infrastructure, roads, or drainage assets. However, local restoration projects continue to demonstrate that wetland flora, fauna and ecological function can recover when pressures are reduced.

Actions to mitigate altered hydrology include the incorporation of water-sensitive urban design in new developments, drainage retrofits in selected catchments, and groundwater allocation planning. Despite these initiatives, legacy drainage systems continue to dewater wetlands or drain water directly into wetlands using traditional, piped drainage; groundwater abstraction remains high; the climate is drying significantly; and declines in rainfall and recharge exceed the capacity of current management interventions. Refer to **threat 3** in the response to **question 18**. However, reduced abstraction under the *Gnangara groundwater allocation plan* (DWER 2022b) is expected to stabilise or improve groundwater levels at wetlands around East Wanneroo, Whiteman Park, Ellenbrook and Yanchep National Park; and in urban wetlands, such as Perry Lakes and Carine Swamp. The expected groundwater level increase under the plan illustrates that hydrological recovery is achievable when water abstraction is reduced.

Management of water quality degradation includes nutrient-stripping basins, revegetation, fertiliser and pollution management programs. Management actions are costly and can improve conditions locally but do not address the diffuse nutrient and pollutant sources and catchment-scale processes that continue to drive eutrophication, algal blooms, deoxygenation and water quality degradation across the wetlands of the Swan Coastal Plain. Refer to **threat 4** in the response to **question 18**. Targeted nutrient reduction projects have shown measurable improvements in some catchments, indicating that broader catchment-scale action could yield significant benefits in the long term.

Control of invasive weeds is undertaken by state agencies, local governments, and community groups, with efforts generally focused on priority species in conservation reserves and selected urban wetlands. These programs are often short-term and achieve localised rather than landscape-scale improvements across the wetlands of the Swan Coastal Plain. Where long-term programs are maintained, weed cover can be substantially reduced, demonstrating the value of sustained investment.

Management of invasive fauna, including fox and cat control and carp removal, is similarly limited in extent. Most invasive species, including invasive fish such as eastern gambusia (*Gambusia holbrooki*), remain unmanaged. However, the first coordinated carp and goldfish control program on Swan Coastal Plain is currently underway by Murdoch University (2025-2027) targeting approximately 20 wetlands funded by the Australian Government through the Urban Rivers and

Catchments program (grant ID URCP000097). The new coordinated carp and goldfish control program, together with ongoing fox and cat management, provide useful models for future and expanded invasive species control.

The widespread distribution of weeds and invasive fauna, combined with the significant cost of control, is expected to continue restricting these actions to local rather than broad-scale improvements. Relevant considerations are discussed under **threats 4 and 5** in the response to **question 18**. Strategic, long-term programs could shift these efforts from localised improvements to broader ecological gains across the wetlands of the Swan Coastal Plain.

Measures to reduce grazing and trampling by farmed animals include installing fencing around wetland reserves and excluding farmed animals from some privately owned wetlands. These actions are relatively effective at protecting wetland flora where implemented, although water quality risks remain. However, many wetlands are unfenced, and several commonly used fence designs can pose risks to native fauna. Historical clearing and the high cost of restoration mean that fenced areas adjacent to wetlands are often narrow and do not provide the level of protection that would be achieved through an adequately sized wetland buffer or waterway foreshore area with native vegetation. These narrow-fenced areas are also unable to protect water quality, and the risk increases where intensive land uses, such as intensive animal feedlots, occur without adequate separation. Relevant considerations are discussed under **threats 2 and 7** in the response to **question 18**. Where fences are used to excluded farmed animals from wetlands, together with restoration, wetland flora responds relatively well.

Management of pathogens, including Phytophthora dieback (*Phytophthora cinnamomi*), is largely confined to hygiene protocols and mapping within the conservation estate. Surveillance in wetlands is limited, and the extent of pathogen impacts on wetland-dependent flora remains poorly understood. Refer to **threat 8**, particularly **threat 8.1** in the response to **question 18**; and threats **8.2**, **8.3** and **8.4** regarding future pathogen threats. Improved surveillance and early detection programs would help to limit future spread of pathogens and protect vulnerable wetland flora and fauna.

Biosecurity measures are in place to prevent the introduction of new pathogens, invasive fauna and weeds; however, recent incursions such as myrtle rust (*Austropuccinia psidii*) and the polyphagous shot-hole borer–fungus complex (*Euwallacea fornicatus* and its symbiotic fungi) demonstrate that these measures have not been fully effective. Refer to **threats 6** and **8**, particularly **6.1** and **8.3** in the response to **question 18**. Strengthening these biosecurity measures could significantly reduce the risk of new incursions and protect the remaining wetlands.

Inappropriate fire regimes continue to affect wetland vegetation, and peat and organic soils remain highly vulnerable to ignition and long-duration burns. Refer to **threat 9**, in the response to **question 18**. Further investigation could help to reduce the risk to wetlands.

Climate adaptation planning is emerging across state and local government, but no practical mechanism exists to mitigate the ecological consequences of a drying climate for the wetlands of the Swan Coastal Plain. Refer to **threat 10**, in the response to **question 18**. There is potential for more proactive responses to the drying climate. For example, consideration should be given to water supplementation for some high priority wetlands, including Forrestdale Lake, given the success of previous programs at Thomsons Lake.

Across all threats, cumulative impacts remain largely unmanaged and poorly understood for the wetlands of the Swan Coastal Plain. Planning frameworks, the *Planning for water guidelines, for the implementation of State planning policy 2.9 water* (WAPC 2025b) and environmental impact assessments acknowledge there are cumulative impacts from land developments, but operational mechanisms to address them are limited, and assessments mostly continue to occur on a site-by-site basis. Refer to **threat 11**, in the response to **question 18**. Developing operational tools for assessing cumulative impacts would enable more strategic, preventative decision-making. An updated State

of the Environment report for Western Australia, and a similar report focused on the Swan Coastal Plain, would also provide valuable guidance for future management.

Some wetlands have particularly high ecological values, for example, wetlands with high naturalness, representativeness, species richness, endemism, special features or threatened, priority or migratory species and could be a particular focus for threat abatement. Consistent with established prioritisation frameworks, threat abatement should ideally be focused on these wetlands before resources are directed toward the more degraded wetlands (for example, Macgregor *et al.* 2011; Rutherfurd *et al.* 1999). However, there are circumstances where working on more degraded wetlands, such as those in the Resource Enhancement category, is appropriate, particularly where active community groups are involved and there are important social or community benefits from collaborative threat abatement activities. Another exception involves preventative actions, such as requiring appropriate wetland buffers or foreshore areas for Resource Enhancement category wetlands, or installing wildlife-friendly fencing before surrounding land uses change or intensify. These actions can prevent future degradation, even where the wetlands themselves are not currently the highest-value sites.

Learning from the priority conservation actions from other threatened ecological communities

The priority conservation actions outlined in the following approved conservation advices are particularly relevant to the wetlands of the Swan Coastal Plain and could inform future threat abatement strategies:

- *Empodisma* peatlands of southwestern Australia (DCCEEW 2023b, pp. 31-42)
- Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain (DCCEEW 2023a, pp. 11-21)
- Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (DCCEEW 2023c, pp. 16-29.)
- River Murray downstream of the Darling River, and associated aquatic and floodplain systems (DCCEEW 2026a, pp. 95-121), located in South Australia.

Effectiveness of actions to date and potential for the future

Although many organisations contribute to wetland management on the Swan Coastal Plain, actions are typically localised, short-term and constrained by funding and time resources. Threat abatement is not occurring at a scale consistent with the drivers of decline, and the wetlands of the Swan Coastal Plain continue to deteriorate despite ongoing management efforts.

With coordinated planning, adequate funding and long-term commitment, many of the threats to the wetlands of the Swan Coastal Plain could be substantially reduced. The strong community interest in wetland protection, recent research and existing local successes demonstrate that recovery is achievable if the necessary investment and coordination are secured.

Monitoring programs

Monitoring relevant to the wetlands of the Swan Coastal Plain is undertaken by multiple organisations. State agencies conduct fauna surveys, groundwater level monitoring and water quality sampling at selected wetlands. Local governments may undertake reserve condition assessments, weed mapping, and water quality testing. Research organisations and community groups contribute information, including species-specific or research project-specific monitoring. However, monitoring is fragmented and is not designed to detect change at the ecological community scale, across the wetlands of the Swan Coastal Plain. Many wetland types, such as damplands, sumplands and palusplains, lack long-term monitoring, except for a limited number of wetlands.

Overall, while many management actions are underway, these efforts are insufficient to counteract the extensive scale, intensity, and cumulative impacts of threats affecting the wetlands of the Swan Coastal Plain. Threat abatement remains localised, fragmented and inconsistently applied, and the wetlands continue to decline despite ongoing management.

Knowledge gaps

Information on management outcomes is uneven and there is no region-wide assessment of management effectiveness across the wetlands of the Swan Coastal Plain. There is limited data on wetland condition outside the conservation estate, other than via aerial imagery, and surveillance to detect the introduction of pathogens, invasive weeds and invasive fauna into additional wetlands is sparse. See also the knowledge gaps in the responses to **question 18**.

21. What existing support networks for the ecological community are there to facilitate recovery? e.g. an active Landcare group, Local NRM/Catchment group, Conservation Management Network or recovery team (for the ecological community or key species).

Answer Question **21** here. Please use as much space as you need to fully answer the question.

The existing support networks to facilitate recovery of the ecological community include:

- Wetlands Centre Cockburn (<www.thewetlandscentre.org.au>), which hosts an annual two-day wetlands conference (<www.thewetlandscentre.org.au/conference>) to mark world wetlands day
- Wetlands Conservation Society of Western Australia (<https://wetlandswa.org.au>), which advocates for wetland protection
- NatureLink Perth (<https://naturelinkperth.org>), which is hosted by Murdoch University and aims to integrate nature into Perth, fostering stronger connections between people and the natural environment
- Urban Bushland Council (<www.bushlandperth.org.au>), which advocates for urban bushland recognition and protection and is an association of approximately 90 community conservation groups
- Community conservation groups (<www.bushlandperth.org.au/groups> and <https://naturelinkperth.org/find-a-friend>) and landcare groups (<https://landcareaustralia.org.au/find-a-group>), which work to protect and restore wetlands and bushland
- WA Landcare Network WA (<www.landcarewa.org.au>), which provides support, coordination and capacity building for landcare groups
- Noongar Regional Corporations (Yued, Whadjuk, Gnaala Karla Booja and Karri Karrak) and the South West Aboriginal Land and Sea Council (SWALSC) (<www.noongarculture.org.au>, select 'country'), which together provide Noongar cultural and heritage support under the South West Native Title Settlement, including on-Country ranger programs
- Bibbul Ngarma Aboriginal Association (<https://bibbul.org>), which restores ecosystems, strengthens cultural heritage and reconnects communities with rivers through BoorYul-Bah-Bilya, a flagship model for community-led catchment planning beginning with the Mandoon Bilya (Helena River). There is a newly established ranger program and work includes cultural mapping, water and sediment sampling, eDNA analysis, fauna monitoring, biodiversity surveys and community engagement

- South East Regional Centre for Urban Landcare (<www.sercul.org.au>), which works with the community and government to protect and restore waterways and bushland in Perth's south-eastern region
- WA Gould League Herdsman Lake Discovery Centre (<www.wagouldleague.com.au>), Canning River Eco Education Centre (<www.canning.wa.gov.au/recreation-and-community/canning-river-eco-education-centre>) and Naragebup Rockingham Regional Environment Centre near Lake Richmond (<https://naragebup.org.au>), which host community education programs and activities around wetlands
- NRMWA (<www.nrmwa.org.au>), Perth NRM (<www.perthnrm.com>), Peel-Harvey Catchments Council (<https://peel-harvey.org.au>) and South West NRM (<https://southwestnrm.org.au>), the peak body and regional natural resource management groups that partner with communities to protect and restore nature
- Wildflower Society of Western Australia (<www.wildflowersocietywa.org.au>), which promotes the conservation of Western Australia's wildflowers (i.e. native flora)
- Western Australian Naturalists' Club (<www.wanaturalists.org.au>), which encourages the study and protection of the natural environment
- Birdlife Western Australia (<https://birdlife.org.au/groups/birdlife-wa>) and Birdlife Australia (<https://birdlife.org.au>), the leading voice for bird conservation
- Conservation Council of Western Australia (CCWA) (<www.ccwa.org.au>), which advocates for the protection and restoration of Western Australia's natural environment. The CCWA Indigenous Advisory Board (<www.ccwa.org.au/indigenous_advisory_board>) provides advice on increasing Indigenous participation and representation in addressing environmental and conservation issues in Western Australia, and guides CCWA decision-making, working practices and cultural competency
- citizen science programs (<https://naturelinkperth.org/citizen-science>), which help people to collect data on flora and fauna
- University researchers from Murdoch University (<www.murdoch.edu.au>), the University of Western Australia (<www.uwa.edu.au>), Edith Cowan University (<www.ecu.edu.au>) and Curtin University (<www.curtin.edu.au>), who have a long history of research on Swan Coastal Plain wetlands and whose work continues to contribute to the scientific knowledge needed to support recovery of the ecological community
- State government departments, including the Department of Water and Environmental Regulation (<www.wa.gov.au/organisation/department-of-water-and-environmental-regulation>) and Department of Biodiversity, Conservation and Attractions (<www.dbca.wa.gov.au>)
- local governments, which manage some wetland reserves, make planning decisions and undertake community engagement, and the Western Australian Local Government Association (<https://walga.asn.au/policy-and-advocacy/our-policy-areas/environment>), which provides support, resources, and expertise to help local governments protect and restore biodiversity and the natural environment
- Healthy Estuaries WA (<https://estuaries.dwer.wa.gov.au>), a State Government program dedicated to improving the health of Peel-Harvey estuary, Leschenault Estuary and Vasse-Geographe waterways, among others – it also improves the health of wetlands in the catchments.

Section 8 - Distribution*

22. Describe the ecological community's current and past national distribution *.

Attach or provide a map or maps showing its known or estimated current and past distribution.* Provide the map data if possible; along with reference sources from which the maps and data may be obtained; or explain how the maps were created and the datasets used.

Also, provide an overview of distribution surveys to date and how well they cover the ecological community's national distribution; and where possible, indicate any areas that should be surveyed to allow sufficient understanding of the community's variability. Please see this link for guidelines and template for biological and survey data

Answer Question **22** here. Please use as much space as you need to fully answer the question.

Distribution summary

The ecological community occurs only in Western Australia and only on the Swan Coastal Plain IBRA region in the South West Botanical Province. It does not occur elsewhere.

Overview of distribution surveys to date

The main distribution survey was conducted in *Wetlands of the Swan Coastal Plain,* Volumes 2a and 2b (Hill *et al.* 1996a, 1996b).

Maps

Maps are provided in **attachment K** (visual map figures) and **attachment L** (spatial data). To produce accurate maps, the existing spatial datasets were modified in accordance with the information below. In **attachment L**, the feature 'wgs_wetl_1' relates to wetland types and 'wgs_wetl_2' relates to wetland evaluation categories (Conservation, Resource Enhancement, Multiple Use, Not Applicable and Not Assessed). Slides 1, 3 and 4 in **attachment K** are the most suitable for inclusion in publications. Slide 2 relates to analyses that excluded the Not Assessed evaluation category, as outlined below.

Maps are also available from the DBCA website (2025j, (<www.dbca.wa.gov.au/management/wetlands/wetland-mapping-datasets>).

Spatial data used

The wetlands of the Swan Coastal Plain are mapped *in Geomorphic wetlands, Swan Coastal Plain (DBCA 019)* (DataWA 2021d), or any updated dataset that supersedes it. This dataset provides the wetland types[57] (creek, dampland, estuary – peripheral, floodplain, lake, palusplain, paluslope, river and sumpland) and the evaluation categories[58] (Conservation and Resource Enhancement) relevant to this nomination.

The nomination does not include the following wetland types listed in the *Geomorphic wetlands, Swan Coastal Plain (DBCA 019)* spatial dataset (DataWA 2021c) or any future updated equivalent: artificial channel, artificial lake, artificial wetland, no longer a wetland, and estuary – waterbody.

Because small portions of the *Geomorphic wetlands, Swan Coastal Plain (DBCA 019)* dataset extend beyond the Swan Coastal Plain, it was clipped to the Swan Coastal Plain IBRA region (DCCEEW 2025d).

In the southernmost part of the Swan Coastal Plain, a small area of wetlands is not included in the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* (DataWA 2021d). For that portion of the

[57] Refer to the 'Wetland types based on hydrological attributes and landform' sub-heading in the response to **question 5a**.

[58] Refer to the responses to **questions 9 and 11**.

plain, the outer perimeters of *Geomorphic wetlands south west – unreviewed (DBCA-040)* (DataWA 2021c) and *Geomorphic wetlands, Leeuwin Naturaliste Ridge and Donnybrook to Nannup – unreviewed (DBCA-043)* (DataWA 2021b) are applied, provided they do not overlap with the primary dataset.

The Rottnest Island lakes are within the Swan Coastal Plain IBRA region and listed in *A directory of important wetlands in Australia* (Environment Australia 2001) and as priority ecological communities in Western Australia but are not mapped in these wetland special datasets. For these lakes, the *Directory of important wetlands in Australia - Western Australia (DBCA-045)* (DataWA 2021a) was applied.

DCCEEW (2025d) provides the Swan Coastal Plain IBRA region boundary.

Spatial data preparation and processing – general overview

A combined spatial dataset representing the best available wetland mapping for the Swan Coastal Plain was compiled for this nomination. This combined dataset is provided as **attachment L**. The primary source was the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* (DataWA 2021d) spatial dataset, which covers most of the nomination area but contains several small gaps around Busselton and Dunsborough, on Rottnest Island, and a larger unmapped area north of Wedge Island. The southern and Rottnest Island gaps were filled using information from the *Geomorphic wetlands south west – unreviewed (DBCA-040)* (DataWA 2021c), *Geomorphic wetlands, Leeuwin Naturaliste Ridge and Donnybrook to Nannup – unreviewed (DBCA-043)* (DataWA 2021b), and *Directory of important wetlands in Australia - Western Australia (DBCA-045)* (DataWA 2021a) datasets. The northern gap was not filled due to the limited availability and completeness of wetland mapping in that part of the Swan Coastal Plain. This is explained briefly in the response to **question 2a**.

Spatial processing was undertaken in QGIS v3.4.15 as follows:

- All wetlands datasets were obtained from DataWA (<https://data.wa.gov.au>) on 16 February 2026 and clipped to the extent of the Swan Coastal Plain IBRA region (Interim Biogeographic Regionalisation for Australia, IBRA Version 7.1 (Regions)).
- Wetlands in the southern data gaps were isolated from the clipped DBCA-040 and DBCA-043 datasets using a difference operation to remove any overlap with DBCA-019.
- Rottnest Island wetlands were manually selected from the DBCA-045 dataset.
- Attribute tables for the gap-fill datasets were harmonised with DBCA-019 to the extent possible. Wetland management categories were not available in DBCA-043 (Dunsborough gap). Neither wetland type nor management categories were available in DBCA-045 (Rottnest Island), although the wetland management category for Rottnest Island is 'Conservation'.
- Features from the prepared gap-fill datasets were appended to DBCA-019 to create the combined dataset. Wetland polygon areas were calculated in hectares using the Map Grid of Australia Zone 50 coordinate reference system with the GDA2020 datum.

Further details on spatial data preparation, processing and analysis versions

The *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* (DataWA 2021d) spatial dataset was clipped to the Swan Coastal Plain IBRA region and used to generate four analysis versions:

- Version 1 – wetland *categories* clipped to the Swan Coastal Plain IBRA Region. Used to calculate the area of each wetland category (Conservation, Resource Enhancement and Multiple Use).
- Version 2 – As per Version 1, with features not required for this analysis removed. This includes removal the following wetland categories: Multiple Use, Not Assessed and Not

Applicable; and the following wetland types: Artificial channel, artificial lake, artificial wetland, dryland and no longer a wetland. The Not Assessed category is included in the nomination but was removed from this analysis version because it was not required for the analysis.

- Version 3 – wetland *types* clipped to the Swan Coastal Plain IBRA region.
- Version 4 – As per version 3, with features not required for this analysis removed. This includes removal of the following wetland categories: Multiple Use, Not Assessed and Not Applicable; and the following wetland types: Artificial channel, artificial lake, artificial wetland, dryland and no longer a wetland. The Not Assessed category is included in the nomination but was removed from this analysis version because it was not required for the analysis.
- Version 5 – As per version 4 but with the Not Assessed category included. This was used to prepare a map for **attachment K**.
- Version 6 – As per version 2 but with the Not Assessed category included. This was used to prepare a map for **attachment K**.

No other modifications were made beyond clipping and the removal of features not included in the nomination.

Additional datasets were clipped only to fill small gaps where the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* (DataWA 2021d) dataset contains omissions. All gap-fill datasets were clipped to avoid overlaps with DBCA-019 and were assigned categories consistent with DBCA-019:

- Dunsborough gap clip: The *Leeuwin Naturaliste Ridge and Donnybrook to Nannup – Unreviewed (DBCA-043)* dataset, clipped to the Swan Coastal Plain IBRA region, and clipped again to fill the small gap where DBCA-019 is missing around Dunsborough. Consistent with the Not Assessed category in DBCA-019 dataset.
- Busselton gap clip: The *Geomorphic wetlands south west - unreviewed (DBCA-040)* dataset, clipped to the Swan Coastal Plain IBRA region, and clipped again to fill in the small gap where DBCA-019 is missing around Busselton. This clip avoided any overlaps with the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* dataset. The layer includes an evaluation category attribute; however, approximately 90% of the mapped area is classified as Not Assessed or has no assigned management category, which is also recorded as Not Assessed.
- Rottnest Island gap clip: The *Directory of important wetlands in Australia - Western Australia (DBCA-045)* dataset clipped to include only wetlands on Rottnest Island. Consistent with the Conservation category in DBCA-019.

This information is relevant to the response to **questions 23** and **24** and to the assessment of nomination **criteria 1** and **2.**

Section 9 - Justification for this Nomination*

Answer all questions and provide data that clearly demonstrate how the ecological community meets at least one of the criteria for listing.* Include evidence demonstrating how it meets the requirements for listing under a particular listing category; for example 'The David et al. (1999) finding of a 95% decline in geographic distribution suggests it should be listed as critically endangered'.*

The ecological community does not need to be eligible for listing under all six criteria. Criteria may be met at different levels of listing category; e.g. Criterion 1 – critically endangered and Criterion 3 – vulnerable. **Advice on how to interpret the listing criteria is provided in the Guidelines.**

Data may already have been provided in previous sections or questions. Refer to the data again and explain specifically how the data referred to demonstrate that the ecological community meets (or does not meet) the listing criterion.* Indicate if any information is unavailable.

Select one or more of the criteria under which you are nominating the community for listing.* (Please check one or more boxes) For further details on these criteria please refer to the Guidelines. The information you below should support the criteria you select here.	☒ Criterion 1 – Decline in geographic distribution ☒ Criterion 2 – Limited geographic distribution coupled with demonstrable threat ☐ Criterion 3 – Loss or decline of functionally important specie ☒ Criterion 4 – Reduction in community integrity ☐ Criterion 5 – Rate of continuing detrimental change ☐ Criterion 6 – Quantitative analysis showing probability of extinction

23. Criterion 1: Decline in geographic distribution.

This criterion refers to a past decline in the geographic distribution of the community.

In your answers, identify whether the quantity represents extent of occurrence, or area of occupancy (as described in the Guidelines); or some other measure of geographic distribution and why.

23a. What is the estimated change in the distribution of the ecological community since European settlement? Give a best estimate (and if possible, plausible bounds); e.g. a reduction of 40% (35-60%).

Answer Question **23a** here. Please use as much space as you need to fully answer the question.

The estimated change in the distribution of the wetlands of the Swan Coastal Plain since European settlement is likely to be **over 80% (by area)**. The methods used to determine this estimate are summarised below.

Published estimates

Attachment H shows that, since 2001, **most published estimates indicate wetland losses of 80% or more**, with all estimates falling within 70% to more than 80%. These estimates include assessments by the Western Australian EPA (2007a, 2008) and State Government agencies (DBCA 2017a; DWER 2022b). For example, the EPA (2007a) reported that 70–80% of wetland area had been lost, noting that continued losses mean the true figure is **likely to be higher**. The DWER (2022b) estimated more than 80% wetland area loss. Two additional sources report higher estimates of wetland area loss, at 80–90% (Western Australian Museum undated(a)) and 90% (Nanda *et al.* 2021).

Wetland area losses exceeding 80% are considered the most likely estimate, as not all historical losses have been mapped and wetland loss is continuing. Further information on ongoing losses and unmapped historical losses is provided under **threat 1** in the response to **question 18**.

Estimate based on the Geomorphic wetlands, Swan Coastal Plain (DBCA-019) dataset, which does not include all wetland losses

Using the modified version of the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset[59], table 3a indicates that wetlands on the Swan Coastal Plain occupied at least 342,853.5 hectares at the time of European settlement. Their extent has since declined by at least 259,721.7 ha[60] (75.8%), with 14,214.1 ha (4.1%) 'not assessed'.

This equates to **approximately 79.1% wetland loss**[61] when excluding the 'not assessed' category from calculations[62] (see table 3b), comprising 78.9% mapped as Multiple Use and 0.2% as 'no longer a wetland'. This approach assumes that the proportion of wetland loss within the 'not assessed' category is broadly similar to the loss observed across the assessed portion of the Swan Coastal Plain, so it would not materially alter the overall result.

Table 3a – the area of each wetland category with the 'not assessed' category included

Wetland category	Area (ha)	Percent of wetland area
Conservation[63]	50,524.1	14.7
Resource Enhancement[64]	18,393.7	5.4
Not assessed[65]	14,214.1	4.1
Multiple Use[66]	259,150.8	75.6
Not applicable (no longer a wetland)[67]	570.9	0.2
Total	**342,853.5**	**100**

Table 3b – the area of each wetland category with the 'not assessed' category excluded

Wetland category	Area (ha)	Percentage of wetland area
Conservation	50,524.1	15.4
Resource Enhancement	18,393.7	5.6
Multiple Use	259,150.8	78.9

[59] Provided as **attachment L** and described in the response to **question 22**. Analysis version 1 was used for this task.

[60] That is, 259,150.8 ha of Multiple Use category plus 570.9 ha of 'Not applicable' category, which is no longer a wetland. Wetlands in the Multiple Use category are excluded from the nomination. These wetlands are substantially degraded, with native vegetation largely removed through clearing or filling. This is described in the response to **question 9**.

[61] 'Multiple Use' wetland area plus 'Not applicable (no longer a wetland)' wetland area.

[62] The estuary – waterbody wetland type is excluded from the nomination, as per the response to **question 5a**. If the estuary – waterbody wetland type was included, this would be 74.4% wetland loss. The estuary –waterbody wetland type has 20,483.6 ha Conservation category and 45.8 ha Multiple Use category.

[63] A combined total of 50,207.7 ha from the DBCA-019 dataset, together with 261 ha for the Rottnest Island gap, and 55.3 ha from the Busselton gap, all clipped to the extent of the Swan Coastal Plain IBRA region.

[64] A combined total of 18,201.4 ha from the DBCA 019 dataset and 192.2 ha from Busselton gap, both clipped to the extent of the Swan Coastal Plain IBRA region.

[65] A combined total of 8,299.1 ha from the DBCA-019 dataset, together with 2,125.8 ha from the Dunsborough gap, 3,789.1 ha for the Busselton gap, all clipped to the extent of the Swan Coastal Plain IBRA region.

[66] A combined total of 258,990.1 ha from the DBCA-019 dataset and 160.7 ha from the Busselton gap, all clipped to the Swan Coastal Plain IBRA region.

[67] A total of 1,080.7 ha is within the 'Not applicable' wetland category. This includes 570.9 ha remaining after excluding 509.9 ha that was identified as dryland, reflecting corrections to errors in the original wetland mapping. Of this remaining area, approximately 569.4 ha is classified as the wetland type 'no longer a wetland', indicating former wetlands that have been drained or filled, and 1.5 ha is classified as the estuary – peripheral wetland type. The 'Not applicable' category only occurred in DBCA-019.

Not applicable (no longer a wetland)	570.9	0.2
Total	**328,639.5**	**100**

The estimated 79.1% loss of wetland area since European settlement using this approach is broadly consistent with DBCA (2017a), which also relied on the DBCA-019 dataset[68] and found that 73% of mapped wetland area had been assigned to the Multiple Use category[69]. Multiple Use category wetlands are severely degraded by clearing, filling or other disturbance, resulting in the loss of most or all native flora. These areas no longer support the ecological functions characteristic of the ecological community and are therefore excluded from this nomination.

When interpreting these estimates, it is important to recognise the limitations of the DBCA-019 dataset. It does not capture all historical wetland losses, meaning that actual losses are higher than those reported. These limitations are outlined in the response to **threat 1** in **question 18** and in **attachment H**.

23b. What is the estimated change in the distribution of the ecological community over any stated period up to 50 years ago? Give a best estimate (and if possible, plausible bounds); e.g. an estimated reduction of 40% (35-60%).

Answer Question **23b** here. Please use as much space as you need to fully answer the question.

Approximately 29,200 hectares of wetlands were lost on the Swan Coastal Plain in the 20-year period between 1992 and 2012. Based on a total mapped wetland area of 363,382.80 hectares, this represents a loss of approximately 8% wetland area over just two decades.

23c. Please identify, reference and (where possible) supply, the time series data from which the estimate was derived (or a point of contact/person from whom it can be obtained) and explain the methods of estimation.

Answer Question **23c** here. Please use as much space as you need to fully answer the question.

Analysis of Landsat satellite imagery from the 20-year period between 1992 to 2012 indicated that about four hectares of perennial vegetation each day were being lost from the wetlands of the Swan Coastal Plain (DBCA 2017a, p. 10). This equates to roughly 1460 hectares, or about 750 football ovals, being cleared each year. This is 29,200 hectares over 20 years.

This analysis used multi-temporal Landsat imagery to detect changes in perennial vegetation cover within the mapped wetland boundaries of the (DBCA-019) dataset. Vegetation loss was identified through spectral change detection and verified using DBCA's wetland mapping and condition assessments.

[68] Although the original DBCA-019 dataset predominantly maps wetlands within the IBRA boundary, it also includes some areas outside it. There has also been continued wetland losses since 2017, only some of which are captured in DBCA-019.

[69] The DBCA assessment included the estuary – waterbody wetland type. If this wetland type were included in the current analysis, the estimated proportion would be 74.4%, which is broadly consistent with the DBCA result.

23d. Eligibility under Criterion 1

Based on your answers to questions 23a-c (and with reference to the Committee's indicative thresholds for Criterion 1 in their Guidelines)**, is the ecological community eligible for listing under this criterion? If it is eligible, then explain why and in which particular category?***

Answer Question **23d** here. Please use as much space as you need to fully answer the question.

Yes. The ecological community is eligible for listing as **endangered** under **criterion 1**.

Spatial analysis of the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* dataset (DataWA 2021d) (**question 23a**) shows that the ecological community has undergone a decline in geographic distribution of at least 79.1% since European settlement, however due to unmapped historical losses and continuing losses, this is very likely to exceed 80%. This exceeds the Committee's indicative threshold for **Endangered**, which requires evidence of a ***severe*** decline (≥70%) in geographic distribution relative to the longer-term (beyond 50 years ago).

Combined with the total losses provided in the response to **question 23a**, the time-series data presented in **questions 23b and 23c** demonstrate that substantial losses have continued, reinforcing the conclusion that the ecological community has experienced a severe long-term decline in geographic distribution.

24. Criterion 2: Does the ecological community have a limited geographic distribution; and due to the nature of that distribution, is it subject to a threatening process that could cause it to be lost in the immediate, near, or medium-term future?

This criterion enables the listing of ecological communities with a limited geographic distribution and for which a threatening process exists within an understood or predicted timeframe. It recognises that an ecological community with a small and/or fragmented distribution (naturally or due to loss and modification) has an inherently higher risk of extinction, if it is subject to one or more threatening process. This criterion is unlikely to be met for an ecological community which has a naturally limited distribution but is not currently subject to any threatening process or is unlikely to be subject to a threatening process in the foreseeable future. **See the Guidelines for further details.**

24a. (i) Identify and (where possible) **supply map data** (refer to Section 8), **published reports, or other information that can be used to estimate the current distribution of the community and patch sizes.** If more than one source is available, please identify and supply all data sets.

(ii) What is the nominated ecological community's current extent of occurrence? E.g. in ha/km^2.

(iii) What is the current (national) area of occupancy of the community? E.g. in ha/km^2.

Answer Question **24a (i-iii)** here. Please use as much space as you need to fully answer the question.

Response to part (i), the data source used to estimate current distribution and patch sizes:

The geographic distribution and patch sizes of the ecological community were estimated using the spatial dataset provided as **attachment L**, using analysis version 4 as described in the response to **question 22**, and excluding the prepared spatial gap clip datasets. This dataset provides the best available information for estimating the ecological community's current distribution, extent of occurrence, area of occupancy, and patch-size characteristics. This is explained further below, as required.

Response to part (ii), current extent of occurrence (EOO):

The extent of occurrence (EOO) is 15,258 km² (1,525,800 ha). This value reflects the area of the Swan Coastal Plain IBRA region, which encompasses the full distribution of the ecological community. Because the wetlands occur throughout, and are restricted to, this bioregion, the IBRA boundary provides the most appropriate spatial unit for estimating EOO. This EOO does not meet the threshold for a limited geographic distribution under criterion 2 (i.e. less than 10,000 km²).

Response to part (iii) current area of occupancy (AOO):

The area of occupancy (AOO) is 68,389.3 ha[70], which meets the threshold for a limited geographic distribution (i.e. less than 100,000 ha).

This value was calculated as the sum of all polygon areas in the spatial dataset provided in **attachment L**, using analysis version 4 as described in the response to **question 22**, and excluding the gap clip datasets for Dunsborough (2,125.8 ha), Busselton (4,197.5 ha), and Rottnest Island (261 ha). These areas largely fall within the 'Not assessed' category, which includes areas where wetlands have been lost (for example, wetlands that would be in the Multiple Use category). Even if their full extent were added, the total AOO would be 95,457.2 ha, which remains below the 100,000 ha threshold for a limited geographic distribution.

The AOO is substantially smaller than the EOO, reflecting the fragmented and discontinuous distribution of wetlands across the Swan Coastal Plain. This fragmentation is further demonstrated by the patch-size analysis (median patch size 2.3 ha).

[70] This calculation excludes the estuary – waterbody polygons, which were not included in the nomination.

24b. Patch size: What is the typical current size for a patch, or discrete occurrence, of the ecological community, if known; e.g. in hectares? Also, provide any analyses of (or data indicating) changes in patch size distribution over time.

With regard to vegetation communities, a patch is a discrete and mostly continuous area of the ecological community[1]. Permanent artificial structures, such as roads and buildings, are typically excluded from a patch. A patch may include small-scale variations and disturbances, such as tracks, paths or breaks (including exposed soil, leaf litter, cryptogams and watercourses/ drainage lines), or localised changes in vegetation that do not significantly alter the overall functionality of the ecological community.

Explain how the typical patch size was calculated and the datasets used (include any relevant information on the likely accuracy of these estimates). Include average[2] patch size and the proportion of patches that are certain sizes (e.g. for many terrestrial vegetation communities patch size classes include: <1 ha, <10 ha, <100 ha, and ≥100 ha). An example of a way to summarise patch size data for assessment is shown in the table below.

Summary of patch size distribution for the ecological community					
EPBC Act listing criteria thresholds		**Patch size range (ha)**	**No. of patches**	**% of patches**	**Median patch size (ha)**
Restricted	**Very Restricted**	**0.1 - 10**	2,614	86	1.7
		> 10 - 100	371	12	
		> 100	656	2	
		Total	3,050		

Other concepts may well apply to determine the size of each discrete occurrence of an aquatic or other type of ecological community. If this is the case, please explain.

[1] Note: Different jurisdictions and methodologies may define 'a patch' differently. For example NSW vegetation assessment tools define a 'patch' as an area of native vegetation, of one or more different communities that occur together, separated by a gap of no greater than a set distance (usually 100 m).

[2] Median average size is a preferred measure, as opposed to mean average. In either case, identify which average is being quoted (median or mean); otherwise it will be assumed to be a mean average value.

Answer Question **24b** here. Please use as much space as you need to fully answer the question.

The patch size analysis results are provided in tables 4a and 4b.

Table 4a – Patch size analysis results

Patch size metrics	**With Estuary – waterbody patches**		**No Estuary – waterbody patches**	
	Total hectares	**%**	**Total hectares**	**%**
patch size distribution (by patch)				
< 1 ha	1722	29.5%	1721	29.6%
1-10 ha	3023	51.8%	3020	51.9%
10-100 ha	990	17.0%	985	16.9%
≥ 100 ha	96	1.6%	92	1.6%
patch size distribution (by area, ha)				
< 1 ha	845.0	1.0%	844.8	1.2%
1-10 ha	10,636.5	12.0%	10,623.2	15.5%
10-100 ha	28,029.6	31.5%	27,792.8	40.6%
≥ 100 ha	49,361.8	55.5%	29,128.6	42.6%
mean patch size (ha)	15.2		11.8	
median patch size (ha)	**2.3**		**2.3**	

n patches	5831	5818

The analysis assessed whether including or excluding the 'estuary – waterbody' wetland type would materially influence the patch-size results[71]. Only 13 polygons were assigned to this wetland type, and their exclusion had virtually no effect on the patch-size distributions when summarised by patch. Several of these estuary polygons were very large, however, and did affect the mean patch size and the total area of patches within each size class. For completeness, the summaries based on total area have been included in the summary table.

Table 4b – Connected patch size analysis results

Connected patch size metrics	**Wetland mosaics**	
	Current	**Historic**
connected patch size distribution (by patch)		
< 1 ha	23.1%	15.4%
1-10 ha	41.0%	20.0%
10-100 ha	19.3%	9.4%
≥ 100 ha	16.5%	55.2%
connected patch size distribution (by area)		
< 1 ha	1.0%	0.6%
1-10 ha	11.3%	5.5%
10-100 ha	27.9%	14.7%
≥ 100 ha	59.8%	79.2%
isolated patches (n, [%])	3966 (68.2%)	2253 (38.7%)
wetland mosaics (n)	4348	2401
mean connected patch size (ha)	15.7	28.5
median connected patch size (ha)	2.1	1.7

Wetland connectivity has declined substantially. Historically, the 5,818 patches occurred within 2,401 wetland mosaics, with most patches forming part of a larger mosaic (only 38.7% of patches were isolated in single-patch mosaics). Under current conditions, wetlands on the Swan Coastal Plain have been fragmented into nearly twice as many mosaics (more than 4,300), and approximately 68.2% of patches are now isolated. The distribution of connected patch areas has also declined sharply: only 16.5% of patches are currently connected to ≥100 ha of wetland habitat (including the focal patch), whereas historically more than half (55.2%) of all patches were connected to a total patch area of ≥100 ha.

Further details on patch size analyses

The patch size analyses were conducted using analysis version 4 of the modified *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* dataset (DataWA 2021d), as described in the response to **question 22**, excluding the prepared spatial gap clip datasets (the Dunsborough gap clip, the Busselton gap clip and the Rottnest Island gap clip). The Dunsborough and Busselton gap-clip datasets were excluded because they fall within the 'Not assessed' category and do not provide reliable information on wetland extent or connectivity. The Rottnest Island gap clip was also excluded; however, given its small wetland area, its inclusion or exclusion does not materially affect the results.

Multi-part features were rare in the dataset (0.2% of features in analysis version 1; 0.1% in analysis version 4) and represented spatially separate portions of the same wetland that were divided either

[71] The analysis was undertaken before the decision to exclude the estuary – waterbody wetland type from the nomination; and therefore assessed patch size both with and without this wetland type.

by differences in management category or by clipping to the Swan Coastal Plain IBRA region. Because these components form parts of the same physical wetland, the multipart features were retained for the patch-area calculations.

A more common issue was the subdivision of discrete wetland units into multiple polygons. This was examined by manually screening a random sample of 5% of polygons (n = 613). In most cases, polygons represented spatially discrete areas of the same wetland type and management category and can therefore be considered 'discrete wetland units'. Contiguous boundaries between neighbouring polygons were frequent but typically reflected transitions between different wetland types and/or management categories. Only 9.5% of screened polygons shared a boundary with an adjacent polygon of the same type and management category. In some instances, these were artefacts of the map-sheet tiling system used in producing the geomorphic wetlands mapping; although this particularly affected the largest polygons, it is unlikely to influence the median patch area or the size-class summaries, as these polygons were all well above the largest size-class threshold. In other cases, high-resolution aerial imagery showed visible discontinuities between adjacent polygons, although this was not assessed systematically. Overall, the subdivision of wetland patches into multiple polygons is unlikely to substantially affect the evaluation of patch size. Nevertheless, the sensitivity of the results to different definitions of 'discrete wetland units' was examined.

In the first sensitivity analysis, all wetland polygons (analysis version 4) were dissolved to remove boundaries between adjacent polygons of the same wetland type but different management categories (Conservation or Resource Enhancement). This produced results that were virtually identical to those from the original dataset and is not discussed further.

The remaining analyses examined the effect of dissolving contiguous wetlands of different types (and management categories). This removed internal boundaries within spatially discrete 'wetland mosaics' and was used to assess changes in wetland-patch connectivity. Many wetland types are naturally fragmented into small patches due to strong geomorphological controls on their distribution. However, in unmodified landscapes, wetlands may occur within extensive wetland mosaics that provide direct physical connections between discrete patches of the same type. Wetland connectivity was assessed using the size (area, ha) of the wetland mosaic containing each wetland patch (version 4 polygons). Current wetland mosaics were generated by dissolving the analysis version 4 polygons, while a subset of analysis version 1 polygons (all management categories, excluding artificial types and drylands) was dissolved to represent historic mosaics. As this does not represent a true baseline of original wetland extent, the depiction of connectivity loss is incomplete and likely conservative. Although the estuary – waterbody wetland type is not included in the nomination, these wetlands were retained as part of the broader wetland mosaics in this connectivity assessment. Connectivity was assessed from the perspective of the remaining wetland patches in both current and historic periods to support comparison. Accordingly, the 'connected patch size' reported in Table 4b reflects the total area of remaining wetland patches (analysis version 4: Conservation or Resource Enhancement) within each wetland mosaic. This is equivalent to the size of the mosaic under current conditions, but for historic conditions excludes areas now classified as Multiple Use or as not applicable/not assessed. For both time periods, the summaries report the percentage of remaining patches connected to each size class.

24c. Explain how the nature of its distribution makes the ecological community likely to be lost to one or more threatening processes.

Describe how the present distribution, in terms of extent of occurrence, area of occupancy, average patch size, or other limits to the distribution makes the ecological community susceptible to relevant threatening processes (as outlined in Question 18) and therefore how it is at risk of further loss and degradation. Include information on the timeframe over which these processes could cause the ecological community to be lost (see the Guidelines for further details on the relevant timeframes and examples).

Answer Question **24c** here. Please use as much space as you need to fully answer the question.

The present distribution of wetlands on the Swan Coastal Plain makes the ecological community highly susceptible to ongoing threatening processes. The area of occupancy (AOO) qualifies as a limited geographic distribution. Within this area, the ecological community is now highly fragmented, with a **median patch size of 2.3 ha** and 68.1% of patches occurring in isolation. Historically, the 5,831 patches occurred within 2,401 wetland mosaics, with most patches forming part of a larger mosaic and only 38.7% of patches isolated. Under current conditions, wetlands have been fragmented into nearly twice as many mosaics (4,349), and the proportion of isolated patches has increased to 68.1%. Large wetland systems have been disproportionately lost, and only 16.8% of remaining patches are connected to ≥100 ha of wetland habitat, compared with more than half (55.3%) of patches historically. This substantial decline in connectivity has reduced the capacity of wetlands to maintain hydrological, biogeochemical and ecological functions across the landscape.

The dominance of small patches, the loss of large wetland systems, and the marked increase in the number of discrete patches indicate severe fragmentation. Small wetlands are particularly vulnerable to edge effects, hydrological isolation, nutrient enrichment, invasive species, and groundwater decline. Fragmentation increases exposure to these pressures, reduces buffering capacity, and limits opportunities for recolonisation or recovery following disturbance. Because the ecological community is confined to a single bioregion and occurs in a limited area of occupancy, threatening processes act across its entire range, leaving few or no refuges where ecological processes can continue unimpeded.

The major threatening processes identified in **question 18** (including altered hydrology, water quality degradation, invasive weeds and fauna, altered fire regimes, climate change, etc.) are intensified by the current geographic distribution and patch size. For example, small, isolated wetlands have limited resilience to altered hydrology, are more prone to eutrophication and weed invasion, and are less able to support viable populations of characteristic flora and fauna. The loss of connectivity also reduces the capacity of species and ecological processes to shift or reorganise in response to climate change, altered hydrology and other threats.

Given the long ecological response times of wetlands and the decadal timescales over which hydrological and climatic pressures intensify, the relevant timeframe for assessing risk is the ***near future*** **(up to 100 years)**. Within this timeframe, the combination of a limited area of occupancy, severe fragmentation, and intensifying threatening processes is likely to result in further loss and degradation of the ecological community across substantial parts of its range. These factors collectively indicate that the ecological community is at significant risk of being lost to one or more threatening processes in the ***near future***.

Basis for near-future timeframe under criterion 2

The nature of the ecological community's distribution makes it likely that the action of threatening processes could cause its loss within the ***near future***. This is defined under criterion 2 as within 20 years, or five generations of any long-lived or key species (whichever is the longer), up to a maximum of 100 years. Its key flora and many of its key fauna (refer to the response to **question 3b**) are long-lived species with slow reproductive turnover and ecological recovery processes that operate over decades.

The wetland trees (moitch or flooded gum (*Eucalyptus rudis*), freshwater paperbark (*Melaleuca rhaphiophylla*), modong or stout paperbark (*Melaleuca preissiana*), saltwater paperbark (*Melaleuca cuticularis*), swamp banksia (*Banksia littoralis*) and other long-lived species, such as the sedges and rushes that structure the community, typically take many years to mature and may regenerate slowly once hydrology or soil conditions are altered. Key fauna also have generation lengths extending over many years, including migratory and resident waterbirds, long-lived freshwater fish, and freshwater turtles such as the south-western snake-necked turtle (*Chelodina oblonga*), for which recent studies document declines driven by adult mortality and reduced breeding success, with recovery occurring only over extended timescales (refer to the response to **question 3b**).

24d. Eligibility under Criterion 2

Based on your answers to questions 24a–c (and with reference to the Committee's indicative thresholds for Criterion 2 in their Guidelines)**, is the ecological community eligible for listing under this criterion? If it is eligible, then summarise why and in which category?***

Answer Question **24d** here. Please use as much space as you need to fully answer the question.

Yes. The ecological community is eligible for listing as **endangered** under **criterion 2**. Its median patch size is 2.3 hectares, which meets the threshold for a very restricted geographic distribution. The nature of its distribution, combined with the long generation lengths and slow ecological turnover of its key flora and fauna, makes it likely that the action of threatening processes could cause its loss in the *near future* (within 20 years, or five generations of any long-lived or key species, up to a maximum of 100 years).

While the area of occupancy **(AOO)** meets the threshold for a **v**ulnerable ecological community, **c**riterion 2 requires applying the highest category met, and the patch-size and timeframe evidence together support eligibility for listing as endangered.

25. Criterion 3: For a population of a native species that is likely to play a major functional role in the community, has there been a decline (of at least 20% over the last 10 years or three generations, whichever is longer) **to the extent that restoration of the community is not likely to be possible** in the immediate, near, or medium-term future?

This criterion refers to native species that are critically important in the processes that sustain or play a major role in the ecological community and whose removal has the potential to precipitate changes in community structure or function, sufficient to undermine the overall community's viability.

25a. Has there been a decline in one or more functionally important species within the ecological community? If so, what are the species and their roles in the community?

Answer Question **25a** here. Please use as much space as you need to fully answer the question.

Several functionally important species of the wetlands of the Swan Coastal Plain are experiencing declines. However, available data do not allow a quantitative assessment demonstrating a decline of at least 20% over the last 10 years or three generations.

25b. What is the magnitude of decline (%) over the last 10 years, or 3 generation lengths (see the Guidelines)**; and why?**

Answer Question **25b** here. Please use as much space as you need to fully answer the question.

This information is not known.

25c. Under what conditions, if any, is restoration possible over time frames defined in the guidelines?

The indicative timeframe threshold that is used to determine eligibility under this criterion depends on the level of decline of the functionally important species (see the Guidelines for further details). Provide evidence of this.

Answer Question **25c** here. Please use as much space as you need to fully answer the question.

This information is not known.

25d. Eligibility under Criterion 3*

Based on your answers to questions 25a – c (and with reference to the Committee's indicative thresholds for Criterion 3 in their Guidelines)**, is the ecological community eligible for listing under this criterion? If it is eligible, then explain why and in which particular category?***

Answer Question **25d** here. Please use as much space as you need to fully answer the question.

There is not enough information to assess whether the wetlands of the Swan Coastal Plain meet the requirements for listing under **criterion 3**.

26. Criterion 4: Has the ecological community experienced a substantial, severe, or very severe reduction in community integrity?

This criterion recognises that changes in integrity can be identified by comparison with the natural condition, or benchmark state of the ecological community with respect to the composition and arrangement of its abiotic and biotic elements and the processes that sustain them. Provide a description of any benchmark states where available. Examples include a reduction in integrity:

through detrimental grazing regimes - e.g. the ground layer impacted by livestock grazing; leading to the loss of grazing-sensitive palatable species and bare soil that is readily colonised by weeds; also soil compaction, hydrological changes, eutrophication and soil erosion.

due to change in vegetation structure and loss of key habitat elements - e.g. tree removal compromising the structure of vegetation, limiting its value as habitat; and weeds diminishing native plant diversity.

through fragmentation - where most remnants are smaller and relatively more isolated (this typically reduces the probability of recolonisation when species are lost from an area and increases the risk of extinction). If fragmentation is a natural or positive characteristic of this ecological community, please state that this is the case and explain why.

through decline in faunal components – where the loss of total area and/or fragmentation and/or invasive species and/or other threat reduces the ecological community's capacity to support a relatively natural and complete faunal assemblage, removing the ecological services provided by these animals. For example, the simplification of the bird assemblage may increase the risk of Eucalyptus dieback associated with defoliation by insects; and other services such as pollination and seed dispersal may also be compromised.

For further information please refer to the Guidelines.

26a. Has there been a substantial, severe, or very severe, reduction in the ecological integrity of the ecological community, across most of its geographic distribution?

If so, is the reduction substantial, severe, or very severe? Describe the degradation of the community or its habitat, or the disruption of important community processes. Identify and justify the indicators of change used; and indicate how much of the ecological community is affected.

Answer Question **26a** here. Please use as much space as you need to fully answer the question.

Yes. The wetlands of the Swan Coastal Plain are subject to multiple interacting threats across most of their geographic distribution, and the cumulative impacts of these threats have ***severely*** reduced the ecological integrity of the community. The responses to **questions 18**, **23 (criterion 1) and 24 (criterion 2)** provide detailed evidence of this decline. Together, they demonstrate a ***severely*** reduced ecological integrity across the full geographic distribution of the wetlands.

The cumulative impacts (threat 11) of wetland loss due to extensive clearing, draining and filling of wetlands and associated habitat fragmentation (threat 1); loss of fringing wetland vegetation and loss or inadequacy of wetland buffers and foreshore areas (threat 2); altered hydrological regimes (threat 3); water quality degradation (threat 4), particularly widespread nutrient enrichment, algal blooms and deoxygenation (threat 4.1); invasive weeds (threat 5); invasive fauna (threat 6), including emerging threats; farmed animal grazing and tramping in rural areas (threat 7); pathogens and disease (threat 8), particularly Phytophthora dieback (*Phytophthora cinnamomi*) (threat 8.1); altered fire regimes (threat 9); and climate change (threat 10), noting that the south-west is experiencing some of the most pronounced drying due to climate change in Australia, have a compounding detrimental influence on ecological processes and increase the complexity of management requirements at site and landscape scales.

Patterns of wetland loss, fragmentation, degradation, loss of fauna and long-term shifts in water regimes indicate that the ecological community has experienced, and is likely to continue to

experience, a ***severe*** reduction in its integrity relative to its natural condition or benchmark state. Many of the processes that sustain the ecological community, including hydrological function, nutrient cycling, habitat, wetland vegetation and fauna, have been disrupted across most of its geographic distribution.

The EPA (2007a, p. 95) strongly summarised that wetlands on the Swan Coastal Plain "are being lost or degraded at an alarming rate by altered catchment water balances, drainage, development, salinity, acidity, pollutant discharge, dieback, weed encroachment and insensitive fire management. Climate change is also an ominous threat for remaining wetlands, particularly in the south west". (refer to the response to **question 18**).

26b. If changes in integrity have occurred, over what timeframe is restoration likely, with positive human intervention?

The indicative timeframe threshold that is used to determine eligibility under this criterion depends on the level of decline of the functionally important species (see the Guidelines for further details). Provide evidence of this.

Answer Question **26b** here. Please use as much space as you need to fully answer the question.

Given the complexity of the threats to the wetlands and subsequent loss of integrity, full restoration of natural structure and function is unlikely to be achievable in the ***near future***, even with positive intervention. However, restoration could improve the wetlands of the Swan Coastal Plain over longer timeframes where pressures are reduced. Achieving this would require sustained, catchment-scale management and long-term investment. Strong community interest in wetland protection, recent research and existing local successes demonstrate that recovery is achievable if the necessary investment and coordination are secured. See also the response to **question 20**.

For example, restoring wetlands that have been extensively cleared, drained or hydrologically modified across the Swan Coastal Plain is complex and unlikely to be achievable in the *near future*. The ecological community is highly diverse, with intricate hydrological, biogeochemical and biological interactions that cannot be rapidly re-established once disrupted. Reinstating natural wetland structure and function requires re-creating appropriate groundwater regimes, surface-water connectivity, hydroperiods and soil conditions, all of which respond slowly to intervention and may be constrained by irreversible landscape-scale changes. However, local restoration projects continue to demonstrate that wetland flora, fauna and ecological function can recover when pressures are reduced.

In many locations, historical drainage has permanently altered groundwater gradients, lowered water tables or redirected flows, making it difficult to restore natural inundation patterns. Re-establishing wetland vegetation is similarly challenging: many species have specific hydrological niches, slow growth rates, or limited dispersal capacity, and recruitment may be further constrained by altered soil profiles, salinity, nutrient legacies and competition from invasive species. Fauna assemblages, including waterbirds, frogs, invertebrates and other fauna, may not return without suitable habitat structure, water regimes and connectivity, and recolonisation is often limited by fragmentation and the loss of nearby source populations. Where suitable habitat has been restored and connectivity improved, some fauna species have shown the capacity to recolonise, indicating that recovery is possible under favourable conditions.

Even where restoration actions are technically feasible, they require sustained, coordinated management across entire catchments. This includes addressing land uses, drainage infrastructure, groundwater abstraction, nutrient inputs, fire regimes and invasive species—factors that operate at scales beyond individual wetland boundaries. As a result, the re-establishment of the ecological processes, species composition and community structure characteristic of the benchmark state is unlikely to occur within the *near future*, even with active intervention. However, long-term,

catchment-scale programs have the potential to support gradual improvements in ecological function in the long term.

In another example, restoring water quality in wetlands affected by nutrient enrichment, algal blooms and deoxygenation is unlikely to be achievable in the *near future*. This requires long-term commitment and measurable improvements may not appear for decades. This delay occurs because excessive nutrients infiltrate catchment soils and enter wetlands, where they are stored in sediments. These legacy nutrients take a very long time to deplete and discharge, so improvements in water quality will only be realised over similarly extended timeframes (DWER 2025b, pp. 94, 225). Achieving water quality objectives may also be difficult if changes cannot be made to existing land uses and activities in the catchments, causing further delays. Despite these constraints, targeted nutrient-reduction programs have demonstrated localised improvements, suggesting that broader catchment-scale action would benefit the wetlands.

26c. Eligibility under Criterion 4*

Based on your answers to questions 26a-b (and with reference to the Committee's indicative thresholds for Criterion 4 in their Guidelines)**, is the ecological community eligible for listing under this criterion? If it is eligible, then explain why and in which particular category?***

Answer Question **26c** here. Please use as much space as you need to fully answer the question.

Yes. The wetlands of the Swan Coastal Plain are eligible for listing as **endangered** under **criterion 4**. The evidence presented in the responses to **questions 18, 26a and 26b** demonstrates a ***severe*** reduction in integrity, consistent with the indicative threshold for this category.

The combined impacts of the various threats have severely reduced the integrity of the wetlands of the Swan Coastal Plain. This severe decline in integrity has diminished the capacity of the ecological community to recover, amplifying the effects of the ongoing and interacting threats.

These wetlands meet the criterion 4 threshold due to the cumulative impacts (threat 11) of extensive historical and ongoing loss of wetland area and associated fragmentation (threat 1); widespread loss of fringing wetland vegetation and loss or inadequacy of wetland buffers and waterway foreshore areas (threat 2); substantially altered hydrological regimes (threat 3); widespread water quality degradation (threat 4); abundant and well-established invasive weeds, invasive fauna and pathogens, including Phytophthora dieback (*Phytophthora cinnamomi*) (threats 5, 6 and 8.1); farmed animal grazing and tramping in rural areas (threat 7); altered fire regimes (threat 9); a large number of dams, crossings and other barriers to aquatic fauna movement (threat 12); and major adverse impacts from climate change (threat 10). As stated in the response to question 26a, the south-west is experiencing some of the most pronounced drying due to climate change in Australia.

The severe reduction in integrity is widespread, persistent and ongoing, and restoration is unlikely within the *near future*. Although some threat abatement measures are underway (see the response to **question 20**), these will not restore the integrity of the wetlands of the Swan Coastal Plain within the *near future*.

In accordance with step 1 of the criterion 4 guidance (DCCEEW 2024a, pp. 40-41), the ecological community has undergone detrimental changes to the identity and number of component species (including flora, fauna and microbial species), the relative and absolute abundance of those species and the abiotic environment that supports them. The evidence provided in the responses to **questions 18, 26a and 26b** demonstrates the following, consistent with the types of degradation identified in step 1 of the guideline:

- declines in key flora and fauna species

- disruption of ecological processes, including altered hydrological regimes, disrupted recruitment and regeneration, nutrient enrichment and changes to nutrient cycling, and fragmentation that interrupts fauna movement and recolonisation
- changes in structure, such as reduced extent and density of fringing vegetation, loss of understorey layers, simplified habitat complexity and fragmentation of formerly connected wetland systems
- changes in composition, including shifts from native-dominated vegetation to weed-dominated vegetation, altered species composition, and declines in characteristic wetland flora and fauna
- impairment of ecological function, including ability to maintain water quality, impaired recruitment of long-lived species and reduced breeding success in wetland-dependent fauna, diminished habitat suitability for wetland fauna and reduced ecosystem productivity
- reduced capacity for recovery, including due to loss of seedbanks, persistent weed dominance, fragmentation that limits recolonisation, and substantially altered hydrological regimes.

In accordance with step 2 of the criterion 4 guidance (DCCEEW 2024a, p. 41), which recognises that ecological processes are important to maintain an ecological community, the ecological community shows clear evidence of disruption of ecological processes that are essential to maintaining its integrity. Hydrological regimes have been significantly altered through water abstraction, drainage, shortened hydroperiods, stormwater drainage inputs and a drying climate, directly affecting the seasonal flooding and soil-moisture patterns that underpin wetland vegetation structure, nutrient cycling and fauna life cycles. These hydrological changes are widespread across wetland types and geographic areas, indicating systemic disruption rather than isolated impacts. Recruitment processes are also disrupted, for example, long-lived wetland trees, sedges and rushes show reduced seedling establishment and high juvenile mortality under changed hydrological and soil conditions, consistent with the guideline's example in which recruitment failure is occurring but long-lived species mask immediate community breakdown. Additional process-level disruptions include nutrient enrichment, salinisation, acidification, invasive fauna impacts, weed dominance, pathogen spread and fragmentation that interrupts fauna movement and recolonisation. Together, these disruptions demonstrate that the ecological processes required to maintain the wetlands of the Swan Coastal Plain are no longer functioning effectively.

27. Criterion 5: Is the ecological community subject to substantial and serious continuing detrimental change?

This criterion refers to recent, current or projected future detrimental change, where the causes are either not known or not adequately controlled and so the detrimental change is likely to continue unless remedial measures are taken. Natural fluctuations will not normally count, but an observed change should not be considered to be part of a natural fluctuation unless there is evidence for this.

The 'rate of continuing detrimental change' may be indicated in a number of ways, according to the regulations i.e. by:

a) a rate of continuing decline in its geographic distribution, or of a population of a native species that is believed to play a major role in the community; or

b) an intensification, across most of its geographic distribution, in degradation, or disruption of important community processes.

27a. Estimate the magnitude of detrimental change over the timeframe specified in the Guidelines.

Answer Question **27a** here. Please use as much space as you need to fully answer the question.

If the guidelines for listing against this criterion require a minimum detrimental change of at least 30 percent over the immediate past, or suspected for the immediate future, then there is insufficient information to meet this criterion. If there is another way to meet this criterion (under pathway(b)) without this data, it may be possible to meet this criterion.

27b. Identify the measures and justify the evidence you used to estimate the rate of change in response to question 27a.

For instance, published data on rate of recent vegetation clearance or documented expected rate of future loss; data on loss of native species or spread of an invasive species; or other measures of loss of biotic elements or functional degradation.

Answer Question **27b** here. Please use as much space as you need to fully answer the question.

Refer to the response to **question 27a**.

27c. Eligibility under Criterion 5

Based on your answers to questions 27a- b (and with reference to the Committee's indicative thresholds for Criterion 5 in their Guidelines) **is the ecological community eligible for listing under this criterion? If it is eligible, then explain why and in which particular category?***

Answer Question **27c** here. Please use as much space as you need to fully answer the question.

Refer to the response to **question 27a**.

28. Criterion 6: Is there a Quantitative analysis estimating the probability of extinction?

This criterion is intended to include any form of analysis that estimates the extinction probability of an ecological community based on known characteristics of important species or other components, habitat requirements, ecological processes, threats and any specified management options.

In presenting the results of quantitative analyses, the assumptions (which must be explicitly stated) and the data used must be documented.

28a. Is there a Quantitative analysis estimating the probability of extinction of the ecological community?

Answer Question **28a** here. Please use as much space as you need to fully answer the question.

This information is not known.

28b. If yes, what results are there from a Quantitative analysis that estimates the extinction probability of this ecological community?

Answer Question **28b** here. Please use as much space as you need to fully answer the question.

This information is not known.

28c. Please cite published or other source of analysis; or if unpublished, fully describe and justify the analysis and its assumptions.

Answer Question **28c** here. Please use as much space as you need to fully answer the question.

This information is not known.

28d. Eligibility under Criterion 6

Based on your answers to questions 28a-c (and with reference to the Committee's Guidelines for Criterion 6) **is the ecological community eligible for listing under this criterion? If it is eligible, then explain why and in which particular category?***

Answer Question **28d** here. Please use as much space as you need to fully answer the question.

There is not enough information to assess whether the wetlands of the Swan Coastal Plain meet the requirements for listing under **criterion 6**.

Section 10 – References*

29. Please provide a list of references cited in your nomination (authors names and publication date; paper/article title; publication name/number (i.e. of the journal or book).* Also provide correct URLs where the documents are available on the Internet; see examples below. Indicate if any of this information is unavailable.*

Note: The opinion of appropriate scientific, First Nations and other experts may be cited (with their approval) in support of a nomination. If this is done the names of the experts, their qualifications and full contact details must also be provided in the reference list below, along with the date of their opinion.*

Create your reference list here.

The references cited in this nomination are provided in **attachment M**. Further reading is provided in **attachment N**. A list of abbreviations used in this nomination is provided in **attachment O**.

30. Please provide (electronic/scanned) copies of key documentation/references (or relevant parts thereof) cited in the nomination, if they are not easily accessible via the internet.

List any attached items here (identify the relevant sections). Please use as much space as you need.

The attachments that are not readily accessible via the internet are listed in **attachment P**. Where possible, these will be provided via email.

31. Identify relevant experts and their contact details, indicating which were consulted during preparation of this nomination.

Provide relevant contacts here. Please use as much space as you need.

32. Please include or attach images of the ecological community if available.

The files are too large to send by email. These images were provided on a thumb drive, which was sent by post.

Additional images can be provided in winter or spring 2026, as wetland conditions vary throughout the year and photographs should be taken after the main rainfall period.

IMAGE CONSENT STATEMENT

The Department is seeking permission to use the image(s) provided with the nomination. The Department may choose to use the image in a variety of ways including (but not limited to) printed and online content, social media and press releases. The owner of the image will be attributed if the image is used.

If you own the copyright to the image(s) please select the appropriate box to state your preference. For images sourced from others, include the copyright owner's details. If the source of the image is unknown, please indicate this.

☒ I own the copyright and give permission for the Department to use the image(s)

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☒ I do not own the copyright. Permission should be sought from: the photographers – the photographers names are provided for each photo and each photographer has given permission for the Department to use their images.

The name of each photographer is included in the label for each photo. I own the copyright for the photos labelled with my name and give permission for the Department to use these images. Other photos were provided by different photographers, and each photographer has given permission for the Department to use their images.

Thank you for taking the time to prepare this nomination.

Please check you have met all the regulated requirements for a valid nomination using the Checklist at Section 11

Section 11 – Completed nomination form checklist

Please check all items on this list have been completed and are included with your nomination. Not including items on this list risks non-compliance with the *EPBC Regulations 2025* which could mean that your nomination will not be eligible for consideration.

☒ I have read and applied the Guidelines for Nominating and Assessing the Eligibility for Listing of Ecological Communities as Threatened according to the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) and the relevant parts of sections 7.01 and 7.02 of the *EPBC Regulations 2025* to this nomination.

I have included:

☒ *Nominator details including name (& organisation/company), address, email and phone number
☒ *Name of the ecological community
☒ *Any other names it is known by
☒ *Map or maps included; or attached
☒ *References cited and a full reference list included
☒ *For any unanswered questions, a statement indicating that insufficient information is available.

I have included a description of:

☒ *Biological components of the ecological community
☒ *Non biological components of the ecological community
☒ *Key interactions and functional processes
☒ *Characteristic features distinguishing it from other ecological communities
☒ *Key species (dominant, characteristic, diagnostic, threatened, functionally important etc)
☒ *Known or estimated current extent of the ecological community
☒ *Past/current/future (and identified as actual/potential) threats, including how they are being/how could they be abated
☒ *The category the ecological community should be listed under and why (and the ecological community's eligibility for listing against each criterion).

Where did you find out about nominating items?

The Committee would appreciate your feedback regarding how you found out about the nomination process. Your feedback will ensure that future calls for nominations can be advertised as effectively as possible

☒ The Department's website
☐ The Australian newspaper
☐ Web search
☒ Word of mouth
☐ Social media. If so which one? (provide details below)
☐ Journal/society/organisation website or email. If so which one? (provide details below)
☐ Other (provide details below)

Details:

How to lodge your nomination.

Completed nominations must be lodged by **5PM** on **31 March 2026** via email or post.

Australian Government

Department of Climate Change, Energy, the Environment and Water

1. via email to: epbcnom@dcceew.gov.au	2. via post[#] to: The Director, Ecological Communities Section Department of Climate Change, Energy, the Environment and Water GPO Box 3090 Canberra ACT 2601
[#] *If submitting by mail, please also provide an electronic copy by email (if the file size is too large, please contact the department at the above email address for advice prior to submission).*	

Attachment A – Wetland flora of the Swan Coastal Plain

Table A1 lists the wetland flora of the Swan Coastal Plain (SCP).

References used in Table A1 to confirm the flora species is found in the wetlands of the Swan Coastal Plain:

1. Keighery G, Keighery B, Longman V and Rye B 2023, 'Appendix B: Plant species native to the Perth metropolitan region' in Powell R and Emberson J 2023, *Growing locals: Gardening with local plants in Perth*, 2nd edn, Western Australian Naturalists' Club, Perth, pp. 99–156.
2. 'Appendix 2, Native wetland vascular plant taxa of the southern Swan Coastal Plain (Moore River-Dunsborough) referred to in this topic or otherwise common to the region' in Department of Environment and Conservation 2012o, 'Wetland vegetation and flora' in *A guide to managing and restoring wetlands in Western Australia*. Prepared by Keighery G, Keighery B and Longman V, Department of Environment and Conservation, Perth. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/026262/026262.003.pdf>. (Accessed: 22 March 2026).
3. Water and Rivers Commission 2000, *Water note 20: Rushes and sedges*, Water and Rivers Commission, Perth. Available at: <www.wa.gov.au/government/document-collections/water-notes-collection>. (Accessed 22 March 2026).
4. Water and Rivers Commission and Department of Conservation and Land Management 1997a, *Native vegetation of estuaries and saline waterways in south Western Australia*, Water and Rivers Commission, Perth. Available at: <www.wa.gov.au/system/files/2023-03/Native-vegetation-of-estuaries-and-saline-waterways-in-south-WA.pdf>. (Accessed 22 March 2026).
5. Water and Rivers Commission 1997b, *Native vegetation of freshwater rivers and creeks in south western Australia*, Water and Rivers Commission, Perth. Available at: <www.wa.gov.au/government/publications/native-vegetation-of-freshwater-rivers-and-creeks-south-wa>. (Accessed 22 March 2026).
6. Department of Climate Change, Energy, the Environment and Water 2025, *Protected Matters Search Tool report for drawn area search of the Swan Coastal Plain IBRA region*. Viewed at: <https://pmst.environment.gov.au> on 12 November 2025. The approved conservation advice is provided as a hyperlink in the report; and it was checked to confirm the species as wetland flora if it was not already listed as wetland flora in the references above.
7. Western Australian Herbarium 1998–, *Florabase—the Western Australian flora*, Department of Biodiversity, Conservation and Attractions. Viewed at <https://florabase.dbca.wa.gov.au> on 22 March 2026.
8. Keighery GJ and Keighery BJ 2013, 'Wetland vegetation and flora, part 5: Southern Swan Coastal Plain' in 'Wetland vegetation and flora (section in chapter 2)', in *A guide to managing and restoring wetlands in Western Australia*. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/026262/026262.003.pdf>. (Accessed: 22 March 2026.)
9. For threatened flora species, the relevant recovery plan (listed in the response to question 19) or approved conservation advice.

Notes:

- Reference 2 provides the base list of wetland flora species, with reference 1 used next. Reference 1 is presented first in the table because it was used to organise species by vegetation structure and growth form. Both references draw on the same underlying database from sampling across the Swan Coastal Plain.
- Common flora were identified from an analysis of more than 1,000 plots on the southern Swan Coastal Plain (DEC 2012o, p. 70). These are the 166 most commonly encountered wetland species (150 native species). Commonly encountered species were determined to be those that occurred in ten or more plots of wetland floristic community types 75 per cent or more of the time (DEC 2012o, p. 70).
- The common names were mainly taken from the Department of Climate Change, Energy, the Environment and Water (2025), *Florabase* (Western Australian Herbarium 1998–) and Keighery, Longman and Rye (2023).
- *Florabase* (Western Australian Herbarium 1998–) was used selectively to confirm that species in references 3, 4 and 5 occur on the Swan Coastal Plain, and to confirm species are found in wetlands where this was unclear in other sources, including cases where Keighery, Longman and Rye (2023) recorded a species for the Perth Metropolitan Region but did not identify it as a wetland species. It was also used to confirm whether threatened and priority flora are wetland species, alongside recovery plans, as these species are unlikely to be included in lists of common wetland flora. *Florabase* was not checked for every species and is not cited where it did not provide clarification, or where it was used only to verify occurrence on the Swan Coastal Plain. Florabase was not generally used as a habitat source because its habitat terms are broad and summarise occurrences across the species' full range. Many species occur in wetlands in one region and drylands in another. Herbarium records can assist where habitat is reported accurately, but there is no standard format for describing wetland habitat on specimen labels. The two species that are confirmed as wetland species only in *Florabase* should ideally be verified as wetland species by consulting the Western Australian Herbarium. These species are *Grevillea brachystylis* Meisn. subsp. *brachystylis* (Priority 3) and *Acacia lasiocarpa* var. *bracteolata* long peduncle variant (Priority 1).
- The following sources were used to identify the threatened and priority flora species:
    - Department of Climate Change, Energy, the Environment and Water 2025, *Protected Matters Search Tool report for drawn area search of the Swan Coastal Plain IBRA region*. Viewed at: <https://pmst.environment.gov.au> on 12 November 2025.

    - Department of Biodiversity, Conservation and Attractions 2025, *Threatened and priority flora list – July 2025*, Department of Biodiversity, Conservation and Attractions, Perth. Available at: <www.dbca.wa.gov.au/management/threatened-species-and-communities>. (Accessed: 22 March 2026.)

- Threatened species are identified by the Australian Government under the *Environmental Protection and Biodiversity Conservation Act 1999* and the Western Australian Government under the *Biodiversity Conservation Act 2016*. Priority species are identified by the Department of Biodiversity, Conservation and Attractions in Western Australia (WA). These are possibly threatened species that do not meet survey criteria or that are not adequately defined (priorities 1, 2 and 3). These three categories are ranked in order of priority for survey, and evaluation of conservation status, so that consideration can be given to their declaration as threatened species. Species that are adequately known and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened species list, are placed in priority 4. Priority species cannot be listed under the *Biodiversity Conservation Act 2016*.
- The response to question 3b in the main body of the nomination form includes additional references.
- References are placed in brackets when they relate to the species but the subspecies is most relevant to this flora list.
- Noongar flora names (*) and Noongar bush foods and medicines [N] were sourced from:
    - Hansen V and Horsfall J 2017, *Noongar bush medicine: Medicinal plants of the south-west of Western Australia*, University of Western Australia Publishing.
    - Hansen V and Horsfall J 2019, *Noongar bush tucker: Bush food plants and fungi of the south-west of Western Australia*, University of Western Australia Publishing.
- Several species names have changed since DEC (2012o) was published: *Actinostrobus acuminatus* is now *Callitris acuminata*; *Actinostrobus pyramidalis* is now *Callitris pyramidalis; Amblysperma minor Trichocline* sp. Treeton is now *Trichocline spathulata; Chamelaucium* sp. C Coastal Plain (*Chamelaucium roycei* ms) is now *Chamelaucium roycei; Eryngium ferox* ms is now *Eryngium* sp. Ferox; *Eryngium pinnatifidum* subsp. *palustre* ms is now *Eryngium pinnatifidum* subsp. Palustre; *Hemichroa diandra* is now *Surreya diandra; Hypoxis occidentalis* var. *occidentalis* is now *Pauridia occidentalis*; *Meeboldina cana* is now *Leptocarpus canus*; *Meeboldina coangustata* is now *Leptocarpus coangustatus; Meeboldina scariosa* is now *Leptocarpus scariosus; Podolepis capillaris* is now *Siemssenia capillaris; Sarcocornia quinqueflora* is now *Salicornia quinqueflora*; *Schoenoplectus validus* is now *Schoenoplectus tabernaemontani; Verticordia plumosa* var. *pleiobotrya* is now *Verticordia plumosa* var. *brachyphylla*. *Drosera gigantea*, *Drosera menziesii* and *Grevillea curviloba* are no longer divided into subspecies. *Baumea* sp. is now *Machaerina* sp. *Azolla filiculoides* was misapplied against the current name *Azolla rubra*. *Eryngium subdecumbens* ms is now *Eryngium subdecumbens*.

Abbreviations:

EPBC Act = *Environmental Protection and Biodiversity Conservation Act 1999* (Australian Government)

BC Act = *Biodiversity Conservation Act 2016* (Western Australia)

WA = Western Australia

[a.r.] = annually renewed

[P] = priority species in Western Australia

[T] = threatened species

[w/d] = wetland and dryland forms

[N] = Noongar bush food or medicine in Hansen and Horsfall (2017, 2019).

[#] = This species is recorded in Keighery, Longman and Rye (2023) as occurring on Swan Coastal Plain soils in the Perth Metropolitan Region but it is not identified as a wetland species in that publication.

[M] = Occurs in wetlands on the Muchea limestones, may not be considered a wetland species elsewhere.

CR = Critically Endangered

E = Endangered

VU = Vulnerable

Y = Yes (indicates common flora)

* = Noongar name in Hansen and Horsfall (2017, 2019).

Table A1 – Wetland flora of the Swan Coastal Plain

Common name Noongar name*	Botanical name	Family	References	Common	Threatened flora		Priority flora (WA)
					EPBC Act	BC Act (WA)	
LARGE TREES: Trees that commonly grow up to 20 m or more							
Large-flowered Flooded Gum	*Eucalyptus rudis* subsp. *cratyantha* [P]	Myrtaceae	1, 2, (4, 5)				4
Moitch*, Flooded Gum, Moich*, Kulurda*, Gulurto*, Gooloorto*, Koolert*, Moja*, Colaille*, Gulli*	*Eucalyptus rudis* subsp. *rudis* [N]	Myrtaceae	1, 2, (4, 5)	Y			
Wattie, Native Cedar, Warren River Cedar	*Taxandria juniperina*	Myrtaceae	2, 5				
SMALL TO MEDIUM TREES: Trees up to 15 m tall (most not more than 10 m tall)							
Jam, Mungart*, Mangart*, Manjart*, Munert*, Munertor*, Mungaitch*, Mungat*, Mungut*	*Acacia acuminata* [N]	Fabaceae	2				
Summer-scented Wattle	*Acacia rostellifera* [#]	Fabaceae	2				
Peppermint, Wanil*, Wanill*, Wannow*, Wanong*, Wannung*, Warndilyy*	*Agonis flexuosa* [#][1][N]	Myrtaceae	5				
White Mangrove	*Avicennia marina*	Acanthaceae	2				
Swamp Banksia, Pungura*, Boongura*, Boora*, Boorarup*, Mimidi*	*Banksia littoralis* [N]	Proteaceae	1, 2, 5	Y			
Cooli, Salt Sheoak	*Casuarina obesa*	Casuarinaceae	1, 2, 4	Y			
Redheart, Limestone Marlock, Moit*	*Eucalyptus decipiens* [#][2][M] [N]	Myrtaceae	7, 8, 9				
Saltwater Paperbark, Bibool*, Yaularung*, Bewel*, Koll*, Mudurda*	*Melaleuca cuticularis* [N]	Myrtaceae	1, 2, 4	Y			
Moonah*, Rottnest Tea-tree	*Melaleuca lanceolata* [#][N]	Myrtaceae	2, 7				
Modong*, Stout Paperbark, Moonah*	*Melaleuca preissiana* [N]	Myrtaceae	1, 2, 5	Y			
Freshwater Paperbark, Yowarl*, Bibool Boorn* Yeymbac*, Yiembak* Yawl*	*Melaleuca rhaphiophylla* [N]	Myrtaceae	1, 2, 4, 5	Y			
Albizia	*Paraserianthes lophantha* subsp. *lophantha*	Fabaceae	1, (5)				
TALL SHRUBS: Shrubs (Bushy plants, with multiple woody stems arising at or near the ground) that normally grow to 3-5m tall							
Red-eyed Wattle, Coastal Wattle	*Acacia cyclops* [#]	Fabaceae	2				
Coojong*, Golden-wreath Wattle, Orange Wattle, Cujong*, Kalyung*, Kileyung*, Kudjong*, Biytch*	*Acacia saligna* [#][w/d][N]	Fabaceae	2, 5				
River-bank Astartea	*Astartea leptophylla*	Myrtaceae	1				
Whicher Range Dryandra	*Banksia squarrosa* subsp. *argillacea* [T][3]	Proteaceae	6, 7, 8, 9		VU	VU	
Wonnich, Native Willow	*Callistachys lanceolata*	Fabaceae	2, 5				
Toobada*, Western Bottlebrush, Tubada*	*Callistemon phoeniceus* [N]	Myrtaceae	1				
Swamp Cypress, Marro*	*Callitris pyramidalis* [N]	Cupressaceae	1, 2	Y			
Fremantle Mallee, Narrow-leaved Red Mallee	*Eucalyptus foecunda* [#][M]	Myrtaceae	2, 9				
River Pea	*Gastrolobium ebracteolatum*	Fabaceae	1, 2, 5				
Variable-leaved Grevillea, Valley Grevillea	*Grevillea diversifolia*	Proteaceae	5				
Banbar*	*Melaleuca teretifolia* [N]	Myrtaceae	1, 2	Y			

[1] Not a true wetland species. It frequently occurs in coastal areas, sometimes fringing creeks and rivers.
[2] Not a true wetland species but it is wetland-tolerant and occurs on the margins of seasonally wet areas.
[3] Formerly *Dryandra squarrosa* subsp. *argillacea*.

Mohan	*Melaleuca viminea* subsp. *viminea*	Myrtaceae	1, 2, (4)	Y			
Basket Bush	*Spyridium globulosum* [#]	Rhamnaceae	2				
Brook Peppermint, Swamp Peppermint	*Taxandria linearifolia*	Myrtaceae	1, 2, 5	Y			
Swishbush, Koweda	*Viminaria juncea*	Fabaceae	1, 2, 5	Y			
MEDIUM TO LARGE SHRUBS: Shrubs normally 1-3 m tall							
-	*Allocasuarina campestris*	Casuarinaceae	2				
West Coast Astartea	*Astartea affinis*	Myrtaceae	1, 2	Y			
Common Astartea	*Astartea scoparia*	Myrtaceae	1				
Swamp Fox Banksia	*Banksia telmatiaea*	Proteaceae	1				
Swamp Bottlebrush	*Beaufortia sparsa*[4] [N]	Myrtaceae	2				
Dwarf Cypress	*Callitris acuminata* [#]	Cupressaceae	2				
-	*Calothamnus lateralis*	Myrtaceae	1, 2	Y			
-	*Calycopeplus oligandrus*	Euphorbiaceae	1				
Butterfly-leaved Gastrolobium	*Gastrolobium papilio* [T][5]	Fabaceae	2, 6, 7, 9		EN	CR	
-	*Grevillea brachystylis* Meisn. subsp. *brachystylis* [P]	Proteaceae	7				3
Freeway Grevillea, Curved-leaf Grevillea	*Grevillea curviloba* [T]	Proteaceae	1, 2, 6, 9		EN[6]	EN	
Ironstone Grevillea	*Grevillea elongata* [T]	Proteaceae	2, 6, 9		VU	EN	
McCutcheon's Grevillea	*Grevillea maccutcheonii* [T]	Proteaceae	2, 6, 9		EN	CR	
-	*Grevillea obtusifolia*	Proteaceae	1, 2				
Horned-leaf Hakea	*Hakea ceratophylla*	Proteaceae	1, 2	Y			
-	*Hakea oldfieldii* [P]	Proteaceae	2				3
Variable-leaved Hakea	*Hakea varia* [N]	Proteaceae	1, 2	Y			
-	*Homalospermum firmum*	Myrtaceae	1, 2				
-	*Isopogon formosus* subsp. *dasylepis* [P]	Proteaceae	2	Y			3
-	*Kunzea micrantha* subsp. *micrantha*	Myrtaceae	1				
-	*Kunzea micrantha* subsp. *petiolata*	Myrtaceae	1				
-	*Kunzea recurva*	Myrtaceae	1, 2	Y			
Tall Labichea	*Labichea lanceolata* subsp. *lanceolata*	Fabaceae	1				
Western Prickly Honeysuckle	*Lambertia echinata* subsp. *occidentalis* [T]	Proteaceae	2, 6, 9		EN	CR	
-	*Leptomeria ellytes*	Santalaceae	2				
Gorada	*Melaleuca acutifolia*	Myrtaceae	1				
-	*Melaleuca brevifolia* [N]	Myrtaceae	1, 2				
Grey Honey-myrtle	*Melaleuca incana* subsp. *incana*	Myrtaceae	1, 2	Y			
Robin Redbreast Bush	*Melaleuca lateritia*	Myrtaceae	1, 2, 5	Y			
Broom Honey-myrtle	*Melaleuca osullivanii*	Myrtaceae	1, 2	Y			
-	*Melaleuca pauciflora*	Myrtaceae	1				
-	*Melaleuca ryeae*	Myrtaceae	1				
Rough Honeymyrtle	*Melaleuca scabra*	Myrtaceae	2				
-	*Melaleuca thyoides*	Myrtaceae	2				
Slender Myoporum	*Myoporum caprarioides* [#]	Scrophulariaceae	4, 7				
Swamp Tea-tree	*Pericalymma ellipticum*	Myrtaceae	1, 2	Y			
-	*Pericalymma spongiocaule*	Myrtaceae	1				
-	*Regelia ciliata*	Myrtaceae	1, 2	Y			
-	*Regelia inops*	Myrtaceae	1, 2				
-	*Stylobasium australe*	Surianaceae	1				

[4] *Beaufortia sparsa* in *Florabase* (Western Australian Herbarium 1998–). Also known as *Melaleuca sparsa*.

[5] Formerly *Brachysema papilio*.

[6] Listed as Narrow Curved-leaf Grevillea (*Grevillea curviloba* subsp. *incurva*) and Curved-leaf Grevillea (*Grevillea curviloba* subsp. *curviloba*), which are both more recently known as *Grevillea curviloba*. That is, the species is now treated as *Grevillea curviloba* without subspecies.

Cockies Tongues, Yackal Djarr*, Injid*	*Templetonia retusa* [#]	Fabaceae	2				
-	*Xanthorrhoea brunonis*	Xanthorrhoeaceae	2				
Balga*, Grass Tree, Baaluk*, Balgarr*, Ballak*, Balligar*, Balluk*, Baluk*, Barar*, Barlock*, Barro*, Beara*, Paaluk*, Paluk*, Yimmen*, Bor*, Borl*, Balag*, Borak*	*Xanthorrhoea preissii* [#][N]	Xanthorrhoeaceae	2, 7				
LOW SHRUBS: Shrubs normally less than 1 m tall (including woody groundcovers)							
-	*Acacia flagelliformis* [P]	Fabaceae	2				4
-	*Acacia lasiocarpa* var. *bracteolata* long peduncle variant [P]	Fabaceae	7				1
Basket Flower	*Adenanthos meisneri* [#]	Proteaceae	2				
-	*Andersonia ferricola* [P]	Eriaceae	2				1
Slender Andersonia	*Andersonia gracilis* [T]	Eriaceae	1, 2, 6, 9		EN	VU	
-	*Aotus cordifolia*	Fabaceae	1, 2				
-	*Astartea zephyra*	Myrtaceae	1				
-	*Atriplex hypoleuca* [#]	Chenopodiaceae	4, 7				
Aniseed Boronia	*Boronia crenulata* subsp. *viminea*	Rutaceae	1				
-	*Boronia juncea*	Rutaceae	7, 8				1 (subsp. *juncea*)
Elegant Tinsel Lily	*Calectasia elegans* [T]	Dasypogonaceae	1, 9		Not listed	CR	
-	*Calothamnus hirsutus*	Myrtaceae	1, 2	Y			
Swamp Starflower	*Calytrix breviseta* subsp. *breviseta* [T]	Myrtaceae	1, 6, 9		EN	CR	
Muchea Bell	*Darwinia foetida* [T]	Myrtaceae	1, 2, 6, 9		CR	EN	
Abba Bell	*Darwinia whicherensis* [T][7]	Myrtaceae	2, 6, 9		EN	CR	
Perth Parrot-Pea	*Dillwynia dillwynioides* [P]	Fabaceae	1, 2				3
Tarbush	*Eremophila glabra* subsp. *chlorella* [T]	Scrophulariaceae	1, 2, 6, 9		EN	EN	
Swamp Pea	*Euchilopsis linearis*	Fabaceae	1, 2				
-	*Eutaxia virgata*	Fabaceae	1				
Sea Heath, Seaheath	*Frankenia pauciflora* [w/d]	Frankeniaceae	1, 2, 4				
Swamp Spider-net, Spider Net Grevillea	*Grevillea thelemanniana* [T]	Proteaceae	1, 6, 9		CR	CR	
Furrowed Hakea	*Hakea sulcata*	Proteaceae	1				
-	*Hakea* sp. Eastern Coastal Plain	Proteaceae	1				
-	*Hemiphora uncinata*	Lamiaceae	1				
-	*Hibbertia perfoliata*	Dilleniaceae	1, 2				
Orange Stars	*Hibbertia stellaris*	Dilleniaceae	1, 2	Y			
White Myrtle, Koodgeed*, Kudjidi*	*Hypocalymma angustifolium* [N]	Myrtaceae	1, 2				
Balbak's White Myrtle	*Hypocalymma balbakiae*	Myrtaceae	1				
Tall White Myrtle	*Hypocalymma suave*	Myrtaceae	1				
Swamp Jacksonia	*Jacksonia gracillima* [P]	Fabaceae	1, 2				3
-	*Lawrencia squamata*	Malvaceae	1, 2				
Phyllanthus, False Boronia	*Lysiandra calycina* [w/d]	Phyllanthaceae	1				
-	*Olearia elaeophila*	Asteraceae	1				
Dog Weed	*Opercularia vaginata* [#] [w/d]	Rubiaceae	2				
Laterite Petrophile	*Petrophile latericola* [T]	Proteaceae	2, 6, 9		EN	CR	
-	*Petrophile seminuda* [w/d]	Proteaceae	1				
Pepper-and-salt	*Philotheca spicata* [w/d]	Rutaceae	1				
-	*Pimelea imbricata* var. *major*	Thymelaeaceae	1, 2	Y			
Thick-head Glasswort, Milyu*	*Salicornia blackiana*	Chenopodiaceae	1, 4				

[7] Formerly *Darwinia* sp. Williamson.

Beaded Samphire, Beaded Glasswort, Milyu*	*Salicornia quinqueflora* subsp. *quinqueflora* [N]	Chenopodiaceae	1, (2, 4)	Y			
Leafless Globe-pea	*Sphaerolobium vimineum*	Fabaceae	1				
Blueboy	*Stirlingia latifolia* [w/d]	Proteaceae	1				
Club-leafed Synaphea	*Synaphea* sp. Pinjarra [#][T]	Proteaceae	6, 7, 9		CR	CR	
-	*Synaphea* sp. Pinjarra Plain [#][T]	Proteaceae	6, 7, 9		EN	EN	
-	*Synaphea* sp. Serpentine [#][T]	Proteaceae	6, 9		CR	CR	
Dwellingup Synaphea	*Synaphea stenoloba* [T]	Proteaceae	6, 7, 9		EN	EN	
Shrubby Samphire, Milyu*	*Tecticornia halocnemoides* subsp. *halocnemoides* [N]	Chenopodiaceae	1, (4)				
Samphire, Milyu*	*Tecticornia indica* subsp. *bidens* [N]	Chenopodiaceae	1, 2, (4)				
Milyu*	*Tecticornia lepidosperma* [N]	Chenopodiaceae	1, 4				
Milyu*	*Tecticornia leptoclada* subsp. *inclusa*	Chenopodiaceae	1				
Blackseed Samphire, Milyu*	*Tecticornia pergranulata* subsp. *pergranulata* [N]	Chenopodiaceae	1, 2				
Milyu*	*Tecticornia syncarpa*	Chenopodiaceae	2				
-	*Thomasia triphylla* [#]	Malvaceae	2				
Variegated Featherflower	*Verticordia huegelii*	Myrtaceae	1				
Yellow Featherflower	*Verticordia chrysantha*	Myrtaceae	2				
Long-stalked Featherflower	*Verticordia densiflora* var. *pedunculata* [T]	Myrtaceae	6, 7, 9		EN	EN	
Tufted Plumed Featherflower	*Verticordia plumosa* var. *ananeotes* [T]	Myrtaceae	6, 7, 9		EN	CR	
-	*Verticordia plumosa* var. *brachyphylla*	Myrtaceae	2				
Vasse Featherflower	*Verticordia plumosa* var. *vassensis* [T]	Myrtaceae	6, 7, 9		EN	EN	
CLIMBERS: Plants rooted in the ground that twine around or attach themselves to other plants							
Pink Rainbow	*Drosera menziesii* [a.r.]	Droseraceae	1, 2				
-	*Parsonsia diaphanophleba* [P]	Apocynaceae	1				4
PERENNIAL HERBS: Non-woody plants that live more than a year (some die off above ground each summer but survive underground)							
Lesser Joyweed	*Alternanthera denticulata*	Amaranthaceae	1				
-	*Amperea protensa*	Euphorbiaceae	1				
Swamp Wallaby-grass	*Amphibromus nervosus*	Poaceae	1, 2	Y			
-	*Amphibromus vickeryae* [P]	Poaceae	2				1
-	*Anarthria laevis*	Anarthriaceae	1				
-	*Anarthria prolifera* [#]	Anarthriaceae	3, 7				
-	*Anarthria scabra*	Anarthriaceae	2, 3				
Dwarf Green Kangaroo Paw, Koroylbardany*, Koroybardang*	*Anigozanthos viridis* subsp. *terraspectans* [T][N]	Haemodoraceae	6, 7, 8, 9		VU	VU	
Green Kangaroo Paw	*Anigozanthos viridis* subsp. *viridis* [a.r.]	Haemodoraceae	1				
-	*Anthotium junciforme* [#]	Goodeniaceae	2, 7				
Sea Celery	*Apium prostratum* subsp. *prostratum* [N]	Apiaceae	1				
Bronwen's Speargrass	*Austrostipa bronweniae* [T]	Poaceae	1, 6, 9		EN[8]	EN	
Marsh Club-rush, Belillah*	*Bolboschoenus caldwellii* [N]	Cyperaceae	1, 4, 5				
-	*Bolboschoenus medianus* [P]	Cyperaceae	1				1
-	*Borya constricta* [#]	Boryaceae	2				
-	*Borya scirpoidea*	Boryaceae	1				
Pincushions	*Borya sphaerocephala*	Boryaceae	1				
-	*Burchardia bairdiae* [a.r.]	Colchicaceae	1, 2	Y			
Dwarf Milkmaids, Cara*	*Burchardia multiflora* [a.r.][N]	Colchicaceae	1, 2	Y			

[8] Listed as *Austrostipa bronwenae*. However, the accepted scientific name is *Austrostipa* bronweniae, as per *Florabase* (Western Australian Herbarium 1998–).

Rainbow Plant, Byblis	*Byblis gigantea* [T]	Byblidaceae	1		Not listed but being assessed[9]	EN	
Pale grass-lily, Karhrh*	*Caesia micrantha* [w/d][a.r.][N]	Hemerocallidaceae	1				
Bussell's Spider Orchid, Kara*, Cara*, Kahta-ninda-yootah*, Kararr*	*Caladenia busselliana* [a.r.][T][N]	Orchidaceae	6, 7, 9		EN	CR	
Rusty Spider Orchid, Kara*, Cara*, Kahta-ninda-yootah*, Kararr*	*Caladenia ferruginea* [a.r.][N]	Orchidaceae	1				
Swamp Spider Orchid, Kara*, Cara*, Kahta-ninda-yootah*, Kararr*	*Caladenia paludosa* [a.r.][N]	Orchidaceae	1, 2				
Tussock Sedge	*Carex appressa*	Cyperaceae	1, 3, 5				
Tassel Sedge	*Carex fascicularis*	Cyperaceae	1, 3, 5				
Knob Sedge	*Carex inversa*	Cyperaceae	1, 4				
-	*Carex tereticaulis* [P]	Cyperaceae	1, 3				3
-	*Caustis dioica* [#][w/d]	Cyperaceae	2				
Centella	*Centella asiatica* [N]	Apiaceae	1, 2, 5				
Bearded Twine-rush	*Chaetanthus aristatus*	Restionaceae	1, 2, 3, 5	Y			
-	*Chamaescilla gibsonii* [a.r.][P]	Hemerocallidaceae	1, 2				3
Royce's Waxflower	*Chamelaucium roycei* [T]	Myrtaceae	2, 6, 9		VU[10]	VU	
-	*Chordifex isomorphus*	Restionaceae	2				
Black Bristle-rush	*Chorizandra enodis*	Cyperaceae	1, 2, 3	Y			
-	*Chorizandra multiarticulata*	Cyperaceae	1				
Western Helmet Orchid	*Corybas recurvus* [a.r.]	Orchidaceae	1				
-	*Cyathochaeta avenacea*	Cyperaceae	1				
-	*Cyathochaeta teretifolia* [P]	Cyperaceae	1, 2				3
-	*Cyclosorus interruptus*	Thelypteridaceae	2				
Spiny Flat-sedge	*Cyperus gymnocaulos* [#]	Cyperaceae	3, 7				
Stiffleaf Sedge	*Cyperus vaginatus*	Cyperaceae	1				
Gnat Orchid	*Cyrtostylis tenuissima* [a.r.]	Orchidaceae	1				
-	*Cytogonidium leptocarpoides*	Restionaceae	1				
-	*Dampiera trigona*	Goodeniaceae	1				
-	*Dielsia stenostachya*	Restionaceae	1, 3				
Short-nosed Donkey Orchid, Cara*, Djubak*	*Diuris brevis* [a.r.][P][N]	Orchidaceae	1				2
Bee Orchid, Cara*, Djubak*	*Diuris carinata* [a.r.][N]	Orchidaceae	1				
Common Bee Orchid, Cara*, Djubak*	*Diuris decrementum* [a.r.][N]	Orchidaceae	1				
Tall Donkey Orchid, Cara*, Djubak*	*Diuris drummondii* [a.r.][T][N]	Orchidaceae	1, 6, 9		VU	EN	
Bee Orchid, Cara*, Djubak*	*Diuris laxiflora* [a.r.] [N]	Orchidaceae	1				
Dwarf Bee Orchid, Cara*, Djubak*	*Diuris micrantha* [a.r.][T][N]	Orchidaceae	1, 2, 6, 9		VU	VU	
Small-flowered Donkey Orchid, Cara*, Djubak*	*Diuris porrifolia* [a.r.][N]	Orchidaceae	1				
Purdie's Donkey Orchid, Cara*, Djubak*	*Diuris purdiei* [a.r.][T][N]	Orchidaceae	1, 6, 9		EN	EN	
Bristly Donkey Orchid, Cara*, Djubak*	*Diuris setacea* [a.r.][N]	Orchidaceae	1				
Glossy-leaved Hammer Orchid, Glossy-leafed Hammer Orchid	*Drakaea elastica* [a.r.][T]	Orchidaceae	1, 6, 9		EN	CR	
Red-leaved Sundew	*Drosera bulbosa* subsp. *bulbosa* [a.r.]	Droseraceae	1				
Giant Sundew	*Drosera gigantea* [a.r.]	Droseraceae	1, 2	Y			
Swamp Rainbow	*Drosera heterophylla* [a.r.]	Droseraceae	1				
Pygmy Sundew	*Drosera occidentalis* [P]	Droseraceae	1				4
-	*Drosera rosulata* [a.r.]	Droseraceae	1				

[9] *Byblis gigantea* is on the finalised priority assessment list for the assessment period commencing 1 October 2025 (<www.dcceew.gov.au/sites/default/files/documents/fpal-assessment-period-commencing-1-october-2025.pdf>).

[10] Listed under its former scientific name, *Chamelaucium* sp. *S coastal plain*. However, the accepted scientific name is now *Chamelaucium roycei*.

-	*Drosera tubaestylis* [a.r.]	Droseraceae	1, 2				
Common Spike-rush	*Eleocharis acuta* [a.r.]	Cyperaceae	1, 2, 3, 5				
-	*Empodisma gracillimum* [#][11]	Restionaceae	3, 7				
Babe-in-a-cradle	*Epiblema grandiflorum* [a.r.]	Orchidaceae	1				
Smooth Willow-herb	*Epilobium billardiereanum* subsp. *billardiereanum*	Onagraceae	1				
Variable Willow-herb	*Epilobium billardiereanum* subsp. cinereum	Onagraceae	1				
-	*Epilobium billardiereanum* subsp. intermedium	Onagraceae	1				
Swamp Bunny Orchid	*Eriochilus helonomos* [a.r.]	Orchidaceae	1				
Pink Bunny Orchid	*Eriochilus scaber* subsp. *scaber* [a.r.]	Orchidaceae	1				
Slender Bunny Orchid	*Eriochilus tenuis* [a.r.]	Orchidaceae	1				
-	*Eryngium pinnatifidum* subsp. Palustre [a.r.] [P]	Apiaceae	2, (1)	Y			3
-	*Eryngium* sp. Ferox [a.r.][P]	Apiaceae	2				3
-	*Eryngium subdecumbens*[12] [a.r.][P]	Apiaceae	1, 2				3
-	*Evandra aristata*	Cyperaceae	2, 3				
-	*Evandra pauciflora*	Cyperaceae	1, 3				
Knotted Club-rush, Yangjet*	*Ficinia nodosa* [N]	Cyperaceae	1, 2, 3, 5				
-	*Gahnia decomposita*	Cyperaceae	1, 3				
Coast Saw-sedge	*Gahnia trifida*	Cyperaceae	1, 2, 3, 4	Y			
-	*Goodenia pulchella*	Goodeniaceae	1				
-	*Goodenia trinervis* [w/d]	Goodeniaceae	1				
Western Brooklime	*Gratiola pubescens*	Plantaginaceae	1				
-	*Haemodorum simplex* [a.r.]	Haemodoraceae	1, 2	Y			
-	*Haemodorum sparsiflorum* [a.r.]	Haemodoraceae	1				
Matgrass	*Hemarthria uncinata*	Poaceae	1, 3, 5				
-	*Hopkinsia anoectocolea* [P]	Anarthriaceae	3				3
-	*Hypolaena exsulca* [w/d]	Restionaceae	1, 3				
-	*Hypolaena fastigiata* [#]	Restionaceae	3, 7				
-	*Hypolaena pubescens*	Restionaceae	1, 3				
Granny's Bonnets	*Isotropis cuneifolia* subsp. *glabra* [P]	Fabaceae	1, 2				3
-	*Juncus amabilis*	Juncaceae	1				
-	*Juncus aridicola*	Juncaceae	1				
Tufted Rush, Grassy Rush	*Juncus caespiticius*	Juncaceae	1				
Jointed Rush	*Juncus holoschoenus*	Juncaceae	1, 3				
Shore Rush, Sea Rush	*Juncus kraussii* subsp. *australiensis*	Juncaceae	1, 2, (3, 4, 5)	Y			
Pale Rush, Giant Rush, Tangil*	*Juncus pallidus* [N]	Juncaceae	1, 2, 3, 5	Y			
Loose-flowered Rush	*Juncus pauciflorus*	Juncaceae	1, 3, 5				
Broadleaf Rush	*Juncus planifolius*	Juncaceae	1				
Finger Rush	*Juncus subsecundus*	Juncaceae	1, 3, 5				
Coral Vine	*Kennedia coccinea* [w/d]	Fabaceae	2				
Spreading Sword-sedge	*Lepidosperma effusum*	Cyperaceae	1, 3, 5				
Coast Sword-sedge, Kerbin*, Kerbein*	*Lepidosperma gladiatum* [#][N]	Cyperaceae	2, 3, 4, 5, 7				
Pithy Sword-sedge	*Lepidosperma longitudinale*	Cyperaceae	1, 2, 3, 5	Y			
Beaked Sword-sedge, Beaked Lepidosperma	*Lepidosperma rostratum* [T]	Cyperaceae	1, 6, 9		EN	EN	
Angled Sword-sedge	*Lepidosperma tetraquetrum*	Cyperaceae	3, 5				

[11] Not listed as a wetland species in Keighery, Longman and Rye (2023). However, it is known to be a wetland species.
[12] Formerly *Eryngium* sp. Subdecumbens.

Hoary Twine-rush	*Leptocarpus canus* [#]	Restionaceae	2, 3	Y			
-	*Leptocarpus coangustatus* [#]	Restionaceae	2, 3	Y			
-	*Leptocarpus laxus* [#]	Restionaceae	3, 7				
-	*Leptocarpus roycei* [#]	Restionaceae	3				
-	*Leptocarpus scariosus* [#]	Restionaceae	2, 3	Y			
Slender Twine Rush	*Leptocarpus tenax*	Restionaceae	3				
-	*Lepyrodia glauca* [#]	Restionaceae	3, 7				
Large Scale-rush	*Lepyrodia macra*	Restionaceae	1				
-	*Lepyrodia muirii*	Restionaceae	1				
-	*Lepyrodia riparia* [#]	Restionaceae	3, 7				
-	*Liparophyllum violifolium* [a.r.]	Menyanthaceae	1				
Ribbed Lobelia	*Lobelia anceps*	Campanulaceae	1				
-	*Loxocarya cinerea* [#]	Restionaceae	3, 7				
Tall Ironstone Loxocarya	*Loxocarya magna* [P]	Restionaceae	2				3
Pale Twig-rush	*Machaerina acuta*	Cyperaceae	1				
Sparse Twig-rush	*Machaerina arthrophylla*	Cyperaceae	1, 2, 5				
Jointed Twig-rush, Waargyl Ngarnak* (Waargyl's beard), Kuiarch*	*Machaerina articulata* [N]	Cyperaceae	1, 2, 3, 5	Y			
Bare Twig-rush	*Machaerina juncea*	Cyperaceae	1, 2, 3, 4, 5	Y			
-	*Machaerina laxa*	Cyperaceae	1				
-	*Machaerina preissii*	Cyperaceae	1, 3				
-	*Machaerina rubiginosa*	Cyperaceae	1, 2, 3				
Sheath Twig-rush	*Machaerina vaginalis*	Cyperaceae	1, 2, 3, 5	Y			
-	*Melanostachya ustulata*	Restionaceae	3				
Semaphore Sedge	*Mesomelaena tetragona* [#]	Cyperaceae	2				
Weeping Grass, Gilba*, Djiraly*, Bobo*	*Microlaena stipoides* [#][N]	Poaceae	3				
Swamp Mignonette Orchid	*Microtis atrata* [a.r.]	Orchidaceae	1				
Sweet Mignonette Orchid	*Microtis brownii* [a.r.]	Orchidaceae	1				
Cupped Mignonette Orchid	*Microtis cupularis* [a.r.]	Orchidaceae	1				
Dark Mignonette Orchid	*Microtis orbicularis* [a.r.]	Orchidaceae	1				
Southern Tetraria	*Morelotia australiensis* [T][#]	Cyperaceae	6, 9		VU[13]	VU	
-	*Muellerolimon salicorniaceum*	Plumbaginaceae	2				
-	*Netrostylis* sp. Chandala [P]	Cyperaceae	1				2
Swamp Purple Flag	*Patersonia occidentalis* var. *angustifolia* [a.r.]	Iridaceae	1, 2	Y			
-	*Pauridia occidentalis* var. *occidentalis* [a.r.]	Hypoxidaceae	1, (2)	Y			
-	*Pauridia occidentalis* var. *quadriloba* [a.r.]	Hypoxidaceae	1, (2)				
Slender Knotweed	*Persicaria decipiens*	Polygonaceae	1				
Water Pepper	*Persicaria hydropiper* [N]	Polygonaceae	1				
Butterfly Flower	*Philydrella drummondii* [a.r.]	Philydraceae	1				
-	*Philydrella pygmaea* subsp. *pygmaea* [a.r.]	Philydraceae	1				
Pygmy Clubmoss	*Phylloglossum drummondii* [a.r.]	Lycopodiaceae	1				
-	*Poa porphyroclados* [#]	Poaceae	4				
Pouched Leek Orchid	*Prasophyllum cyphochilum* [a.r.]	Orchidaceae	1				
Swamp Leek Orchid	*Prasophyllum drummondii* [a.r.]	Orchidaceae	1				
Humped Leek Orchid	*Prasophyllum gibbosum* [a.r.]	Orchidaceae	1				
Little Laughing Leek Orchid	*Prasophyllum gracile* [a.r.]	Orchidaceae	1				
Laughing Leek Orchid	*Prasophyllum macrostachyum* [a.r.]	Orchidaceae	1				

[13] Listed under its former scientific name, *Tetraria australiensis*. However, the accepted scientific name is now *Morelotia australiensis*.

Little Leek Orchid	*Prasophyllum ovale* [a.r.]	Orchidaceae	1				
Dainty Leek Orchid	*Prasophyllum plumiforme* [a.r.]	Orchidaceae	1				
Bog Clubmoss	*Brownseya serpentina*[14]	Lycopodiaceae	1				
Bracken, Munda*, Moondan-gurnang*, Karbara*, Moondark*, Manya*	*Pteridium esculentum* subsp. *esculentum* [N]	Dennstaedtiaceae	1, (2)				
Chinese Brake	*Pteris vittata* [#]	Pteridaceae	2, 7				
Pyramid Mulla-mulla	*Ptilotus pyramidatus* [T]	Amaranthaceae	1, 6, 9		CR	CR	
-	*Samolus junceus*	Primulaceae	1, 2, 4	Y			
Creeping Brookweed	*Samolus repens*	Primulaceae	1, 4				
Long-leaved Fanflower	*Scaevola lanceolata*	Goodeniaceae	1				
Schoenolaena	*Schoenolaena juncea* [a.r.]	Apiaceae	1				
Lake Club-rush, Waargyl Ngarnak* (Waargyl's beard)	*Schoenoplectus tabernaemontani* [a.r.][N]	Cyperaceae	1, 2, 3, 4, 5				
-	*Schoenus bifidus*	Cyperaceae	1				
-	*Schoenus rigens*	Cyperaceae	1				
-	*Schoenus subfascicularis* [#]	Cyperaceae	3, 5, 7				
-	*Schoenus unispiculatus*	Cyperaceae	1				
Salt Couch, Marine Couch	*Sporobolus virginicus*	Poaceae	1, 2, 3, 4	Y			
-	*Stackhousia huegelii*	Celastraceae	1				
Pink Fountain	*Stylidium brunonianum*	Stylidiaceae	1				
Thick-leaved Triggerplant	*Stylidium crassifolium*	Stylidiaceae	1				
Daddy-Long-Legs	*Stylidium divaricatum*	Stylidiaceae	1, 2	Y			
Dotted Triggerplant	*Stylidium guttatum*	Stylidiaceae	1				
-	*Stylidium paludicola* [P]	Stylidiaceae	1				3
Horn Triggerplant	*Stylidium petiolare* [a.r.]	Stylidiaceae	1				
Thumbelina Triggerplant	*Stylidium pulchellum* [a.r.]	Stylidiaceae	1				
Sea Blite	*Suaeda australis* [N]	Chenopodiaceae	1, 4				
-	*Surreya diandra*	Amaranthaceae	2				
-	*Taraxis grossa*	Restionaceae	3				
Lemon-scented Sun Orchid, Joobuk*	*Thelymitra antennifera* [a.r.][N]	Orchidaceae	1, 2	Y			
Twisted Sun Orchid, Joobuk*	*Thelymitra flexuosa* [a.r.][N]	Orchidaceae	1				
Plum Orchid, Joobuk*	*Thelymitra mucida* [a.r.][N]	Orchidaceae	1				
Plain Sun Orchid, Joobuk*	*Thelymitra paludosa* [a.r.][N]	Orchidaceae	1				
Tiger Orchid, Joobuk*	*Thelymitra tigrina* [a.r.] [N]	Orchidaceae	1				
Yellow-tufted Sun Orchid, Joobuk*	*Thelymitra xanthotricha* [a.r.][N]	Orchidaceae	1				
Gilba*, Djiraly*, Bobo*	*Themeda triandra* [#][N]	Poaceae	2, 7				
Nodding Tiurndin	*Tribonanthes brachypetala* [a.r.]	Haemodoraceae	1				
Keighery's Tiurndin	*Tribonanthes keigheryi* [a.r.]	Haemodoraceae	1				
Branching Tiurndin	*Tribonanthes longipetala* [a.r.]	Haemodoraceae	1				
Widespread Tiurndin	*Tribonanthes monantha* [a.r.]	Haemodoraceae	1				
Purple-budded Tiurndin	*Tribonanthes porphyrea* [a.r.]	Haemodoraceae	1				
Woolly Tiurndin	*Tribonanthes uniflora* [a.r.]	Haemodoraceae	1, 2				
Hairy-stigma Tiurndin	*Tribonanthes variabilis* [a.r.]	Haemodoraceae	1				
-	*Tribonanthes violacea* [a.r.]	Haemodoraceae	1				
Native Gerbera	*Trichocline spathulata* [a.r.][#] [w/d]	Asteraceae	2				
Streaked Arrowgrass	*Triglochin striata*	Juncaginaceae	1, 2				
-	*Trihalogoragis hexandra* subsp. *integrifolia*	Haloragaceae	1				
-	*Tripterococcus* sp. Brachylobus [P]	Celastraceae	1				4

[14] Formerly *Pseudolycopodiella serpentina*.

Silky Wilsonia	*Wilsonia humilis*	Convolvulaceae	1				
Narrow-leaf Wilsonia	*Wilsonia backhousei*	Convolvulaceae	1, 2				
-	*Wilsonia rotundifolia*	Convolvulaceae	Herbarium[15]				
Early Nancy	*Wurmbea dioica* subsp. *alba* [a.r.][N]	Colchicaceae	1, 2	Y			
-	*Wurmbea monantha* [a.r.][#]	Colchicaceae	2, 7				
-	*Xyris lanata*	Xyridaceae	2				
ANNUAL HERBS: Non-woody plants that normally live less than a year							
-	*Angianthus drummondii* [P]	Asteraceae	1, 2				3
-	*Angianthus preissianus*	Asteraceae	1, 2	Y			
Camel-grass	*Angianthus tomentosus*	Asteraceae	2				
-	*Aphelia brizula*	Centrolepidaceae	1				
-	*Aphelia cyperoides*	Centrolepidaceae	1				
-	*Aphelia drummondii*	Centrolepidaceae	1, 2				
-	*Aphelia nutans*	Centrolepidaceae	1				
-	*Aphelia* sp. Albany	Centrolepidaceae	1				
-	*Apium annuum*	Apiaceae	1				
-	*Asteridea athrixioides*	Asteraceae	2				
-	*Blennospora doliiformis* [P]	Asteraceae	2	Y			3
-	*Brachyscome bellidioides* [#]	Asteraceae	2, 7	Y			
-	*Brachyscome pusilla* [#]	Asteraceae	2, 7				
Pygmy Purslane	*Calandrinia granulifera* [#]	Montiaceae	2				
-	*Calandrinia uncinella* [P]	Montiaceae	1				1
-	*Calandrinia* sp. Kenwick	Montiaceae	1				
-	*Centrolepis alepyroides*	Centrolepidaceae	1				
Pointed Centrolepis	*Centrolepis aristata*	Centrolepidaceae	1				
	Centrolepis caespitosa	Centrolepidaceae	1				
	Centrolepis cephaloformis subsp. *cephaloformis*	Centrolepidaceae	1				
Smooth Centrolepis	*Centrolepis glabra*	Centrolepidaceae	1				
-	*Centrolepis inconspicua*	Centrolepidaceae	1				
-	*Centrolepis mutica*	Centrolepidaceae	1				
-	*Centrolepis pilosa*	Centrolepidaceae	1				
Wiry Centrolepis	*Centrolepis polygyna*	Centrolepidaceae	1, 2				
Smooth Cotula	*Cotula cotuloides*	Asteraceae	1				
Pimpernel Sundew	*Drosera glanduligera* [#]	Droseraceae	2	Y			
-	*Dysphania glomulifera* subsp. *glomulifera*	Chenopodiaceae	1				
Clammy Goosefoot	*Dysphania pumilio*	Chenopodiaceae	1				
-	*Fimbristylis velata*	Cyperaceae	1, 2				
-	*Goodenia micrantha*	Goodeniaceae	1				
Smooth Heliotrope	*Heliotropium curassavicum*	Boraginaceae	1				
-	*Hyalosperma cotula*	Asteraceae	2				
-	*Hydrocotyle alata*	Araliaceae	1				
-	*Hydrocotyle diantha*	Araliaceae	1				
Limestone Pennywort	*Hydrocotyle tetragonocarpa* [#]	Araliaceae	2				
Nodding Club-rush	*Isolepis cernua* [w/d]	Cyperaceae	1, 2	Y			
-	*Isolepis cyperoides* [w/d]	Cyperaceae	1				
-	*Isolepis oldfieldiana*	Cyperaceae	1				

[15] Based on records in the Western Australian Herbarium.

Small Isotoma	*Isotoma pusilla*	Campanulaceae	1, 2				
-	*Isotoma scapigera*	Campanulaceae	1, 2				
Blownglass	*Lachnagrostis filiformis*	Poaceae	1				
-	*Lachnagrostis plebeia*	Poaceae	1				
-	*Myriocephalus helichrysoides*	Asteraceae	1, 2	Y			
Marsh Mitrewort	*Phyllangium palustre* [P]	Loganiaceae	1				2
Shade Plantain	*Plantago debilis* [w/d][N]	Plantaginaceae	1				
Slender Podolepis	*Podolepis gracilis* [w/d]	Asteraceae	1				
Stiff Angianthus	*Pogonolepis stricta*	Asteraceae	1, 2	Y			
-	*Polypogon tenellus*	Poaceae	1				
-	*Rhodanthe manglesii* [#]	Asteraceae	2				
-	*Rhodanthe pyrethrum*	Asteraceae	1, 2				
-	*Rhodanthe spicata*	Asteraceae	1				
-	*Schoenus odontocarpus*	Cyperaceae	1				
-	*Schoenus plumosus*	Cyperaceae	1, 2	Y			
-	*Schoenus tenellus*[16]	Cyperaceae	1, 2	Y			
-	*Schoenus* sp. Beaufort [P]	Cyperaceae	1, 2				1
-	*Schoenus* sp. Waroona [P]	Cyperaceae	1				3
Tiny Clubmoss	*Selaginella gracillima*	Selaginellaceae	1				
-	*Sida hookeriana*	Malvaceae	1				
Wiry Podolepis	*Siemssenia capillaris*[w/d]	Asteraceae	2				
Native Sowthistle	*Sonchus hydrophilus*	Asteraceae	1, 2				
Book Triggerplant	*Stylidium calcaratum*	Stylidiaceae	1				
Foot Triggerplant	*Stylidium ecorne*	Stylidiaceae	1				
Hundreds-and-Thousands	*Stylidium inundatum*	Stylidiaceae	1				
Jumping Jacks	*Stylidium longitubum* [P]	Stylidiaceae	1, 2	Y			4
Pink-fan Triggerplant	*Stylidium utricularioides*	Stylidiaceae	1				
Native Parsnip	*Trachymene pilosa* [#]	Araliaceae	2				
Prickly Arrowgrass	*Triglochin mucronata*	Juncaginaceae	1, 2	Y			
-	*Triglochin muelleri*	Juncaginaceae	1				
Pink Petticoats	*Utricularia multifida*	Lentibulariaceae	1, 2	Y			
Pink Fans	*Utricularia tenella*	Lentibulariaceae	1				
AQUATIC PLANTS: Plants that live entirely or partly in water (with their leaves submerged, floating on the surface, or emerging through it)							
Common Water-mat	*Althenia australis*	Potamogetonaceae	1				
Slender Water-mat	*Althenia preissii*	Potamogetonaceae	1				
Stalked Water-ribbons	*Aponogeton hexatepalus* [a.r.][P]	Aponogetonaceae	1, 2	Y			4
Ferny Azolla	*Azolla pinnata*	Salviniaceae	1, 2				
Red Water-fern	*Azolla rubra*	Salviniaceae	1				
Water-ribbons	*Cycnogeton huegelii* [a.r.][N]	Juncaginaceae	1				
Water-ribbons	*Cycnogeton lineare* [a.r.]	Juncaginaceae	1				
Waterwort	*Elatine gratioloides* [a.r.]	Elatiaceae	1				
Keighery's Spike-rush, Keighery's Eleocharis	*Eleocharis keigheryi* [a.r.][T]	Cyperaceae	1, 2, 6, 9		VU	VU	
Tall Spike-rush, Goorgogo*	*Eleocharis sphacelata* [a.r.][N]	Cyperaceae	1, 2				
Mudmat	*Glossostigma diandrum*	Phrymaceae	1, 2				
-	*Glossostigma drummondii*	Phrymaceae	1, 2				
Aquatic Pennywort	*Hydrocotyle lemnoides* [P]	Araliaceae	1				4
Quillwort	*Isoetes australis*	Isoetaceae	1				

[16] Identified as an annual species in Keighery, Longman and Rye (2023) and *Florabase* (Western Australian Herbarium 1998–); and an 'aquatic – emergent' species by the Department of Environment and Conservation (2012o).

Drummond's Quillwort	*Isoetes drummondii* subsp. *drummondii* [a.r.]	Isoetaceae	1, 2				
-	*Isolepis producta*	Cyperaceae	1				
Thin Duckweed	*Landoltia punctata*	Araceae	1				
Duckweed	*Lemna disperma* [N]	Araceae	1				
Common Mudwort	*Limosella australis* [a.r.]	Scrophulariaceae	1				
-	*Liparophyllum capitatum*	Menyantaceae	1				
Nardoo, Ngalkoo*	*Marsilea drummondii* [a.r.][N]	Marsileaceae	1, 2				
-	*Marsilea mutica* [a.r.]	Marsileaceae	1				
Swamp Raspwort	*Meionectes brownii*	Haloragaceae	1				
-	*Montia australasica* [a.r.][P]	Montiaceae	2				2
-	*Myriophyllum crispatum* [N]	Haloragaceae	1, 2				
-	*Myriophyllum drummondii*	Haloragaceae	1				
-	*Myriophyllum echinatum* [P]	Haloragaceae	1				3
-	*Myriophyllum limnophilum*	Haloragaceae	1				
-	*Myriophyllum salsugineum*	Haloragaceae	1				
-	*Myriophyllum tillaeoides*	Haloragaceae	1				
Red Water Milfoil	*Myriophyllum verrucosum*	Haloragaceae	2				
Prickly water-Nymph	*Najas marina*	Hydrocharitaceae	1, 2				
-	*Ornduffia albiflora* [a.r.]	Menyanthaceae	1				
-	*Ornduffia submersa* [a.r.][P]	Menyanthaceae	1, 2				4
Swamp Lily	*Ottelia ovalifolia* subsp. *ovalifolia* [a.r.]	Hydrocharitaceae	1, 2				
Pillwort	*Pilularia novae-hollandiae* [a.r.][17]	Marsileaceae	1, 2				
Blunt Pondweed	*Potamogeton ochreatus*	Potamogetonaceae	1				
Sea Tassel	*Ruppia maritima*	Ruppiaceae	1				
Saline Pondweed	*Ruppia megacarpa*	Ruppiaceae	1				
-	*Ruppia polycarpa*	Ruppiaceae	1, 2				
-	*Ruppia tuberosa* [a.r.]	Ruppiaceae	2				
Sharpleaf Club-rush	*Schoenoplectus pungens*	Cyperaceae	1, 3				
-	*Schoenus capillifolius* [P]	Cyperaceae	1				3
-	*Schoenus loliaceus* [P]	Cyperaceae	1				2
Floating Bog-rush	*Schoenus natans* [P]	Cyperaceae	1, 2				4
Sago Pondweed, Fennel Pondweed	*Stuckenia pectinata*	Potamogetonaceae	1				
-	*Trithuria bibracteata*	Hydatellaceae	1				
-	*Trithuria fitzgeraldii*	Hydatellaceae	1				
Swan Hydatella	*Trithuria occidentalis* [T][18]	Hydatellaceae	1, 2, 6, 9		EN	EN	
	Trithuria submersa	Hydatellaceae	1, 2				
Yanget*, Native Bulrush, Yangeti*, Lirimbi*, Yanjidi*, Yunjeedie*, Yunjid*, Tanjil*, Yandijut*, Jetta*	*Typha domingensis* [a.r.][N]	Typhaceae	1, 2, 5				
Bulrush, Yanget*, Yangeti*, Lirimbi*, Yanjidi*, Yunjeedie*, Yunjid*, Tanjil*, Yandijut*, Jetta*	*Typha orientalis* [a.r.][N]	Typhaceae	1				
-	*Utricularia australis*	Lentibulariaceae	1				
-	*Utricularia gibba*	Lentibulariaceae	1, 2				
-	*Utricularia inaequalis*	Lentibulariaceae	1				
Redcoats, Red Bladderwort	*Utricularia menziesii* [a.r.]	Lentibulariaceae	1, 2				
Violet Bladderwort	*Utricularia violacea*	Lentibulariaceae	1				
Twining Bladderwort	*Utricularia volubilis* [a.r.]	Lentibulariaceae	1, 2				

[17] Listed as annually renewed by the Department of Environment and Conservation (2012o); but not listed as annually renewed in *Florabase* (Western Australian Herbarium 1998–) or Keighery, Longman and Rye (2023).

[18] Formerly *Hydatella dioica*.

Attachment B - Threatened and priority flora

Table B1 lists the threatened flora under the Australian Government's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian Government's *Biodiversity Conservation Act 2016* (BC Act). Table B2 lists the priority flora under Western Australian policy.

The following sources were used to identify the threatened and priority flora species:

- Department of Climate Change, Energy, the Environment and Water 2025, *Protected Matters Search Tool report for drawn area search of the Swan Coastal Plain IBRA region*. Viewed at: <https://pmst.environment.gov.au> on 12 November 2025.
- Department of Biodiversity, Conservation and Attractions 2025, *Threatened and priority flora list – July 2025*, Department of Biodiversity, Conservation and Attractions, Perth. Available at: <www.dbca.wa.gov.au/management/threatened-species-and-communities>. (Accessed: 22 March 2026.)

Threatened species are identified by the Australian Government under the *Environmental Protection and Biodiversity Conservation Act 1999* and the Western Australian Government under the *Biodiversity Conservation Act 2016*. Priority species are identified by the Department of Biodiversity, Conservation and Attractions in Western Australia (WA). These are possibly threatened species that do not meet survey criteria or that are not adequately defined (priorities 1, 2 and 3). These three categories are ranked in order of priority for survey, and evaluation of conservation status, so that consideration can be given to their declaration as threatened species. Species that are adequately known and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened species list, are placed in priority 4. Priority species cannot be listed under the *Biodiversity Conservation Act 2016*.

Attachment A lists the references used to confirm the presence of these flora species in the wetlands of the Swan Coastal Plain.

Abbreviations:

EPBC Act = *Environmental Protection and Biodiversity Conservation Act 1999* (Australian Government)

BC Act = *Biodiversity Conservation Act 2016* (Western Australia)

WA = Western Australia

CR = Critically Endangered

E = Endangered

VU = Vulnerable

Table B1 – Threatened flora under the EPBC Act (Australian Government) and Biodiversity Conservation Act 2016 (Western Australia)

Common name	Botanical name	EPBC Act listing	BC Act listing (WA)
Slender Rice-flower	*Andersonia gracilis*	EN	VU
Dwarf Green Kangaroo Paw	*Anigozanthos viridis* subsp. *terraspectans*	VU	VU
Bronwen's Speargrass	*Austrostipa bronweniae*	EN[1]	EN
Whicher Range Dryandra	*Banksia squarrosa* subsp. *argillacea*	VU	VU
Rainbow Plant, Byblis	*Byblis gigantea*	Not listed but being assessed[2]	EN
Bussell's Spider Orchid	*Caladenia busselliana*	EN	CR
-	*Calectasia elegans*	Not listed	CR
Swamp Starflower	*Calytrix breviseta* subsp. *breviseta*	EN	CR

[1] Listed as *Austrostipa bronwenae*. However, the accepted scientific name is *Austrostipa bronweniae*, as per *Florabase* (Western Australian Herbarium 1998–).

[2] *Byblis gigantea* is on the finalised priority assessment list for the assessment period commencing 1 October 2025 (<www.dcceew.gov.au/sites/default/files/documents/fpal-assessment-period-commencing-1-october-2025.pdf>).

Common name	Botanical name	EPBC Act listing	BC Act listing (WA)
Royce's Waxflower	*Chamelaucium roycei*	VU[3]	VU
Muchea Bell	*Darwinia foetida*	CR	EN
Abba Bell	*Darwinia whicherensis*	EN	CR
Glossy-leaved Hammer Orchid, Glossy-leafed Hammer Orchid	*Drakaea elastica*	EN	CR
Tall Donkey Orchid	*Diuris drummondii*	VU	EN
Dwarf Bee Orchid	*Diuris micrantha*	VU	VU
Purdie's Donkey Orchid	*Diuris purdiei*	EN	EN
Keighery's Spike-rush, Keighery's Eleocharis	*Eleocharis keigheryi*	VU	VU
Tarbush	*Eremophila glabra* subsp. *chlorella*	EN	EN
Butterfly-leaved Gastrolobium	*Gastrolobium papilio*	EN	CR
Freeway Grevillea, Curved-leaf Grevillea	*Grevillea curviloba*	EN[4]	EN

[3] Listed under its former scientific name, *Chamelaucium* sp. *S coastal plain*. However, the accepted scientific name is now *Chamelaucium roycei.*

[4] Listed as Narrow Curved-leaf Grevillea (*Grevillea curviloba* subsp. *incurva*) and Curved-leaf Grevillea (*Grevillea curviloba* subsp. *curviloba*), which are both more recently known as *Grevillea curviloba*. That is, the species is now treated as *Grevillea curviloba* without subspecies.

Common name	Botanical name	EPBC Act listing	BC Act listing (WA)
Ironstone Grevillea	*Grevillea elongata*	VU	EN
McCutcheon's Grevillea	*Grevillea maccutcheonii*	EN	CR
Swamp Spider-net, Spider Net Grevillea	*Grevillea thelemanniana*	CR	CR
Western Prickly Honeysuckle	*Lambertia echinata* subsp. *occidentalis*	EN	CR
Beaked Sword-sedge, Beaked Lepidosperma	*Lepidosperma rostratum*	EN	EN
Southern Tetraria	*Morelotia australiensis*	VU[5]	VU
Laterite Petrophile	*Petrophile latericola*	EN	CR
Pyramid Mulla-mulla	*Ptilotus pyramidatus*	CR	CR
Club-leafed Synaphea	*Synaphea* sp. Pinjarra	CR	CR
-	*Synaphea* sp. Pinjarra Plain	EN	EN
-	*Synaphea* sp. Serpentine	CR	CR
Dwellingup Synaphea	*Synaphea stenoloba*	EN	EN

[5] Listed under its former scientific name, *Tetraria australiensis*. However, the accepted scientific name is now *Morelotia australiensis*.

Common name	Botanical name	EPBC Act listing	BC Act listing (WA)
Swan Hydatella	*Trithuria occidentalis*	EN	EN
Long-stalked Featherflower	*Verticordia densiflora* var. *pedunculata*	EN	EN
Vasse Featherflower	*Verticordia plumosa* var. *vassensis*	EN	EN
Tufted Plumed Featherflower	*Verticordia plumosa* var. *ananeotes*	EN	CR

Table B2 – Priority flora under Western Australian policy

Common name	Botanical name	WA priority
-	*Acacia flagelliformis*	4
-	*Acacia lasiocarpa* var. *bracteolata* long peduncle variant	1
-	*Amphibromus vickeryae*	1
-	*Andersonia ferricola*	1
-	*Angianthus drummondii*	3
Stalked Water-ribbons	*Aponogeton hexatepalus*	4

Common name	Botanical name	WA priority
-	*Blennospora doliiformis*	3
-	*Bolboschoenus medianus*	1
-	*Boronia juncea* subsp. *juncea*	1
-	*Calandrinia uncinella*	1
-	*Carex tereticaulis*	3
-	*Chamaescilla gibsonii*	3
-	*Cyathochaeta teretifolia*	3
Perth Parrot-Pea	*Dillwynia dillwynioides*	3
Short-nosed Donkey Orchid	*Diuris brevis*	2
Pygmy Sundew	*Drosera occidentalis*	4
-	*Eryngium sp.* Ferox	3
-	*Eryngium pinnatifidum* subsp. Palustre	3
-	*Eryngium subdecumbens*	3
Large-flowered Flooded Gum	*Eucalyptus rudis* subsp. *cratyantha*	4

Common name	Botanical name	WA priority
-	*Grevillea brachystylis* Meisn. subsp. *brachystylis*	3
-	*Hakea oldfieldii*	3
-	*Hopkinsia anoectocolea*	3
Aquatic Pennywort	*Hydrocotyle lemnoides*	4
-	*Isopogon formosus* subsp. *dasylepis*	3
Granny's Bonnets	*Isotropis cuneifolia* subsp. *glabra*	3
Swamp Jacksonia	*Jacksonia gracillima*	3
Tall Ironstone Loxocarya	*Loxocarya magna*	3
-	*Montia australasica*	2
-	*Myriophyllum echinatum*	3
-	*Netrostylis* sp. Chandala	2
-	*Ornduffia submersa*	4
-	*Parsonsia diaphanophleba*	4
Marsh Mitrewort	*Phyllangium palustre*	2

Common name	Botanical name	WA priority
-	*Schoenus capillifolius*	3
-	*Schoenus loliaceus*	2
Floating Bog-rush	*Schoenus natans*	4
-	*Schoenus* sp. Beaufort	1
-	*Schoenus* sp. Waroona	3
Jumping Jacks	*Stylidium longitubum*	4
-	*Stylidium paludicola*	3
-	*Tripterococcus* sp. Brachylobus	4

Attachment C – Wetland flora by soil types on the Swan Coastal Plain, Perth Metropolitan Region

Table C1 lists the wetland flora for the soil types on the Swan Coastal Plain (SCP) in the Perth Metropolitan Region. This table is comprehensive for the Perth Metropolitan Region but it does not cover the whole extent of the wetlands of the SCP.

Adapted from:

- 'Table 1 – Soil types of the Swan Coastal Plain, Perth Metropolitan Region' in Powell R and Emberson J 2023, 2nd edn, Western Australian Naturalists' Club, Perth, pp. 10–11.
- Keighery G, Keighery B, Longman V and Rye B 2023, 'Appendix B: Plant species native to the Perth metropolitan region' in Powell R and Emberson J 2023, *Growing locals: Gardening with local plants in Perth*, 2nd edn, Western Australian Naturalists' Club, Perth, pp. 99–156.

Abbreviations for soil types:

Q = Quindalup

C = Cottesloe

CR = Cottesloe Ridge

H = Herdsman

K = Karrakatta

B = Bassendean

BS = Bassendean Swamps

V = Vasse

S = Swan

Be = Beermullah

G = Guildford

Y = Yanga

F = Forrestfield

D = Dandaragan Plateau

● = Typical of the soil type

○ = Occurs in this soil type

Other abbreviations:

EPBC Act = *Environmental Protection and Biodiversity Conservation Act 1999* (Australian Government)

BC Act = *Biodiversity Conservation Act 2016* (Western Australia)

WA = Western Australia

[a.r.] = annually renewed, [e] = endemic to the Perth metropolitan region, [P] = priority species in Western Australia, [T] = threatened species (see footnote), [x] = extinct in the Perth metropolitan region, [w/d] = wetland and dryland forms

Table C1 – Wetland flora by soil types on the Swan Coastal Plain, Perth Metropolitan Region

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
LARGE TREES: Trees that commonly grow up to 20 m or more																
Large-flowered Flooded Gum	*Eucalyptus rudis* subsp. *cratyantha* [P]	Myrtaceae									○					
Flooded Gum, Moitch	*Eucalyptus rudis* subsp. *rudis*	Myrtaceae				●			●	●	●	○	●	○	○	●

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
SMALL TO MEDIUM TREES: Trees up to 15 m tall (most not more than 10 m tall)																
Swamp Banksia	*Banksia littoralis*	Proteaceae	○			●		○	○		○		○	○	○	
Salt Sheoak, Cooli	*Casuarina obesa*	Casuarinaceae								●	●	●	○			
Saltwater Paperbark	*Melaleuca cuticularis*	Myrtaceae				○				●	○		○	○		
Modong, Stout Paperbark	*Melaleuca preissiana*	Myrtaceae				●	○	○	●	●	●	○	○	○		○
Freshwater Paperbark	*Melaleuca rhaphiophylla*	Myrtaceae				●			●	●	●	○	○	○		○
Albizia	*Paraserianthes lophantha* subsp. *lophantha*	Fabaceae				○			○		○					
TALL SHRUBS: Shrubs (Bushy plants, with multiple woody stems arising at or near the ground) that normally grow to 3-5m tall																
River-bank Astartea	*Astartea leptophylla*	Myrtaceae									○		○			
Toobada, Western Bottlebrush	*Callistemon phoeniceus*	Myrtaceae												○		
Swamp Cypress	*Callitris pyramidalis*	Cupressaceae								○		●	○	●		○
River Pea	*Gastrolobium ebracteolatum*	Fabaceae				○	○		○	○	○		○	○		
Banbar	*Melaleuca teretifolia*	Myrtaceae	○			●			○		○	○	○	○		
Mohan	*Melaleuca viminea* subsp. *viminea*	Myrtaceae	○			○				●	●	●	○	●		○
Brook Peppermint	*Taxandria linearifolia*	Myrtaceae							○		●		○			
Swishbush, Koweda	*Viminaria juncea*	Fabaceae				●			○	●	○	●	●	●	○	
MEDIUM TO LARGE SHRUBS: Shrubs normally 1-3 m tall																
West Coast Astartea	*Astartea affinis*	Myrtaceae							○			○	●	●	○	
Common Astartea	*Astartea scoparia*	Myrtaceae				●			●		○	○	○			
Swamp Fox Banksia	*Banksia telmatiaea*	Proteaceae											○	○		
-	*Calothamnus lateralis*	Myrtaceae						○	○		○		○	○	○	
-	*Calycopeplus oligandrus*	Euphorbiaceae				○				○			○			
Freeway Grevillea, Curved-leaf Grevillea	*Grevillea curviloba* [T][1]	Proteaceae												○		
-	*Grevillea obtusifolia*	Proteaceae									○	○		●	○	
Horned-leaf Hakea	*Hakea ceratophylla*	Proteaceae										○	●		○	
Variable-leaved Hakea	*Hakea varia*	Proteaceae	○			○		○	○	○	●	●	●	●	○	○
-	*Homalospermum firmum*	Myrtaceae							○							
-	*Kunzea micrantha* subsp. *micrantha*	Myrtaceae							○				●		○	
-	*Kunzea micrantha* subsp. *petiolata*	Myrtaceae											○	○		
-	*Kunzea recurva*	Myrtaceae							○		○	○	●	●	●	○
Tall Labichea	*Labichea lanceolata* subsp. *lanceolata*	Fabaceae									○					
Gorada	*Melaleuca acutifolia*	Myrtaceae							○			○	○	○		
-	*Melaleuca brevifolia*	Myrtaceae									○	○	○	○		○
Grey Honey-myrtle	*Melaleuca incana* subsp. *incana*	Myrtaceae	○			○			○		○		●			
Robin Redbreast Bush	*Melaleuca lateritia*	Myrtaceae							●		○	○	●	○		
Broom Honey-myrtle	*Melaleuca osullivanii*	Myrtaceae							○			○	●	●		○
-	*Melaleuca pauciflora*	Myrtaceae								○	○		○			
-	*Melaleuca ryeae*	Myrtaceae								○		○	○	○		
Swamp Tea-tree	*Pericalymma ellipticum*	Myrtaceae				○		○	●		○	●	●	●	○	○
-	*Pericalymma spongiocaule*	Myrtaceae											○			
-	*Regelia ciliata*	Myrtaceae				○			○	○	○	●	○	●		○
-	*Regelia inops*	Myrtaceae					○	○	○	○			○			
-	*Stylobasium australe*	Surianaceae									○	○	○	○		

[1] Endangered under the EPBC Act, endangered under the BC Act (WA).

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
LOW SHRUBS: Shrubs normally less than 1 m tall (including woody groundcovers)																
Slender Rice-flower	*Andersonia gracilis* [T][2]	Eriaceae											○			
-	*Aotus cordifolia*	Fabaceae				○			○		○		○	○	○	
-	*Astartea zephyra*	Myrtaceae							○							
Aniseed Boronia	*Boronia crenulata* subsp. *viminea*	Rutaceae				○		○	○				○			
-	*Calectasia elegans* [T][3]	Dasypogonaceae							○							
-	*Calothamnus hirsutus*	Myrtaceae											○	●		
Swamp Starflower	*Calytrix breviseta* subsp. *breviseta* [e][T][4]	Myrtaceae											○			
Muchea Bell	*Darwinia foetida* [T][5]	Myrtaceae							○			○		○		
Perth Parrot-Pea	*Dillwynia dillwynioides* [P]	Fabaceae				○			○							
Tarbush	*Eremophila glabra* subsp. *chlorella* [T][6]	Scrophulariaceae											○			
Swamp Pea	*Euchilopsis linearis*	Fabaceae				○	○	○	○			●	○		○	○
-	*Eutaxia virgata*	Fabaceae				●			○			○	●			
Sea Heath	*Frankenia pauciflora* [w/d]	Frankeniaceae	○		○					○						
Swamp Spider-net	*Grevillea thelemanniana* [e][T][7]	Proteaceae											○			
Furrowed Hakea	*Hakea sulcata*	Proteaceae										○	●	○		
-	*Hakea* sp. Eastern Coastal Plain	Proteaceae											○			
-	*Hemiphora uncinata*	Lamiaceae									○		○			
-	*Hibbertia perfoliata*	Dilleniaceae							○							
Orange Stars	*Hibbertia stellaris*	Dilleniaceae				●			○				○	○		○
White Myrtle	*Hypocalymma angustifolium*	Myrtaceae											●			○
Balbak's White Myrtle	*Hypocalymma balbakiae*	Myrtaceae				○	○		●			○	○	○		
Tall White Myrtle	*Hypocalymma suave*	Myrtaceae				●	○		●	○	●	●	●	●	○	○
Swamp Jacksonia	*Jacksonia gracillima* [P]	Fabaceae							○				○	○		
-	*Lawrencia squamata*	Malvaceae										●	○	●		
Phyllanthus, False Boronia	*Lysiandra calycina* [w/d]	Phyllanthaceae	●	●	●	○	○					○	○	○		○
-	*Olearia elaeophila*	Asteraceae					○	○					●		●	
-	*Petrophile seminuda* [w/d]	Proteaceae		○					○			○	○	○		○
Pepper-and-salt	*Philotheca spicata* [w/d]	Rutaceae		○	●	○	○	●	○		○	○	●	○	●	○
-	*Pimelea imbricata* var. *major*	Thymelaeaceae							○				○	○		
Thick-head Glasswort	*Salicornia blackiana*	Chenopodiaceae	○			○				●		●	○	●		
Beaded Glasswort	*Salicornia quinqueflora* subsp. *quinqueflora*	Chenopodiaceae	○							●	○					
Leafless Globe-pea	*Sphaerolobium vimineum*	Fabaceae				○						○	○	○	○	
Blueboy	*Stirlingia latifolia* [w/d]	Proteaceae		○		○	●	●	○			●	○	●	●	○
Shrubby Samphire	*Tecticornia halocnemoides* subsp. *halocnemoides*	Chenopodiaceae				○				●	○		○			
Samphire	*Tecticornia indica* subsp. *bidens*	Chenopodiaceae				○				●	○					
-	*Tecticornia lepidosperma*	Chenopodiaceae				○				○	●	●		○		
-	*Tecticornia leptoclada* subsp. *inclusa*	Chenopodiaceae									○					
Blackseed Samphire	*Tecticornia pergranulata* subsp. *pergranulata*	Chenopodiaceae								○						
Variegated Featherflower	*Verticordia huegelii*	Myrtaceae									○	○	○		○	○
Silky Wilsonia	*Wilsonia humilis*	Convolvulaceae		○	○											

[2] Endangered under the EPBC Act, vulnerable under the BC Act (WA).
[3] Not listed under the EPBC Act, critically endangered under the BC Act (WA).
[4] Endangered under the EPBC Act, critically endangered under the BC Act (WA).
[5] Critically endangered under the EPBC Act, endangered under the BC Act (WA).
[6] Endangered under the EPBC Act, endangered under the BC Act (WA).
[7] Critically endangered under the EPBC Act, critically endangered under the BC Act (WA).

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
CLIMBERS: Plants rooted in the ground that twine around or attach themselves to other plants																
Pink Rainbow	*Drosera menziesii* [a.r.]	Droseraceae		○			○	●	○	○		●	●	●	○	○
-	*Parsonsia diaphanophleba* [P]	Apocynaceae				○					○					
PERENNIAL HERBS: Non-woody plants that live more than a year (some die off above ground each summer but survive underground)																
Lesser Joyweed	*Alternanthera denticulata*	Amaranthaceae				○					●		○			
-	*Amperea protensa*	Euphorbiaceae				○			○				○			
Swamp Wallaby-grass	*Amphibromus nervosus*	Poaceae											●			
-	*Anarthria laevis*	Anarthriaceae										●				○
Green Kangaroo Paw	*Anigozanthos viridis* subsp. *viridis* [a.r.]	Haemodoraceae				○			○		○	○	○	○	○	
Sea Celery	*Apium prostratum* subsp. *prostratum*	Apiaceae	○		○	●	○			○	●		○			
Bronwen's Speargrass	*Austrostipa bronweniae* [T][8]	Poaceae											○			
Marsh Club-rush	*Bolboschoenus caldwellii*	Cyperaceae	○			●			○	○	○	○	○			
-	*Bolboschoenus medianus* [P]	Cyperaceae				○					○					
-	*Borya scirpoidea*	Boryaceae											●	○	○	○
Pincushions	*Borya sphaerocephala*	Boryaceae										○	○		○	○
-	*Burchardia bairdiae* [a.r.]	Colchicaceae				○			○	○		●	○	●		○
Dwarf Milkmaids	*Burchardia multiflora* [a.r.]	Colchicaceae				○			○			●	●	○	○	○
Rainbow Plant, Byblis	*Byblis gigantea* [T][9]	Byblidaceae							○		○		●			
Pale grass-lily	*Caesia micrantha* [w/d][a.r.]	Hemerocallidaceae	○	○	○	○	○	○	○			●	●	●	●	○
Rusty Spider Orchid	*Caladenia ferruginea* [a.r.]	Orchidaceae							○				●		○	
Swamp Spider Orchid	*Caladenia paludosa* [a.r.]	Orchidaceae				○			●			●	●	●	●	
Tussock Sedge	*Carex appressa*	Cyperaceae				○			○		○		○			
Tassel Sedge	*Carex fascicularis*	Cyperaceae				○										
Knob Sedge	*Carex inversa*	Cyperaceae									○					
-	*Carex tereticaulis* [P]	Cyperaceae									○					
Centella	*Centella asiatica*	Apiaceae	○	○		●			○	○	●	○	○		○	
Bearded Twine-rush	*Chaetanthus aristatus*	Restionaceae	○						○	○	○	○	●		○	
-	*Chamaescilla gibsonii* [a.r.][P]	Hemerocallidaceae											○			
Black Bristle-rush	*Chorizandra enodis*	Cyperaceae				○			○	○	○	●	●	○	○	○
-	*Chorizandra multiarticulata*	Cyperaceae											○			
Western Helmet Orchid	*Corybas recurvus* [a.r.]	Orchidaceae					○	○	○							
-	*Cyathochaeta avenacea*	Cyperaceae				○			○			●	●	●	●	○
-	*Cyathochaeta teretifolia* [P]	Cyperaceae				○			○				○	○		
Stiffleaf Sedge	*Cyperus vaginatus*	Cyperaceae								○		○				
Gnat Orchid	*Cyrtostylis tenuissima* [a.r.][x]	Orchidaceae							○							
-	*Cytogonidium leptocarpoides*	Restionaceae						○	○				○	○		
-	*Dampiera trigona*	Goodeniaceae							○				●			
-	*Dielsia stenostachya*	Restionaceae				●		○	○	○	○	○	○	○		○
Short-nosed Donkey Orchid	*Diuris brevis* [a.r.][e][P]	Orchidaceae											○			
Bee Orchid	*Diuris carinata* [a.r.]	Orchidaceae					○		●				○			
Common Bee Orchid	*Diuris decrementum* [a.r.]	Orchidaceae											○			
Tall Donkey Orchid	*Diuris drummondii* [a.r.][T][10][x]	Orchidaceae				○			○				○	○		
Bee Orchid	*Diuris laxiflora* [a.r.]	Orchidaceae						●	●				●		●	

[8] Not listed under the EPBC Act, endangered under the BC Act (WA).
[9] Not listed under the EPBC Act, endangered under the BC Act (WA).
[10] Vulnerable under the EPBC Act, endangered under the BC Act (WA).

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
Dwarf Bee Orchid	*Diuris micrantha* [a.r.][T][11][x]	Orchidaceae							○							
Small-flowered Donkey Orchid	*Diuris porrifolia* [a.r.]	Orchidaceae														○
Purdie's Donkey Orchid	*Diuris purdiei* [a.r.][T][12]	Orchidaceae						○	○				○			
Bristly Donkey Orchid	*Diuris setacea* [a.r.]	Orchidaceae					○	○	●							
Glossy-leaved Hammer Orchid	*Drakaea elastica* [a.r.][T][13]	Orchidaceae						○	○							
Red-leaved Sundew	*Drosera bulbosa* subsp. *bulbosa* [a.r.]	Droseraceae											○			
Giant Sundew	*Drosera gigantea* [a.r.]	Droseraceae		○		○			○		○	○	●	●	○	○
Swamp Rainbow	*Drosera heterophylla* [a.r.]	Droseraceae							○			○	○		○	○
Pygmy Sundew	*Drosera occidentalis* [P]	Droseraceae				○			○			○	○			
-	*Drosera rosulata* [a.r.]	Droseraceae										○	●		○	
-	*Drosera tubaestylis* [a.r.]	Droseraceae											○			
Common Spike-rush	*Eleocharis acuta* [a.r.]	Cyperaceae										○	○		○	
Babe-in-a-cradle	*Epiblema grandiflorum* [a.r.]	Orchidaceae				○			●				○			
Smooth Willow-herb	*Epilobium billardiereanum* subsp. *billardiereanum*	Onagraceae	○			○										
Variable Willow-herb	*Epilobium billardiereanum* subsp. cinereum	Onagraceae				○										
-	*Epilobium billardiereanum* subsp. intermedium	Onagraceae	○			○										
Swamp Bunny Orchid	*Eriochilus helonomos* [a.r.]	Orchidaceae					○	○	○							○
Pink Bunny Orchid	*Eriochilus scaber* subsp. *scaber* [a.r.]	Orchidaceae						●	●				○		○	
Slender Bunny Orchid	*Eriochilus tenuis* [a.r.][x]	Orchidaceae						○	○							
Blue Devils	*Eryngium pinnatifidum* [w/d][a.r]	Apiaceae		●	○	○	●	○	○			●	○	●	○	○
-	*Eryngium subdecumbens*[14] [a.r.][P]	Apiaceae											●			
-	*Evandra pauciflora*	Cyperaceae							○				○			
Knotted Club-rush	*Ficinia nodosa*	Cyperaceae	●		○	○			○	○	●	○	○			
-	*Gahnia decomposita*	Cyperaceae							○							
Coast Saw-sedge	*Gahnia trifida*	Cyperaceae	○			●	○			○		●	○	○		
-	*Goodenia pulchella*	Goodeniaceae				○	○	○	○	○	○	○	●	○	●	○
-	*Goodenia trinervis* [w/d]	Goodeniaceae							○			○	○	○		○
Western Brooklime	*Gratiola pubescens*	Plantaginaceae				○			○		○	○	○	○		
-	*Haemodorum simplex* [a.r.]	Haemodoraceae										○	●	○	○	○
-	*Haemodorum sparsiflorum* [a.r.]	Haemodoraceae							○			●	●	●		
Matgrass	*Hemarthria uncinata*	Poaceae	○			●			○	○	○		○			
-	*Hypolaena pubescens*	Restionaceae	○			○		○					○	○		
-	*Hypolaena exsulca* [w/d]	Restionaceae		○		○	○	●	●			○	●	●	●	○
Granny's Bonnets	*Isotropis cuneifolia* subsp. *glabra* [P]	Fabaceae										○	○			
-	*Juncus amabilis*	Juncaceae							○		○					
-	*Juncus aridicola*	Juncaceae											○			
Tufted Rush, Grassy Rush	*Juncus caespiticius*	Juncaceae								○	○		○			
Jointed Rush	*Juncus holoschoenus*	Juncaceae				○			○		○	○	○			○
Shore Rush	*Juncus kraussii* subsp. *australiensis*	Juncaceae	○			○			○	●	○	○	○		○	
Giant Rush, Pale Rush	*Juncus pallidus*	Juncaceae	○			●			○	○	●	○	○	○	○	○
Loose-flowered Rush	*Juncus pauciflorus*	Juncaceae									○		○			

[11] Vulnerable under the EPBC Act, vulnerable under the BC Act (WA).
[12] Endangered under the EPBC Act, endangered under the BC Act (WA).
[13] Endangered under the EPBC Act, critically endangered under the BC Act (WA).
[14] Formerly *Eryngium* sp. Subdecumbens.

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
Broadleaf Rush	*Juncus planifolius*	Juncaceae											○			
Finger Rush	*Juncus subsecundus*	Juncaceae											○			
Spreading Sword-sedge	*Lepidosperma effusum*	Cyperaceae				○					○					
Pithy Sword-sedge	*Lepidosperma longitudinale*	Cyperaceae	○			●	○		○	○	●	●	○	●		○
Beaked Sword-sedge	*Lepidosperma rostratum* [T][15]	Cyperaceae											○			
Large Scale-rush	*Lepyrodia macra*	Restionaceae							○			○	●	●	○	○
-	*Lepyrodia muirii*	Restionaceae				○			○		○		○			
-	*Liparophyllum violifolium* [a.r.]	Menyanthaceae				○		○	○		○		○			
Ribbed Lobelia	*Lobelia anceps*	Campanulaceae				●			○	○	○	○	●	○		
Pale Twig-rush	*Machaerina acuta*	Cyperaceae											○			
-	*Machaerina arthrophylla*	Cyperaceae				○			○				○			
Jointed Twig-rush	*Machaerina articulata*	Cyperaceae				●			○	○	○		○	○	○	
Bare Twig-rush	*Machaerina juncea*	Cyperaceae	●		○	●	○		●		●	●	○	○		
-	*Machaerina laxa*	Cyperaceae	○			○	○	○	○	○	○		○		○	
-	*Machaerina preissii*	Cyperaceae				○				○	○					
-	*Machaerina rubiginosa*	Cyperaceae							○		○	○				
Sheath Twig-rush	*Machaerina vaginalis*	Cyperaceae	○			○	○		●							
Swamp Mignonette Orchid	*Microtis atrata* [a.r.]	Orchidaceae				○			●				○		○	○
Sweet Mignonette Orchid	*Microtis brownii* [a.r.]	Orchidaceae							○				○			
Cupped Mignonette Orchid	*Microtis cupularis* [a.r.]	Orchidaceae				○			○							
Dark Mignonette Orchid	*Microtis orbicularis* [a.r.]	Orchidaceae				○			○				○			
-	*Netrostylis* sp. Chandala [P]	Cyperaceae							○					○		
Swamp Purple Flag	*Patersonia occidentalis* var. *angustifolia* [a.r.]	Iridaceae							○		○			○		
-	*Pauridia occidentalis* var. *occidentalis* [a.r.]	Hypoxidaceae			○	○							○			○
-	*Pauridia occidentalis* var. *quadriloba* [a.r.]	Hypoxidaceae		○									●			
Slender Knotweed	*Persicaria decipiens*	Polygonaceae				●			○		○					
Water Pepper	*Persicaria hydropiper*	Polygonaceae									○		○			
Butterfly Flower	*Philydrella drummondii* [a.r.]	Philydraceae							○				○			
-	*Philydrella pygmaea* subsp. *pygmaea* [a.r.]	Philydraceae							○			○	●	○	○	○
Pygmy Clubmoss	*Phylloglossum drummondii* [a.r.]	Lycopodiaceae				○			○				●	○		○
Pouched Leek Orchid	*Prasophyllum cyphochilum* [a.r.]	Orchidaceae							○							
Swamp Leek Orchid	*Prasophyllum drummondii* [a.r.]	Orchidaceae					○	○	○						○	
Humped Leek Orchid	*Prasophyllum gibbosum* [a.r.]	Orchidaceae							○							
Little Laughing Leek Orchid	*Prasophyllum gracile* [a.r.]	Orchidaceae						○	○							
Laughing Leek Orchid	*Prasophyllum macrostachyum* [a.r.]	Orchidaceae				○			●							
Little Leek Orchid	*Prasophyllum ovale* [a.r.]	Orchidaceae						○	○				○		○	
Dainty Leek Orchid	*Prasophyllum plumiforme* [a.r.]	Orchidaceae					○	○	●				○		○	
Bog Clubmoss	*Brownseya serpentina*[16]	Lycopodiaceae												○		
Bracken	*Pteridium esculentum* subsp. *esculentum*	Dennstaedtiaceae	○			●		○	○		●		○			
Pyramid Mulla-mulla	*Ptilotus pyramidatus* [T][17]	Amaranthaceae											○			
-	*Samolus junceus*	Primulaceae	○			○	○			●		●	○	●		
Creeping Brookweed	*Samolus repens*	Primulaceae	○			○				○	●					
Long-leaved Fanflower	*Scaevola lanceolata*	Goodeniaceae										●	○	●		
Schoenolaena	*Schoenolaena juncea* [a.r.]	Apiaceae									○	○	●	○		○
Lake Club-rush	*Schoenoplectus tabernaemontani* [a.r.]	Cyperaceae	○			○					●					

[15] Endangered under the EPBC Act, endangered under the BC Act (WA).
[16] Formerly *Pseudolycopodiella serpentina*.
[17] Critically endangered under the EPBC Act, critically endangered under the BC Act (WA).

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
-	*Schoenus bifidus*	Cyperaceae									○		●		○	○
-	*Schoenus rigens*	Cyperaceae									○	●	●	●		○
-	*Schoenus unispiculatus*	Cyperaceae										●	●		○	○
Salt Couch	*Sporobolus virginicus*	Poaceae	○		○	○			○	●	●		○			
-	*Stackhousia huegelii*	Celastraceae	○			○			○							
Pink Fountain	*Stylidium brunonianum*	Stylidiaceae					●	●	●	○	○	○	●	○	●	○
Thick-leaved Triggerplant	*Stylidium crassifolium*	Stylidiaceae						○					○			
Daddy-Long-Legs	*Stylidium divaricatum*	Stylidiaceae				○			○			○	○	○		○
Dotted Triggerplant	*Stylidium guttatum*	Stylidiaceae							○				○			○
-	*Stylidium paludicola* [P]	Stylidiaceae				○			○				○	○		
Horn Triggerplant	*Stylidium petiolare* [a.r.]	Stylidiaceae			○						○		●	●	○	○
Thumbelina Triggerplant	*Stylidium pulchellum* [a.r.]	Stylidiaceae							○				●		○	○
Sea Blite	*Suaeda australis*	Chenopodiaceae	○			○				●	●					
Lemon-scented Sun Orchid	*Thelymitra antennifera* [a.r.]	Orchidaceae				○	○	○	○				○		○	○
Twisted Sun Orchid	*Thelymitra flexuosa* [a.r.]	Orchidaceae				○		○	●				○		○	
Plum Orchid	*Thelymitra mucida* [a.r.]	Orchidaceae					○	○	○				○			
Plain Sun Orchid	*Thelymitra paludosa* [a.r.]	Orchidaceae				○		○								
Tiger Orchid	*Thelymitra tigrina* [a.r.]	Orchidaceae							○							
Yellow-tufted Sun Orchid	*Thelymitra xanthotricha* [a.r.]	Orchidaceae						○	○				○			
Nodding Tiurndin	*Tribonanthes brachypetala* [a.r.]	Haemodoraceae											○		●	
Keighery's Tiurndin	*Tribonanthes keigheryi* [a.r.]	Haemodoraceae											○			
Branching Tiurndin	*Tribonanthes longipetala* [a.r.]	Haemodoraceae											●		○	○
Widespread Tiurndin	*Tribonanthes monantha* [a.r.]	Haemodoraceae											○			
Purple-budded Tiurndin	*Tribonanthes porphyrea* [a.r.]	Haemodoraceae											○			
Woolly Tiurndin	*Tribonanthes uniflora* [a.r.]	Haemodoraceae									○		○			
Hairy-stigma Tiurndin	*Tribonanthes variabilis* [a.r.]	Haemodoraceae				○			○			○	●	○	○	○
-	*Tribonanthes violacea* [a.r.]	Haemodoraceae							○	○	○	●	○	●		
Streaked Arrowgrass	*Triglochin striata*	Juncaginaceae	○			●				●	○		○			
-	*Trihalogoragis hexandra* subsp. *integrifolia*	Haloragaceae									○		○			
-	*Tripterococcus* sp. Brachylobus [P]	Celastraceae							○				○			○
Narrow-leaf Wilsonia	*Wilsonia backhousei*	Convolvulaceae	○			○					○		○			
Early Nancy	*Wurmbea dioica* subsp. *alba* [a.r.]	Colchicaceae		○	○	○			○			○	○		○	○
ANNUAL HERBS: Non-woody plants that normally live less than a year																
Joyweed	*Alternanthera nodiflora*	Amaranthaceae				●			○		●	○	○			
-	*Angianthus drummondii* [P]	Asteraceae											○			
-	*Angianthus preissianus*	Asteraceae				○				●	●	●	○	●		○
-	*Aphelia brizula*	Centrolepidaceae											●			
-	*Aphelia cyperoides*	Centrolepidaceae				○			●			○	●	○	○	○
-	*Aphelia drummondii*	Centrolepidaceae							○				●			
-	*Aphelia nutans*	Centrolepidaceae							○				●			
-	*Aphelia* sp. Albany	Centrolepidaceae											●		○	
-	*Apium annuum*	Apiaceae	○	○	○	○				○	○					
-	*Calandrinia uncinella* [P]	Montiaceae											○			
-	*Calandrinia* sp. Kenwick	Montiaceae										○	○			
-	*Centrolepis alepyroides*	Centrolepidaceae				○						●	●	○		
-	*Centrolepis aristata*	Centrolepidaceae		○		○		○	●			●	●	●	○	○
	Centrolepis caespitosa	Centrolepidaceae											●			
	Centrolepis cephaloformis subsp. *cephaloformis*	Centrolepidaceae							○			○	○		○	

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
Smooth Centrolepis	*Centrolepis glabra*	Centrolepidaceae							○			○	●		○	
-	*Centrolepis inconspicua*	Centrolepidaceae											●			
-	*Centrolepis mutica*	Centrolepidaceae										●	●			
-	*Centrolepis pilosa*	Centrolepidaceae										●				
Wiry Centrolepis	*Centrolepis polygyna*	Centrolepidaceae										●	●	●		○
Smooth Cotula	*Cotula cotuloides*	Asteraceae					○	○		●	○	●	○	●		○
-	*Dysphania glomulifera* subsp. *glomulifera*	Chenopodiaceae								○	○					
Clammy Goosefoot	*Dysphania pumilio*	Chenopodiaceae							○							
-	*Fimbristylis velata*	Cyperaceae				●					○		○			
-	*Goodenia micrantha*	Goodeniaceae							○			●	●	○	○	○
Smooth Heliotrope	*Heliotropium curassavicum*	Boraginaceae				●				○	○					
-	*Hydrocotyle alata*	Araliaceae							○			●	●		○	○
-	*Hydrocotyle diantha*	Araliaceae	○	●		○	○					○	○		○	○
Nodding Club-rush	*Isolepis cernua* [w/d]	Cyperaceae	○	●	○	○	○		○	○		●	○	●		○
-	*Isolepis cyperoides* [w/d]	Cyperaceae						○	○				○		○	
-	*Isolepis oldfieldiana*	Cyperaceae							○			○	○			●
Small Isotoma	*Isotoma pusilla*	Campanulaceae											○			
-	*Isotoma scapigera*	Campanulaceae										○	○	●		○
Blownglass	*Lachnagrostis filiformis*	Poaceae	○	○		○	○	○	○		○	●	○	●		
-	*Lachnagrostis plebeia*	Poaceae				○			○		○		●			
-	*Myriocephalus helichrysoides*	Asteraceae											○			○
Marsh Mitrewort	*Phyllangium palustre* [P]	Loganiaceae									○		○			
Shade Plantain	*Plantago debilis* [w/d]	Plantaginaceae	○		○											
Slender Podolepis	*Podolepis gracilis* [w/d]	Asteraceae	○	●		○	○	○	○		○	○	○	●	●	○
Stiff Angianthus	*Pogonolepis stricta*	Asteraceae				●						●	○	●		
-	*Polypogon tenellus*	Poaceae										○	●	○		
-	*Rhodanthe pyrethrum*	Asteraceae											○			
-	*Rhodanthe spicata*	Asteraceae											○		○	
-	*Schoenus odontocarpus*	Cyperaceae							○				●		○	
-	*Schoenus plumosus*	Cyperaceae										●	●			○
-	*Schoenus tenellus*	Cyperaceae							○			●	●			
-	*Schoenus* sp. Beaufort [P]	Cyperaceae											○			
-	*Schoenus* sp. Waroona [P]	Cyperaceae											●			
Tiny Clubmoss	*Selaginella gracillima*	Selaginellaceae				○			●			○	●	○		○
-	*Sida hookeriana*	Malvaceae							○		○					
Native Sowthistle	*Sonchus hydrophilus*	Asteraceae	○	○		●				○						
Book Triggerplant	*Stylidium calcaratum*	Stylidiaceae		○	○	○	●	●	○			○	●	○	○	○
Foot Triggerplant	*Stylidium ecorne*	Stylidiaceae							○			○	●			
Hundreds-and-Thousands	*Stylidium inundatum*	Stylidiaceae											○	○		○
Jumping Jacks	*Stylidium longitubum* [P]	Stylidiaceae							○				●	○		
Pink-fan Triggerplant	*Stylidium utricularioides*	Stylidiaceae				○			○				●	○		○
Prickly Arrowgrass	*Triglochin mucronata*	Juncaginaceae	○		○	○			○	○	●	●	○	●		
-	*Triglochin muelleri*	Juncaginaceae										○	○	○		
Pink Petticoats	*Utricularia multifida*	Lentibulariaceae							○		○	○	●	●		○
Pink Fans	*Utricularia tenella*	Lentibulariaceae										○	○		○	
AQUATIC PLANTS: Plants that live entirely or partly in water (with their leaves submerged, floating on the surface, or emerging through it)																
Common Water-mat	*Althenia australis*	Potamogetonaceae											○			
Slender Water-mat	*Althenia preissii*	Potamogetonaceae								○	○	●				

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
Stalked Water-ribbons	*Aponogeton hexatepalus* [a.r.][P]	Aponogetonaceae											●			
Ferny Azolla	*Azolla pinnata*	Salviniaceae				○										
Red Water-fern	*Azolla rubra*	Salviniaceae				○			○		○		○		○	
Water-ribbons	*Cycnogeton huegelii* [a.r.]	Juncaginaceae	○			●			○	○	●	○	●	○		
Water-ribbons	*Cycnogeton lineare* [a.r.]	Juncaginaceae				●			○		○	○	●	○		○
Waterwort	*Elatine gratioloides* [a.r.]	Elatiaceae							○		○					
Keighery's Spike-rush	*Eleocharis keigheryi* [a.r.][T][18]	Cyperaceae											○			
Tall Spike-rush	*Eleocharis sphacelata* [a.r.]	Cyperaceae				○			○							
Mudmat	*Glossostigma diandrum*	Phrymaceae									○		○			
-	*Glossostigma drummondii*	Phrymaceae											○			
Aquatic Pennywort	*Hydrocotyle lemnoides* [P]	Araliaceae											●			
Quillwort	*Isoetes australis*	Isoetaceae											○			
Drummond's Quillwort	*Isoetes drummondii* subsp. *drummondii* [a.r.]	Isoetaceae											●			
-	*Isolepis producta*	Cyperaceae										○		○		
Thin Duckweed	*Landoltia punctata*	Araceae				○					○		○			
Duckweed	*Lemna disperma*	Araceae				●						○		○		
Common Mudwort	*Limosella australis* [a.r.][x]	Scrophulariaceae											○			
-	*Liparophyllum capitatum*	Menyantaceae				○					○	○	●	○		
Nardoo	*Marsilea drummondii* [a.r.]	Marsileaceae											○			
-	*Marsilea mutica* [a.r.]	Marsileaceae							○							
Swamp Raspwort	*Meionectes brownii*	Haloragaceae	○			○							○			
-	*Myriophyllum crispatum*	Haloragaceae	○			○					○		○			
-	*Myriophyllum drummondii*	Haloragaceae				○							●			
-	*Myriophyllum echinatum* [P]	Haloragaceae											●			
-	*Myriophyllum limnophilum*	Haloragaceae											○			
-	*Myriophyllum salsugineum*	Haloragaceae	○			○										
-	*Myriophyllum tillaeoides*	Haloragaceae				○			○							
Prickly water-Nymph	*Najas marina*	Hydrocharitaceae				○				○	○					
-	*Ornduffia albiflora* [a.r.]	Menyanthaceae				○	○		○		○		○	○		
-	*Ornduffia submersa* [a.r.][P]	Menyanthaceae											○	○		
Swamp Lily	*Ottelia ovalifolia* subsp. *ovalifolia* [a.r.]	Hydrocharitaceae				○			○		○		○			
Pillwort	*Pilularia novae-hollandiae*	Marsileaceae											●			
Blunt Pondweed	*Potamogeton ochreatus*	Potamogetonaceae				○							○			
Sea Tassel	*Ruppia maritima*	Ruppiaceae	○							○						
Saline Pondweed	*Ruppia megacarpa*	Ruppiaceae	○							○						
-	*Ruppia polycarpa*	Ruppiaceae	○			○				○			○			
Sharpleaf Club-rush	*Schoenoplectus pungens*	Cyperaceae				○			○		○					
-	*Schoenus capillifolius* [P]	Cyperaceae										○	●			
-	*Schoenus loliaceus* [P]	Cyperaceae											○			
Floating Bog-rush	*Schoenus natans* [P]	Cyperaceae											●			
Sago Pondweed, Fennel Pondweed	*Stuckenia pectinata*	Potamogetonaceae	○			○			○	○	○					
-	*Trithuria bibracteata*	Hydatellaceae										○	○			○
-	*Trithuria fitzgeraldii*	Hydatellaceae											○			
Swan Hydatella	*Trithuria occidentalis* [T][19]	Hydatellaceae											○			

[18] Vulnerable under the EPBC Act, vulnerable under the BC Act (WA).
[19] Endangered under the EPBC Act, endangered under the BC Act (WA).

Common Name	Botanical name	Family	Q	C	CR	H	K	B	BS	V	S	Be	G	Y	F	D
	Trithuria submersa	Hydatellaceae											●			
Yanget, Native Bulrush	*Typha domingensis* [a.r.]	Typhaceae	○			●				○	○		○			
Bulrush	*Typha orientalis* [a.r.]	Typhaceae	○			○			○	○	○		○			
-	*Utricularia australis*	Lentibulariaceae				○			○				○			
-	*Utricularia gibba*	Lentibulariaceae				○			○							
-	*Utricularia inaequalis*	Lentibulariaceae											○			
Redcoats, Red Bladderwort	*Utricularia menziesii* [a.r.]	Lentibulariaceae											○		○	○
Violet Bladderwort	*Utricularia violacea*	Lentibulariaceae							○			○	○	○		
Twining Bladderwort	*Utricularia volubilis* [a.r.]	Lentibulariaceae							○							

Attachment D – Some of the common sedges, rushes and grasses on the Swan Coastal Plain by wetland type

Table D1 lists the lists some of the common sedges, rushes and grasses on the Swan Coastal Plain by wetland type.

Adapted from:

- Water and Rivers Commission 2000s, *Water note 20: Rushes and sedges*, Water and Rivers Commission, Perth. Available at: <www.wa.gov.au/government/document-collections/water-notes-collection>. (Accessed 22 March 2026).

Notes:

- Table D1 is biased towards the sedges, rushes and grasses found in inundated wetlands. There are many sedges, rushes and grasses from seasonally waterlogged wetlands (such as damplands and palusplains) that are not included in this table.
- Some common grasses that are not included in this table include:
    - Swamp Wallaby-grass (*Amphibromus nervosus*)
    - *Themeda triandra*
    - Blownglass (*Lachnagrostis filiformis*)
    - *Lachnagrostis plebeia*
    - *Polypogon tenellus.*
- The Water and Rivers Commission (2000c) recorded some species as occurring in wetlands that are permanently wet (PWe), even where there is no record for permanently inundated habitats. PWe was removed from Table D1 where field evidence shows that a species does not survive permanent inundation. Species retained in PWe can tolerate permanent inundation, although most occur primarily in seasonally inundated wetlands.
- The Water and Rivers Commission (2000c) included *Spartochloa scirpoidea*; however, this species occurs in seasonally waterlogged granite crevices and does not occur on the Swan Coastal Plain, so it is not included in Table D1.

Table D1 – Common sedges, rushes and grasses on the Swan Coastal Plain by wetland type

Common name	Species	River[1]		Creek[1]		Floodplain[1]	Wetland				Soil Type	Water Depth	Salt-tolerance[2]
		Channel Permanently inundated	**Embankment** Seasonally wet	**Channel** Seasonally wet	**Embankment** Seasonally wet	**Floodplain** Seasonally inundated flat	**Lake**[1] Permanently inundated	**Sumpland**[1] Seasonally inundated basin	**Dampland**[1] Seasonally waterlogged basin	**Palusplain**[1] Seasonally waterlogged flat	C = clay P = peat S = sand	DW = deep water (0.5-1m) SW = shallow water (<0.5m) PWe = permanently wet SWe = seasonally wet	F = fresh B = brackish S = saline
Sedges													
Tussock Sedge	*Carex appressa*						✔	✔			C, P, S	PWe, SWe	F
Tassel Sedge	*Carex fascicularis*		✔	✔	✔		✔				C, P, S	SW, PWe, SWe	F
-	*Carex tereticaulis*			✔				✔			C, S	PWe, SWe	F
Black Bristle-rush	*Chorizandra enodis*			✔		✔		✔	✔		C, S	SW, SWe	F, B
-	*Cyperus gymnocaulos*		✔			✔					P, S	PWe	F, B
Common Spike-rush	*Eleocharis acuta*			✔				✔	✔		C, S	SW, SWe	F, B, S
-	*Evandra pauciflora*							✔	✔	✔	S	SWe	F
-	*Evandra aristata*							✔	✔	✔	S, P	PWe, SWe	F
-	*Gahnia decomposita*					✔		✔	✔		P, S	PWe, SWe	F, B

Common name	Species	River[1]		Creek[1]		Floodplain[1]	Wetland				Soil Type	Water Depth	Salt-tolerance[2]
		Channel Permanently inundated	**Embankment** Seasonally wet	**Channel** Seasonally wet	**Embankment** Seasonally wet	**Floodplain** Seasonally inundated flat	**Lake**[1] Permanently inundated	**Sumpland**[1] Seasonally inundated basin	**Dampland**[1] Seasonally waterlogged basin	**Palusplain**[1] Seasonally waterlogged flat	C = clay P = peat S = sand	DW = deep water (0.5-1m) SW = shallow water (<0.5m) PWe = permanently wet SWe = seasonally wet	F = fresh B = brackish S = saline
Coast Saw-sedge	*Gahnia trifida*					✔	✔	✔	✔		C, P, S	PWe, SWe	F, B, S
Knotted Club-rush	*Ficinia nodosa*					✔	✔	✔	✔		P, S	PWe, SWe	F, B, S
Spreading Sword-sedge	*Lepidosperma effusum*		✔		✔		✔				C, S	SWe, PWe	F
Coast Sword-sedge	*Lepidosperma gladiatum*		✔		✔		✔	✔	✔		C, P, S	SWe	F
Pithy Sword-sedge	*Lepidosperma longitudinale*					✔	✔	✔	✔	✔	P, S	PWe, SWe	F
-	*Lepidosperma tetraquetrum*		✔	✔	✔						C, P, S	SW, PWe, SWe	F
Jointed Twig-rush	*Machaerina articulata*					✔	✔	✔			C, P, S	DW, SW, PWe	F, B
-	*Machaerina juncea*		✔	✔	✔	✔	✔	✔	✔	✔	C, P, S	SW, PWe, SWe	F, B
-	*Machaerina preissii*						✔	✔			P, S	SW, PWe, SWe	F, B
-	*Machaerina rubiginosa*			✔				✔			C, P, S	SW, PWe, SWe	F

Common name	Species	River[1]		Creek[1]		Floodplain[1]	Wetland				Soil Type	Water Depth	Salt-tolerance[2]
		Channel Permanently inundated	**Embankment** Seasonally wet	**Channel** Seasonally wet	**Embankment** Seasonally wet	**Floodplain** Seasonally inundated flat	**Lake**[1] Permanently inundated	**Sumpland**[1] Seasonally inundated basin	**Dampland**[1] Seasonally waterlogged basin	**Palusplain**[1] Seasonally waterlogged flat	C = clay P = peat S = sand	DW = deep water (0.5-1m) SW = shallow water (<0.5m) PWe = permanently wet SWe = seasonally wet	F = fresh B = brackish S = saline
Sheath Twig-rush	*Machaerina vaginalis*		✔	✔	✔						C, P, S	SW, PWe, SWe	F, B
Sharpleaf Club-rush	*Schoenoplectus pungens*							✔	✔		C, P, S	SW, PWe	F
Lake Club-rush	*Schoenoplectus tabernaemontani*	✔	✔	✔			✔				C, P, S	DW, SW	F, B, S
-	*Schoenus subfascicularis*		✔				✔	✔			C, P, S	PWe, SWe	F
Rushes													
-	*Anarthria prolifera*		✔		✔	✔					P, S	SWe	F
-	*Anarthria scabra*				✔	✔		✔	✔	✔	P, S	SWe	F
Bearded Twine-rush	*Chaetanthus aristatus*			✔					✔	✔	P, S	SW, SWe	F
-	*Dielsia stenostachya*					✔	✔	✔	✔		P, S	PWe, SWe	F
-	*Empodisma gracillimum*		✔		✔	✔		✔	✔	✔	P	SW, PWe	F, Never in brackish

Common name	Species	River[1]		Creek[1]		Floodplain[1]	Wetland				Soil Type	Water Depth	Salt-tolerance[2]
		Channel Permanently inundated	**Embankment** Seasonally wet	**Channel** Seasonally wet	**Embankment** Seasonally wet	**Floodplain** Seasonally inundated flat	**Lake**[1] Permanently inundated	**Sumpland**[1] Seasonally inundated basin	**Dampland**[1] Seasonally waterlogged basin	**Palusplain**[1] Seasonally waterlogged flat	C = clay P = peat S = sand	DW = deep water (0.5-1m) SW = shallow water (<0.5m) PWe = permanently wet SWe = seasonally wet	F = fresh B = brackish S = saline
-	*Hopkinsia anoectocolea*		✔		✔						S	SW, SWe	F, B, S
-	*Hypolaena exsulca*				✔	✔	✔		✔	✔	P, S	SW, SWe	F
-	*Hypolaena fastigiata*								✔	✔	P, S	SWe	F
-	*Hypolaena pubescens*				✔	✔		✔	✔	✔	P, S	SWe	F
Jointed Rush	*Juncus holoschoenus*		✔					✔	✔		C, P, S	SWe, PWe	F
Shore Rush	*Juncus kraussii*		✔				✔	✔			C, P, S	SW, PWe	B, S
Giant Rush, Pale Rush	*Juncus pallidus*		✔		✔	✔	✔	✔	✔		C, P, S	PWe, SWe	F, B
Loose-flowered Rush	*Juncus pauciflorus*		✔		✔						C, P, S	SWe	F
Finger Rush	*Juncus subsecundus*		✔		✔			✔	✔		C, P, S	PWe, SWe	F, B
Hoary Twine-rush	*Leptocarpus canus*			✔	✔			✔	✔	✔	C, P, S	SWe	F
-	*Leptocarpus coangustatus*		✔	✔	✔			✔	✔		C, P, S	SWe	F

Common name	Species	River[1]		Creek[1]		Floodplain[1]	Wetland				Soil Type	Water Depth	Salt-tolerance[2]
		Channel Permanently inundated	**Embankment** Seasonally wet	**Channel** Seasonally wet	**Embankment** Seasonally wet	**Floodplain** Seasonally inundated flat	**Lake**[1] Permanently inundated	**Sumpland**[1] Seasonally inundated basin	**Dampland**[1] Seasonally waterlogged basin	**Palusplain**[1] Seasonally waterlogged flat	C = clay P = peat S = sand	DW = deep water (0.5-1m) SW = shallow water (<0.5m) PWe = permanently wet SWe = seasonally wet	F = fresh B = brackish S = saline
-	*Leptocarpus laxus*			✔	✔			✔	✔	✔	P, S	SW, SWe	F
-	*Leptocarpus roycei*		✔	✔	✔			✔	✔		C, P, S	SW, SWe	F
-	*Leptocarpus scariosus*		✔		✔	✔		✔	✔	✔	P, S	SW, SWe	F
Slender Twine Rush	*Leptocarpus tenax*		✔		✔			✔	✔	✔	C, P, S	SW, SWe	F
-	*Lepyrodia glauca*			✔	✔			✔	✔		C, P, S	SW, SWe	F, B
-	*Lepyrodia riparia*		✔	✔	✔						C, S	PWe, SWe	F
-	*Loxocarya cinerea*		✔		✔	✔					C, S	SWe	F
-	*Melanostachya ustulata*			✔	✔			✔	✔	✔	P, S	PWe, SWe	F
-	*Taraxis grossa*		✔		✔	✔		✔			C, P, S	SW, PWe, SWe	F
Grasses													
Matgrass	*Hemarthria uncinata*		✔		✔	✔			✔		C, S	PWe, SWe, SW	B, S

Common name	Species	River[1]		Creek[1]		Floodplain[1]	Wetland				Soil Type	Water Depth	Salt-tolerance[2]
		Channel Permanently inundated	**Embankment** Seasonally wet	**Channel** Seasonally wet	**Embankment** Seasonally wet	**Floodplain** Seasonally inundated flat	**Lake**[1] Permanently inundated	**Sumpland**[1] Seasonally inundated basin	**Dampland**[1] Seasonally waterlogged basin	**Palusplain**[1] Seasonally waterlogged flat	C = clay P = peat S = sand	DW = deep water (0.5-1m) SW = shallow water (<0.5m) PWe = permanently wet SWe = seasonally wet	F = fresh B = brackish S = saline
Weeping Grass	*Microlaena stipoides*		✔		✔	✔					C, S	SWe	F
Salt Couch	*Sporobolus virginicus*		✔		✔	✔					C, P, S	SWe, SW	F, B, S

[1] River = permanently inundated channel; Creek = seasonally inundated channel; Dampland = seasonally waterlogged basin; Sumpland = seasonally inundated basin; Lake = permanently inundated basin; Floodplain = seasonally inundated flat; Palusplain = seasonally waterlogged flat.

[2] Fresh = <1000 mg/L TDS; Brackish/Subhaline = 1000 – 3000 mg/L TDS; Saline = 3000 – 20 000 mg/L TDS.

Attachment E – Existing threatened and priority ecological communities of the Swan Coastal Plain

This attachment provides an overview of the wetland and terrestrial ecological communities of the Swan Coastal Plain, including threatened ecological communities (TECs) listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Biodiversity Conservation Act 2016* (BC Act), and priority ecological communities (PECs) identified under Western Australian policy. This information is presented in three tables, E1, E2 and E3.

Table E1 lists the wetland TECs of the Swan Coastal Plain that are currently recognised under the EPBC Act and the BC Act in Western Australia.

The references used to identify the TECs related to the wetlands of the Swan Coastal Plain include:

- Department of Biodiversity, Conservation and Attractions 2025, *Threatened ecological communities list – November 2025*. Available at: <www.dbca.wa.gov.au/wildlife-and-ecosystems/threatened-ecological-communities/list-threatened-ecological-communities>. (Accessed: 22 March 2026).
- Department of Biodiversity, Conservation and Attractions undated(b), *Threatened ecological community fact sheet: Corymbia calophylla – Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in Gibson et al. 1994)*, Department of Biodiversity, Conservation and Attractions, Perth. Available at: <www.dbca.wa.gov.au/wildlife-and-ecosystems/threatened-ecological-communities>. (Accessed: 22 March 2026.)
- Department of Biodiversity, Conservation and Attractions undated(e), *Threatened ecological community fact sheet: Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson et al. 1994)*, Department of Biodiversity, Conservation and Attractions, Perth. Available at: <www.dbca.wa.gov.au/wildlife-and-ecosystems/threatened-ecological-communities>. (Accessed: 22 March 2026.)
- Department of Climate Change, Energy, the Environment and Water undated, *Species Profile and Threats Database: Swan Coastal Plain [Search result]*, Australian Government. Viewed at <www.environment.gov.au/cgi-bin/sprat/public/spratlookupcommunity.pl?name=Swan+coastal+plain&searchtype=wildcard> on 22 March 2026.
- Department of Climate Change, Energy, the Environment and Water undated, *Species Profile and Threats Database: Western Australian ecological communities [Search result]*, Australian Government. Viewed at <www.environment.gov.au/cgi-bin/sprat/public/publicreports.pl?proc=community>.
- Department of Environment and Conservation 2012, 'Table 2: WA's wetland threatened ecological communities that are defined or reliant on vascular plant taxa' in 'Wetland vegetation and flora', *A guide to managing and restoring wetlands in Western Australia*. Prepared by Keighery G, Keighery B and Longman V, Department of Environment and Conservation, Perth. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/026262/026262.003.pdf>. (Accessed: 22 March 2026).
- Gibson N, Keighery B, Keighery G, Burbidge A and Lyons M 1994, *A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Available at: <https://library.dbca.wa.gov.au/FullTextFiles/001217.pdf>. (Accessed 22 March 2026).

Notes:

- Table E1 is adapted from the *Threatened ecological communities list – November 2025* (Department of Biodiversity, Conservation and Attractions 2025).
- The Department of Environment and Conservation (2012) and Gibson *et al*. (1994) identify wetland TECs.
- The TEC names in Department of Environment and Conservation (2012) were updated to the names used in the current (2025) listings under the BC Act.
- The Department of Environment and Conservation (2012) described the following as wetland ecological communities but Gibson *et al.* (1994) did not:
    - 'Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson *et al.* 1994)'; and
    - '*Corymbia calophylla — Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in Gibson *et al.* 1994)'.
- The Department of Biodiversity, Conservation and Attractions (undated(e)) described the habitat requirements for the 'Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson *et al.* 1994)' as: "The plant assemblage is dependent on the maintenance of local hydrological conditions. The wet flats or palusplain become waterlogged, forming small depressions and provide the community's winter-wet habitat." This confirms it is a wetland ecological community.

- The Department of Biodiversity, Conservation and Attractions (undated(b) described the habitat requirements of '*Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in Gibson *et al.* 1994)' as: "Marri dominated plant communities were probably some of the most common on heavy soils on the eastern side of the Swan Coastal Plain (Keighery and Trudgen 1992; Gibson *et al.* 1994). Gibson *et al.* (1994) recognised three distinct communities in this group. The floristic composition of these communities varies with rainfall, with the Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands occurring on the driest of the sites." This may indicate it is not a wetland ecological community.
- Threatened ecological communities are identified by the Australian Government under the *Environmental Protection and Biodiversity Conservation Act 1999* and the Western Australian Government under the *Biodiversity Conservation Act 2016*. Priority ecological communities are identified by the Department of Biodiversity, Conservation and Attractions in Western Australia (WA). These are possibly threatened ecological communities that do not meet survey criteria or that are not adequately defined (priorities 1, 2 and 3). These three categories are ranked in order of priority for survey or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological communities that are adequately known and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list, are placed in priority 4. Priority ecological communities cannot be listed under the *Biodiversity Conservation Act 2016*.

Abbreviations:

BC Act = Biodiversity Conservation Act 2016 (Western Australia)

EPBC Act = Environmental Protection and Biodiversity Conservation Act 1999 (Australian Government)

IBRA = Interim Biogeographic Regionalisation for Australia

N/A = Not applicable

SCP = Swan Coastal Plain

TEC = Threatened ecological community

PEC = Priority ecological community in Western Australia

WA = Western Australia

Table E1 – Existing threatened ecological communities of the Swan Coastal Plain, with the wetland threatened ecological communities highlighted in blue.

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
Aquatic Root Mat Community in Caves of the Swan Coastal Plain	Endangered	N/A	Aquatic Root Mat community Number 1 of Caves of the Swan Coastal Plain	Critically endangered	CR A1, A2b, A3 CR B1a(i),(ii),b,c, B2a(i),(ii),b,c CR C1, C2b, C3	Schedule 1, Division 1, item 02	CAVES SCP01	The community occurs in caves at sites that include Yanchep National Park and surrounds. It comprises root mats of *Eucalyptus gomphocephala* (tuart) supported by groundwater fed streams and pools that occur in the caves. The root mats support a highly diverse and distinctive assemblage of cave fauna including the critically endangered cave shrimp *Hurleya* sp. (WAM 23193; Crystal Cave crangonyctoid).	Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	N/A	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Critically endangered	CR A3, CR B1b	Schedule 1, Division 1, item 16	Mound Springs SCP	The community occurs in tumulus springs (organic mound springs) on the Swan Coastal Plain. The habitat of the mound springs is characterised by continuous discharge of groundwater in raised areas of peat. The peat and surrounds provide a stable, permanently moist series of microhabitats, with a high level of heterogeneity of invertebrate fauna assemblages between sites. Groups commonly represented include Ostracoda, Nematoda, Cladocera, Copepoda, Oligochaeta, Tardigrada, Turbellaria and Insecta. Typical and common native vascular plant species associated with the tumulus springs are the trees *Banksia littoralis* (swamp banksia), *Melaleuca preissiana* (moonah) and *Eucalyptus rudis* (flooded gum), and the shrubs *Taxandria linearifolia* (swamp peppermint), Pteridium esculentum (bracken fern), *Astartea scoparia* (common astartea) and *Cyclosorus interruptus* (swamp shield-fern).	Swan Coastal Plain	
Clay Pans of the Swan Coastal Plain	Critically endangered	Component of Clay Pans of the Swan Coastal Plain	Dense shrublands on clay flats (floristic community type 9 as originally described in Gibson *et al*. 1994)	Endangered	EN B1a(iii),b, B2a(iii),b	Schedule 1, Division 2, item 03	SCP09	The community occurs as shrublands or open woodlands on clay flats that are inundated for long periods. It has been recorded between Moore River National Park and Dunsborough. Sedges are more apparent in the community than in other claypans, generally with moderate frequencies of *Chorizandra enodis* (black bristlerush), *Cyathochaeta avenacea, Lepidosperma longitudinale* (pithy sword-sedge) and *Leptocarpus coangustatus*. The community has a lower species richness and weed frequency than other claypan threatened ecological communities. The community is also known as 'floristic community type 9' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
			Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson *et al*. 1994)	Endangered	EN B1a(iii),b, B2a(iii),b	Schedule 1, Division 2, item 04	SCP07	The community is generally dominated by *Melaleuca viminea* (mohan), *Melaleuca osullivanii*, *Melaleuca cuticularis* (saltwater paperbark) or *Casuarina obesa* (swamp sheoak) or a mixture of these species. It has been recorded between Mogumber and Ambergate on heavy clay soils that are generally inundated from winter to mid-summer. The species *Melaleuca cuticularis* and *Casuarina obesa* may indicate some saline influence for at least part of the year. Herbs such as *Brachyscome bellidioides*, *Centrolepis polygyna* (wiry centrolepis), *Pogonolepis stricta* (stiff angianthus) and *Cotula coronopifolia* (waterbuttons; note: listed as alien in Florabase) are typical of this community. In addition, species such as *Angianthus drummondii* (priority 3), *Eryngium pinnatifidum* subsp. Palustre (priority 3) and *Blennospora drummondii* occur in the community at low frequency. A suite of annual flora is seen in the community as the season progresses. In early spring many of the occurrences of the community are covered by free water up to 30cm deep. *Cotula coronopifolia* sometimes forms yellow floating mats in some pools while others may be dominated by Ornduffia submersa (priority 4). Aquatic species are common in the community early in the growing season. As the wetland dries a succession of species such as *Centrolepis* spp. and annual *Stylidium* spp. successively germinate, grow and flower, resulting in an extended flowering period of over three months. The community is also known as 'floristic community type 7' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	
			Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson *et al*. 1994)	Endangered	EN B1a(iii),b, B2a(iii),b	Schedule 1, Division 2, item 05	SCP08	The community has been recorded between Bullsbrook and Ludlow and occurs in low-lying flats with a clay impeding layer that facilitates seasonal inundation. The vegetation can be dominated by *Viminaria juncea* (swishbush), *Melaleuca viminea* (mohan), *Melaleuca lateritia* (robin redbreast bush) or *Melaleuca osullivanii* (broombush) but also occasionally by *Eucalyptus wandoo* (wandoo). Commonly occurring flora include *Hypocalymma angustifolium* (white myrtle), *Acacia lasiocarpa* var. *bracteolata* (long peduncle form) and *Verticordia huegelii* (variegated featherflower), and aquatic annuals. The community is also known as 'floristic community type 8' as	Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
								originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).		
			Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson *et al*. 1994)	Endangered	EN A3 EN B1a(iii),b, B2a(iii),b	Schedule 1, Division 2, item 09	SCP10a	The community occurs on clay flats with thin skeletal soils and has been recorded largely between Wattle Grove and Sabina River. It comprises rapidly drying clay flats. Typical and common shrubs include *Hakea sulcata* (furrowed hakea), *Verticordia densiflora* (compacted featherflower), *Hakea varia* (variable-leaved hakea), *Pericalymma ellipticum* (swamp teatree) and *Viminaria juncea* (swishbush). *Aphelia cyperoides* (hairy aphelia), *Centrolepis aristata* (pointed centrolepis), *Drosera gigantea* (giant sundew) and *Drosera menziesii* (pink rainbow) also commonly occur. The community is also known as 'floristic community type 10a' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	
Empodisma peatlands of southwestern Australia	Endangered	N/A	Not listed	Not listed	N/A	N/A	N/A	N/A	Warren and Jarrah Forest (predominantly); and may occur in Swan Coastal Plain and Esperance Plains	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered	N/A	Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in Gibson *et al*. 1994)	Critically endangered	CR B2a(i),b	Schedule 1, Division 1, item 35	SCP19	The community is within wetland depressions (swales) occurring between parallel Holocene dunes, mostly located on the Rockingham-Becher Plain but also extending further north to Lancelin and south to Dalyellup. Typical and common native species in the community are the shrubs *Acacia rostellifera* (summer-scented wattle), *Acacia saligna* (orange wattle) and *Xanthorrhoea preissii* (balga), the sedges *Machaerina juncea* (bare twigrush), *Ficinia nodosa* (knotted club rush) and *Lepidosperma gladiatum* (coast sword-sedge), and the grass *Poa porphyroclados*. The community is also known as 'floristic community type 19' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	N/A	Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	EN A3 EN B1b, B2b	Schedule 1, Division 2, item 08	Muchea Limestone	The community occurs on the heavy soils of the eastern side of the Swan Coastal Plain and has been recorded between Beermullah and Wokalup. Known patches include wetland and well-drained habitats, in a variety of landforms. It is defined on the basis of substrates with a limestone influence. Many of the species are commonly associated with the limestone soils that occur on the coast, and do not generally occur further inland. Typical and common native species in areas of best developed limestone are: the tree *Casuarina obesa* (swamp sheoak); the mallees Eucalyptus decipiens (redheart) and *Eucalyptus foecunda* (narrow-leaved red mallee); the shrubs *Melaleuca huegelii* (chenille honey-myrtle), *Alyogyne huegelii* (lilac hibiscus), *Grevillea curviloba* (endangered), *Grevillea evanescens* (priority 1) and *Melaleuca systena* (coastal honeymyrtle); and the herb *Thysanotus arenarius* (sand-dune fringed lily). Where the limestone substrate is less well developed and limestone may occur as nodules or chunks, the flora assemblages can be influenced by other characteristics of the substrate, such as clay content, with the presence of calcicoles such as *Thysanotus arenarius*, *Gahnia trifida* (coast saw-sedge), *Eremophila glabra* (tar bush) and *Melaleuca brevifolia* (mallee honey-myrtle) providing evidence of the limestone influence. *Melaleuca huegelii* shrublands, *Eucalyptus decipiens* mallee, *Casuarina obesa* woodlands and *Melaleuca brevifolia*, *Melaleuca systena* or *Melaleuca viminea* shrublands have been recorded on Muchea Limestone.	Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
Shrublands and Woodlands on Perth to Gingin ironstone (Perth to Gingin ironstone association) of the Swan Coastal Plain	Endangered	N/A	Perth to Gingin Ironstone Association	Critically endangered	CR B1a(iii),b,c, B2a(iii),b,c	Schedule 1, Division 1, item 30	NTHIRON	The community occurs on ironstone soils in the Perth area and is characterised by massed everlastings. Many of the plant species present are specifically adapted to shallow seasonal inundation, specifically the rich herb layer present in late winter and early spring which is a major distinguishing characteristic of the community. The daisies *Rhodanthe manglesii, Rhodanthe spicata and Myriocephalus helichrysoides* dominate. Other common herbs include *Tribonanthes variabilis* (southern tiurndin), *Stylidium longitubum* (jumping jacks) (priority 4) and *Isotropis cuneifolia* subsp. *glabra* (priority 3). A very open shrub layer is typical with common shrubs *Melaleuca viminea* (mohan), *Banksia sessilis* (parrot bush), *Acacia saligna* (orange wattle), *Jacksonia furcellata* (grey stinkwood), *Grevillea curviloba* (endangered) and *Kunzea recurva*.	Swan Coastal Plain	
Shrublands on southern Swan Coastal Plain ironstones	Endangered	N/A	Shrublands on southern Swan Coastal Plain Ironstones (Busselton area) (floristic community type 10b as originally described in Gibson *et al*. 1994)	Critically endangered	CR A2b, A3 CR B1a(iii)	Schedule 1, Division 1, item 38	SCP10b	This species-rich plant community is a seasonal wetland on ironstone sheet rock overlain by shallow loam soils on the Swan Coastal Plain and Whicher Scarp near Busselton. Much of the species diversity comes from annuals and geophytes (plants with an underground storage organ). Typical and common shrubs include *Kunzea rostrata, Pericalymma ellipticum* (swamp teatree), *Hakea oldfieldii, Hemiandra pungens* (snakebush) and *Viminaria juncea* (swishbush). *Aphelia cyperoides* (hairy aphelia) and *Centrolepis aristata* (pointed centrolepis) also commonly occur. Many taxa in the community are endemic to this unusual geology including a suite of threatened flora. The community is also known as 'floristic community type 10b' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Jarrah Forest, Swan Coastal Plain	
Subtropical and temperate coastal saltmarsh	Vulnerable	N/A	Not listed	Not listed	N/A	N/A	N/A	N/A	Carnarvon, Geraldton Sandplains, Swan Coastal Plain, Warren, Jarrah Forest, Esperance Plains	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)	Critically endangered	N/A	Stromatolite like freshwater microbialite community of coastal brackish lakes (Lake Clifton)	Critically endangered	CR B1a(ii,iii),b,c	Schedule 1, Division 1, item 41	Clifton-microbialite	The community occurs on a relict foredune plain on Holocene sands at Lake Clifton. It is a thrombolitic community comprising a complex assemblage of photosynthetic cyanobacteria and purple sulphur bacteria, eukaryotic microalgae and true bacteria. The thrombolitic structures generally have an internal clotted structure and are formed through precipitation of calcium carbonate within the microenvironment of microbes as a result of photosynthetic and metabolic activity. The most abundant cyanobacterium in the early 1990s was Scytonema, as well as others including Oscillatoria, Dichothrix, Chroococcus, Gloeocapsa, Johannesbaptistia, Gomphosphaeria and Spirulina (Moore L.S. 1993, *The modern thrombolites of Lake Clifton, south-western Australia*, unpublished doctoral thesis, The University of Western Australia). More recent work suggests there has been a dramatic shift in the cyanobacterial population.	Swan Coastal Plain	
Thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond)	Endangered	N/A	Stromatolite like microbialite community of coastal freshwater lakes (Lake Richmond)	Critically endangered	CR B1a(ii,iii),b,c B2a(ii,iii),b,c	Schedule 1, Division 1, item 42	Richmond-microbial	The community occurs on a relict foredune plain on Holocene sands at Lake Richmond, Rockingham. It is a thrombolitic community comprising a complex assemblage of photosynthetic cyanobacteria and purple sulphur bacteria, eukaryotic microalgae and true bacteria. The thrombolitic structures generally have an internal clotted structure and are formed through precipitation of calcium carbonate within the microenvironment of microbes as a result of photosynthetic and metabolic activity.	Swan Coastal Plain	
Not listed	N/A	N/A	Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (floristic community type 15 as originally described in Gibson *et al*. 1994)	Critically endangered	CR A3 CR B1b	Schedule 1, Division 1, item 21	SCP15	The community has been recorded from Bambun to Nirimba, on alluvial sediments on sites that are inundated for long periods resulting in more typical aquatic and flora of deeper wetlands. The community is generally dominated by *Melaleuca rhaphiophylla* (swamp paperbark) or *Casuarina obesa* (swamp sheoak). Other species can include *Melaleuca teretifolia* (banbar), *Atriplex cinerea* (grey saltbush), *Samolus repens* (creeping brookweed), *Salicornia quinqueflora* (beaded samphire) and *Sporobolus virginicus* (marine couch). The community is also known as 'floristic community type 15' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) A floristic survey of the southern Swan Coastal Plain (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
Not listed	N/A	N/A	Shrublands on calcareous silts of the Swan Coastal Plain (floristic community type 18 as originally described in Gibson *et al*. 1994)	Critically endangered	CR B1a(iii),b CR D2b	Schedule 1, Division 1, item 37	SCP18	The community is recorded from between Yalgorup National Park and Bunbury. It is species rich, consists of open low shrubs with a rich annual flora and is known from calcareous silt flats. A suckering form of *Acacia saligna* (orange wattle), *Melaleuca viminea* (mohan), *Melaleuca teretifolia* (banbar), *Hakea varia* (variable-leaved hakea), Xanthorrhoea preissii (balga) and *Leptomeria ellytes* are common in the shrub layer, with sedges including *Lepidosperma longitudinale* (pithy sword-sedge) and *Gahnia trifida* (coast saw-sedge), and a suite of herbs including *Meionectes tenuifolia* (priority 3) also common. The community is also known as 'floristic community type 18' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	
Not listed	N/A	N/A	Southern wet shrublands, Swan Coastal Plain (floristic community type 2 as originally described in Gibson *et al.* 1994)	Critically endangered	CR A3	Schedule 1, Division 1, item 39	SCP02	The community typically comprises shrublands or open woodlands. It occurs on seasonally inundated sandy clay soils that are restricted to small remnants on the eastern side of the Swan Coastal Plain. It has been recorded from Forrestfield to Chapman Hill. The community has moderate species richness with the occurrence of species reflecting the wetter nature of the sites. Typical and common native taxa in the community are the shrubs *Kingia australis* (kingia), *Pericalymma ellipticum* (swamp teatree), *Hakea ceratophylla* (horned leaf hakea), *Calothamnus lateralis*, *Hypocalymma angustifolium* (white myrtle), *Eutaxia virgata, Stirlingia latifolia* (blueboy), *Banksia dallanneyi* (couch honeypot) and herbs, rushes and sedges including *Dampiera linearis* (common dampiera), *Comesperma virgatum* (milkwort), *Stylidium brunonianum* (pink fountain triggerplant), *Thysanotus multiflorus* (many-flowered fringe lily) and *Mesomelaena tetragona* (semaphore sedge). The community also contains priority flora including *Isopogon formosus* subsp. *dasylepis* (priority 3) and *Grevillea brachystylis* subsp. *brachystylis* (priority 3). This community is also known as 'floristic community type 2' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the	Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
								Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).		
Not listed	N/A	N/A	Stromatolite community of stratified hypersaline coastal lakes (Lake Thetis)[1]	Critically endangered	CR B1c, B2c	Schedule 1, Division 1, item 40	Thetis-microbialite	The community occurs in Lake Thetis, Cervantes. It comprises a distinctive and diverse group of benthic microbial assemblages, each producing a mat that is associated with one specific zone within the lake. Crenulate cyanobacterial mats occur in the low-lying areas adjacent to the lake. Lithified stromatolites, resembling those at Shark Bay, with patches of living cyanobacterial mats and nodular mats characterise the littoral areas. Filamentous mats reside in cavities and coat the surface of the flocculant mat in the basin, a mobile diatomaceous mat occurs in the shallows, and thick flocculant mats of phototrophic prokaryotes, other microbes and/or diatoms occur in the central basin. Lake Thetis has benthic microbial mats adjacent to the lithified stromatolites and well-developed flocculant mats in the basin. Under current conditions microbial reef-forming communities and flocculant mat communities are both scarce. Some stromatolites have branching columns.	Swan Coastal Plain	

[1] This wetland threatened ecological community is on the Swan Coastal Plain north of Wedge Island, about 30 kilometres north of the nominated area.

Table E2 lists the wetland-related, or potentially wetland-related, priority ecological communities (PECs) of the Swan Coastal Plain (SCP), which are identified under Western Australian policy but are not protected under legislation. The PECs related to, or likely to be related to, the wetlands of the Swan Coastal Plain (SCP) are highlighted in blue. The PEC highlighted in grey requires further investigation, as it may prove to be wetland-related but this has not yet been determined.

Table E2 is adapted from the *Priority ecological communities list – November 2025* (Department of Biodiversity, Conservation and Attractions 2025). Available at: <www.dbca.wa.gov.au/wildlife-and-ecosystems/threatened-ecological-communities/list-threatened-ecological-communities>. (Accessed: 22 March 2026). It provides information about the different priorities, 1 to 5.

Table E2 – Wetland-related or potentially wetland-related priority ecological communities of the Swan Coastal Plain

Item	Community identifier	Community name	Summary description	WA category	National listing (EPBC Act)
22	SCP22	*Banksia ilicifolia* woodlands, southern Swan Coastal Plain ('floristic community type 22')	Low lying sites generally consisting of *Banksia ilicifolia – B. attenuata* woodlands, but *Melaleuca preissiana* woodlands and scrubs are also recorded. Occurs on Bassendean and Spearwood systems in the central Swan Coastal Plain north of Rockingham. Typically has very open understorey, and sites are likely to be seasonally waterlogged[2].	Priority 3(iii)	A component of 'Banksia Woodlands of the Swan Coastal Plain ecological community' (Endangered TEC)
45	Walyungup Microbial	Brackish microbial community number 1 (Lake Walyungup)	Microbial community formed in Lake Walyungup, Rockingham. Data required about status and composition.	Priority 1	
58	Casuarina obesa association	*Casuarina obesa* association	Thomas Rd to Serpentine River, Swan Coastal Plain. No detailed information to assess if distinct community.	Priority 1	
76	Dunsborough Forest Swamp	*Corymbia calophylla, Melaleuca rhaphiophylla, Banksia littoralis, Eucalyptus rudis, Agonis flexuosa low open forest with seasonal subsoil moisture of the Dunsborough area*	*Corymbia calophylla, Agonis flexuosa, Banksia littoralis, Melaleuca rhaphiophylla* low open forest over *Viminea juncea, Jacksonia furcellata* tall open shrubland over *Xanthorrhoea preissii, Pericalymma elliptica* shrubland over *Hibbertia* spp., *Astroloma pallidum*[3], open low heath over *Hypolaena pubescens, Mesomelaena tetragona, Lepidosperma* spp. dense sedges over *Amphipogon* and *Thysanotus* spp. open herbs. The community occurs on sandy loam soils at the southern tip of the Swan Coastal Plain.	Priority 1	
94	Elongate Fluviatile Delta System	Elongate fluviatile delta system	Peel Harvey system, the site appears to contain common vegetation types on an unusual substrate, may not meet the criteria for TECs.	Priority 1	
103	*Eucalptus rudis*, Marri and Peppermint Forest	*Eucalyptus rudis, Corymbia calophylla, Agonis flexuosa* Closed Low Forest (near Busselton)	A low-lying Spearwood Dune plant community associated with shallow sandy soils over Tamala limestone that in places is exposed at the surface. The plant community on these soils supports a unique mixture of wetland and upland flora. Typically, low forest dominated by *Eucalyptus rudis, Eucalyptus calophylla, Agonis flexuosa* over a diverse understorey including *Hibbertia hypericoides, Logania vaginalis, Conospermum caeruleum, Agrostocrinum hirsutum* and *Lomandra micrantha.* Other associated species include *Eucalyptus decipiens, Melaleuca rhaphiophylla, Banksia littoralis, Hakea varia* and the sedge species *Baumea juncea* and *Gahnia trifida.*	Priority 1	
140	Government House Lake Microbial	Hypersaline microbial community 1 (Government House Lake, Rottnest)		Priority 2	
189	Living microbial mats in hypersaline ponds	Living microbial mats in hypersaline ponds	Extant hypersaline pond stromatolitic 'Conophyton' like unlithified communities formed with little sediment incorporation by (?) *Phormidium hypersalinum* (Pamelup Pond, Lake Preston, Yalgorup).	Priority 2	
207	Rottnest Island Microbial - Garden	Microbialites and microbial mats of coastal hypersaline lakes (Rottnest Island); Garden Lake		Priority 1	
208	Rottnest Island Microbial - Herschel	Microbialites and microbial mats of coastal hypersaline lakes (Rottnest Island); Herschel Lake		Priority 1	

[2] This is floristic community type 22 in Gibson *et al.* (1994). Although it is 'seasonally waterlogged', Gibson *et al.* (1994) and Department of Environment and Conservation (2012) did not identify it as a wetland ecological community. Florabase (Western Australian Herbarium 1998–) notes that *Banksia ilicifolia* is found on "consolidated dunes or low-lying flats".

[3] More recently named *Styphelia pallida*.

Item	Community identifier	Community name	Summary description	WA category	National listing (EPBC Act)
209	Rottnest Island Microbial - Baghdad	Microbialites and microbial mats of coastal hypersaline lakes (Rottnest Island); Lake Baghdad		Priority 1	
210	Rottnest Island Microbial - Timperley	Microbialites and microbial mats of coastal hypersaline lakes (Rottnest lakes); Lake Timperley		Priority 1	
211	Rottnest Island Microbial - Vincent	Microbialites and microbial mats of coastal hypersaline lakes (Rottnest lakes); Lake Vincent		Priority 1	
212	Rottnest Island Microbial - Serpentine	Microbialites and microbial mats of coastal hypersaline lakes (Rottnest lakes); Serpentine Lake		Priority 1	
283	Relictual White Mangrove Community	Relictual White Mangrove Community (Leschenault Inlet)	May not be considered a separate community type as is possibly a geographic outlier.	Priority 1	
295, 296, 297	Seasonal clay wetlands of the SW (groups 1-3)	Seasonal rainfall filled wetlands with impeding substrate of the Swan Coastal Plain and Jarrah Forest in transitional rainfall zones (previously 'Claypans of the Swan Coastal Plain')	This listing encompasses Claypan Group 1, 2 and 3 (as defined by Gibson *et al*. 2005: Threatened plant communities of Western Australia. 2 The seasonal clay-based wetland communities of the South West. Pacific Conservation Biology 11:287-301) that are included under the EPBC-listed TEC and are not listed as a TEC at the State level. Floristic community types 7, 8, 9, and 10a (as defined in Gibson *et al*. 1994; A floristic survey of the southern Swan Coastal Plain) are also part of the synonymous EPBC-listed claypan TEC but those claypans have existing State TEC status.	Priority 1	Synonymous with sub-types of 'Clay Pans of the Swan Coastal Plain' (Critically Endangered TEC)
314	Coastal saltmarsh	Subtropical and Temperate Coastal Saltmarsh	"Consists of the assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23oS latitude). It occurs on the coastal margin, along estuaries and coastal embayments and on low wave energy coast in places with at least some tidal connection, including rarely-inundated supratidal areas, intermittently opened or closed lagoons, and groundwater tidal influences. The community occurs on sandy or muddy substrate and may include coastal clay pans and similar habitats. It consists of dense to patchy areas of characteristic coastal saltmarsh plant species that include salt-tolerant herbs, succulent shrubs or grasses, and may also include bare sediment as part of the mosaic. It can occur where the proportional cover by tree canopy such as mangroves, Melaleucas, or Casuarinas or seagrass is not greater than 50%. The description, area and condition thresholds that apply to the EPBC-listed TEC of the same name, also apply to this Priority ecological community."	Priority 3(iii)	"Synonymous with 'Subtropical and Temperate Coastal Saltmarsh' (Vulnerable TEC)"
317	Whicher Scarp Paluslope Wetlands	Swan Coastal Plain Paluslope Wetlands	These wetlands are very wet all year round and are associated with areas of groundwater seepage from the sandy low hills at the base of the Whicher Scarp. At times these wetlands are contiguous with areas of Pinjarra Plain wetlands, and the wetlands of the two landforms merge. Combinations of the following species are typically found in the type: *Melaleuca preissiana, Taxandria linearifolia, Taxandria fragrans, Melaleuca incana,* and *Cyathochaeta teretifolia.* Other species include: *Eucalyptus patens, Homalospermum firmum, Gahnia decomposita, Callistachys lanceolata, Hakea linearis, Melanostachya ustulata, Evandra aristata, Beaufortia sparsa, Callistemon glaucus* and *Pultenaea pinifolia*[4].	Priority 1	
377	Wooded waterbird wetlands	Wooded wetlands that support colonial waterbird nesting areas	Chandala, Booragoon Lake, unnamed wetland near Pinjarra, McCarleys Swamp. This type differs from the listed 'Perched wetlands of the Wheatbelt region with extensive stands of *Casuarina obesa* and *Melaleuca strobophylla'* ('Toolibin-type' wetlands) in that the Wheatbelt type is Casuarina, rather than Melaleuca dominated. Also, Toolobin Lake type is now brackish-saline (formerly fresh-brackish), whereas this type are currently fresh-brackish.	Priority 2	

[4] More recently named *Loricobbia pinifolia*.

Table E3 lists the terrestrial (non-wetland) threatened ecological communities (TECs) of the Swan Coastal Plain (SCP) that are recognised under the EPBC Act and the BC Act, noting that these communities are not wetland-related but may overlap with some wetlands on the SCP.

The references used to identify the terrestrial TECs include:

- Department of Biodiversity, Conservation and Attractions 2025, *Threatened ecological communities list – November 2025*. Available at: <www.dbca.wa.gov.au/wildlife-and-ecosystems/threatened-ecological-communities/list-threatened-ecological-communities>. (Accessed: 22 March 2026).
- Department of Climate Change, Energy, the Environment and Water undated, *Species Profile and Threats Database: Swan Coastal Plain [Search result]*, Australian Government. Viewed at <www.environment.gov.au/cgi-bin/sprat/public/spratlookupcommunity.pl?name=Swan+coastal+plain&searchtype=wildcard> on 22 March 2026.
- Department of Climate Change, Energy, the Environment and Water undated, *Species Profile and Threats Database: Western Australian ecological communities [Search result]*, Australian Government. Viewed at <www.environment.gov.au/cgi-bin/sprat/public/publicreports.pl?proc=community>.
- Gibson N, Keighery B, Keighery G, Burbidge A and Lyons M 1994, *A floristic survey of the Southern Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.). Available at: <https://library.dbca.wa.gov.au/FullTextFiles/001217.pdf>. (Accessed 22 March 2026).

Notes:

- Table E3 is adapted from the *Threatened ecological communities list – November 2025* (Department of Biodiversity, Conservation and Attractions 2025).

Table E3 – Existing terrestrial (not wetland) threatened ecological communities of the Swan Coastal Plain

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
Banksia Woodlands of the Swan Coastal Plain	Endangered	Commonly a component of Banksia Woodlands of the Swan Coastal Plain ecological community (Endangered)	*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20b as originally described in Gibson *et al*. 1994)	Critically endangered	CR B1a(iii)	Schedule 1, Division 1, item 11	SCP20b	The community is found on a range of soil and landform units at the base of the Darling Scarp that are described in Churchward and McArthur (1978) The landforms and soils of the Darling System (Division of Land Resources Management, CSIRO, Perth, Western Australia). The community occurs largely on the Forrestfield unit (Ridge Hill Shelf), Guildford unit or at the confluence of Guildford with Forrestfield, but also occurs on the Southern River unit. The community is generally very species rich. Most occurrences of this community type are *Eucalyptus marginata – Banksia attenuata* woodlands but *Banksia* woodlands and heaths are also found, with *Mesomelaena pseudostygia, Morelotia octandra, Banksia dallanneyi* (couch honeypot), *Desmocladus fasciculatus*, and *Chamaescilla corymbosa* (blue squill) being common in the understorey. The community is also known as 'floristic community type 20b' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Jarrah Forest, Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
			Banksia attenuata woodlands over species rich dense shrublands (floristic community type 20a as originally described in Gibson *et al.* 1994)	Critically endangered	CR B1a(i),b	Schedule 1, Division 1, item 12	SCP20a	The community has been recorded from sands near Koondoola and Banksia Grove, and at the base of the Darling Scarp between Wannamal and Maddington. This community is generally very species rich. It is usually dominated by *Banksia attenuata* (slender banksia), occasionally with *Eucalyptus marginata* (jarrah) with *Bossiaea eriocarpa* (common brown pea), *Conostephium pendulum* (pearl flower), *Hibbertia huegelii, Hibbertia hypericoides* (yellow buttercups), *Petrophile linearis* (pixie mops), *Scaevola repens, Stirlingia latifolia* (blueboy), *Mesomelaena pseudostygia* and *Alexgeorgea nitens* being common in the understorey. The community is also known as 'floristic community type 20a' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	
***Corymbia calophylla - Kingia australis* woodlands on heavy soils of the Swan Coastal Plain**	Endangered	N/A	*Corymbia calophylla* – *Kingia australis* woodlands on heavy soils (floristic community type 3a as originally described in Gibson *et al*. 1994)	Critically endangered	CR B1b	Schedule 1, Division 1, item 17	SCP3a	The community has been recorded from heavy soils of the eastern side of the southern Swan Coastal Plain largely between Capel and Chittering. Typical native taxa in the community are the tree Corymbia calophylla (marri), the shrubs *Banksia dallanneyi* (couch honeypot), *Philotheca spicata* (pepper and salt), *Kingia australis* (kingia) and *Xanthorrhoea preissii* (balga), and the herbs, rushes and sedges *Cyathochaeta avenacea*, *Dampiera linearis* (common dampiera), *Haemodorum laxum*, *Desmocladus fasciculatus*, *Mesomelaena tetragona* (semaphore sedge) and *Morelotia octandra*. The community is also known as 'floristic community type 3a' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Jarrah Forest, Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
***Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain**	Endangered	N/A	*Corymbia calophylla* — *Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in Gibson *et al.* 1994)	Endangered	EN A3 EN B1a(ii),b B2a(ii),b	Schedule 1, Division 2, item 02	SCP3c	The community occurs on heavy soils of the eastern side of the southern Swan Coastal Plain, generally between Bullsbrook and Stratham. The community is usually dominated by *Corymbia calophylla* (marri) and *Xanthorrhoea preissii* (balga). It also occasionally includes Eucalyptus wandoo (wandoo). The more common shrubs include *Gompholobium marginatum, Hypocalymma angustifolium* (white myrtle) and *Banksia dallanneyi* (couch honeypot), with herbs, grasses and sedges including *Burchardia congesta* (milkmaids), *Cyathochaeta avenacea, Neurachne alopecuroidea* (foxtail mulga grass), *Caesia micrantha* (pale grass-lily), *Mesomelaena tetragona* (semaphore sedge), *Morelotia octandra, Desmocladus flexuosus, Opercularia vaginata* (dog weed), *Sowerbaea laxiflora* (purple tassels), *Lepidosperma* spp. and *Drosera menziesii* (pink rainbow) also common. The community is also known as 'floristic community type 3c' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Jarrah Forest, Swan Coastal Plain	
Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion	Critically endangered	N/A	*Melaleuca huegelii – M. systena* shrublands of limestone ridges (floristic community type 26a as originally described in Gibson *et al*. 1994)	Critically endangered	CR B1b	Schedule 1, Division 1, item 25	SCP26a	The community is known from shallow soils over limestone or massive limestone ridges of Tamala Limestone between Yanchep north of Perth, and south of Perth near Lake Clifton. The community generally comprises species-rich thickets, heaths and scrubs dominated by *Melaleuca huegelii* (chenille honeymyrtle), *Melaleuca systena* (coastal honeymyrtle) and *Banksia sessilis* (parrot bush), commonly over *Grevillea preissii* (spider net grevillea), *Spyridium globulosum* (basket bush), and *Acacia lasiocarpa* (pajang). A suite of herbs commonly occurs under the shrub layer. The community is also known as 'floristic community type 26a' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	
Shrublands and Woodlands of the eastern Swan Coastal Plain	Endangered	N/A	Shrublands and woodlands of the eastern	Critically endangered	CR B1a(i),(iii),b, B2a(i),(iii),b	Schedule 1, Division 1, item 36	SCP20c	The community occurs mainly on the transitional soils of the Ridge Hill Shelf, on the Swan Coastal Plain adjacent to the Darling Scarp, but also extends marginally onto the alluvial clays deposited on the eastern fringe of the Swan	Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
			side of the Swan Coastal Plain (floristic community type 20c as originally described in Gibson *et al*. 1994)					Coastal Plain. It has been recorded between Stratton and Maddington. It generally comprises a shrubland or woodland of *Banksia attenuata* (slender banksia) and *Banksia menziesii* (firewood banksia), sometimes with *Allocasuarina fraseriana* (western sheoak), over a shrub layer that can include the species *Adenanthos cygnorum* (woolybush), *Hibbertia huegelii*, *Scaevola repens* var. *repens* (fan flower), *Allocasuarina humilis* (dwarf sheoak), *Bossiaea eriocarpa* (common brown pea), *Hibbertia hypericoides* (yellow buttercups) and *Stirlingia latifolia* (blueboy). A suite of herbs including *Conostylis aurea* (golden conostylis), *Trachymene pilosa* (native parsnip), Lomandra hermaphrodita, *Burchardia congesta* (milkmaids) and *Patersonia occidentalis* (purple flag), and the sedges *Mesomelaena pseudostygia* (semaphore sedge) and *Lyginia barbata* usually occur in the community. The community is also known as 'floristic community type 20c' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).		
Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain	Critically endangered	N/A	Not listed	Not listed	N/A	N/A	N/A	N/A	Swan Coastal Plain	While this TEC mainly occurs where soils are sandy and well drained, it can also occur in other areas such as on protected swales, saline and freshwater wetlands, close to river banks and on limestone slopes (Keighery *et al*. 2002; Keighery 2002, in Department of the Environment

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
										and Energy 2019).
Not listed	N/A	N/A	*Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the Swan Coastal Plain (floristic community type 30a as originally described in Gibson *et al*. 1994)	Critically endangered	CR B1b	Schedule 1, Division 1, item 14	SCP30a	The community is located on calcareous sandy soils of the Quindalup Dunes generally occurring between Trigg and Point Peron and on the Swan River in Peppermint Grove. The community also occurs on Garden Island and Rottnest Island. Typical and common native taxa in the community are: *Callitris preissii* (Rottnest Island pine), *Melaleuca lanceolata* (Rottnest teatree), *Spyridium globulosum* (basket bush), *Acanthocarpus preissii*, *Rhagodia baccata* (berry saltbush), *Austrostipa flavescens* and *Trachymene pilosa* (native parsnip). The community is also known as 'floristic community type 30a' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	
Not listed	N/A	N/A	*Corymbia calophylla* — *Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain (floristic community type 3b as originally described in Gibson *et al*. 1994)	Endangered	EN A3 EN B1b, B2b	Schedule 1, Division 2, item 01	SCP3b	The community is known from the eastern side of the Swan Coastal Plain largely between Wannamal and Dunsborough. Most occurrences of the community are dominated by both *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah) with additional common taxa comprising low shrubs, sedges, grasses and herbs. These include *Bossiaea eriocarpa* (common brown pea), *Conostylis juncea, Hibbertia hypericoides* (yellow buttercups), *Morelotia octandra, Chamaescilla corymbosa* (blue squill), *Desmocladus fasciculatus, Banksia dallanneyi* (couch honeypot), *Mesomelaena tetragona* (semaphore sedge), *Babingtonia camphorosmae* (camphor myrtle), *Lepidosperma squamatum, Neurachne alopecuroidea* (foxtail mulga grass), *Philotheca spicata* (pepper and salt), *Burchardia congesta* (milkmaids), *Caesia micrantha* (pale grass-lily), *Kingia australis* (kingia), *Drosera erythrorhiza* (red ink sundew), *Lomandra hermaphrodita* and *Caladenia flava* (cowslip orchid). The community is also known as 'floristic community type 3b' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Jarrah Forest, Swan Coastal Plain	

EPBC Act TEC name	EPBC Act category	BC Act TEC (WA) notes related to EPBC Act TECs	BC Act TEC name (WA)	BC Act category (WA)	WA listing criteria met (IUCN red list of ecosystems)	Item (WA)	Community identifier (WA)	Summary description (WA)	IBRA bioregions	Notes
Not listed	N/A	N/A	*Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain (floristic community type 1b as originally described in Gibson *et al*. 1994)	Critically endangered	CR B1a(ii),(iii),b	Schedule 1, Division 1, item 18	SCP1b	The community has been recorded from heavy fertile soils of the southern Swan Coastal Plain south of Dardanup. It consists largely of *Corymbia calophylla* (marri) forests and woodlands. *Eucalyptus marginata* (jarrah) is also common in the tree layer. Common understorey species include *Acacia extensa* (wiry wattle), *Gompholobium polymorphum*, *Billardiera variifolia*, *Hibbertia hypericoides* (yellow buttercups), *Hypocalymma angustifolium* (white myrtle) and *Xanthorrhoea preissii* (balga) over a rich herb layer including *Scaevola calliptera, Agrostocrinum scabrum* (blue grass lily), *Austrostipa semibarbata, Dampiera linearis* (common dampiera), *Mesomelaena tetragona* (semaphore sedge), *Morelotia octandra and Lomandra purpurea* (purple mat rush). The community is also known as 'floristic community type 1b' as originally described in Gibson N., Keighery B.J., Keighery G.J., Burbidge A.H. and Lyons M.N. (1994) *A floristic survey of the southern Swan Coastal Plain* (unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.)).	Swan Coastal Plain	
Not listed	N/A	N/A	Vegetation alliances on ridges and slopes of the chert hills of the Coomberdale floristic region	Critically endangered	CR B1a(iii),b	Schedule 1, Division 1, item 45	Coomberdale chert hills	The community occurs on ridges and slopes of the chert hills of the Coomberdale floristic region. It was originally described in Griffin E.A. (1992) Floristic survey of remnant vegetation in the Bindoon to Moora area, Western Australia (Resource Management Technical Report 142, Department of Agriculture, Western Australia). It encompasses seven vegetation alliances including the core units and three vegetation alliances of the buffer units of the Coomberdale Chert community. Core vegetation alliances include *Allocasuarina campestris* (sheoak) shrubland, *Allocasuarina microstachya* scrub, *Regelia megacephala* (priority 4) shrubland, *Kunzea praestans* shrubland and scrub, *Melaleuca calyptroides* heath, *Hibbertia subvaginata* shrubland and *Xanthorrhoea drummondii* shrubland.	Avon Wheatbelt, Geraldton Sandplains, Swan Coastal Plain	

Attachment F – Wetland fauna of the Swan Coastal Plain

Table F1 summarises the wetland fauna of the Swan Coastal Plain.

The following references were used in Table F1 to confirm the fauna species is associated with the wetlands of the Swan Coastal Plain:

1. Department of Climate Change, Energy, the Environment and Water 2025, *Protected Matters Search Tool report for drawn area search of the Swan Coastal Plain IBRA region*. Viewed at: <https://pmst.environment.gov.au> on 12 November 2025.
2. Biodiversity Information Office 2026, *Species search – Swan Coastal Plain Perth (IBRA regions), Swan Coastal Plain Dandaragan Plateau (IBRA Regions) (Dandjoo)*. Viewed at: <https://bio.wa.gov.au/dandjoo> on 22 March 2026.
3. Storey AW, Vervest RM, Pearson GB & Halse SA 1993, *Wetlands of the Swan Coastal Plain,* Volume 7 Waterbird usage of wetlands on the Swan Coastal Plain. Available at: <www.bennelongia.com.au/wp-content/uploads/2012/11/wetlands_vol_7_storey_etal_1993.pdf>. (Accessed: 22 March 2026).
4. Storr GM & Johnstone RE 1988, *Birds of the Swan Coastal Plain and adjacent seas and islands*, Western Australian Museum, Perth. Available at: <https://museum.wa.gov.au/sites/default/files/1.%20Storr,%20Johnstone.pdf>. (Accessed: 22 March 2026).
5. International Union for Conservation of Nature (IUCN) 2026, *IUCN Red List search page*. Viewed at: <www.iucnredlist.org> on 22 March 2026.
6. Morgan DL, Beatty SJ, Klunzinger MW, Allen M & Burnham Q 2011, *A field guide to freshwater fishes, crayfishes & mussels of south western Australia*, Perth. <www.researchgate.net/publication/229150802_A_Field_Guide_to_Freshwater_Fishes_Crayfishes_Mussels_of_South_Western_Australia> . (Accessed: 22 March 2026).
7. Department of Water and Environmental Regulation 2026, *Healthy rivers south-west, Fauna biodiversity*. Viewed at: <https://rivers.dwer.wa.gov.au/southwest/fauna> on 22 March 2026.
8. Western Australian Museum undated(b), *Southwest – Swan Coastal Plain frogs*. Viewed at: <https://museum.wa.gov.au/explore/frogwatch/regions/southwest/swan-coastal-plain> on 22 March 2026.
9. Davis JA and Christidis F 1997, *A guide to wetland invertebrates of southwestern Australia*, Western Australian Museum for the Urban Water Research Association of Australia, Perth. This reference identifies species found on the Swan Coastal Plain.
10. van Looij, E 2009, 'WA AUSRIVAS macroinvertebrate sampling field sheet' in *WA AUSRIVAS sampling and processing manual*, Water Science Technical Series Report No. 13, Department of Water, Western Australia. Available at: <www.wa.gov.au/system/files/2023-03/Western-Australia-Ausrivas-sampling-and-processing-manual.pdf>. (Accessed: 22 March 2026.)
11. Endersby I 2021, 'Swan Coastal Plain' in *The distribution of Australian dragonflies*, Busybird Publishing, Victoria. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/631852.pdf>. (Accessed: 22 March 2026.)
12. Theischinger G, Hawking J & Orr A 2021, *The complete field guide to dragonflies of Australia*, second edition, CSIRO Publishing, Victoria.
13. Menkhorst P and Knight F 2011, *A field guide to the mammals of Australia*, third edition, Oxford University Press, Melbourne.
14. Department of Environment and Conservation 2012, 'Wetland ecology', in *A guide to managing and restoring wetlands in Western Australia*, Prepared by J Lawn and A Lam, Department of Environment and Conservation, Perth, Western Australia. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/026262/026262.006.pdf>. (Accessed: 22 March 2026.)
15. Tyler MJ and Doughty P 2009, *Field guide to frogs of Western Australia*, fourth edition, Western Australian Museum, Perth.
16. Tyler MJ and Knight F 2020, *Field guide to the frogs of Australia*, second edition, CSIRO publishing, Victoria.
17. Menkhorst P, Rogers D, Clarke R, Davies J, Marsack P and Franklin K 2019, *The Australian bird guide*, revised edition, CSIRO Publishing, Victoria.
18. Horwitz P, Rogan R, Halse S, Davis J and Sommer B 2009a, Wetland invertebrate richness and endemism on the Swan Coastal Plain, Western Australia. Marine and Freshwater Research, 60(10), 1006-1020. Available at: <www.publish.csiro.au/mf/MF08204>. (Accessed: 22 March 2026.)

Abbreviations:

EPBC Act = *Environmental Protection and Biodiversity Conservation Act 1999* (Australian Government)

BC Act = *Biodiversity Conservation Act 2016* (Western Australia)

WA = Western Australia

[P] = priority species in Western Australia

[T] = threatened species

CR = Critically Endangered

E = Endangered

MI = Migratory species

VU = Vulnerable

CD = Species of special conservation interest (conservation dependent)

OS = Species otherwise in need of special protection (other specially protected)

Y = Yes

Notes:

- The response to question 3b in the main body of the nomination form includes additional references.
- The following reference was used to update the species and common names of birds that were not listed in the *Protected Matters Search Tool*: BirdLife Australia 2022, *The BirdLife Australia working list of Australian birds; version 4.3.* Available at: <https://birdata.birdlife.org.au/taxonomy-25>. (Accessed: 22 March 2026).
- Bird guides for various wetland locations were used to confirm the list of terrestrial birds found in wetland habitats: Birdlife Australia 2026, 'Bird guides' in *Birdlife WA – our publications*. Viewed at: <https://birdlife.org.au/news/birdlife-wa-our-publications> on 22 March 2026.
- The following references were used to identify the threatened and priority fauna species:
    - Department of Climate Change, Energy, the Environment and Water 2025, *Protected Matters Search Tool report for drawn area search of the Swan Coastal Plain IBRA region*. Viewed at: <https://pmst.environment.gov.au> on 12 November 2025.
    - Department of Biodiversity, Conservation and Attractions 2025, *Threatened and priority fauna list – July 2025*, Department of Biodiversity, Conservation and Attractions, Perth. Available at: <www.dbca.wa.gov.au/management/threatened-species-and-communities>. (Accessed: 22 March 2026.)
- Threatened species are identified by the Australian Government under the *Environmental Protection and Biodiversity Conservation Act 1999* and the Western Australian Government under the *Biodiversity Conservation Act 2016*. Priority species are identified by the Department of Biodiversity, Conservation and Attractions in Western Australia (WA). These are possibly threatened species that do not meet survey criteria or that are not adequately defined (priorities 1, 2 and 3). These three categories are ranked in order of priority for survey, and evaluation of conservation status, so that consideration can be given to their declaration as threatened species. Species that are adequately known and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened species list, are placed in priority 4. Priority species cannot be listed under the *Biodiversity Conservation Act 2016*.
- The information in the 'simple presence' and 'presence text' columns is from the *Protected Matters Search Tool* search results (Department of Climate Change, Energy, the Environment and Water 2025).
- Reference 18 (Horwitz *et al*. 2009a) reported 520 aquatic invertebrate taxa from 176 families or higher-order taxonomic levels on the Swan Coastal Plain. The full list of taxa is provided in Table A1 of Horwitz *et al.* (2009a), which is available as an accessory publication. A copy of this table is likely to be available, but it was not located prior to submission of the nomination.
- The Noongar names were sources from:
    - Abbott I 2001, 'Aboriginal names of mammal species in south west Western Australia' in *CALM Science*, vol 3(4), pp. 433-486. Available at: <www.researchgate.net/publication/286990758_Aboriginal_names_of_mammals_species_in_south-west_Western_Australia>. (Accessed: 22 March 2026.) See Abbott (2001) for the full list of names; only the recommended names are included in this attachment.
    - ——2009, 'Aboriginal names of bird species in south-west Western Australia, with suggestions for their adoption into common usage', *Conservation Science Western Australia*, vol 7(3), pp. 213-278. Available at: <https://library.dbca.wa.gov.au/Journals/080559/080559-07.015.pdf>. (Accessed: 22 March 2026.) See Abbott (2009) for the full list of names; only the recommended names are included in this attachment.
    - Hill AL 2013, *Sharing sweet water: Culture and the wise use of wetlands in Western Australia*, Thesis for Doctor of Philosophy (PhD), Murdoch University, Perth. Available via : <www.academia.edu/121119999/Sharing_sweet_water_Culture_and_the_wise_use_of_wetlands_in_Western_Australia>. (Accessed: 22 March 2026.)
    - >. (Accessed: 22 March 2026.)
    - Perth NRM 2015, *Traditional ecological knowledge*, Perth NRM, Perth. Available at: <www.perthnrm.com/nrmwp/wp-content/uploads/2020/03/Traditonal-Ecological-Knowledge-By-Noongar-Names-Jan-2016.pdf>. (Accessed: 22 March 2026.)
    - ——undated, *Traditional ecological knowledge of Forrestdale Lake*. Available at: <www.perthnrm.com/nrmwp/wp-content/uploads/2020/03/Forrestdale-Lake-Traditional-Ecological-Database.pdf>.

Table F1 – Wetland fauna of the Swan Coastal Plain

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Birds							
Migratory birds[1] (wetland-dependent; migratory; mainly the lake, sumpland, river, floodplain and estuary - peripheral wetland types)							
Common Sandpiper	*Actitis hypoleucos*	1, 2, 3, 4, 17	MI	MI		Known	Species or species habitat known to occur within area
Ruddy Turnstone	*Arenaria interpres* [T]	1, 2, 3, 4, 17	MI, VU	MI		Known	Roosting known to occur within area
Sharp-tailed Sandpiper	*Calidris acuminata* [T]	1, 2, 3, 4, 17	MI, VU	MI		Known	Roosting known to occur within area
Sanderling	*Calidris alba*	1, 2, 4, 17	MI	MI		Known	Roosting known to occur within area
Red Knot, Knot	*Calidris canutus* [T]	1, 2, 3, 4, 17	MI, VU	EN		Known	Species or species habitat known to occur within area
Broad-billed Sandpiper	*Calidris falcinellus*	1, 2, 4, 17	MI	MI		Known	Roosting known to occur within area
Curlew Sandpiper	*Calidris ferruginea* [T]	1, 2, 3, 4, 17	MI, CR	CR		Known	Species or species habitat known to occur within area
Pectoral Sandpiper	*Calidris melanotos*	1, 2, 3, 4, 17	MI	MI		Known	Species or species habitat known to occur within area
Ruff	*Calidris pugnax*	1, 2, 4, 17	MI	MI		Known	Roosting known to occur within area
Red-necked Stint	*Calidris ruficollis*	1, 2, 3, 4, 17	MI	MI		Known	Roosting known to occur within area
Long-toed Stint	*Calidris subminuta*	1, 2, 3, 4, 17	MI	MI		Known	Roosting known to occur within area
Great Knot	*Calidris tenuirostris* [T]	1, 2, 3, 4, 17	MI, VU	CR		Known	Roosting known to occur within area
Double-banded Plover	*Charadrius bicinctus*	1, 2, 4, 17	MI	MI		Known	Roosting known to occur within area
Little Ringed Plover[2]	*Charadrius dubius*	1, 4	MI	MI		Known	Roosting known to occur within area
Greater Sand Plover	*Charadrius leschenaultii* [T]	1, 2, 4, 17	MI, VU	VU		Known	Species or species habitat known to occur within area
Lesser Sand Plover	*Charadrius mongolus* [T]	1, 2, 4, 17	MI, EN	EN		Known	Roosting known to occur within area
Latham's Snipe[3]	*Gallinago hardwickii* [T]	2	MI, VU	MI		-	-
Swinhoe's Snipe[4]	*Gallinago megala*	1	MI	MI		Likely	Roosting likely to occur within area
Pin-tailed Snipe[5]	*Gallinago stenura*	1, 2, 4	MI	MI		Likely	Roosting likely to occur within area
Caspian Tern	*Hydroprogne caspia*	1, 2, 3, 4, 17	MI	MI		Known	Foraging, feeding or related behaviour known to occur within area
Bar-tailed Godwit	*Limosa lapponica*	1, 2, 3, 4, 17	MI	MI		Known	Species or species habitat known to occur within area
Bar-tailed Godwit (Western Alaskan)	*Limosa lapponica baueri* [T]	-	EN	VU			
Bar-tailed Godwit (Northern Siberian)	*Limosa lapponica menzbieri* [T]	-	EN	CR			
Black-tailed Godwit	*Limosa limosa* [T]	1, 2, 3, 4, 17	MI, EN	MI		Known	Roosting known to occur within area
Far Eastern Curlew, Widjonong*	*Numenius madagascariensis* [T]	1, 2, 4, 17	MI, CR	CR		Known	Species or species habitat known to occur within area
Little Curlew	*Numenius minutus*	1, 2, 4	MI	MI		Likely	Roosting likely to occur within area
Whimbrel	*Numenius phaeopus*	1, 2, 4, 17	MI	MI		Known	Roosting known to occur within area
Bridled Tern	*Onychoprion anaethetus*	1, 2, 4, 17	MI	MI		Known	Breeding known to occur within area
Eastern Osprey, Yoondoordo*	*Pandion haliaetus*	1, 2, 3, 4, 17	MI	MI		Known	Breeding known to occur within area
Glossy Ibis[6]	*Plegadis falcinellus*	2, 3, 4, 17	MI	MI			
Pacific Golden Plover	*Pluvialis fulva*	1, 2, 4, 17	MI	MI		Known	Roosting known to occur within area
Grey Plover	*Pluvialis squatarola* [T]	1, 2, 3, 4, 17	MI, VU	MI		Known	Roosting known to occur within area
Common Tern[7]	*Sterna hirundo*	2, 4, 17	MI	MI			
Little Tern	*Sternula albifrons* [T]	1, 2, 4	MI, VU	MI		May	Species or species habitat may occur within area
Greater Crested Tern[8]	*Thalasseus bergii*	2, 3, 4, 17	MI	MI			

[1] The response to **question 3b** under the sub-heading 'Key fauna – sources of information' names some of the key wetlands for migratory birds.
[2] Very infrequent visitor
[3] Very infrequent visitor
[4] Very infrequent visitor
[5] Very infrequent visitor
[6] Known in wetlands on the Swan Coastal Plain and listed as a migratory species under the EPBC Act, but it was not recorded in the Protected Matters Search Tool search results.
[7] Very infrequent visitor. Known in wetlands on the Swan Coastal Plain and listed as a migratory species under the EPBC Act, but it was not recorded in the Protected Matters Search Tool search results.
[8] Known in wetlands on the Swan Coastal Plain and listed as a migratory species under the EPBC Act, but it was not recorded in the Protected Matters Search Tool search results.

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Grey-tailed Tattler	*Tringa brevipes* [P]	1, 2, 4, 17	MI	MI	4	Known	Roosting known to occur within area
Wood Sandpiper	*Tringa glareola*	1, 2, 3, 4, 17	MI	MI		Known	Roosting known to occur within area
Common Greenshank	*Tringa nebularia* [T]	1, 2, 3, 4, 17	MI, EN	MI		Known	Species or species habitat known to occur within area
Marsh Sandpiper	*Tringa stagnatilis*	1, 2, 3, 4, 17	MI	MI		Known	Roosting known to occur within area
Common Redshank[9]	*Tringa totanus*	1, 4	MI	MI		Known	Roosting known to occur within area
Terek Sandpiper	*Xenus cinereus* [T]	1, 2, 4, 17	MI, VU	MI		Known	Roosting known to occur within area
Birds (other wetland-dependent)							
Western Australian Reed-warbler, Koordjikotji*	*Acrocephalus australis gouldi*	2, 3, 4, 17					
Chestnut Teal[10], Ngwoolnakerong*	*Anas castanea*	2, 3, 4, 17					
Grey Teal, Kalyong*	*Anas gracilis*	2, 3, 4, 17					
Pacific Black Duck, Yet*, Ngoonana*, Bandji*, Ngwonana*, Wommainya*, Gwoomnana*, Yerderap*[11]	*Anas superciliosa*	2, 3, 4, 17					
Australian Darter, Mimal*	*Anhinga novaehollandiae novaehollandiae*	2, 3, 4, 17					
White-necked Heron, Djilimilyan*, Koondji*, Nanto*	*Ardea pacifica*	2, 3, 4, 17					
Hardhead, Erooto*	*Aythya australis*	2, 3, 4, 17					
Musk Duck, Kodara*, Koodjak*, Yerderap*	*Biziura lobata*	2, 3, 4, 17					
Australian Little Bittern	*Botaurus dubius* [P]	2, 3, 4, 17			4		
Australasian Bittern, Boordenitj*	*Botaurus poiciloptilus* [T]	1, 2, 3, 4, 17	EN	EN		Known	Species or species habitat known to occur within area
Cattle Egret	*Bubulcus ibis*	2, 3, 4, 17					
Recherche Cape Barren Goose[12], Cape Barren Goose (south-western)	*Cereopsis novaehollandiae grisea* [T]	2, 4, 17	VU	VU			
Hooded Plover	*Charadrius cucullatus* [P]	2, 4, 17			4		
Red-capped Plover	*Charadrius ruficapillus*	2, 3, 4, 17					
Australian Wood Duck, Maranganna*, Boota*, Yerderap*	*Chenonetta jubata*	2, 3, 4, 17					
Whiskered Tern	*Chlidonias hybrida*	2, 3, 4, 17					
Swamp Harrier, Djilyoordo*, Dilyurdu*	*Circus approximans*	2, 3, 4, 17					
Banded Stilt	*Cladorhynchus leucocephalus*	2, 3, 4, 17					
Black Swan, Maali*, Koltjak*, Marli*, Wilar*, Wanar*, Woorotho*, Kuljak*, Kowarduk*,	*Cygnus atratus*	2, 3, 4, 17					
Great Egret	*Egretta alba*	3, 4, 17					
Little Egret	*Egretta garzetta*	2, 3, 4, 17					
White-faced Heron, Wyan*, Boolong*, Jilimilyan*	*Egretta novaehollandiae*	2, 3, 4, 17					
Eastern Reef Egret	*Egretta sacra*	2, 3, 4, 17					
Black-fronted Dotterel, Nidoolyorong*	*Elseyornis melanops*[13]	2, 3, 4, 17					
Red-kneed Dotterel	*Erithrogonys cinctus*	3, 4, 17					

[9] Very infrequent visitor

[10] Very infrequent visitor

[11] The common Noongar name for ducks.

[12] Very infrequent visitor. The Dandjoo record lists *Cereopsis novaehollandiae*. This is likely to be *Cereopsis novaehollandiae grisea*, which is the subspecies found in Western Australia. This species was not recorded in the Protected Matters Search Tool search results but it was recorded in other references, including Dandjoo.

[13] This species is recognised as *Elseyornis melanops* in BirdLife Australia (2022) but is listed as *Charadrius melanops* in the *Dandjoo* database.

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Eurasian Coot, Kidjibroon*, Moolyawindo*, Moolya*, Windoo*, Gidjee-broon*	*Fulica atra*	2, 3, 4, 17					
Dusky Moorhen	*Gallinula tenebrosa*	2, 3, 4, 17					
Sooty Oystercatcher[14], Kwikan*, Boorgortbotong*	*Haematopus fuliginosus*	2, 4, 17					
Australian Pied Oystercatcher, Kornkorn*	*Haematopus longirostris*	2, 3, 4, 17					
White-bellied Sea-eagle, Djilyon*, Ngoolar*, Ngolar*, Chillion*, Jiir*	*Haliaeetus leucogaster*	2, 3, 4, 17					
Pied Stilt, Dit*, Djandjarok*, Djoka*	*Himantopus leucocephalus*	2, 3, 4, 17					
Buff-banded Rail, Kooli*	*Hypotaenidia philippensis*	2, 3, 4, 17					
Black Bittern[15], Wandjima*	*Ixobrychus flavicollis*	3, 4, 17			2[16]		
Silver Gull, Djidjinook*, Djiranger*	*Larus novaehollandiae*	2, 3, 4, 17					
Pink-eared Duck, Wimbin*, Yerderap*	*Malacorhynchus membranaceus*	2, 3, 4, 17					
Little Pied Cormorant, Kokoko*	*Microcarbo melanoleucos*	2, 3, 4, 17					
Nankeen Night Heron, Ngalganing*	*Nycticorax caledonicus*	2, 3, 4, 17					
Blue-billed Duck, Boodo*, Yerderap*	*Oxyura australis* [P]	2, 3, 4, 17			4		
Australian Pelican, Nerimba*, Boodelong*, Ngooloomberri*, Boodalang*, Nirimba*, Boodalan*	*Pelecanus conspicillatus*	2, 3, 4, 17					
Great Cormorant	*Phalacrocorax carbo*	2, 3, 4, 17					
Little Black Cormorant	*Phalacrocorax sulcirostris*	2, 3, 4, 17					
Great Pied Cormorant, Madi*	*Phalacrocorax varius*	2, 3, 4, 17					
Yellow-billed Spoonbill	*Platalea flavipes*	2, 3, 4, 17					
Royal Spoonbill	*Platalea regia*	2, 3, 4, 17					
Great Crested Grebe, Kali*	*Podiceps cristatus*	2, 3, 4, 17					
Hoary-headed Grebe, Wyooda*	*Poliocephalus poliocephalus*	2, 3, 4, 17					
Little Grassbird	*Poodytes gramineus*	2, 3, 4, 17					
Purple Swamphen, Kwilom*, Koolema*, Moolar*, Moolah*, Margt*	*Porphyrio porphyrio*	2, 3, 4, 17					
Australian Spotted Crake	*Porzana fluminea*	2, 3, 4, 17					
Red-necked Avocet, Yadjinkorong*	*Recurvirostra novaehollandiae*	2, 3, 4, 17					
Australian Painted Snipe[17]	*Rostratula australis* [T]	1, 2, 3, 4, 17	EN	EN		Known	Species or species habitat known to occur within area
Australasian Shoveler, Bardoongooba*	*Spatula rhynchotis*	2, 3, 4					
Australian Fairy Tern	*Sternula nereis nereis* [T]	1, 2, 3, 4, 17	VU	VU		Known	Foraging, feeding or related behaviour known to occur within area
Freckled Duck, Yerderap*	*Stictonetta naevosa*	2, 3, 4, 17					
Australasian Grebe, Ngoonan*	*Tachybaptus novaehollandiae*	2, 3, 4, 17					
Australian Shelduck, Koorak*, Kooraka*, Yerderap*	*Tadorna tadornoides*	2, 3, 4, 17					
Australian White Ibis	*Threskiornis moluccus*	2, 3, 4, 17					
Straw-necked Ibis	*Threskiornis spinicollis*	2, 3, 4, 17					
Black-tailed Native-hen, Ngalyan*, Belgarbedjal*	*Tribonyx ventralis*	2, 3, 4, 17					
Baillon's Crake	*Zapornia pusilla*	2, 3, 4, 17					
Spotless Crake, Warradja*	*Zapornia tabuensis*	2, 3, 4, 17					

[14] Infrequent visitor.

[15] Storr and Johnstone (1988) noted the Black Bitter was almost extinct on the Swan Coastal Plain.

[16] The Black Bittern (*Botaurus flavicollis australis*) (southwest subpopulation) is priority 2.

[17] Very infrequent visitor.

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Terrestrial birds (not wetland-dependent but found in wetland habitats[18])							
Yellow-rumped Thornbill, Djidbot*	*Acanthiza chrysorrhoa*	2, 4, 17					
Western Spinebill, Booldjit*	*Acanthorhynchus superciliosus*	2, 4, 17					
Collared Sparrowhawk, Djilildjili*, Minmin*, Koordop*	*Accipiter cirrocephalus*	2, 4, 17					
Brown Goshawk, Djildjil*, Matwelitj*, Koodjilarn*	*Accipiter fasciatus*	2, 4, 17					
Red Wattlebird, Wodjalok*, Djoongong*, Durdal*, Doongorok*, Djidero*	*Anthochaera carunculata*	2, 4, 17					
Western Wattlebird, Djoongong*	*Anthochaera lunulata*	2, 4, 17					
Wedge-tailed Eagle, Woldja*, Warlitj*, Warlik*, Warbako*, Yelka*, Waldja*, Walich*	*Aquila audax*	2, 4, 17					
Australian Ringneck, Dowarn*, Doomolok*	*Barnardius zonarius*	2, 4, 17					
Forest Red-tailed Black-Cockatoo, Karak*, Dirandi*, Yarbi*	*Calyptorhynchus banksii naso* [T]	1, 2, 4, 17	VU	VU		Known	Species or species habitat known to occur within area
Black-faced Cuckoo-shrike, Ngoolako*, Karebomdo*, Nulargo*	*Coracina novaehollandiae*	2, 4, 17					
Australian Raven (Western Australian Raven subspecies), Wodang*, Kwokom*, Karlo*, Wordung*	*Corvus coronoides perplexus*	2, 4, 17					
Grey Butcherbird, Wadowadong*, Wardawawt*	*Cracticus torquatus*	2, 4, 17					
Black-shouldered Kite	*Elanus axillaris*	2, 4, 17					
White-fronted Chat, Yabawilban*	*Epthianura albifrons*	2, 4, 17					
Brown Falcon, Kargyne*, Dondorn*, Gudjelan*	*Falco berigora*	2, 4, 17					
Nankeen Kestrel, Martiet*	*Falco cenchroides*	2, 4, 17					
Australian Hobby, Wowo*, Ngowerngo*	*Falco longipennis*	2, 4, 17					
Peregrine Falcon, Kwetolbo*, Moldern*, Kwetalbur*, beebara*	*Falco peregrinus*	2, 4, 17		OS			
Singing Honeyeater (South-western Singing Honeyeater subspecies), Dooromdorom*, Koolbot*	*Gavicalis virescens virescens*	2, 4, 17					
Western Gerygone (South-west Western Gerygone subspecies), Warylbodang*	*Gerygone fusca fusca*	2, 4, 17					
Magpie-lark, Dilabot*, Byoolkolyedi*, Koolyibarak*	*Grallina cyanoleuca*	2, 4, 17					
Australian Magpie (South-western Australian Magpie subspecies), Koorbat*, Koorbardi*, Koorbardo*, Gurbal*, Kulbardie*	*Gymnorhina tibicen dorsalis*	2, 4, 17					
Whistling Kite, Djando*, Jandu*	*Haliastur sphenurus*	2, 4, 17					
Welcome Swallow, Koonamit*, Boodibring*, Kabritj*	*Hirundo neoxena*	2, 4, 17					
Brown Honeyeater, Djindjoko*, Kyeet*	*Lichmera indistincta*	2, 4, 17					

[18] The list of terrestrial birds found in the wetlands is not comprehensive. It includes common terrestrial birds found across many habitats, as well as less common birds that may be associated with wetlands but are not dependent on them.

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Red-winged Fairy-wren	*Malurus elegans*	2, 4, 17					
Splendid Fairy-wren, Djorrdjilya*, Djodjal*	*Malurus splendens*	2, 4, 17					
Rufous Whistler, Bambon*	*Pachycephala rufiventris*	2, 4, 17					
Western Whistler, Bedilmidong*, Bedjemer*	*Pachycephala occidentalis*	2, 4, 17					
Spotted Pardalote	*Pardalotus punctatus*	2, 4, 17					
Striated Pardalote	*Pardalotus striatus*	2, 4, 17					
Tree Martin, Kybot*, Kabikolongkorong*, Kabiwatwat*, Kybotkybot*, Maningwilwil*, Kabarang*, Jittijitti*	*Petrochelidon nigricans*	2, 4, 17					
Scarlet Robin, Kooba*, Mendidi*, Binibintj*, Demclik*, Koobadjit*, Guba*, Piny*	*Petroica boodang*	2, 4, 17					
White-cheeked Honeyeater	*Phylidonyris niger*	2, 4, 17					
New Holland Honeyeater, Bandin*, Woorening*	*Phylidonyris novaehollandiae*	2, 4, 17					
Tawny Frogmouth, Kambekor*, Kambyne*	*Podargus strigoides*	2, 4, 17					
White-breasted Robin, Boydjil*	*Quoyornis georgianus*	2, 4, 17					
Southern Boobook (Western Boobook subspecies), Koorkoda*, Kookobort*, Kookomit*, Yartj*, Gurgurda*, Gugumit*, Cubine*	*Ninox boobook ocellata, Ninox boobook*	2, 4, 17					
Grey Fantail, Koodjinok*, Yadoort*, Kedjat*	*Rhipidura albiscapa*	2, 4, 17					
Willie Wagtail, Djitidjiti*, Wilaring*, Jittijitti*	*Rhipidura leucophrys*	2, 4, 17					
White-browed Scrubwren (South-western Spotted Scrubwren subspecies), Binkimom*, Kikal*	*Sericornis frontalis maculatus*	2, 4, 17					
Weebill, Kiderbot*	*Smicrornis brevirostris*	2, 4, 17					
Southern Emu-wren, Jirjilya*, Irdibilyi*	*Stipiturus malachurus*	2, 4, 17					
Sacred Kingfisher, Koonyenok*, Djok*, Kanyinnak*, Beringo*, Nambun*	*Todiramphus sanctus*	2, 4, 17					
Banded Lapwing, Kilkil*	*Vanellus tricolor*	2, 3, 4, 17					
Baudin's Black-Cockatoo, Ngolak*, Woolah*	*Zanda baudinii* [T]	1, 2, 4, 17	EN	EN		Known	Breeding known to occur within area
Carnaby's Black-Cockatoo, Ngolyenok*, Gnollark*, Ngolak*,	*Zanda latirostris* [T]	1, 2, 4, 17	EN	EN		Known	Breeding known to occur within area
Silvereye (Western Silvereye subspecies)	*Zosterops lateralis chloronotus*	2, 4, 17					
Mammals							
Mammals (wetland-dependent or known to be associated with wetlands[19])							
Mardo, Yellow-footed Antechinus, Mado*, Domat*	*Antechinus flavipes*	2, 5, 13, 14					

[19] Rakali (*Hydromys chrysogaster*) are dependent on wetland habitats. Reaveley (2009), Bamford and Bamford (2003), How and Dell (1993) and Department of Environment and Conservation (2012l) document associations between wetland habitats and mardo (*Antechinus flavipes*), quenda (*Isoodon fusciventer*), Kwoora (*Notamacropus irma*), moodit or bush rat *(Rattus fuscipes*) and quokka (*Setonix brachyurus*). Bamford and Bamford (2003) noted that western pygmy possum (*Cercartetus concinnus*) may favour the high density of trees and shrubs close to wetlands and damplands. The species names of quenda and kwoora were updated after these publications.

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Western Pygmy Possum, Mandada*, Nyeranit*	*Cercartetus concinnus*	2, 5, 13					
Rakali, Water-rat, Ngoodjo*, Ngwiridjin, Wamp Wamp*, Ngangaritj*,	*Hydromys chrysogaster* [P]	2, 5, 13, 14			4		
Quenda*, Southwestern Brown Bandicoot, Went*, Midgegooroo*, Maggorong*	*Isoodon fusciventer* [P]	2, 5, 13, 14			4		
Kwoora*, Western Brush Wallaby, Quell*, Kwara*, Koora*, Gurhre*, Quarre* ,Warr*,	*Notamacropus irma* [P]	2, 5, 13, 14			4		
Moodit*, Bush Rat, Western Bush Rat, Modit*	*Rattus fuscipes*	2, 5, 13, 14					
Quokka, Kwoka*, Bangop*	*Setonix brachyurus* [T]	1, 2, 5, 13, 14	VU	VU		Known	Species or species habitat known to occur within area
Mammals (not wetland-dependent but may be found in wetland habitats)							
White-striped Free-tailed Bat	*Austronomus australis*	2, 5, 13					
Gould's Wattled Bat	*Chalinolobus gouldii*	2, 5, 13					
Chocolate Wattled Bat	*Chalinolobus morio*	2, 5, 13					
Chuditch, Western Quoll, Barr jit*, Djooditj*, Ngooldjangit*, Badjada*	*Dasyurus geoffroii* [T]	1, 2, 5, 13	VU	VU		Known	Species or species habitat known to occur within area
Western False Pipistrelle	*Falsistrellus mackenziei* [P]	2, 5, 13			4		
Fat-tailed Dunnart	*Sminthopsis crassicaudata*	2, 5, 13					
Little Long-tailed Dunnart	*Sminthopsis dolichura*	2, 5, 13					
White-tailed Dunnart[20]	*Sminthopsis granulipes*	2, 5, 13					
Grey-bellied Dunnart	*Sminthopsis griseoventer*	2, 5, 13					
Western Grey Kangaroo, Yonga*, Yongka*	*Macropus fuliginosus*	2, 5, 13, 14					
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	2, 5, 13					
Holt's Long-eared Bat	*Nyctophilus holtorum*	2, 5					
Western Long-eared Bat	*Nyctophilus major*	2, 5, 13					
South-western Free-tailed Bat	*Ozimops kitcheneri*	2, 5, 13					
Wambenger, South-western Brush-tailed Phascogale	*Phascogale tapoatafa wambenger* [T]	2, 5, 13		CD			
Ngwayir*, Western Ringtail Possum, Womp*, Woder*, Ngoor*, Ngoolangit*, Ngora*	*Pseudocheirus occidentalis* [T]	1, 2, 5, 13, 14	CR	CR		Known	Breeding known to occur within area
Short-beaked Echidna	*Tachyglossus aculeatus*	2, 5, 13					
Honey Possum, Ngoolboongoor*, Djebin*, Dat*, Ballagara*	*Tarsipes rostratus*	2, 5, 13					
Common Brush-tailed Possum, Koomal*, Coomal*, Goomal*, Cooma*	*Trichosurus vulpecula*	2, 5, 13					
Southern Forest Bat	*Vespadelus regulus*	2, 5, 13					
Fish (wetland-dependent; only open water wetlands (the lake, sumpland, river and creek wetland types))[21]							
South-western Goby	*Afurcagobius suppositus*	2, 5, 6, 7					
Nightfish	*Bostockia porosa*	2, 5, 6, 7					
Western Minnow	*Galaxias occidentalis*	2, 5, 6, 7					
Common Jollytail, Common Galaxias	*Galaxias maculatus*	2, 5, 6					

[20] Found in the northern part of the Swan Coastal Plain.

[21] Black striped minnow (*Galaxiella nigrostriata*) and western mud minnow (*Galaxiella munda*) are found only sporadically on the Swan Coastal Plain, in disjunct populations (Hourston *et al.* (2014); Morgan *et al.* (1996, 1998). Balston's pygmy perch (*Nannatherina balstoni*) has not been found on the Swan Coastal Plain for decades and may now be locally extinct on the Swan Coastal Plain. See the response to **question 16**.

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Western Mud Minnow, Mud Minnow, Western Dwarf Galaxias	*Galaxiella munda* [T]	1, 2, 5, 6, 7	VU	VU		Known	Species or species habitat known to occur within area
Black-stripe Minnow, Black-striped Dwarf Galaxias	*Galaxiella nigrostriata* [T]	1, 2, 5, 6, 7	EN	EN		Known	Species or species habitat known to occur within area
Pouched Lamprey	*Geotria australis* [P]	2, 5, 6, 7			3		
Western Hardyhead	*Leptatherina wallacei*	2, 6, 7					
Balston's Pygmy Perch	*Nannatherina balstoni* [T]	1, 2	VU	VU		Known	Species or species habitat known to occur within area
Western Pygmy Perch	*Nannoperca vittata*	2, 5, 6, 7					
Blue-spot Goby, Swan River Goby	*Pseudogobius olorum*	2, 5, 6, 7					
Freshwater Cobbler	*Tandanus bostocki*	2, 5, 6, 7					
Frogs (wetland-dependent)[22]							
Quacking Frog, Kwidja*[23], Culkeyurk*	*Crinia georgiana*	2, 5, 8, 15, 16					
Rattling Froglet, Clicking Froglet, Glauert's Froglet, Gudjarra*, Kwidja*	*Crinia glauerti*	2, 5, 8, 15, 16					
Squelching Froglet, Sign-bearing Froglet, Sandplain Froglet, Kwidja*	*Crinia insignifera*	2, 5, 8, 15, 16					
False Western Froglet, Kwidja*	*Crinia pseudinsignifera*	2, 5, 15, 16					
Lea's Frog, Kwidja*	*Geocrinia leai*	2, 5, 15, 16					
Western Spotted Frog, Kwidja*	*Heleioporus albopunctatus*	2, 5, 15, 16					
Western Marsh Frog, Kwidja*	*Heleioporus barycragus*	2, 5, 15, 16					
Moaning Frog, Kwidja*	*Heleioporus eyrei*	2, 5, 8, 15, 16					
Plains Frog, Kwidja*	*Heleioporus inornatus*	2, 5, 15, 16					
Sand Frog, Marbled Frog, Kwidja*	*Heleioporus psammophilus*	2, 5, 15, 16					
Western Banjo Frog, Pobblebonk, Kwidja*, Twonk*	*Limnodynastes dorsalis*	2, 5, 8, 15, 16					
Slender Tree Frog, Kwidja*	*Litoria adelaidensis*	2, 5, 8, 15, 16					
Motorbike Frog, Wurgyl*, Kwidja*	*Litoria moorei*[24]	2, 5, 8, 15, 16					
Kunapalari Frog, Kwidja*	*Neobatrachus kunapalari*	2, 5 (15, 16[25])					
Humming Frog, Kwidja*	*Neobatrachus pelobatoides*	2, 5, 15, 16					
Crawling Toadlet, Günther's Toadlet, Kwidja*	*Pseudophryne guentheri*	2, 5, 8, 15, 16					
Reptiles (wetland-dependent or often found in wetland habitats)							
Western Three-lined Skink, South-western Cool Skink	*Acritoscincus trilineatus*	2, 5, 14					
South-western Snake-necked Turtle, Choonya* (Booyi*), Nyagyn*, Yagan*, Ngyakin*, Yarragan*	*Chelodina oblonga*	2, 5, 7, 14					
South-western Mulch Skink	*Hemiergis gracilipes*	2, 5, 14					
Southwestern Earless Skink, Southern Five-toed Mulch Skink	*Hemiergis initialis, Hemiergis initialis initialis*[26]	2, 5, 14					
Two-toed Mulch Skink	*Hemiergis quadrilineata*	2, 14					
Crowned Snake	*Elapognathus coronatus*	2, 5, 14					
Short-nosed Snake, Large-eyed Sedge Snake, Little Brown Snake	*Elapognathus minor* [P]	2, 5, 14			2		

[22] The turtle frog (*Myobatrachus gouldii*) is also found on the Swan Coastal Plain but is not wetland-dependent.
[23] The common Noongar name for frogs.
[24] Formerly *Ranoidea moorei*.
[25] Likely included in references 15 and 16; however, the small scale and limited detail of the map makes it difficult to confirm.
[26] Reference 14 confirms it is found in wetlands but does not refer to the Swan Coastal Plain. Reference 2 confirms it is found on the Swan Coastal Plain. Reference 5 confirms *Hemiergis initialis* is found on the Swan Coastal Plain but does not refer specifically to the sub-species *Hemiergis initialis initialis*.

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Western Swamp Skink, Western Mourning Skink, Western Glossy Swamp Skink	*Lissolepis luctuosa*[27]	2, 5, 14					
Tiger Snake, Moyop*, Norn*	*Notechis scutatus*	2, 5, 14					
Western Swamp Tortoise, Yarkiny*	*Pseudemydura umbrina* [T]	1, 2, 5, 7, 14	CR	CR		Known	Species or species habitat known to occur within area
Crustaceans (wetland-dependent)							
Smooth Marron	*Cherax cainii*	2, 5, 6, 7					
Koonac	*Cherax preissii*	2, 5, 6, 7					
Gilgie	*Cherax quinquecarinatus*	2, 5, 6, 7					
Dunsborough Burrowing Crayfish	*Engaewa reducta* [T]	1, 2	CR	EN		Known	Species or species habitat known to occur within area
South-west Glass Shrimp	*Palaemonetes australis*	5, 6, 7, 18					
Freshwater Isopod	*Paramphisopus palustris*	18					
Freshwater prawns	Palaemonidae	9					
Water fleas	Sub-order Cladocera	9, 18					
Scuds	Order Amphipoda	9, 18					
Fairy shrimps	Order Anostraca	9					
Water slaters, isopods	Order Isopoda	9					
Clam shrimps	Orders Laevicaudata, Spinicaudata and Cyclestherida (formerly Order Order Conchostraca)	9, 18					
Tadpole or shield shrimps	Order Notostraca	9					
Copepods	Class Copepoda	9, 18					
Seed shrimps	Class Ostracoda	9, 18					
Molluscs (wetland-dependent)							
Salt Lake Snail, Saline Snail	*Coxiella striatula*	9, 18					
Freshwater Limpet	*Ferrissia* sp.	2, 9					
-	*Glyptophysa* sp.	9					
-	*Isidorella newcombi*	9					
Blue Mussel	*Mytilus planulatus*	2					
-	*Potamopyrgus* sp.	2, 9					
Pea Clam	*Sphaerium kendricki*	2, 9					
Carter's Freshwater Mussel	*Westralunio carteri* [T]	1, 2, 5, 6, 7, 9, 18	VU	VU		Known	Species or species habitat known to occur within area
Native bees (wetland-dependent)							
Short-tongued bee	*Leioproctus douglasiellus* [T]	1, 2, 14	CR	EN		Known	Species or species habitat known to occur within area
Megamouth bee	*Leioproctus muelleri*	2, 14					
-	*Neopasiphae simplicior* [T]	1, 2, 14	CR	EN		Known	Species or species habitat known to occur within area
Aquatic and semi-aquatic insects (wetland-dependent)							
Aquatic beetles							
Predaceous diving beetles	Dytiscidae	9, 10, 18					
Crawling water beetles	Haliplidae	9					
Minute moss beetles, water beetles	Hydraenidae	9					
Water scavenger beetles	Hydrophilidae	9, 10					
Minute marsh-loving beetles	Limnichidae	9					
Burrowing water beetles	Noteridae	9					
Feather-wing beetles	Ptilidae	9					

[27] Formerly *Egernia luctuosa.*

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Toe-winged beetles	Ptilodactylidae	9					
Marsh beetles	Scirtidae	9					
Caddisfly larvae							
Caseless caddisflies	Ecnomidae	9, 10					
Micro-caddisflies, Purse-case caddisflies	Hydroptilidae	9					
Long-horned caddisflies	Leptoceridae	9, 10					
Dragonflies and Damselflies							
Blue-spotted Hawker	*Adversaeschna brevistyla*	2, 9[28], 11, 12					
Twinspot Tigertail	*Archaeosynthemis leachii*	2, 11, 12					
Western Brown Tigertail	*Archaeosynthemis occidentalis*	2, 11, 12					
Midget Flatwing	*Archiargiolestes parvulus*	2, 11, 12					
Little Flatwing	*Archiargiolestes pusillus*	2, 9, 11, 12					
Armourtail, Clubtail Dragonfly	*Armagomphus armiger*	2, 11, 12					
Western Darner, Darner Dragonfly	*Austroaeschna anacantha*	11, 12					
Southwestern Billabongfly	*Austroagrion cyane*	2, 9, 11, 12					
Western Red Hunter, Clubtail Dragonfly	*Austroepigomphus gordoni*	11, 12					
Western Inland Hunter	*Austrogomphus collaris*	2, 11, 12					
Australian Duskhawker	*Austrogynacantha heterogena*	2, 11, 12					
Western Ringtail	*Austrolestes aleison*	2, 11, 12					
Slender Ringtail	*Austrolestes analis*	2, 9, 11, 12					
Blue Ringtail	*Austrolestes annulosus*	2, 9, 11, 12					
Inland Ringtail	*Austrolestes aridus*	2, 11, 12					
Iota Ringtail	*Austrolestes io*	2, 9, 11, 12					
Turquoise Tigertail	*Austrosynthemis cyanitincta*	2, 11, 12					
Swamp Flat-tail	*Austrothemis nigrescens*	2, 9, 11, 12					
Wandering Percher Dragonfly	*Diplacodes bipunctata*	2, 9, 11, 12					
Scarlet Percher	*Diplacodes haematodes*	2, 11, 12					
Australian Emperor	*Hemianax papuensis*	9, 11, 12					
Australian Emerald	*Hemicordulia australiae*	2, 9, 11, 12					
Tau Emerald	*Hemicordulia tau*	2, 9, 11, 12					
Orange Streamcruiser	*Hesperocordulia berthoudi*	2, 11, 12					
Aurora Bluetail	*Ischnura aurora*	2, 9, 11, 12					
Western Swiftwing, Hawker Dragonfly	*Lathrocordulia metallica*	2, 11, 12					
Stream Flatwing	*Miniargiolestes minimus*	2, 11, 12					
Western Pygmyfly	*Nannophya occidentalis*	2, 11, 12					
Blue Skimmer	*Orthetrum caledonicum*	2, 9, 11, 12					
Wandering Glider	*Pantala flavescens*	11, 12					
Western Petaltail, Giant Western Dragonfly	*Petalura hesperia*	2, 11, 12					
Western Swamp Emerald	*Procordulia affinis*	2, 9, 11, 12					
Common Glider	*Tramea loewii*	11					
Narrow-lobed Glider	*Tramea stenoloba*	2, 11, 12					
Red & Blue Damsel	*Xanthagrion erythroneurum*	2, 9, 11, 12					
Lilac Hunter	*Zephyrogomphus lateralis*	2, 11, 12					
Fly larvae							
Non-biting midges	Chironomidae	9, 10, 18					
Biting midges	Ceratopogonidae	9, 10, 18					

[28] Listed under a former species name.

Common name Noongar name*	Scientific name	References	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
			EPBC Act	BC Act (WA)			
Mosquitoes	Culicidae	9, 10, 18					
Blackflies	Simuliidae	9, 10, 18					
Soldierflies	Stratiomyidae	9, 10					
Horse flies, March flies	Tabanidae	9, 10					
Crane flies	Tipulidae	9					
Mayflies							
Small minnow mayflies	Baetidae	9, 10					
Square-gilled mayflies	Caenidae	9, 10					
Prong-gilled mayflies	Leptophlebiidae	10					
Stoneflies							
Stoneflies	Gripopterygidae	10, 18					
True bugs							
Water boatmen	Corixidae	9, 10, 18					
Backswimmers	Notonectidae	9, 10, 18					
Water striders	Gerridae	10					
Other aquatic and semi-aquatic macroinvertebrates (water-dependent)							
Roundworms	Phylum Nematoda	9, 10, 18					
Flatworms	Phylum Platyhelminthes, including Turbellaria	9, 10, 18					
Leeches	Sub-class Hirudinea	9, 10, 18					
Segmented worms	Sub-class Oligochaeta	9, 10, 18					
Water mites	Sub-order Hydrachnidia[29]	9, 10, 18					
Sponges	Phylum Porifera	18					
Freshwater hydra	Phylum Cnidaria	18					

[29] Davis & Christidis (1997) refer to Hydracarina, a general term for water mites. The taxonomic name for this group is the sub-order Hydrachnidia. Van Looij (2009) refers to the sub-class Acarina, which is now called Acari.

Attachment G – Migratory, threatened and priority wetland fauna of the Swan Coastal Plain

Table G1 summarises the migratory, threatened, specially protected and priority wetland fauna of the Swan Coastal Plain under the Australian Government's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian Government's *Biodiversity Conservation Act 2016* (BC Act).

The following references were used to identify the threatened and priority fauna species:

- Department of Climate Change, Energy, the Environment and Water 2025, *Protected Matters Search Tool report for drawn area search of the Swan Coastal Plain IBRA region*. Viewed at: <https://pmst.environment.gov.au> on 12 November 2025.
- Department of Biodiversity, Conservation and Attractions 2025, *Threatened and priority fauna list – July 2025*, Department of Biodiversity, Conservation and Attractions, Perth. Available at: <www.dbca.wa.gov.au/management/threatened-species-and-communities>. (Accessed: 22 March 2026.)

Threatened species are identified by the Australian Government under the *Environmental Protection and Biodiversity Conservation Act 1999* and the Western Australian Government under the *Biodiversity Conservation Act 2016*. Priority species are identified by the Department of Biodiversity, Conservation and Attractions in Western Australia (WA). These are possibly threatened species that do not meet survey criteria or that are not adequately defined (priorities 1, 2 and 3). These three categories are ranked in order of priority for survey, and evaluation of conservation status, so that consideration can be given to their declaration as threatened species. Species that are adequately known and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened species list, are placed in priority 4. Priority species cannot be listed under the *Biodiversity Conservation Act 2016*.

Attachment G lists the references used to confirm the presence of these fauna species in the wetlands of the Swan Coastal Plain.

Abbreviations:

EPBC Act = *Environmental Protection and Biodiversity Conservation Act 1999* (Australian Government)

BC Act = *Biodiversity Conservation Act 2016* (Western Australia)

WA = Western Australia

[P] = priority species in Western Australia

[T] = threatened species

CR = Critically Endangered

E = Endangered

MI = Migratory species

VU = Vulnerable

CD = Species of special conservation interest (conservation dependent)

OS = Species otherwise in need of special protection (other specially protected)

Y = Yes

Notes:

- The following references were used to identify the threatened and priority fauna species:
    - Department of Climate Change, Energy, the Environment and Water 2025, *Protected Matters Search Tool report for drawn area search of the Swan Coastal Plain IBRA region*. Viewed at: <https://pmst.environment.gov.au> on 12 November 2025.
    - Department of Biodiversity, Conservation and Attractions 2025, *Threatened and priority fauna list – July 2025*, Department of Biodiversity, Conservation and Attractions, Perth. Available at: <www.dbca.wa.gov.au/management/threatened-species-and-communities>. (Accessed: 22 March 2026.)
- Threatened species are identified by the Australian Government under the *Environmental Protection and Biodiversity Conservation Act 1999* and the Western Australian Government under the *Biodiversity Conservation Act 2016*. Priority species are identified by the Department of Biodiversity, Conservation and Attractions in Western Australia (WA). These are possibly threatened species that do not meet survey criteria or that are not adequately defined (priorities 1, 2 and 3). These three categories are ranked in order of priority for survey, and evaluation of conservation status, so that consideration can be given to their declaration as

threatened species. Species that are adequately known and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list, are placed in priority 4. Priority species cannot be listed under the *Biodiversity Conservation Act 2016*.

- The information in the 'simple presence' and 'presence text' columns is from the *Protected Matters Search Tool* search results (Department of Climate Change, Energy, the Environment and Water 2025).

Table G1 – Migratory, threatened and priority wetland fauna of the Swan Coastal Plain

Common Name	Scientific name	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
		EPBC Act	BC Act (WA)			
Birds						
Migratory birds (wetland-dependent, migratory)						
Common Sandpiper	*Actitis hypoleucos*	MI	MI		Known	Species or species habitat known to occur within area
Ruddy Turnstone	*Arenaria interpres* [T]	MI, VU	MI		Known	Roosting known to occur within area
Sharp-tailed Sandpiper	*Calidris acuminata* [T]	MI, VU	MI		Known	Roosting known to occur within area
Sanderling	*Calidris alba*	MI	MI		Known	Roosting known to occur within area
Red Knot, Knot	*Calidris canutus* [T]	MI, VU	EN		Known	Species or species habitat known to occur within area
Broad-billed Sandpiper	*Calidris falcinellus*	MI	MI		Known	Roosting known to occur within area
Curlew Sandpiper	*Calidris ferruginea* [T]	MI, CR	CR		Known	Species or species habitat known to occur within area
Pectoral Sandpiper	*Calidris melanotos*	MI	MI		Known	Species or species habitat known to occur within area
Ruff	*Calidris pugnax*	MI	MI		Known	Roosting known to occur within area
Red-necked Stint	*Calidris ruficollis*	MI	MI		Known	Roosting known to occur within area
Long-toed Stint	*Calidris subminuta*	MI	MI		Known	Roosting known to occur within area
Great Knot	*Calidris tenuirostris* [T]	MI, VU	CR		Known	Roosting known to occur within area
Double-banded Plover	*Charadrius bicinctus*	MI	MI		Known	Roosting known to occur within area
Little Ringed Plover[1]	*Charadrius dubius*	MI	MI		Known	Roosting known to occur within area
Greater Sand Plover	*Charadrius leschenaultii* [T]	MI, VU	VU		Known	Species or species habitat known to occur within area
Lesser Sand Plover	*Charadrius mongolus* [T]	MI, EN	EN		Known	Roosting known to occur within area
Latham's Snipe[2]	*Gallinago hardwickii* [T]	MI, VU	MI		-	-
Swinhoe's Snipe[3]	*Gallinago megala*	MI	MI		Likely	Roosting likely to occur within area
Pin-tailed Snipe[4]	*Gallinago stenura*	MI	MI		Likely	Roosting likely to occur within area
Caspian Tern	*Hydroprogne caspia*	MI	MI		Known	Foraging, feeding or related behaviour known to occur within area
Bar-tailed Godwit	*Limosa lapponica*	MI	MI		Known	Species or species habitat known to occur within area
Bar-tailed Godwit (Western Alaskan)	*Limosa lapponica baueri* [T]	EN	VU			
Bar-tailed Godwit (Northern Siberian)	*Limosa lapponica menzbieri* [T]	EN	CR			
Black-tailed Godwit	*Limosa limosa* [T]	MI, EN	MI		Known	Roosting known to occur within area
Far Eastern Curlew	*Numenius madagascariensis* [T]	MI, CR	CR		Known	Species or species habitat known to occur within area
Little Curlew	*Numenius minutus*	MI	MI		Likely	Roosting likely to occur within area
Whimbrel	*Numenius phaeopus*	MI	MI		Known	Roosting known to occur within area
Bridled Tern	*Onychoprion anaethetus*	MI	MI		Known	Breeding known to occur within area
Eastern Osprey	*Pandion haliaetus*	MI	MI		Known	Breeding known to occur within area
Glossy Ibis[5]	*Plegadis falcinellus*	MI	MI			
Pacific Golden Plover	*Pluvialis fulva*	MI	MI		Known	Roosting known to occur within area
Grey Plover	*Pluvialis squatarola* [T]	MI, VU	MI		Known	Roosting known to occur within area

[1] Very infrequent visitor

[2] Very infrequent visitor

[3] Very infrequent visitor

[4] Very infrequent visitor

[5] Known in wetlands on the Swan Coastal Plain, and listed as a migratory species under the EPBC Act, but it was not recorded in the Protected Matters Search Tool search results.

Common Name	Scientific name	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
		EPBC Act	BC Act (WA)			
Common Tern[6]	*Sterna hirundo*	MI	MI			
Little Tern	*Sternula albifrons* [T]	MI, VU	MI		May	Species or species habitat may occur within area
Greater Crested Tern[7]	*Thalasseus bergii*	MI	MI			
Grey-tailed Tattler	*Tringa brevipes* [P]	MI	MI	4	Known	Roosting known to occur within area
Wood Sandpiper	*Tringa glareola*	MI	MI		Known	Roosting known to occur within area
Common Greenshank	*Tringa nebularia* [T]	MI, EN	MI		Known	Species or species habitat known to occur within area
Marsh Sandpiper	*Tringa stagnatilis*	MI	MI		Known	Roosting known to occur within area
Common Redshank[8]	*Tringa totanus*	MI	MI		Known	Roosting known to occur within area
Terek Sandpiper	*Xenus cinereus* [T]	MI, VU	MI		Known	Roosting known to occur within area
Birds (other wetland-dependent)						
Australian Little Bittern	*Botaurus dubius* [P]			4		
Australasian Bittern	*Botaurus poiciloptilus* [T]	EN	EN		Known	Species or species habitat known to occur within area
Recherche Cape Barren Goose[9], Cape Barren Goose (south-western)	*Cereopsis novaehollandiae grisea* [T]	VU	VU			
Hooded Plover	*Charadrius cucullatus* [P]			4		
Blue-billed Duck	*Oxyura australis* [P]			4		
Australian Painted Snipe[10]	*Rostratula australis* [T]	EN	EN		Known	Species or species habitat known to occur within area
Australian Fairy Tern	*Sternula nereis nereis* [T]	VU	VU		Known	Foraging, feeding or related behaviour known to occur within area
Terrestrial birds (not wetland-dependent but found in wetland habitats)						
Forest Red-tailed Black-Cockatoo	*Calyptorhynchus banksii naso* [T]	VU	VU		Known	Species or species habitat known to occur within area
Peregrine Falcon	*Falco peregrinus*		OS			
Baudin's Black-Cockatoo	*Zanda baudinii* [T]	EN	EN		Known	Breeding known to occur within area
Carnaby's Black-Cockatoo	*Zanda latirostris* [T]	EN	EN		Known	Breeding known to occur within area
Mammals						
Mammals (wetland-dependent or known to be associated with wetlands[11])						
Rakali, Water-rat	*Hydromys chrysogaster* [P]			4		
Quenda, Southwestern Brown Bandicoot	*Isoodon fusciventer* [P]			4		
Kwoora, Western Brush Wallaby	*Notamacropus irma* [P]			4		
Quokka	*Setonix brachyurus* [T]	VU	VU		Known	Species or species habitat known to occur within area
Mammals (not wetland-dependent but may be found in wetland habitats)						
Chuditch, Western Quoll	*Dasyurus geoffroii* [T]	VU	VU		Known	Species or species habitat known to occur within area
Western False Pipistrelle	*Falsistrellus mackenziei* [P]			4		
Wambenger, South-western Brush-tailed Phascogale	*Phascogale tapoatafa wambenger* [T]		CD			
Ngwayir, Western Ringtail Possum	*Pseudocheirus occidentalis* [T]	CR	CR		Known	Breeding known to occur within area

[6] Very infrequent visitor. Known in wetlands on the Swan Coastal Plain, and listed as a migratory species under the EPBC Act, but it was not recorded in the Protected Matters Search Tool search results.

[7] Known in wetlands on the Swan Coastal Plain, and listed as a migratory species under the EPBC Act, but it was not recorded in the Protected Matters Search Tool search results.

[8] Very infrequent visitor.

[9] Very infrequent visitor. The Dandjoo record lists *Cereopsis novaehollandiae*. This is likely to be *Cereopsis novaehollandiae grisea*, which is the subspecies found in Western Australia. This species was not recorded in the Protected Matters Search Tool search results but it was recorded in other references, including Dandjoo.

[10] Very infrequent visitor

[11] Rakali (*Hydromys chrysogaster*) are dependent on wetland habitats. Reaveley (2009), Bamford & Bamford (2003) and How & Dell (1993) document associations between wetland habitats and mardo (*Antechinus flavipes*), quenda (*Isoodon fusciventer*), Kwoora (*Notamacropus irma*), moodit or bush rat *(Rattus fuscipes*) and quokka (*Setonix brachyurus*). Bamford & Bamford (2003) noted that western pygmy possum (*Cercartetus concinnus*) may favour the high density of trees and shrubs close to wetlands and damplands. The species names of quenda and kwoora were updated after these publications.

Common Name	Scientific name	Threatened fauna		Priority fauna (WA)	Simple presence (EPBC Act listings)	Presence text (EPBC Act listings)
		EPBC Act	BC Act (WA)			
Fish (wetland-dependent)						
Western Mud Minnow, Mud Minnow, Western Dwarf Galaxias	*Galaxiella munda* [T]	VU	VU		Known	Species or species habitat known to occur within area
Black-stripe Minnow, Black-striped Dwarf Galaxias	*Galaxiella nigrostriata* [T]	EN	EN		Known	Species or species habitat known to occur within area
Pouched Lamprey	*Geotria australis* [P]			3		
Balston's Pygmy Perch	*Nannatherina balstoni* [T]	VU	VU		Known	Species or species habitat known to occur within area
Reptiles (wetland-dependent or often found in wetland habitats)						
Short-nosed Snake, Large-eyed Sedge Snake, Little Brown Snake	*Elapognathus minor* [P]			2		
Western Swamp Tortoise	*Pseudemydura umbrina* [T]	CR	CR		Known	Species or species habitat known to occur within area
Crustaceans (wetland-dependent)						
Dunsborough Burrowing Crayfish	*Engaewa reducta* [T]	CR	EN		Known	Species or species habitat known to occur within area
Molluscs (wetland-dependent)						
Carter's Freshwater Mussel	*Westralunio carteri* [T]	VU	VU		Known	Species or species habitat known to occur within area
Native bees (wetland-dependent)						
Short-tongued bee	*Leioproctus douglasiellus* [T]	CR	EN		Known	Species or species habitat known to occur within area
-	*Neopasiphae simplicior* [T]	CR	EN		Known	Species or species habitat known to occur within area

Attachment H – Wetland losses on the Swan Coastal Plain

Historical and ongoing clearing, draining and filling have caused substantial loss of the wetlands on the Swan Coastal Plain and are among the most significant threats to these wetlands. The wetlands that remain are increasingly fragmented and subject to physical disturbance from infrastructure, recreation and vehicle access, further reducing habitat extent, connectivity and resilience.

Table H1 shows different estimates of wetland loss across the Swan Coastal Plain. One commonly quoted figure is that approximately 80% of wetlands have been lost or heavily altered. This number appears in many publications, but its origin and how it was calculated are unclear. However, what is clear from the publications in Tables H1 and H2 is that there is a consensus view that there has been a massive loss of wetlands on the Swan Coastal Plain since 1829.

Figures H1 and H2 show historical wetland losses, most of which are not mapped in the *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset (DataWA 2021).

In addition to wetland loss and fragmentation, the whole Swan Coastal Plain is subject to ongoing threats from land clearing and fragmentation, which has contributed to the decline of multiple ecological communities.

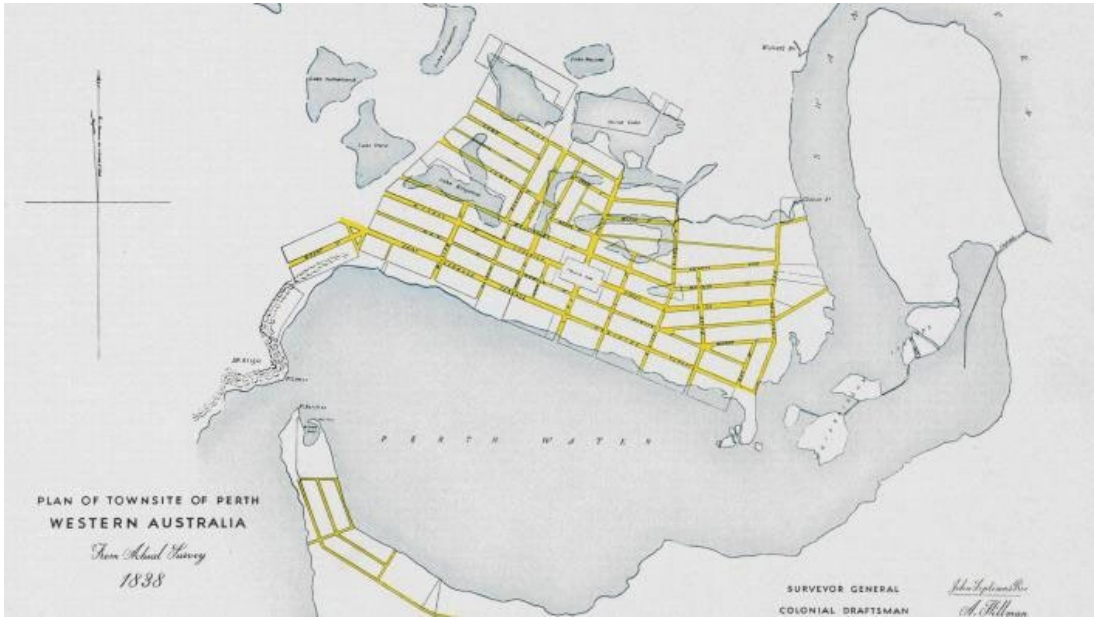


Figure H1 – 1838 Plan of the townsite of Perth showing wetlands that are not included in the Geomorphic wetlands, Swan Coastal Plain (DBCA-019) spatial dataset. (Source: Western Australian Museum, undated(a)).

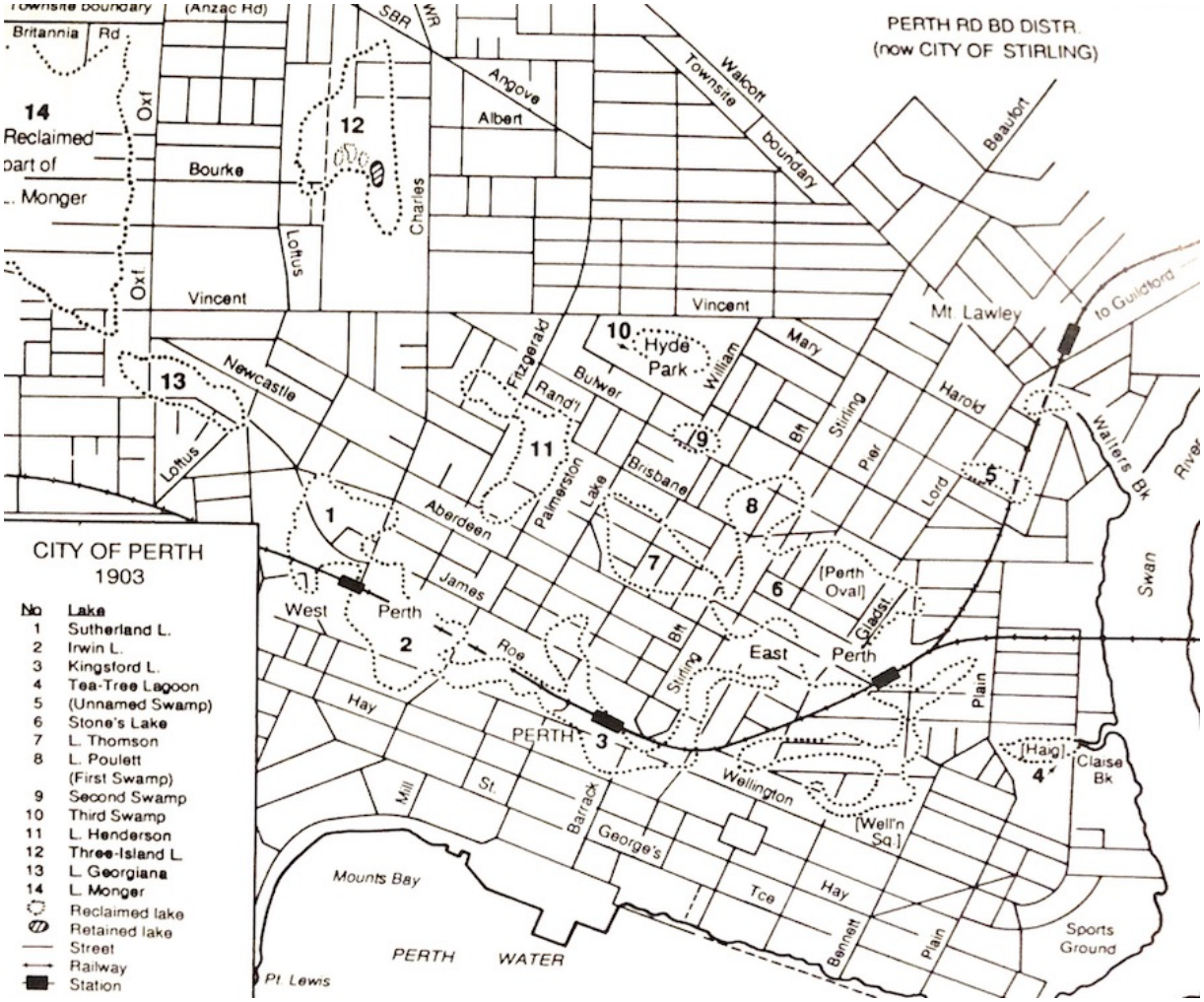


Figure H2 – Perth's 'lost' lakes drawn on a 1903 plan of Perth (Source: Bekle & Gentilli 1993)

Table H2 provides further information about historical wetland losses, many of which are not included in the *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* spatial dataset (DataWA 2021).

Table H1 – Estimates of wetland losses on the Swan Coastal Plain

Year	Quotes	Estimate of loss	Reference
1966	Page 1: “The destruction of thousands of acres of wetland has had drastic effects on the wildlife occurring on the Swan Coastal Plain. This plain, only 25 years ago, harboured one of the most stable populations of waterfowl in Western Australia. The devastation which has occurred since has affected thousands of West Australians who find recreation in the medium of hunting and general observation of waterfowl. It is intended that the information compiled in this research programme may reduce future destruction of valuable wildlife habitat…” Page 25: “Over the past eleven years reclamation has reduced wetland acreages by 150,503 acres [60,906 hectares]. Modern drainage methods will be capable of increasing this rate of reclamation in the coming years and will probably do so if not checked. Aerial photographs show recent reclamation work quite clearly, but as cultivation and regrowth continue, the original shape of the wetland area becomes obscure. Within a span of eleven years the wetland areas have transformed so greatly that they are unrecognizable from aerial photographs. It is possible that our calculations of 150,503 acres [60,906 hectares] fall short of the actual area that has been reclaimed because these calculations were made on well defined reclaimed areas so that we could at least ascertain the minimal acres of wetlands that have been drained.” Pages 25-26: “The metropolitan area, or Zone A, has undergone severe drainage programmes. This is to be expected with	60,906 hectares in the past 11 years 200,216 hectares drained (summary from a 1965 annual report) 49% wetlands between Yanchep and Rockingham (Zone A), 31% wetlands between Rockingham and Harvey (Zone B) and 96% between Harvey and Busselton (Zone C)	Riggert TL 1966, *A study of the wetlands of the Swan Coastal Plain, being a pilot study of the wetlands of Western Australia with a particular reference to their use by waterfowl*, Department of Fisheries and Fauna, Western Australia. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/002768.pdf>. (Accessed: 22 March 2026.)

Year	Quotes	Estimate of loss	Reference
	the rapid urbanisation and industrial expansion which is now in progress in Western Australia. Reclamation of 13,154 acres [5,323 hectares] or 49% of Zone A's wetland has drastically changed its role as a stable waterfowl production area. Similarly, Zone B has also suffered severe drainage, especially on the flat alluvial areas, as crop lands are hard to manage when they become saturated and boggy. Drainage in this zone has become more difficult now as only the deep lakes, which are usually situated in difficult areas for natural drainage, remain untouched. Approximately 31 % of Zone B's wetland has been drained away for agricultural production. The total acreage lost in Zone C is much greater than the 3306 acres [1338 hectares] which we can calculate from aerial photographs. In the annual report (1965) of the Public Works Department (Irrigation and Drainage Section), it has been stated that 146,000 acres [59,084 hectares] of wetland has been reclaimed in the Busselton area alone. Therefore, from our calculation we estimate that 96% of the wetland areas has been drained and is no longer usable for waterfowl. Drainage of this zone has been made easier by the general flat terrain which allows canals to be dug rapidly throughout the entire area." Page 30: "As previously stated the actual area drained is much higher than can be calculated from aerial photographs. In the Public Works Department Annual Report (1965) a figure of 494, 739 acres [200, 214 hectares] of wetland has been drained on the Swan Coastal Plain by 1,259 miles [2,026 kilometres] of drains. The following list denotes acreages of drained wetlands.		

<table>
<tr><th>Year</th><th>Quotes</th><th>Estimate of loss</th><th>Reference</th></tr>
<tr><td></td><td>
<table>
<tr><th>District</th><th>Acres</th><th>Hectares</th></tr>
<tr><td>Harvey</td><td>65,608</td><td>26,551</td></tr>
<tr><td>Collie River</td><td>40,272</td><td>16,298</td></tr>
<tr><td>Waroona</td><td>69,569</td><td>28,154</td></tr>
<tr><td>Myalup</td><td>4,683</td><td>1,895</td></tr>
<tr><td>Pinjarra</td><td>66,540</td><td>26,928</td></tr>
<tr><td>Busselton</td><td>146,152</td><td>59,146</td></tr>
<tr><td>Stirling</td><td>6,726</td><td>2,722</td></tr>
<tr><td>Serpentine-Mundijong</td><td>95,189</td><td>38,522</td></tr>
<tr><td>Total</td><td>494,739</td><td>200,216</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>1972</td><td>Page 226:

“Of all the resources of the coastal plain, the rivers, estuaries, lakes and swamps have been most affected by European occupation. They are also the most biologically productive areas on the plain and directly or indirectly support most of its wildlife. More than half a million acres [202, 343 hectares] of wetland have been drained for agriculture on the coastal plain and reclamation has claimed 1,501 acres [607 hectares] of wetland along the shores of the Swan and Canning estuaries alone. This area was once a valuable waterfowl habitat, and its destruction has drastically reduced waterfowl use. In the area from Yanchep to Rockingham 49 per cent (13,154 acres) [5,323 hectares] of all wetlands had been drained by 1966; from Rockingham to Harvey, 31 per cent; from Harvey to Dunsborough, 96 per cent [Riggert (1966)]. The most southerly section of the plain is flat alluvial terrain, so that it has both been worth draining, and relatively easy to drain by digging canals.”</td><td>More than 202, 343 hectares of wetland have been drained and reclamation has claimed 607 hectares of wetlands along the shores of the Swan and Canning estuaries</td><td>Seddon G 1972, Sense of place: A response to an environment – the Swan Coastal Plain, Western Australia. UWA Publishing, Perth.</td></tr>
</table>

Year	Quotes	Estimate of loss	Reference
	“The lakes and waterways that have survived in the metropolitan region are not now likely to be drained, because they are in reserves, because they are too deep to drain, or because they are salt lakes near the coast, and not worth draining for agriculture. This does not mean that such wildlife as is left is secure, for many reasons. Clearing around the lakes is common…”. “No species can survive unless all of its seasonal requirements are met, and the abundance of ducks, swans, coots and other water-birds in summer on a few lakes is misleading. Yanchep, Joondalup, Monger, Claremont, North, Goollelal, Bibra and Thompson lakes are crowded in summer, but the birds rarely breed in these waters, and the crowding comes of concentration on shrinking summer refuges.” Page 228: “Nevertheless, the breeding and migratory parts of the cycle [for waterbirds] are more vulnerable than the summer 'loafing'. The chain of seasonal swamps between the breeding grounds, mostly near the Darling Scarp, and the permanent water, mostly near the coast, is first to be drained, and this makes migration difficult for immature birds, especially when a dry season forces them prematurely from the breeding grounds. The breeding grounds are fresh-water marshes, mostly in the alluvial soils of the Pinjarra Plain. In 1966 there were 7,016 acres [2839 hectares] of shallow inland fresh-water marshland; there had been 19,697 acres [7971 hectares] in 1955. In the same year, there were only 3,622 acres [1466 hectares] of deep fresh-water marsh; there had been 15,388 acres [6227 hectares] in 1955. These winter swamps are often insignificant individually, and the loss of one or two is of no significance, but collectively they provide most of the nesting sites for the waterfowl of the		

Year	Quotes	Estimate of loss	Reference
	coastal plain. The figures given are for the whole of the coastal plain, but there are few nesting sites left north of Armadale or south of Harvey. The sixty-mile strip along the Pinjarra Plain from Armadale to Harvey now supplies most of the nesting sites on the plain. Pinjarra, in the centre of this strip, is marked out for rapid industrial and urban expansion, and the first step is improved drainage. Page 229: "The coastal plain harboured one of the most stable populations of waterfowl in Western Australia only thirty years ago: it does so no longer [Riggert (1966)]". "There are no remedies. The decline is an irreversible consequence of European occupation. But palliative measures are available, and of some urgency".		
1981	Page 81: "Although over the years upward of fifty percent of the wetlands of the Swan Coastal Plain have been lost to landfill or drainage, fortunately many of those that are still present are reserved within Regional or Local open space where their management is part and parcel of broader land management considerations. There is now a need to distil practical management strategies from research results and to employ resource managers with adequate support." Page 83: "Everyone is now aware that significant areas of wetlands have been lost through drainage and filling (Riggert, 1966), and that wetland qualities have been reduced in some areas by partial filling with sanitary landfill. Less is said about gains in wetland areas	Over 50%	Arnold JM & Sanders CS 1981, 'Wetlands of the Swan Coastal Plain' in *Groundwater Resources of the Swan Coastal Plain: Proceedings of a public symposium, University of Western Australia*, *21–22 May 1981*, CSIRO Division of Land Resources Management and Water Research Foundation of Australia, Wembley, WA. Available on request via <https://catalogue.nla.gov.au/catalog/1397352>. (Accessed: 22 March 2026.)

Year	Quotes	Estimate of loss	Reference
	resulting from water level rises following clearing and urbanisation. Some such gains have occurred but with consequent damage to the fringing vegetation as, for example at Lake Claremont and the southern end of Lake Joondalup. All of the lakes and swamps of the Swan Coastal Plain have been subjected to the influence of European settlement and it would be difficult to guess at pre-settlement base-lines. A study by the Western Australian Museum (How, 1978) showed how significant the changes have been on the northern Swan Coastal Plain, even in an area relatively little urbanised." Pages 88 to 89: "Singleton (1979) has noted an assumption in Perth that urban lakes should look and be like European lakes. Most people enjoy open water, landscaped banks with grass and shady trees; they like to be able to go to the waters edge and may be upset if the water levels fall in summer to expose mud banks. This kind of wetland can be exemplified by the modified Emu Swamp at Ballajura. It has a sealed bottom and a concrete shoreline with provision for aeration, cleaning and recharge (MacFarlane 1980)."		
1988	Page 4: "Wetlands are lakes, swamps, tidal marshes and mudflats, estuaries, rivers and streams. The people of Perth are fortunate in having many wetlands nearby on the Swan Coastal Plain, despite the fact that 80% have been lost since European settlement due to filling and draining. However, increasing public appreciation of our wetlands can be expected to generate resistance to any further erosion of this natural asset."	80%	Godfrey N 1988, 'The value of wetlands' in *Wetlands in crisis. What can local government do? Conference papers 15 June 1988*, Murdoch University and Environmental Protection Authority, Perth. Available at: <https://library.dbca.wa.gov.au/static/Journals/080218/080218-372.pdf>. (Accessed 22 March 2026.)

Year	Quotes	Estimate of loss	Reference
	Page 5: “Despite living in one of the world's driest continents, the people of Perth are fortunate in having adequate rainfall and ready access to many wetlands throughout the Swan Coastal Plain. This extends from the Moore River in the north to Bunbury, and east-west from the Darling Scarp to the Indian Ocean. These wetlands have not always been regarded with favour as many have been drained or filled for a variety of reasons including agricultural development, sanitary landfill, industrial waste disposal, stormwater sumps, road construction and urban development. As a consequence, about 80 per cent of the wetlands existing at the time of European settlement have been lost forever.”		
1988	Page 27-29: “Urban development in the region has been considerably influenced, hampered and encouraged by the existence of wetlands. In summary, one can say that the larger wetlands within the urban area mostly remain, even if variously modified, but smaller swamps were often eradicated. The reasons for modification and eradication are numerous, the most frequent being drainage to create more land for development and the convenient disposal of rubbish, the latter often in conjunction with the former. Total figures are not available for the area of wetlands modified for various purposes. However it was estimated that in the period 1950 to 1976 some 121.4 hectares of wetland and a further 242.8 hectares of river foreshore had been reclaimed by landfill waste disposal methods, and that approximately 20.23 hectares/year were required to keep pace (Iveson, 1976).		Singleton J 1988, ‘The history and tenure of wetlands’ in *Wetlands in crisis. What can local government do? Conference papers 15 June 1988*, Murdoch University and Environmental Protection Authority, Perth. Available at: <https://library.dbca.wa.gov.au/static/Journals/080218/080218-372.pdf>. (Accessed 22 March 2026.)

Year	Quotes	Estimate of loss	Reference
	A survey of the whole of the Swan Coastal Plain undertaken between 1964 and 1966, established that close to 50% of all wetlands had been eradicated (Riggert, 1966). It has also been estimated that some 200 000 hectares of land had been filled or drained by 1964 and that 40% of the remaining 65 000 hectares of wetland are reclaimable with existing technology (Department of Conservation & Environment, 1977). A typical example of the way in which urban development has resulted in the disappearance of wetlands through drainage and landfill is shown in Figures 7 & 8 which illustrate natural and modified drainage before and after development of the suburbs of Bull Creek and Riverton (Stegena, 1975)…" Page 33 to 33: "In summary it appears that from the earliest days with the first settlers, those wetlands that could be drained were. Those that could have been drained but were not, were in many cases eventually converted into formal lakes in 'manicured' parkland. Wetlands too large to do anything with were perhaps slightly modified along their margins, but until recently mainly ignored (Hiller, 1977)."		
1989	Page 106: "During the last 100 years, approximately 70% of the wetlands have been drained, filled or cleared of vegetation so that they no longer fulfil their former functions." "Arnold & Sanders (1981), in probably the most authoritative published survey of wetlands of the Swan	70%	Halse SA 1989, 'Wetlands of the Swan Coastal Plain past and present' in *Proceedings of the Swan Coastal Plain Groundwater Management Conference*, Western Australian Water Resources Council, Perth. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/Biblio05085.pdf>. (Accessed: 22 March 2026.)

Year	Quotes	Estimate of loss	Reference
	Coastal Plain, concluded that over 50% had been lost to landfill or drainage. In an earlier, more formal study of wetland loss Riggert (1966) calculated that by 1966 49% of wetlands on the coastal plain between Yanchep and Rockingham had been drained, filled or cleared, 31% between Rockingham and Harvey had been lost and 96% had been lost between Harvey and Busselton. Riggert's figures included areas like the Swan River and Peel-Harvey Estuary that contain a lot of open water that has not been, and is unlikely to be, modified so that, theoretically at least, he probably under-estimated loss of small wetlands. On the basis of a recent aerial survey of the coastal plain, I believe that a reasonable working figure is that, averaged over the whole coastal plain, 70% of wetlands have either been lost or have been drastically modified by clearing of vegetation. However, exact percentage losses of wetlands are not important. The pertinent fact is that there has been massive loss of wetlands on the Swan Coastal Plain and the process is continuing in spite of the increasing biological importance of the wetlands as inland areas turn saline (Halse 1987)…"		
1991	Page 1: "Since European settlement, the values of more than two-thirds of wetlands on the Swan Coastal Plain have been reduced or destroyed as a result of filling in, mining, excavation, pollution or changes in drainage, and the purpose of this policy is to protect the values of wetlands on the Swan Coastal Plain from being reduced or destroyed any further by those activities."	More than two-thirds	Environmental Protection Authority 1991, *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 1991,* Environmental Protection Authority, Perth. Available at: <https://library.dbca.wa.gov.au/static/FullTextFiles/011538.pdf>. (Accessed: 22 March 2026.) Note: This draft was not finalised and is not part of current policy.

Year	Quotes	Estimate of loss	Reference
1993	“In 1966 it was estimated that 75 per cent of the wetlands of the coastal plain (including streams as well as lakes) had been lost. In the City of Perth the loss probably nears 99 per cent.”	75% in 1966 Near 99% loss in the City of Perth	Bekle H & Gentilli J 1993, 'History of the Perth lakes' in *Early Days: Journal and proceedings of the Royal Western Australian Historical Society*, vol. 10, part 5: pp. 442-460. Available at: <https://freotopia.org/earlydays/10/bekle.html>. (Accessed: 22 March 2026.)
1993	Page 6: “Since European settlement, more than 200,000ha of wetland have been destroyed (Seddon 1972). In 1955 there was 7879ha of seasonal wetlands and 6155ha of permanent wetlands. In 1966 there remained only 2806ha of seasonal and 1449ha of permanent wetland (Seddon 1972). Arnold and Sanders (1981) concluded that over 50% of wetlands had been lost to landfill or drainage. In an earlier, formal study of wetland loss Riggert (1966) calculated that by 1966, 49% of wetlands on the Coastal Plain between Yanchep and Rockingham had been drained, filled or cleared, 31 % between Rockingham and Harvey had been lost and 96% had been lost between Harvey and Busselton. Riggert's figures included areas like the Swan River and Peel-Harvey Estuary that contain a lot of open water so that theoretically at least, he probably underestimated loss of small wetlands. On the basis of a recent aerial survey Halse (1988) concluded that 70% of wetlands have either been lost or drastically modified by clearing of vegetation. The process is continuing despite the increasing biological importance of these wetlands as inland areas become saline (Halse 1987), with the most recent estimate of 80% loss of wetlands by Godfrey (1989).”	80% as the most recent estimate	Balla SA and Davis JA 1993, *Wetlands of the Swan Coastal Plain,* Volume 5, Managing Perth's wetlands to conserve the aquatic fauna. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/001700.pdf>. (Accessed: 22 March 2026.)
1994	Page 11:	70 or 80%	Balla SA 1994, *Wetlands of the Swan Coastal Plain, Volume 1 Their nature and management*. Available at:

Year	Quotes	Estimate of loss	Reference
	"…Singleton (1991) commented that a European oriented society has a great deal of difficulty coming to terms with the nature of the wetlands of the Swan Coastal Plain. As Perth grows, the wetlands become engulfed and destroyed or degraded. It is difficult to estimate exactly how many wetlands have been filled, drained or the vegetation cleared, but it may be as high as 70 or 80%. In the agricultural land surrounding Perth, wetlands have also been cleared and drained. As a result, very few wetlands remain in a natural condition."		<https://library.dbca.wa.gov.au/FullTextFiles/001688.pdf>. (Accessed: 22 March 2026.)
1996	Page 12: "Only 17% of all the basin and flat wetlands in the Wedge Island to Mandurah area remain fully vegetated with mainly native species. An additional 45% of the resource is more than 50% vegetated. Only 48% of rivers and 33% of creeks support more than half of their original vegetation." Page 17: "Regionally, rivers and creeks require urgent attention to reverse the decline in their condition." "Rivers, creeks and artificial channels are often enveloped by palusplain or floodplain, the vast majority of which have been cleared. Only 6% of palusplain and 22% of floodplain between Gingin and Mandurah remains vegetated."	See quotes	Hill AL, Semeniuk CA, Semeniuk V and Del Marco A 1996, *Wetlands of the Swan Coastal Plain,* Volume 2a, Wetland mapping, classification and evaluation, Main report. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/001689.pdf>. (Accessed: 22 March 2026.)
1999	Page 5: "The EPA is concerned at the apparent continuing loss and degradation of important wetlands, particularly as this follows on from its 1991 estimate that some 80% of	80%	Environmental Protection Authority 1999, *Review of the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*, Environmental Protection Authority, Perth. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/019421.pdf>. (Accessed: 22 March 2026.)

Year	Quotes	Estimate of loss	Reference
	wetlands on the Swan Coastal Plain have already been lost or heavily modified (EPA, 1991)." "In preparing this review and new draft Swan Coastal Plain Wetlands EPP the EPA, while noting the apparent continuing loss and degradation of important wetlands and that some 80% of wetlands on the Swan Coastal Plain have already been lost or heavily modified (EPA, 1991), is mindful that the community expects greater protection of wetlands on the Swan Coastal Plain." Page 6: "The EPA recognises the substantial loss, degradation and modification of wetlands that has occurred in Western Australia. Urbanisation, infrastructure development (including road construction), industrial and agricultural development and groundwater abstraction have had a significant impact on wetland ecosystems in many areas of the state. The EPA has estimated that some 80% of wetlands on the Swan Coastal Plain have been lost and most of the remainder heavily modified (EPA, 1991)." Note: The estimate that approximately 80% of wetlands on the Swan Coastal Plain have been lost or significantly modified has been widely repeated in publications. However, the original source and method of calculation for this figure remain unclear. Although EPA (1999) attributes it to EPA (1991), the statement does not appear in the 1991 draft policy. See further advice about EPA (1991) above.		Note: The policy was repealed.
1999	Abstract, page 13: "Many wetlands (estimated to be about 70%) have been lost in the coastal plain region of southwestern Australia	About 70%	Davis JA & Froend R 1999, 'Loss and degradation of wetlands in southwestern Australia: underlying causes, consequences and solutions' in *Wetlands Ecology and Management*

Year	Quotes	Estimate of loss	Reference
	since British settlement (in 1829), primarily as a result of infilling or drainage to create land for agricultural use or urban development. While further loss is almost universally acknowledged as undesirable, wetland degradation continues with little overt public recognition of the causes or consequences. Obvious and direct causes include nutrient enrichment, salinization, pollution with pesticides and heavy metals, the invasion of exotic flora and flora, loss of fringing vegetation and altered hydrological regimes occurring as a result of urbanization and agricultural practices. Underlying causes include a lack of understanding of wetland hydrology and ecology on behalf of both planning agencies and the private sector, and poor coordination of the many different agencies responsible for wetland management…" Page 13: "…An estimated 70% of the original wetland area was drained, filled in or otherwise lost as a consequence of agriculture activities and urban development over the past 160 years (Halse, 1989). Of the wetlands remaining, many are experiencing or are threatened with severe degradation. Despite State legislation protecting wetlands from direct physical disturbance (EPA, 1993), most wetlands, and especially rural wetlands, are threatened or degraded as a result of various land use activities (agricultural, horticultural and urban) within their catchments." Page 14: "The increasing population of the region resulted in wetland areas being targeted by planners and developers to provide land for urban development. Draining and infilling of wetlands and damplands to create dry land for housing still occurs. In addition,		vol 7, pp. 13–23. Available at: <www.researchgate.net/publication/227141195_Loss_and_degradation_of_wetlands_in_southwestern_Australia_Underlying_causes_consequences_and_solutions>. (Accessed: 22 March 2026.)

Year	Quotes	Estimate of loss	Reference
	fringing vegetation is often removed and wetland habitats destroyed in the process of landscaping wetland areas for use as urban parks. Hill *et al.* (1996) found that only 17% of wetlands on the Swan Coastal Plain between Mandurah and Wedge Island remained fully vegetated with predominantly native species and only 45% remained more than 50% vegetated."		
2001	Page 1: Most wetlands have been either cleared, filled or developed over, leaving only 20% of all the wetlands that were present on the Swan Coastal Plain prior to European settlement. Of these, an estimated 15% of the wetland area has retained high ecological values. These are conservation category wetlands.	80% (20% remaining)	Water and Rivers Commission 2001, *Position statement: Wetlands*, Water and Rivers Commission, Perth. Note: This policy was repealed.
2003	Page 4: "A collection of old maps arranged in chronological order reveals the sequence of settlement and progressive sub-division of the landscape. Locations of former and existing lakes can be identified and changes in their outline recorded. The impact of drainage and reclamation has seen the disappearance of seventy-five percent of the wetlands of the Swan Coastal Plain, representing approximately 200,000 hectares of lost habitat (Riggert, 1966; Bekle, 1981; Bekle and Gentilli, 1993)…"	75%	Bekle H 2003, Wetland landscapes: Towards an ecological vision. *Landscapes: the Journal of the International Centre for Landscape and Language*, 2(1). Available at: <https://ro.ecu.edu.au/landscapes/vol2/iss1/2>. (Accessed: 22 March 2026.)
2004	Foreword: "The EPA is concerned that over 80 per cent of the wetlands on the Plain have already been lost to land development pressures, which are ongoing. The Policy and its proposed wetlands register are designed to protect the environmental values of the most important Swan Coastal Plain wetlands, which constitute less than	Over 80%	Environmental Protection Authority 2004a, *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004*, Environmental Protection Authority, Perth. Available at: <https://library.dbca.wa.gov.au/static/FullTextFiles/34140.pdf>. (Accessed: 22 March 2026.)

Year	Quotes	Estimate of loss	Reference
	15 per cent of the remaining wetlands, while continuing to protect the Swan Coastal Plain lakes." Page 3: "Wetlands on the Swan Coastal Plain are coming under increasing pressure, mostly due to urban development and changes in rural land use. Since European settlement, it has been estimated that more than 80 per cent of the original wetlands on the Plain have been either lost or seriously degraded due to filling, clearing and other land use impacts (see Balla, 1996). The loss of wetlands is continuing, making it important to protect those wetlands that remain, especially those that are still in good condition. A recent decline in annual rainfall in the southwest has put further pressure on these wetlands." Page 4: "Methodologies for identifying management objectives for wetlands on the Swan Coastal Plain were first published through EPA Bulletin 374 in 1990, which were then updated in Bulletin 686 in 1993. The methodologies in these Bulletins focused on wetlands with open water bodies, such as lakes. In 1996, the Water and Rivers Commission, in conjunction with the Department of Environmental Protection, published the first comprehensive mapping of wetlands on the Plain (Balla, 1996). Wetlands were mapped, classified according to wetland type and evaluated into one of three management categories, namely Conservation, Resource Enhancement or Multiple Use (Hill et al., Volume 2b: in Balla, 1996). Recent work undertaken by the DOE has updated this database. Note that the majority of wetlands on the Plain are evaluated as		Note: This draft was not finalised and is not part of current policy.

Year	Quotes	Estimate of loss	Reference
	Multiple Use (80%), 5% as Resource Enhancement and 15% as Conservation, with this last group also known as Conservation Category Wetlands (see Appendix 1).”		
2004	Foreword: “In the past little regard has been given to our wetlands. The Authority has estimated that some 80% of wetlands on the Swan Coastal Plain have been lost and many of the remainder have been heavily modified. Today there is an increased public appreciation for wetlands and the Authority places considerable importance on the protection of these remaining areas. Wetlands are now widely recognised wildlife habitats and are among the most biologically productive and biologically diverse habitats on the planet. They are key indicators of environmental health of ecosystems.” Page 2: “The EPA has previously estimated that some 80% of wetlands on the Swan Coastal Plain have been lost and most of the remainder have been heavily modified (EPA, 2004). Of the remainder, an estimated 15% of the wetland area has retained high ecological values. These are conservation category wetlands (WRC, 2001).”	80%	Environmental Protection Authority 2004b, *Position statement no. 4 Environmental protection of wetlands*, Environmental Protection Authority, Perth. Available at : <https://library.dbca.wa.gov.au/static/FullTextFiles/022579.pdf>. (Accessed: 22 March 2026.) Note: This position statement was repealed. It was replaced by environmental factor guidelines on flora and vegetation, inland waters, environmental quality and terrestrial fauna (EPA 2006b).
2006	Page 4: “The Swan Coastal Plain has high natural values, is the most populous and densely settled area of the State and, together with the Wheatbelt, is the most heavily cleared area of the State. Only 22% of the Swan Coastal Plain in System 6 and System 1 remains vegetated (Appendix 3). The EPA has previously estimated that some 80% of the	80%	Environmental Protection Authority 2006, *Guidance for the assessment of environmental factors Western Australia (in accordance with the Environmental Protection Act 1986) Environmental Protection Authority no. 10 June 2006, Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the*

Year	Quotes	Estimate of loss	Reference
	wetlands on the Swan Coastal Plain have been lost or irreversibly degraded (EPA 2004a[1]). More than 97% of the heavier more fertile soils on the eastern side of the Swan Coastal Plain have been cleared (CALM 1990)."		*System 1 region*, Environmental Protection Authority, Perth. Available at: <https://library.dbca.wa.gov.au/static/FullTextFiles/020658/020658-10.pdf>. (Accessed: 22 March 2026.) Note: This guidance was repealed. It was replaced by an environmental factor guideline on flora and vegetation (EPA 2006b).
2007	Page 76: "Key findings [related to the wetlands of the Swan Coastal Plain]: • Only seventeen per cent of remaining wetlands on the Swan Coastal Plain have high conservation significance. • Wetland vegetation on the Swan Coastal Plain is being lost or degraded at the rate of about two football ovals per day." Page 77: "Only 17% of remaining wetlands on the Swan Coastal Plain have high conservation significance (Environmental Protection Authority, unpublished data). Information about the condition of other WA wetlands is extremely limited." "Recent analysis indicates that wetland vegetation on the Swan Coastal Plain decreased by about 1500 hectares per year between 1996 and 2004 (Environmental Protection Authority, unpublished). This equates to the	70–80%, although with continued wetland losses this figure is likely to be much higher About 6% of wetlands of high conservation value on the Swan Coastal Plain were lost or degraded between 1996 and 2004. Wetland vegetation on the Swan Coastal Plain is being lost or degraded at the rate	Environmental Protection Authority 2007, 'Theme 4, Inland waters' in *State of the environment report*, Environmental Protection Authority, Perth. Available at: <www.epa.wa.gov.au/state-environment-report-2007>. (Accessed: 22 March 2026.)

[1] This reference is: Environmental Protection Authority 2004, *Position statement no. 4 Environmental protection of wetlands*, Environmental Protection Authority, Perth. Available at: <https://library.dbca.wa.gov.au/static/FullTextFiles/022579.pdf>. (Accessed: 22 March 2026.) This position statement was repealed.

Year	Quotes	Estimate of loss	Reference
	loss of an area about the size of two football ovals per day." Page 79: "Most information is available for wetlands on the Swan Coastal Plain, as this area has been subject to ongoing development and other pressures (see 'Loss or degradation of wetlands'; Figure IW0.3). Approximately 17% of wetlands on the Swan Coastal Plain have high conservation significance and 14% are formally protected." Page 92: Key findings: • Wetland vegetation on the Swan Coastal Plain is being lost or degraded at the rate equivalent of two football ovals per day. • About 6% of wetlands of high conservation value on the Swan Coastal Plain were lost or degraded between 1996 and 2004. Page 93: "…Although difficult to ascertain, previous estimates indicate that 70–80% of original wetlands on the plain have been cleared, drained or filled since European settlement (Balla, 1994), although with continued wetland losses this figure is likely to be much higher. The ecological function of many remaining wetlands has been so significantly altered that they now bear little resemblance to their original state (Environmental Protection Authority, 2004). In 2004 approximately 36% of the Swan Coastal Plain was wetlands, by area. Of the remaining wetlands, about 17% have high conservation significance and only 14% are protected through formal	equivalent of two football ovals per day.	

Year	Quotes	Estimate of loss	Reference
	statutory policies such as environmental protection policies (Figure IW3.1). A review of the Swan Coastal Plain Wetlands Environmental Protection Policy indicates that many valuable wetlands are still in decline. Between 1996 and 2004, Land Monitor showed that 4% of vegetation in remaining wetlands was lost or became severely degraded (Figure IW3.2). This represents an approximate rate of loss of 1500 ha (equivalent to about 750 football ovals) of wetland area each year. About 6% of wetlands lost or degraded during this time were of high conservation significance (Figure IW3.2, Table IW3.1)." Page 95: "Wetlands on the Swan and Scott coastal plains of South West WA are being lost or degraded at an alarming rate by altered catchment water balances, drainage, development, salinity, acidity, pollutant discharge, dieback, weed encroachment and insensitive fire management. Climate change is also an ominous threat for remaining wetlands, particularly in the South West, where a drying climate is expected."		
2008	Page 1 of Chapter B4 Wetlands: The continued degradation and loss of wetland habitat in Western Australia, particularly on the Swan Coastal Plain, is an important issue. In 1994, it was estimated that over 80% of the original wetlands on the Swan Coastal Plain had been lost or seriously degraded (Balla 1994[2]).	Over 80%	Environmental Protection Authority 2008, 'Chapter B4 Wetlands' in *Environmental guidance for planning and development – Guidance statement 33*, Environmental Protection Authority, Perth. Available at: <www.epa.wa.gov.au/policies-

[2] This reference is Balla SA 1994, *Wetlands of the Swan Coastal Plain, Volume 1 Their nature and management*. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/001688.pdf>. (Accessed: 22 March 2026.) See above.

Year	Quotes	Estimate of loss	Reference
			guidance/environmental-guidance-planning-and-development-gs-33>. (Accessed: 22 March 2026.)
2014	Under 'Wetland conservation': "Of all the ecosystems of the Swan Coastal Plain, the rivers, estuaries, lakes and swamps have been most affected by European occupation. Swamps are also the most biologically diverse and productive areas on the Swan Coastal Plain and directly or indirectly support most of its wildlife. In 1972 George Seddon estimated that more than half a million acres (202,342ha) of wetlands had been drained, filled in and built upon (Seddon 1972). Philip Jennings, Professor of Physics and Energy Studies at Murdoch University, wrote in 1988 that 80% of wetlands had been lost or 'disappeared'. Rod Giblett, an academic who has been living on, and writing about Perth's wetlands for many decades, comments that, "there has been a massive loss of wetlands on the Swan Coastal plain and the process is continuing" (Giblett and Webb 1996). Wetlands are still being lost underneath the growth and spread of the Perth metropolitan area with an estimated 10% of original wetlands areas remaining."	80 to 90%	Western Australian Museum undated(b)[3], *Reimagining Perth's lost wetlands: Have you ever wondered what Perth was like before it was a city?* Viewed at: <https://museum.wa.gov.au/explore/wetlands> on 22 March 2026.
2015	Page 14: "Habitat loss occurring as a result of development is the most significant threat currently affecting Australian migratory shorebirds, both in Australia and along the EAAF [East Asian-Australasian Flyway]. It is estimated	75%	Department of the Environment 2015, *Wildlife conservation plan for migratory shorebirds*, Department of Environment, Canberra. Available at: <www.dcceew.gov.au/sites/default/files/documen

[3] Prepared for an exhibition in 2014.

Year	Quotes	Estimate of loss	Reference
	that since European settlement approximately 50 per cent of Australia's non-tidal wetlands have been converted to other uses. In some regions the rate of loss has been even higher. On the Swan Coastal Plain of Western Australia 75 per cent of wetlands have been filled or drained."		ts/widlife-conservation-plan-migratory-shorebirds.pdf>. (Accessed: 22 March 2026.)
2017	Executive summary: "Approximately, 73 per cent of wetlands currently mapped on the Swan Coastal Plain have been degraded and have an assigned management category of Multiple Use. Only 21 per cent of wetlands are in a relatively undisturbed condition and have an assigned management category of Conservation. An analysis of Landsat satellite imagery from 1992-2012 indicated that approximately four ha of perennial vegetation within wetlands was lost per day on the Swan Coastal Plain." Page 16: "…Wetlands on the Swan Coastal Plain have been assigned either a Conservation, Resource Enhancement or Multiple Use management category. Table 2 outlines the description and recommended management objectives for each wetland management category (Environmental Protection Authority 2008). Approximately 21 per cent of the wetlands on the Swan Coastal Plain are assigned Conservation category, 6 per cent are assigned Resource Enhancement category and the majority of wetlands (73 per cent) are assigned Multiple Use category as displayed in Figure 4 (Department of Parks and Wildlife 2016[4])."	73%	Department of Biodiversity, Conservation and Attractions 2017, *A methodology for the evaluation of wetlands on the Swan Coastal Plain,* Department of Biodiversity, Conservation and Attractions, Perth. Available at: <www.dbca.wa.gov.au/media/1877/download>. (Accessed: 22 March 2026.)

[4] Department of Parks and Wildlife (2016) is the *Geomorphic wetlands, Swan Coastal Plain* spatial dataset. It is more recently available as: DataWA 2021, *Geomorphic wetlands, Swan Coastal Plain (DBCA-019)*. Viewed at: <https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain> on 22 March 2026.

Year	Quotes	Estimate of loss	Reference
	Note: These estimates are taken from the Geomorphic wetlands, Swan Coastal Plain (DBCA-019) spatial dataset. This dataset was first developed in the mid-1990s and has been updated from time to time, but not in a comprehensive way. It does not include many historically filled or drained wetlands, such as those shown in Riggert (1966), the Western Australian Museum (undated(a)), Wikipedia (undated), and Bekle & Gentilli (1993).		
2017	Page 1: "Lake Claremont is ecologically significant because in less than 200 years of European style urban development at least 80% of the landlocked wetlands on the Swan Coastal Plain have been destroyed (Fairbridge 1950; Department of Environmental Protection 2004[5])."	At least 80%	Simpson G & Newsome D 2017, 'Environmental history of an urban wetland: from degraded colonial resource to nature conservation area' in *Geo: Geography and Environment*, 4(1), e00030. Available at: <www.researchgate.net/publication/313090016_Environmental_history_of_an_urban_wetland_from_degraded_colonial_resource_to_nature_conservation_area_Environmental_history_of_an_urban_wetland>. (Accessed: 22 March 2026.)
2019	"Meanwhile, in the 1960s ecologists estimated that over half of the wetlands of the Swan Coastal Plain had been lost already, and predicted that the public and private abstraction of large amounts of groundwater would endanger those that remained. They expected the draw on groundwater would threaten sensitive communities of flora and fauna, including migratory waterbirds. These concerns were realized in 1991 when large tracts of groundwater-dependent banksia woodland perished, prompting the water authorities to curb their pumping."	Over half of the wetlands lost by the 1960s	Gaynor A, Cook M, Frost L, Gregory J, Morgan R, Shanahan M, Spearritt P, Avey S, Etherington N, Gralton E & Martin D 2019, 2019, 'Perth: Water beneath the city' in *Drought, mud, filth, and flood: Water crises in Australian cities, 1880s–2010s*. Environment and Society Portal, Virtual Exhibitions 2019, no. 3. Rachel Carson Center for Environment and Society. Available at:<www.environmentandsociety.org/exhibitions/drought-mud-filth-and-flood/perth-water-beneath-city>. (Accessed: 22 March 2026.)

[5] This is Environmental Protection Authority 2004, *Position statement no. 4 Environmental protection of wetlands*, Environmental Protection Authority, Perth. Available at: <https://library.dbca.wa.gov.au/static/FullTextFiles/022579.pdf>. (Accessed: 22 March 2026.) This position statement was repealed.

Year	Quotes	Estimate of loss	Reference
2021	Page 1: “An estimated 90% of the Swan Coastal Plain (SCP) wetlands, located in southwestern Australia, have been lost because of infilling or drainage. This loss continues despite the well-known causes, which include nutrient enrichment; the invasion of exotic flora and fauna; loss of fringing vegetation; and altered hydrological regimes caused by groundwater abstraction; urbanization; and a drying climate. Further loss is expected with climate change exacerbating the undesirable ecosystem changes of remaining wetlands.”	90%	Nanda AVV, Beesley L, Locatelli L, Gersonius B, Hipsey MR and Ghadouani A 2021, ‘Resilience and adaptive capacity of the Swan Coastal Plain wetlands’ in *Frontiers in Water*, 3:754564. Available at: <www.frontiersin.org/journals/water/articles/10.3389/frwa.2021.754564/full>. (Accessed: 22 March 2026.)
2022	Page 62: “The natural areas remaining on the Swan Coastal Plain are critically important, given most of the native bushland and more than 80 per cent of the original wetlands have been lost through clearing and draining since European settlement. The Gnangara groundwater system sustains these and other valuable areas including wetlands, mound springs, cave systems and large areas of bushland that overlie shallow groundwater (Figure 12). Many of these features: • have conservation significance and are recognised and protected under state and federal legislation[6] • are some of the most biologically diverse and ecologically productive parts of Perth’s environment north of the Swan River (Derbarl Yerrigan).	More than 80%	Department of Water and Environmental Regulation 2022, *Gnangara groundwater allocation plan*, Department of Water and Environmental Regulation, Perth. Available at: <www.wa.gov.au/system/files/2023-02/Gnangara-groundwater-allocation-plan.pdf>. (Accessed: 22 March 2026.)

[6] Footnote 9 in the plan says: “In 2016 the Banksia Woodlands of the Swan coastal plain ecological community was listed as ‘endangered’ under Australia’s national environment law, the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth). As most of the groundwater-dependent native vegetation in the Gnangara plan area is Banksia woodland, this listing signals a significant increase in the level of legal protection for much of the area shown in Figure 12. Banksia woodlands provide vital habitat for more than 20 nationally threatened species, including the Carnaby’s black cockatoo.”

Table H2 – References to historical wetland losses that are not likely to be included in the Geomorphic wetlands, Swan Coastal Plain spatial dataset (DataWA 2021)

Year	Quotes	Full reference
1966	Refer to Table H1, above.	Riggert TL 1966, *A study of the wetlands of the Swan Coastal Plain, being a pilot study of the wetlands of Western Australia with a particular reference to their use by waterfowl*, Department of Fisheries and Fauna, Western Australia. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/002768.pdf>. (Accessed: 22 March 2026.)
1981	Page 31: “Today, most of the former wetlands in the metropolitan area have disappeared because of the advance of urban development. The remaining wetland areas have been considerably modified and are no longer in their natural state. The old lakes and swamps had marshy, wet edges covered with dense stands of paperbarks, thick belts of reeds in the shallows, and patches of permanent water at the centre. Clearing, drainage, filling and fire caused serious interference with the vegetation, thus affecting wildlife habitats.”	Bekle H 1981, The wetlands lost: Drainage of the Perth lake systems. *Western geographer* 5, 21-41.
1993	“This article attempts an historical reconstruction of the transformation and almost complete obliteration of what used to be an intriguing, very significant and, for some people, embarrassing element of Perth’s landscapes, namely the many small lakes, basin swamps and marshes situated ‘at the back’ of the town.” “Let us hope that the sad history of the Perth lakes will not be repeated elsewhere by future generations, and that these ‘lost lakes’ may live in our memory. Their ‘presence’ is still a reality: any plan to sink the railway and take it underground past today’s Perth Railway Station must take into account a potential, albeit partial, revival of Lake Kingsford, whose soft muddy southern	Bekle H & Gentilli J 1993, 'History of the Perth lakes' in *Early Days: Journal and proceedings of the Royal Western Australian Historical Society*, vol. 10, part 5: pp. 442-460. Available at: <https://freotopia.org/earlydays/10/bekle.html>. (Accessed: 22 March 2026.)

	shore had to be pierced by countless timber piles before the General Post Office could be built…" Bekle & Gentilli (1993) provides further information on historical wetland loss.	
2003	Pages 4 to 5: "A collection of old maps arranged in chronological order reveals the sequence of settlement and progressive sub-division of the landscape. Locations of former and existing lakes can be identified and changes in their outline recorded. The impact of drainage and reclamation has seen the disappearance of seventy-five percent of the wetlands of the Swan Coastal Plain, representing approximately 200,000 hectares of lost habitat (Riggert, 1966; Bekle, 1981; Bekle and Gentilli, 1993). Old maps are often useful, as they may allow the contraction or expansion of an area of wetlands to be traced through the years; early maps of the Perth townsite show many lakes and swamps of which there are now few or no surface traces. They serve to illustrate the irreversible damage caused to almost an entire complex of wetlands by drainage and reclamation as the city expanded. The reconstruction of 1829, in Bekle and Gentilli (1993), shows the position of many of the former wetlands which occupied shallow depressions north of Perth townsite. A multiplicity of names appear for these lakes and swamps. Many are known after the original owner or user, such as Lake Kingsford which was named after Samuel Kingsford, who in 1833, erected a water mill driven by water he derived from the lake. For some other wetlands, there is uncertainty in the most popular identification of names (e.g. Stone's Lake, also known as Tea-tree Lake, Lotus Paddock, and now Perth Oval). The area of these wetlands varied significantly between winter and summer, therefore if a comparison is to be made with later maps the dates of survey must be established.	Bekle H 2003, Wetland landscapes: Towards an ecological vision. *Landscapes: the Journal of the International Centre for Landscape and Language*, 2(1). Available at: <https://ro.ecu.edu.au/landscapes/vol2/iss1/2/>. (Accessed: 22 March 2026.)

	Later maps disclose more detail, as illustrated by the survey plans of 1845 and 1903, which indicates that urban settlement has been extended to encroach on the lakes area (cf. Bekle, 1981; Bekle and Gentilli, 1993). Some wetlands, including Lake Kingsford, have been omitted from later surveys, possibly in anticipation of their eventual drainage and infilling. Additional information obtained from old newspapers, however, reveals that Lake Kingsford was still in existence. Reports from such (old) newspapers (e.g. The Swan River News, The Inquirer) have a tendency to record either the negative aspects or sensational occurrences, such as the heavy rains during the winter of 1847, which caused Lake Kingsford to flood parts of the Perth townsite: "In Murray, and all the streets in its rear, the water had risen so much as to compel the inhabitants to quit and seek for drier homes" (Inquirer, August 11, 1847, p. 2). When dealing with this material it is easy to overlook unpublished, but equally significant events, such as the gradual reclamation of a lake for market gardens. Flooding may be also caused by human action – the same amount of water would rise to a higher level after a lake cavity has been partially filled." Page 7 to 8: "But a study of maps and old documents, however scholarly, can reveal only an incomplete picture (Armstrong, 1975). Field observations can supply information both of ecological and historical value, by providing a link between historical documents and the contemporary landscape…" "…Care must be taken in the ecological interpretation of historical material. The investigation of a wetland environment as a dynamic, functioning system requires the approaches and skills of the ecologist, as well as the historian. For the successful application of this approach, a knowledge both of the historical material and eco system structure and dynamics is essential. Proper assessment of the sources is equally important when dealing with descriptions of the natural environment. The interpretation of aerial photographs, the scrutiny of legal	

	documents and old maps, and field studies are complementary to one another (Armstrong, 1975)..."	
2009	Page 1006-1007: "The wetlands have undergone dramatic change over the past 200 years, primarily as a result of a growing human population and associated changes in land use from uncleared to agriculture to urbanisation. The SCP has experienced the alienation of the land and water from indigenous Nyoongar stewardship (Marchant 1973; O'Connor *et al*. 1989), the damming of rivers flowing onto the plains, the drainage of low-lying areas to allow for agriculture and transportation routes during wet periods (Bradby 1977), changed fire regimes (O'Connor *et al*. 1989; Horwitz and Sommer 2005), the clearing of native vegetation, wetland infilling, successive periods of rapid urban expansion, groundwater extraction, extensive plantings of non-native pine trees (mainly *Pinus pinaster*), and more recently, a decline in rainfall. Most wetlands of the SCP have consequently disappeared and most of the remaining ones have undergone excessive nutrient loading from decades of runoff from urban or horticulture areas; the exposure of acid sulfate soils as a result of groundwater extraction, drainage and reduced rainfall; encroachment by terrestrial vegetation where water levels have declined; discharge of industrial, urban and agricultural chemicals to pollute waterways; sedimentation; and salinisation (for reviews see Halse 1989; Davis and Froend 1999; Sommer and Horwitz 2001). In general terms, the effects of urbanisation, at least for urban streams, lead to reduced biotic richness, with increased dominance of tolerant species (Walsh *et al*. 2005)."	Horwitz P, Rogan R, Halse S, Davis J and Sommer B 2009, Wetland invertebrate richness and endemism on the Swan Coastal Plain, Western Australia. *Marine and Freshwater Research*, 60(10), 1006-1020. Available at: <www.publish.csiro.au/mf/MF08204>. (Accessed: 22 March 2026.)
2010	Page 12: "European settlement has seen many changes to the catchment's hydrology. Before these changes occurred, very few waterways flowed directly into Geographe Bay. They instead flowed first into an extensive chain of wetlands stretching along the coast that emptied into the Vasse or Wonnerup estuaries (Lane *et al.* 1997). Hydrological change in	Department of Water 2010, *Vasse Wonnerup wetlands and Geographe Bay water quality improvement plan*, Department of Water, Perth. Available at: <www.wa.gov.au/government/document-collections/water-quality-improvement-plans>. (Accessed: 22 March 2026.)

	the catchment started as early as the 1880s when the Capel River was diverted from the Wonnerup Inlet into Geographe Bay through the Higgins Cut. From this time until the 1950s, a series of hydrological alterations were made, with drainage works escalating during the 1920s and again in the 1950s (WRM 2007). These works included the construction of floodgates to prevent saltwater incursion, a network of small drains to remove water from farmland, and a series of large arterial drains and river diversions to discharge surface flow directly to Geographe Bay (English 1994). These changes enabled farming of coastal areas that were previously inundated during winter, reduced saltwater incursion into pasture that bordered the estuaries, and protected the growing town of Busselton from flooding – thereby allowing it to expand into floodplain areas. However, these works also resulted in removal of the nutrient settlement and filtration functions once served by coastal wetlands, an increase in the velocity of water transport, reduced flushing of estuarine systems and increased sedimentation. Geographe Bay and the Vasse Wonnerup Wetlands now receive large loads of nutrient-laden flow delivered by the waterways during winter."	
2012	Page 20: "Much of the urban, agricultural and industrial landscapes present today across the southwestern coastal areas of WA were made possible through extensive draining, clearing and infilling of wetlands. Much of Perth was built on drained wetlands (for example, the northern Perth area, known as the 'Great Lakes District', shown in Figure 9." Page 21: "Most areas of pasture on the eastern side of the Swan Coastal Plain either are or were wetlands that, when intact, had exceptional ecological significance. The remaining intact areas are representative of what was naturally a mosaic of an extensive area of flat, seasonally waterlogged wetlands that were interspersed with shallow, seasonally inundated basins and channels and dryland prior to European settlement. They	Department of Environment and Conservation 2012, 'Managing hydrology, (section in chapter 3)', in *A guide to managing and restoring wetlands in Western Australia*, Prepared by J Lawn and A Lam, Department of Environment and Conservation, Perth, Western Australia. Available at: <https://library.dbca.wa.gov.au/FullTextFiles/026262/026262.018.pdf>. (Accessed: 22 March 2026.)

	are described as a “broad, interconnected chain of swamps many kilometres wide”. There are a number of accounts of wetland loss and devastation of such areas (including Riggert [1966], Seddon [1972] and Bekle [1981]), and all indicate the significant extent of impact. For example, Seddon reported that between 1955 and 1966, the area of wetland identified as ‘shallow freshwater marshland’ on the Pinjarra Plain declined in extent from around 8,000 hectares to less than 3,000 hectares, whilst ‘deep freshwater marshland’ declined from more than 6,000 hectares to less than 1,500 hectares [Seddon 1972]. Rural drainage on the Swan Coastal Plain was reported as extending over 200 kilometres south of Perth, covering an area of 321,000 hectares, and encompassing five gazetted drainage districts: Mundijong, Waroona, Harvey, Roelands and Busselton.”	
Undated Circa 2014	Under ‘Wetland conservation’: “Of all the ecosystems of the Swan Coastal Plain, the rivers, estuaries, lakes and swamps have been most affected by European occupation. Swamps are also the most biologically diverse and productive areas on the Swan Coastal Plain and directly or indirectly support most of its wildlife. In 1972 George Seddon estimated that more than half a million acres (202,342ha) of wetlands had been drained, filled in and built upon (Seddon 1972). Philip Jennings, Professor of Physics and Energy Studies at Murdoch University, wrote in 1988 that 80% of wetlands had been lost or ‘disappeared’. Rod Giblett, an academic who has been living on, and writing about Perth’s wetlands for many decades, comments that, “there has been a massive loss of wetlands on the Swan Coastal plain and the process is continuing” (Giblett and Webb 1996). Wetlands are still being lost underneath the growth and spread of the Perth metropolitan area with an estimated 10% of original wetlands areas remaining.”	Western Australian Museum undated(a)[7], *Reimagining Perth's lost wetlands: Have you ever wondered what Perth was like before it was a city?* Viewed at: <https://museum.wa.gov.au/explore/wetlands> on 22 March 2026.

[7] Prepared for an exhibition in 2014.

	Under ‘Draining the swamps’: “Drainage of the swamps began in 1833 for commercial purposes with the construction of drains to power Reveley’s and Kingsford’s mills. As Perth expanded northward, more swamps were drained for market gardens and new town lots. After 1834, wetlands increasingly diminished on Perth’s town plans. Whereas the 1833 town plan had plainly stated the presence of “fresh water swamps with rushy margins”, the 1838 maps show the swamps overlaid by roads and absorbed into the town plan with the effect of making the lakes vanish incrementally as if they had never existed (Morel-EdnieBrown 2008). Wetlands were regarded as sources of disease and insect infestation. The lakes regularly flooded and were seen as an impediment to productivity. A list of public works needed in August 1848 included the draining of all the lakes behind Perth. The floods of 1842 and 1847 had covered the north side of Hay Street with a single sheet of water from Lake Kingsford to Claise Brook, while the run off down to Perth water had damaged St Georges Terrace premises and road (Stannage 1979). From 1840 onwards, drainage works to alleviate flooding and to eradicate miasmas began in earnest, and the swampland was being sold for town lots. By 1845, the swamps were shown as irregular shapes on town plans and over half had disappeared off the map. Lakes Kingsford, Irwin, Sutherland and Henderson were named, but the remaining swamps were depicted as empty spaces, joined by drains (Morel-EdnieBrown 2008). More works took place in the 1870s and 1890s. By the end of the century, the swamp system would be subsumed into the formal grid of Perth. Claise Brook to the east, originally the mouth of the swamp system, functioned as an exit point for underground drains that, even today, carry water as part of the Claise Brook Catchment Area (Stannage 1979).” Under ‘Claise Brook: The lost river of Perth’:	

	"As Perth began to expand, one of the obstacles to development was the Claise Brook valley with its intermittent flows and seasonal lakes. Claise Brook was an ephemeral fresh water stream which ran from Lake Monger through Lakes Georgiana, Sutherland, Irwin and Kingsford, and drained down Wellington Street to Tea Tree Lagoon at what is now known as Claisebrook Cove. Another tributary of the drain ran from Lakes Thompson and Poulett (Birdwood Square), through Stones Lake (Perth Oval) to join the main stream at Water Street (now Royal Street)." "…In 1885 most swamps at the back of Perth had been drained but Smith's Lake and Lake Monger were still used for domestic water supply and the water from the main drain running into Claise Brook was used by residents living along its banks (Hunt 1980)."	
2018	Page 292: "…Urban dwellers of Perth are largely unaware that the seasonal lakes and wetlands of the centre of the city were the larders, gardens, hideouts, dumps and playgrounds of previous generations; both Noongar and settler." Page 293: "The limited visual traces of Perth's wetlands, in maps, artworks and photographs has led to a loss of understanding of the biogeography of the region alongside the physical loss of the wetlands, which can no longer be experienced."	Brady D and Murray J 2018, 'Reimagining the cultural significance of wetlands: From Perth's lost swamps to the Beeliar Wetlands' in *Coolabah*, (24&25), 292-307. Available at: <https://ro.ecu.edu.au/ecuworkspost2013/4811>. (Accessed: 22 March 2026.)
2016	"Like many cities, Perth was founded on wetlands that have been integral to its history and culture (Seddon 226–32). However, in order to promote a settlement agenda, early mapmakers sought to erase the city's wetlands from cartographic depictions (Giblett, Cities). Since the colonial era, inner-Perth's swamps and lakes have been drained, filled,	Ryan JC, Brady D, Kueh C 2016, 'Where Fanny Balbuk walked: Re-imagining Perth's wetlands' in *M/C Journal*, 18(6). Available at: <https://doi.org/10.5204/mcj.1038>. (Accessed: 22 March 2026.)

	significantly reduced in size, or otherwise reclaimed for urban expansion (Bekle). Not only have the swamps and lakes physically disappeared, the memories of their presence and influence on the city's development over time are also largely forgotten. What was the site of Perth, specifically its wetlands, like before British settlement?"	
2022	"A visual tour through the past, present and future of Perth's wetlands".	Naturelink Perth 2022, *Reimagining Perth's lost wetlands*. Viewed at: <https://vimeo.com/672591770> on 22 March 2026.
undated	"The Perth Wetlands, also known as the Perth Great Lakes or the Great Lakes District, was a collection of fresh-water wetlands, swamps and lakes located on the Swan Coastal Plain north of the city of Perth in Western Australia. Over a period of 80 years from the first British settlement in Western Australia in 1829 most of the wetlands were reclaimed for use as housing, parks and market gardens." "Following the arrival of the first Europeans in 1829, the township of Perth was gradually expanded. The area to the north of the township, was not considered ideal for settlement due to the extensive wetlands that stretched for almost 10 kilometres (6.2 mi) immediately north of the town site. Gradually, lakes closer to the city were drained, with the first drainage work commencing in 1832. Some wetlands were reclaimed by individual settlers on whose land the lakes encroached, others were reclaimed to be used for public works and housing. At the same time, the Swan River foreshore was reclaimed to ease transportation along the river. The last of the lakes were drained in the 1880s. However, some areas including Herdsman Lake, Lake Monger and Third Swamp (now Hyde Park) were unable to be drained due to their location, size or depth." Note: This reference names the remaining and lost wetlands in inner Perth.	Wikipedia undated, *Perth wetlands*. Viewed at: <https://en.wikipedia.org/wiki/Perth_Wetlands> on 22 March 2026.

Attachment I – Wetland buffer widths and separation distances recommended in various references

Tables I1 summarise the wetland buffer widths and separation distances in various references, including the *Draft guideline for the determination of wetland buffer requirements* (Western Australian Planning Commission 2005), *Approved Conservation advice for the Empodisma peatlands of southwestern Australia* (Department of Climate Change, Energy, the Environment and Water 2023), *Guidelines for design of effective buffers for wetlands on the swan coastal plain* (Davies and Lane 1995) and a repealed position statement, which is intended to provide historical context, the *Position statement: Wetlands* (Water and Rivers Commission 2001), plus other references as indicated in the last column. The table simplifies the information in Davies and Lane (1995). Refer to the original reference for further information.

Table I1 – Wetland buffer widths and separation distances recommended in various references to protect wetlands from different threats

Reason for buffer width recommendation	Recommended separation and/or management (Western Australian Planning Commission 2005)		Recommended separation and/or management (DCCEEW 2023)	Davies and Lane (1995)	Water and Rivers Commission (2001), a repealed reference included as historical information	Other references, as indicated
	Conservation Category wetlands	Resource Enhancement category wetlands				
Buffers to protect wetlands from threats						
Alteration to the water regime	Regulation of groundwater abstraction as catchment management measure		Regulation of groundwater abstraction as catchment management measure. Drainage inflows and outflows eliminated or managed. Where a proposal may affect the hydrology or water quality of an occurrence, detailed site-specific work should be undertaken to determine the specific separation measures required, including management measures.	-		-
Habitat modification	100 m weed infestation Up to 100 m for bird habitat dependent on extent of use 6-50 m firebreak Fence for controlling exotic fauna access ≥100 m to minimise edge effects	50 m weed infestation 50 m bird habitat 6 m firebreak	≥100 m weed infestation. Up to 100 m for fauna habitat dependent on extent of use. Fence for controlling exotic fauna (i.e., pigs) and preventing direct stock access. ≥100 m to minimise edge effects.	-	50-100 m weeds	-
Inappropriate recreational use	≥50 m to improve aesthetics ≥50 m for barrier Fence, paths for controlling access	10 m - 50 m for improving aesthetics 10 m - 50 m for barrier Fence, paths for controlling access	-	-		-
Diminishing water quality	Drainage inflows eliminated or managed Where a proposal may affect wetland water quality, particularly through un-channelised flow, detailed site specific work should be undertaken to determine the specific separation measures required, including management measures		-	-		-
Fire regimes that cause biodiversity decline	-	-	Further research is required to determine the most appropriate separation (see DCCEEW 2023)	-		-

Inappropriate access	-	-	Follow guidelines to prevent dieback and other pathogens (see DCCEEW 2023) ≥50 m to improve aesthetics ≥50 m for barrier fence, paths for controlling access	-		-
Carbon flow (maintenance of ecological processes associated with carbon flow)	-	-	-	20-50 m		-
Nutrients (assuming the nutrients are not entering the water via a drain)	-	-	-	200 m on sandy soils 100 m on non-sandy soils	200 m on transmissive soils, 100 m on non-transmissive soils	-
Salinity	-	-	-	250 m	-	-
Nuisance insects	-	-	-	100-800 m	800-1,000 m to residential housing, depending on orientation of wetland	-
Sediment	-	-	-	100 m	100 m	-
Groundwater protection	-	-	-	2000 m	2,000 m in direction of groundwater flow for transmissive soils	-
Disturbance	-	-	-	0-400 m	-	-
Water temperature	-	-	-	20 m	-	-
Heavy metals	-	-	-	100-200 m	200 m	-
Pollution (e.g. petroleum hydrocarbons, surfactants)	-	-	-	-	200 m	-
Pesticide drift	-	-	-	-	200 m	-
Buffers to protect wetland fauna or values						
Scientific values	-	-	-	Depends on the specific scientific value of interest	-	-
Aesthetic values	-	-	-	Depends on slope of land, orientation from development and vegetation density	-	-
Bird nesting or roosting sites	-	-	-	-	200-800 m	-
Southwestern snake-necked turtle nesting	-	-	-	-	-	Refer to Santoro A, Chambers J, Ebner BCC, Sturm AL and Beatty S 2023, 'Long-term habitat degradation affects nest site selection behaviour by a freshwater turtle (*Chelodina oblonga*) in Western Australia' in *Aquatic conservation: Marine and freshwater ecosystems*, vol. 34(2), e4085. Available at: <https://doi.org/10.1002/aqc.4085>. (Accessed: 22 March 2026.)

Attachment J – Invasive fauna in the wetlands of the Swan Coastal Plain

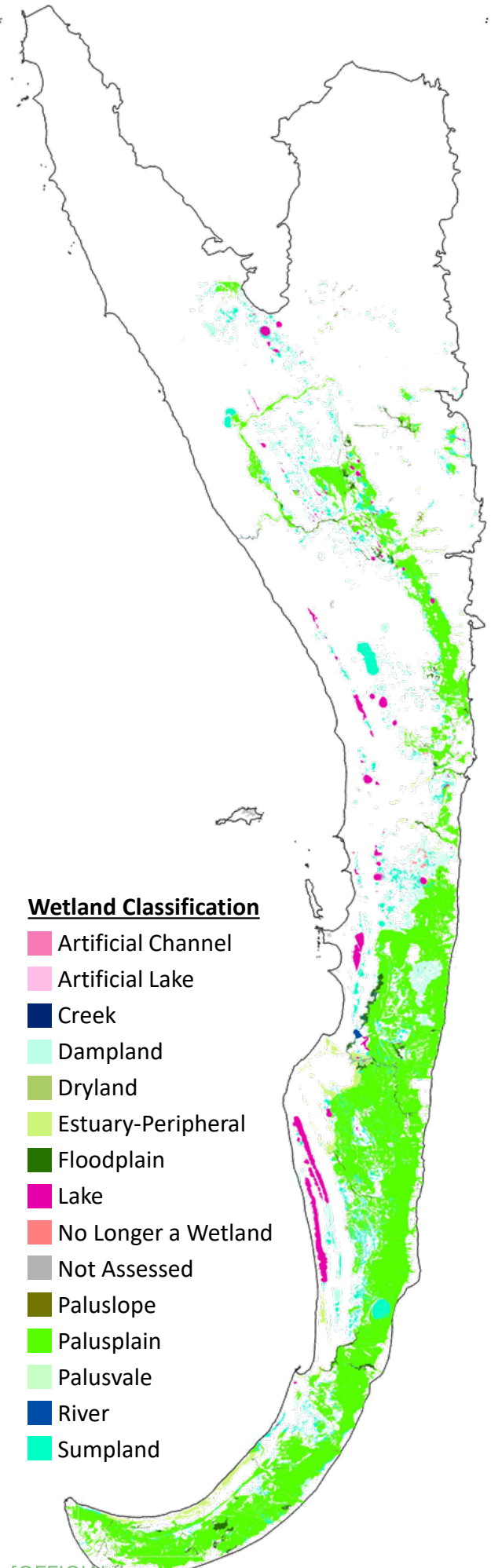
Table J1 is adapted from the EPA (2007b, p. 145) to summarise the invasive fauna present in the wetlands of the Swan Coastal Plain and their effects on native species and wetlands.

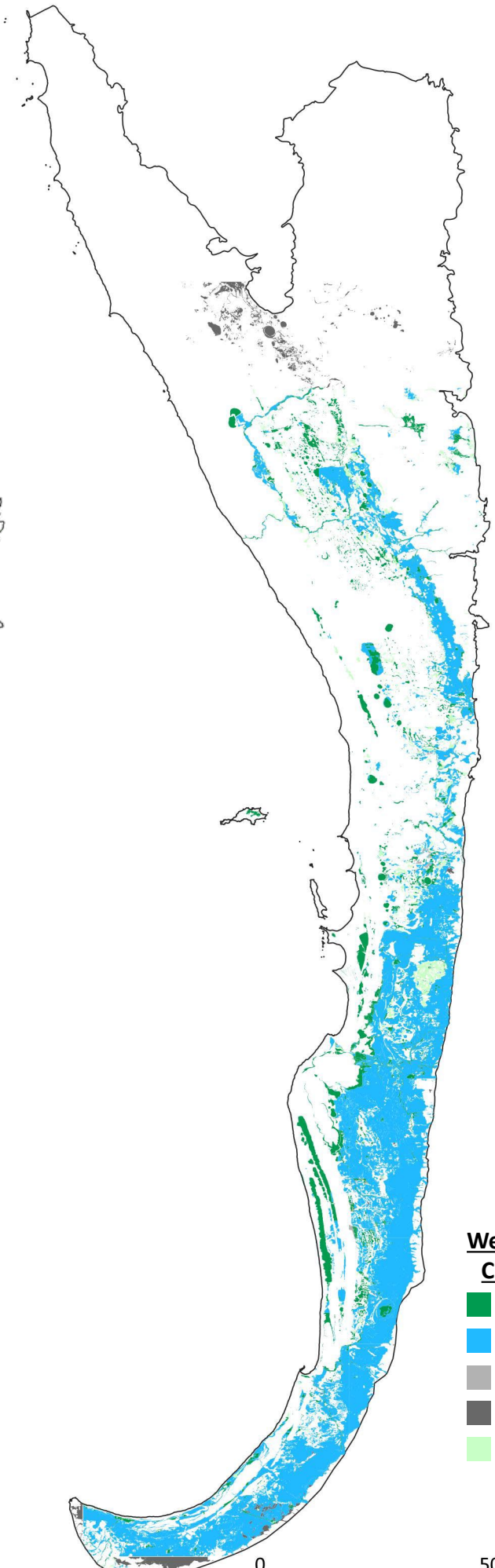
Table J1 – Invasive fauna in the wetlands of the Swan Coastal Plain and their effect on native species and the wetlands

Animal	Appears on the 100 most invasive species list	Declared or restricted in WA	Competes for food and habitat	Predation	Direct degradation of wetlands	Degradation of soil structure	Grazing pressures on vegetation and seeds	Spreads weeds, diseases and pathogens
Cat	✓		✓	✓				
Fox	✓	✓ [a]	✓	✓				
Rabbit	✓	✓ [a]	✓			✓	✓	
Pig	✓	✓ (feral)	✓	✓	✓	✓	✓	✓
Rat (black and brown)	✓		✓	✓			✓	✓
House mouse	✓		✓				✓	✓
Rainbow lorikeet		✓ [a]	✓				✓	✓
Kookaburra			✓	✓				
European honeybee			✓					
Coastal brown ant	✓		✓	?				
Argentine ant	✓	✓ [a]	✓	?				
Snails		✓ [a]	✓	✓			✓	
polyphagous shot-hole borer-fungus complex		✓ [a]			✓		✓	✓
European wasp		✓ [a]	✓	?				
Polyphagous shot-hole borer		✓ [a]			✓			✓
Redfin perch		✓ [c]	✓	✓	✓			
Rainbow trout	✓		✓	✓	✓			
Brown trout	✓		✓	✓	✓			
Carp, goldfish, koi	✓	✓ [b] (1 species)	✓		✓			
Mosquito fish	✓	✓ [c]	✓	✓	✓			
Cichlids		✓ [b] (1 species)	✓	✓	✓			
One-spot live-bearer			✓				✓	
Yabbies		✓ [c]	✓		✓			

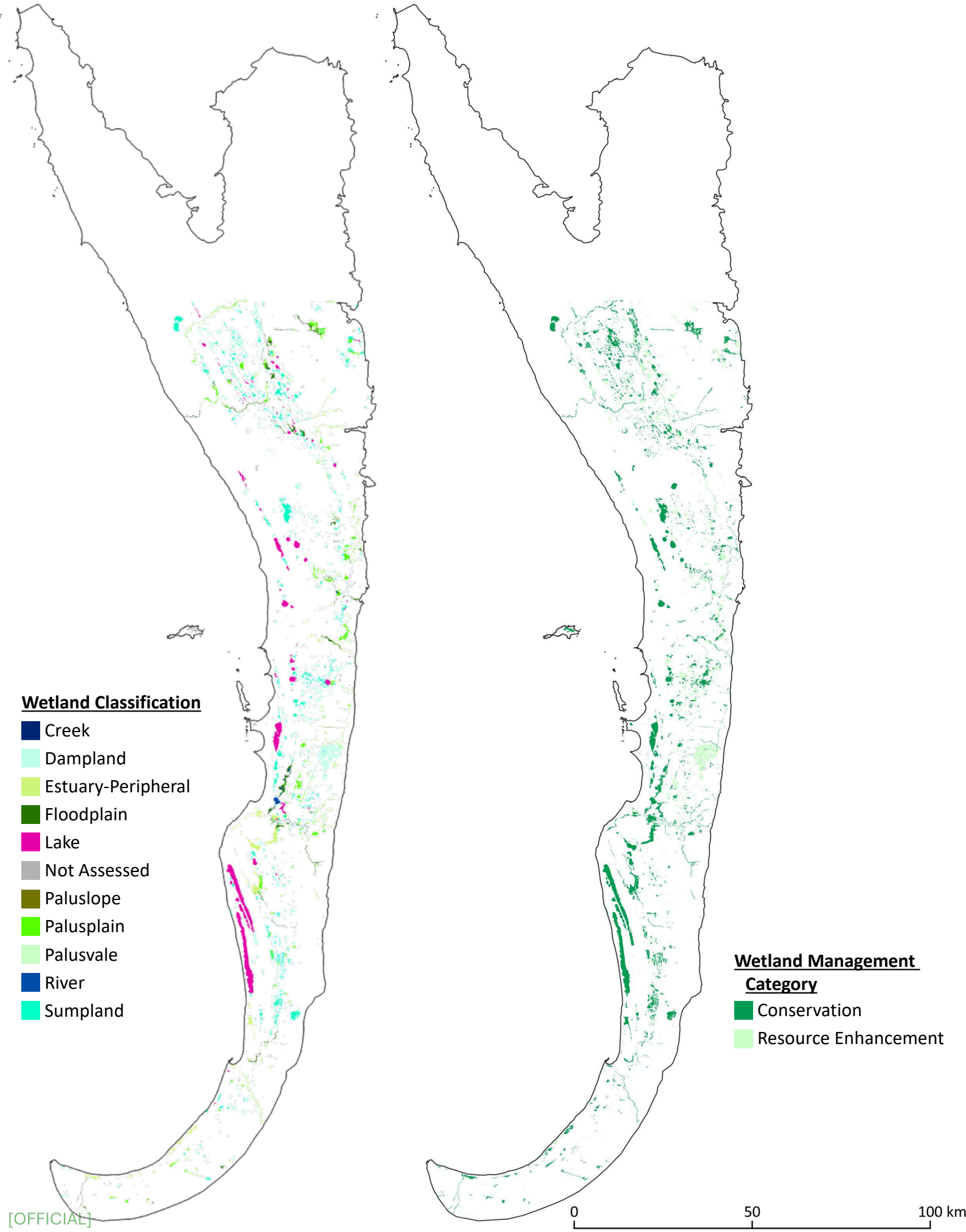
Notes listed by the EPA (2007b, p145), as adapted: A question mark (?) indicates the effect is possible but not well known or researched; A tick (✓) indicates that the effect is known or recorded in the literature; (a) Declared under the *Biosecurity and Agriculture Management Act 2007* – there are a variety of categories including entry prohibited, subject to eradication in the wild, keeping prohibited, entry subject to permits or conditions, numbers will be reduced or controlled, keeping subject to

Departmental permits or conditions and the requirement for a management program; (b) Classified as noxious fish under the Fish Resources Management Regulations 1995 and prohibited from import into the State; (c) restricted under the Fish Resources Management Regulations 1995 written approval or authority is required to import these species into WA.

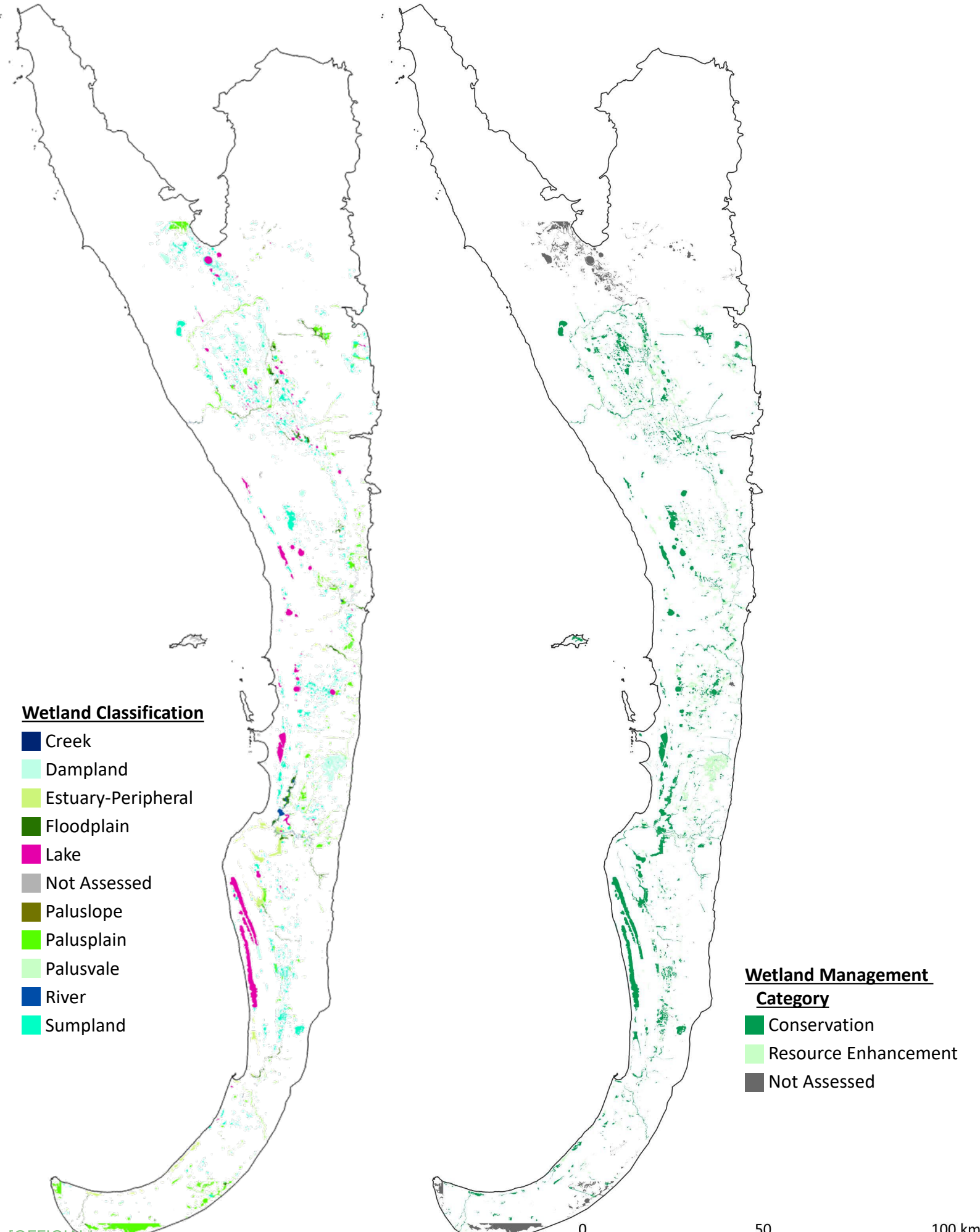

Wetland Classification
Artificial Channel
Artificial Lake
Creek
Dampland
Dryland
Estuary-Peripheral
Floodplain
Lake
No Longer a Wetland
Not Assessed
Paluslope
Palusplain
Palusvale
River
Sumpland


Wetland Management Category
Conservation
Multiple Use
Not Applicable
Not Assessed
Resource Enhancement
0
50
100 km

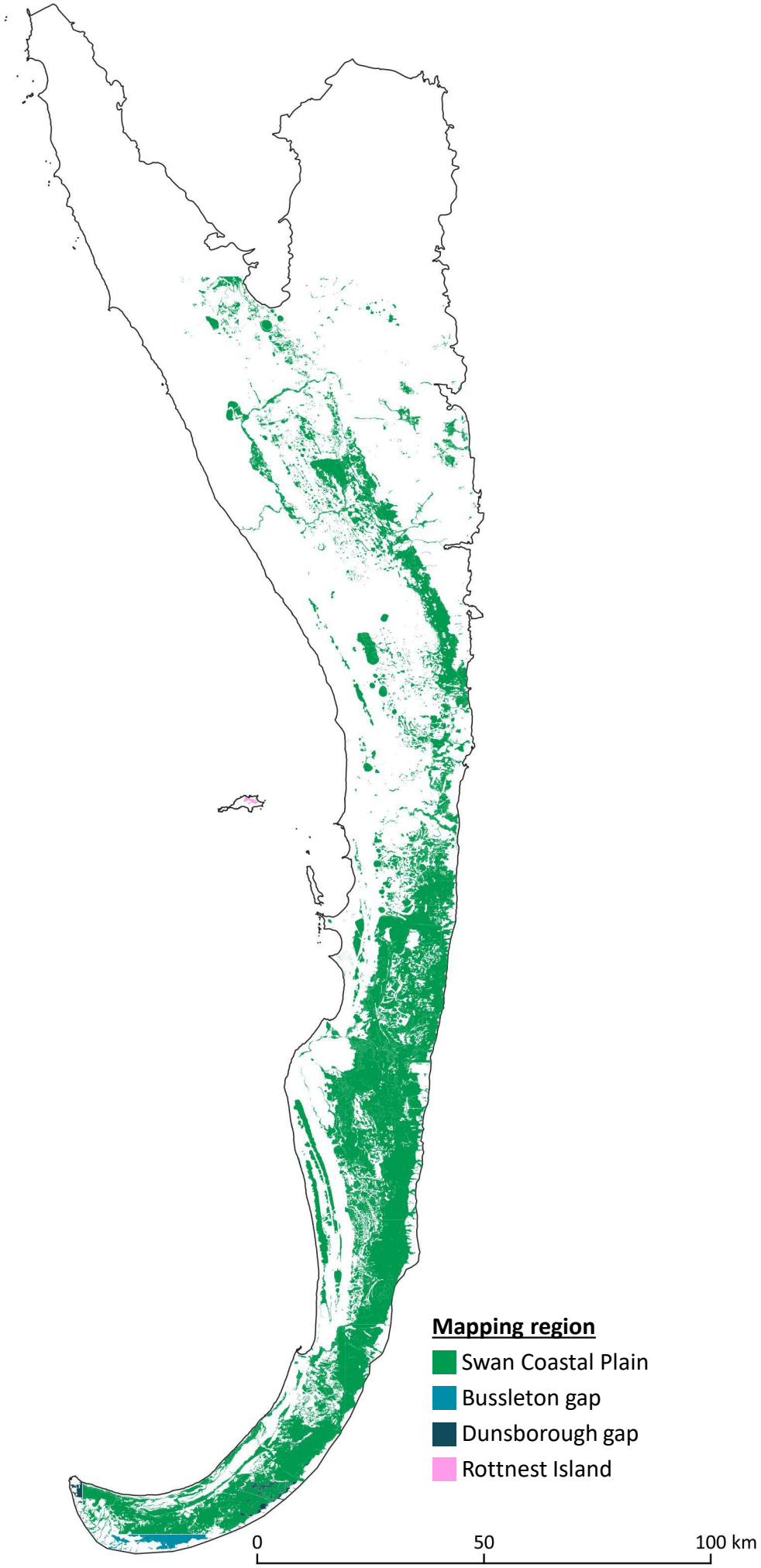
[OFFICIAL]


Wetland Classification
Creek
Dampland
Estuary-Peripheral
Floodplain
Lake
Not Assessed
Paluslope
Palusplain
Palusvale
River
Sumpland
Wetland Management Category
Conservation
Resource Enhancement
0
50
100 km

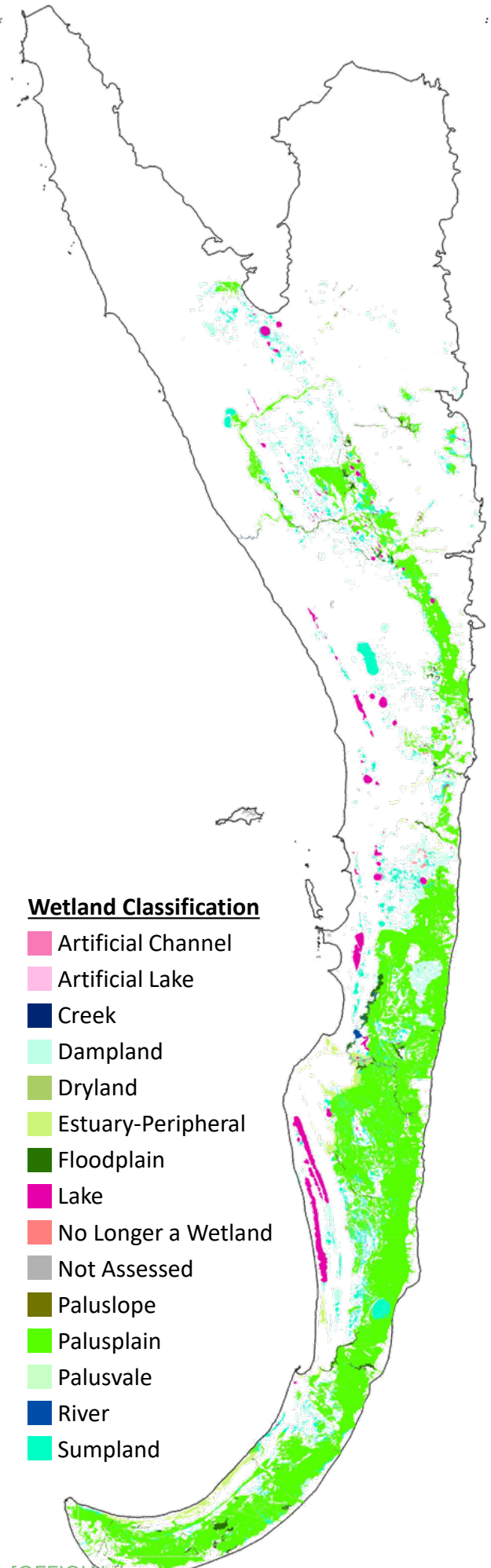
[OFFICIAL]

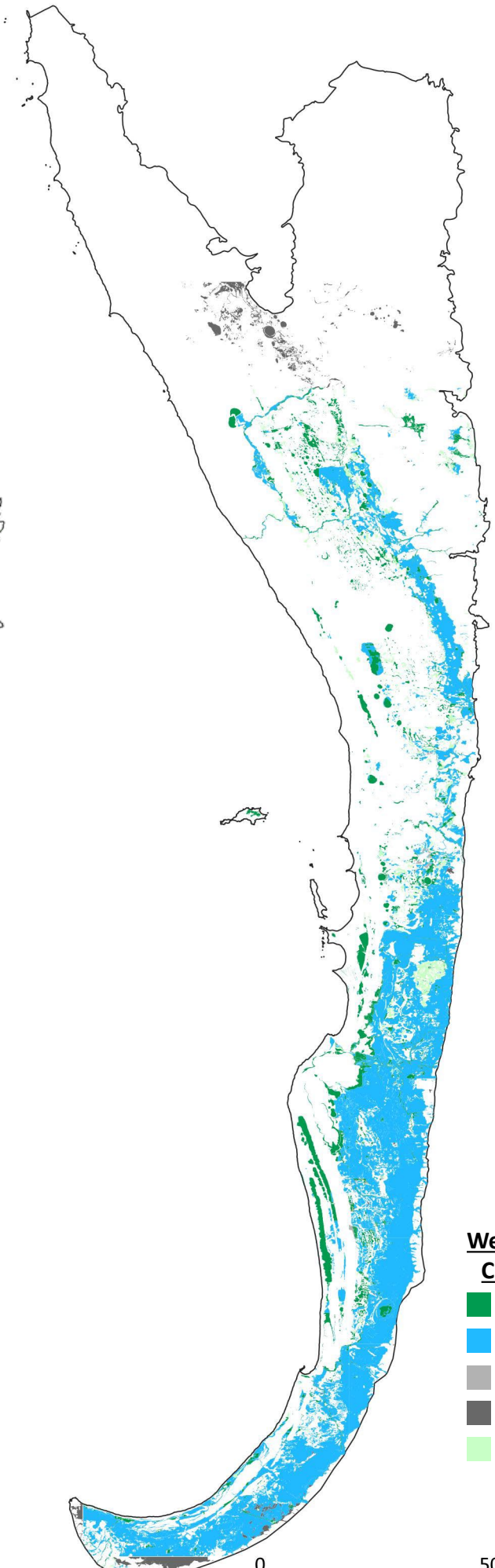

Wetland Classification
Creek
Dampland
Estuary-Peripheral
Floodplain
Lake
Not Assessed
Paluslope
Palusplain
Palusvale
River
Sumpland
Wetland Management Category
Conservation
Resource Enhancement
Not Assessed
0
50
100 km

[OFFICIAL]

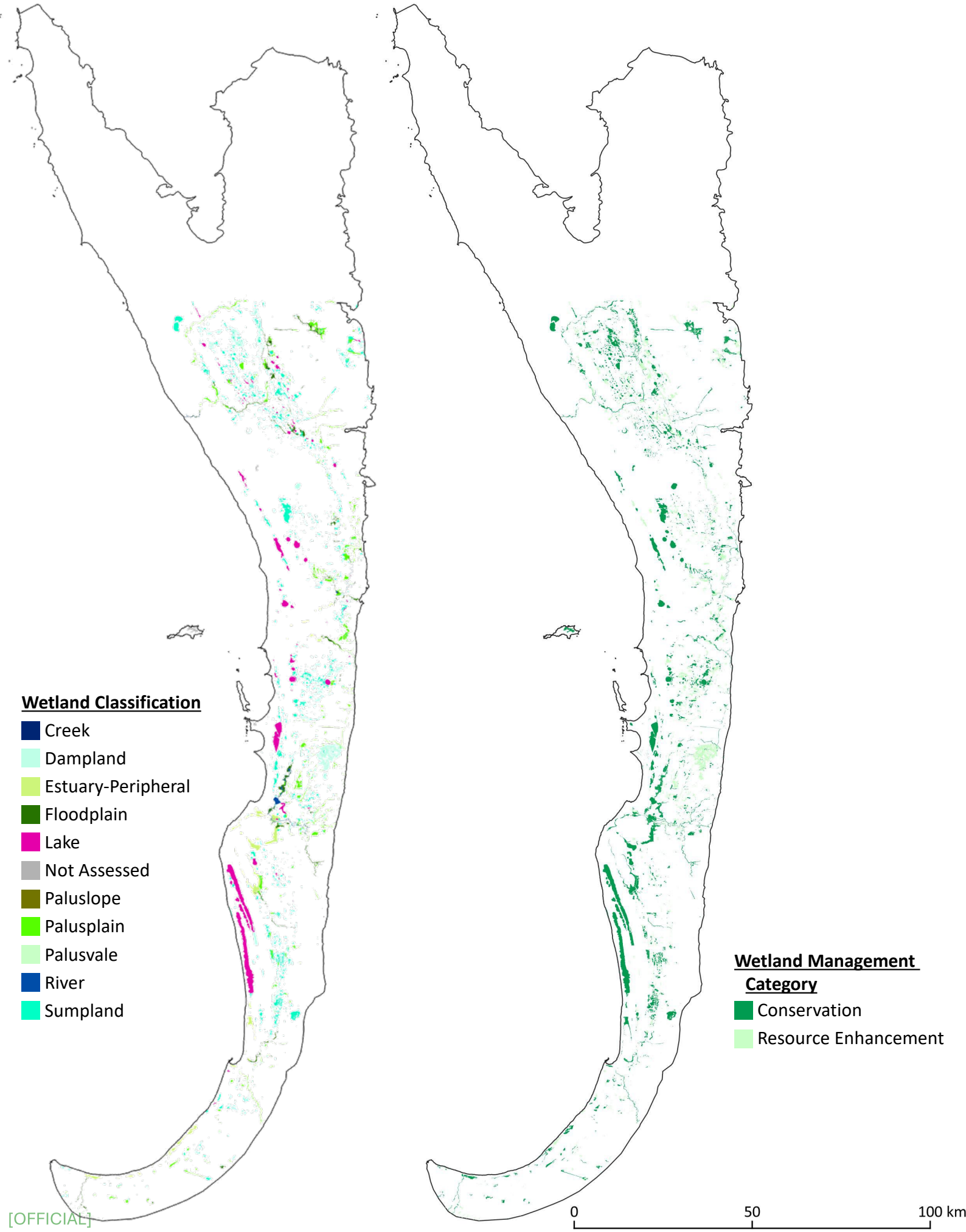

Mapping region
Swan Coastal Plain
Bussleton gap
Dunsborough gap
Rottnest Island
0
50
100 km

[OFFICIAL]

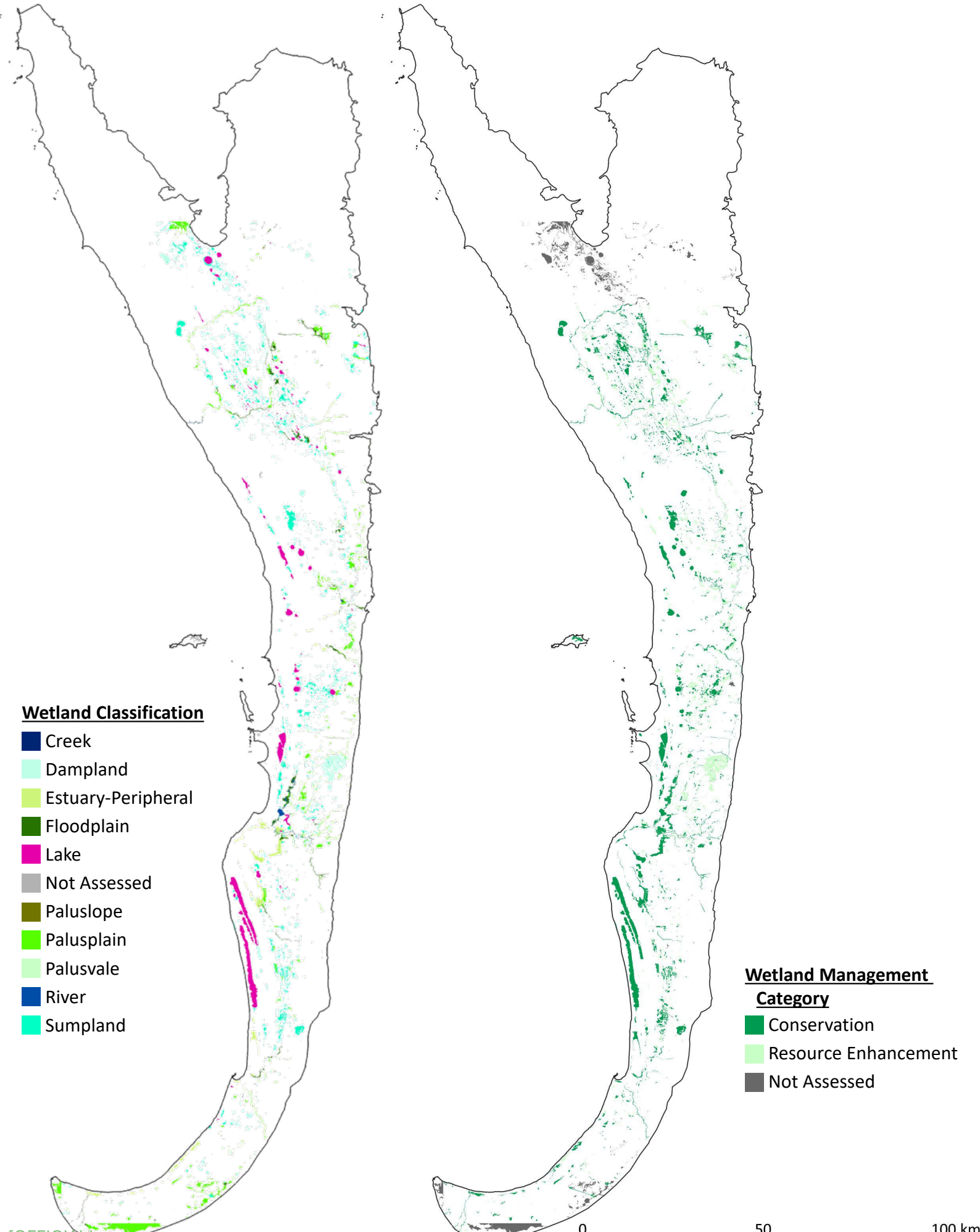

Wetland Classification
Artificial Channel
Artificial Lake
Creek
Dampland
Dryland
Estuary-Peripheral
Floodplain
Lake
No Longer a Wetland
Not Assessed
Paluslope
Palusplain
Palusvale
River
Sumpland


Wetland Management Category
Conservation
Multiple Use
Not Applicable
Not Assessed
Resource Enhancement
0
50
100 km

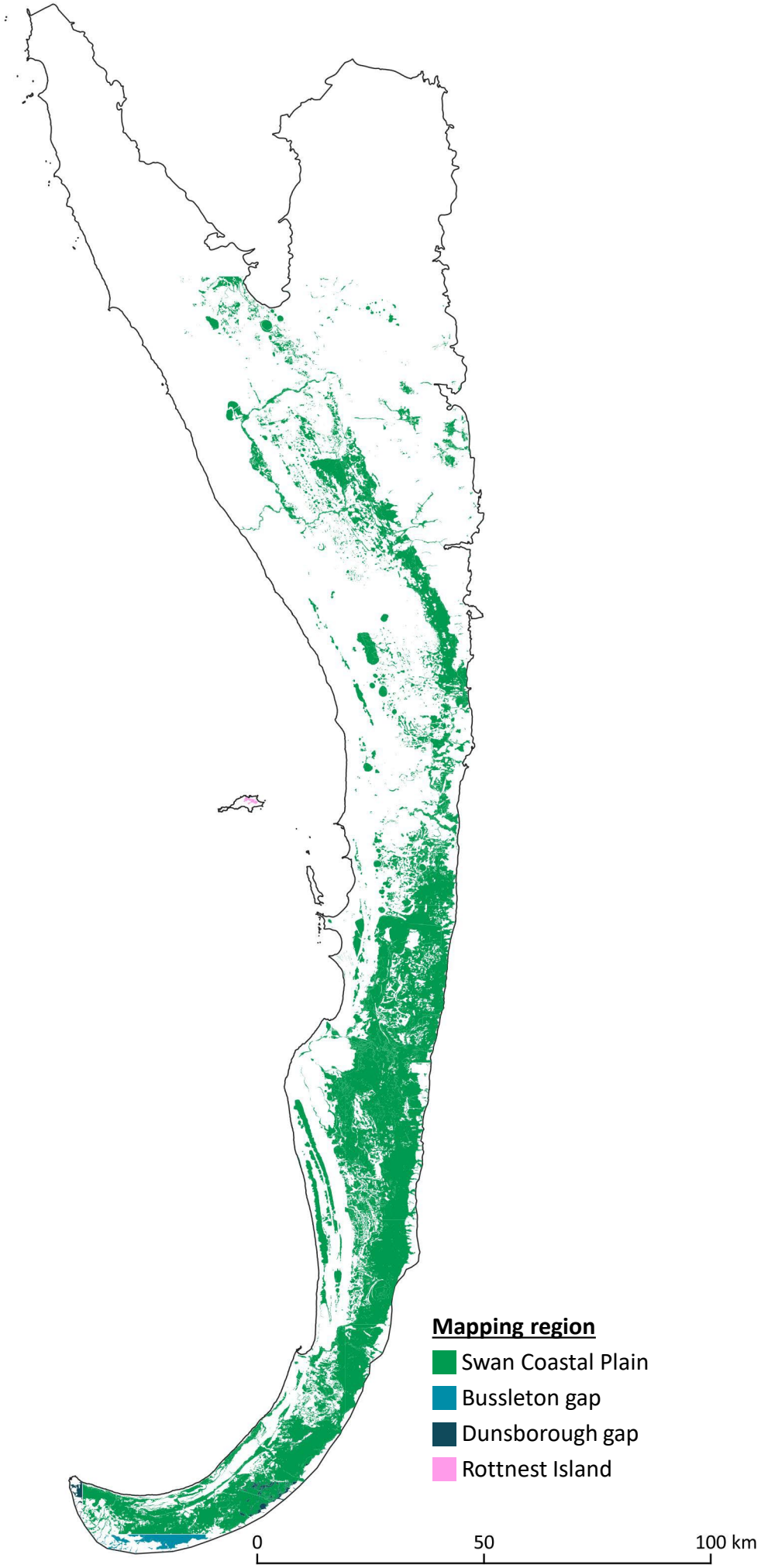
[OFFICIAL]


Wetland Classification
Creek
Dampland
Estuary-Peripheral
Floodplain
Lake
Not Assessed
Paluslope
Palusplain
Palusvale
River
Sumpland
Wetland Management Category
Conservation
Resource Enhancement
0
50
100 km

[OFFICIAL]


Wetland Classification
Creek
Dampland
Estuary-Peripheral
Floodplain
Lake
Not Assessed
Paluslope
Palusplain
Palusvale
River
Sumpland
Wetland Management Category
Conservation
Resource Enhancement
Not Assessed
0
50
100 km

[OFFICIAL]


Mapping region
Swan Coastal Plain
Bussleton gap
Dunsborough gap
Rottnest Island
0
50
100 km

[OFFICIAL]

Attachment M – References used in the nomination form

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Attachment N – Further reading for a proposal to nominate the wetlands of the Swan Coastal Plain as a threatened ecological community under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)

This attachment is best viewed with the navigation pane turned on. Go to the 'view' tab at the top of Word and check the box next to 'navigation pane'. This will open a sidebar on the left where you can select headings, pages or search results.

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[1] For threatened ecological communities, select the 'Threatened and collapsed Nov 2025' worksheet. For priority ecological communities, select the 'Priority Nov 2025' worksheet.

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[74] Do not currently have the spatial data.

[75] Do not currently have the spatial data.

page, they are treated as valid and in effect. The *Forest management plan 2024-2033* has its own webpage.

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Attachment O – Abbreviations used in the nomination form

The following abbreviations were used in the nomination form:

ANZG	Australian and New Zealand Governments
BC Act	*Biodiversity Conservation Act 2016* (WA)
BOM	Bureau of Meteorology
CALM	Former Department of Conservation and Land Management (WA)
CCWA	Conservation Council of Western Australia
CMS	Convention on the conservation of migratory species of wild animals
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DBCA	Department of Biodiversity, Conservation and Attractions (WA)
DBCA-019	*Geomorphic wetlands, Swan Coastal Plain (DBCA-019)* (DataWA 2021d) spatial dataset
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DDT	Dichlorodiphenyltrichloroethane, an organochlorine pesticide
DEC	Former Department of Environment and Conservation (WA)
DEP	Former Department of Environmental Protection (WA)
DEWHA	Former Department of the Environment, Water, Heritage and the Arts
DPAW	Former Department of Parks and Wildlife (WA)
DPLH	Department of Planning, Lands and Heritage
DPIRD	Department of Primary Industries and Regional Development (WA)
DWER	Department of Water and Environmental Regulation (WA)
EPA	Environmental Protection Authority (WA)
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
GL	Gigalitres
H5N1	Highly pathogenic avian influenza, which is also known as H5 bird flu and H5 avian influenza
ha	Hectares

HEPA	Heads of Environmental Protection Authorities Australia and New Zealand
IBRA	Interim Biogeographic Regionalisation for Australia
IOCI	Indian Ocean Climate Initiative
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australia migratory bird agreement
PRI	Phosphorus Retention Index
MNES	Matters of national environmental significance
PAHs	Polycyclic aromatic hydrocarbons
PFAS	Perfluoroalkyl and polyfluoroalkyl substances
PSHB	Polyphagous shot-hole borer (*Euwallacea fornicatus*)
ROKAMBA	Republic of Korea-Australia migratory bird agreement
UNEP	United Nations Environment Programme
WAPC	Western Australian Planning Commission
SWALSC	South West Aboriginal Land and Sea Council
WA	Western Australia

Other abbreviations that apply only to attachments are provided within those attachments.

Attachment P - References not readily accessible via the internet

This attachment is related to question 30 on the nomination form, which requires "(electronic/scanned) copies of key documentation/references (or relevant parts thereof) cited in the nomination, if they are not easily accessible via the internet."

It summarises the references used in the nomination:

- that will be provided via email, including partial scans
- books available for loan via post
- purchased under licence conditions that restrict sharing.

References to be provided via email (not readily accessible online)

The following references were either purchased from the National Library of Australia and may be shared; were provided by the author; or were previously available on the internet as PDFs, although the original links are no longer active:

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