SYRINX

TYPHA DISTRIBUTION IN CITY OF SOUTH PERTH NATURE RESERVES AND PARKS

September 2020

For City of South Perth

SYRINX

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1.0 INTRODUCTION

The City of South Perth (the City) is responsible for management of approximately 50 reserves totalling 218 hectares or 11% of the municipality's total area (City of South Perth, 2002). Several reserves contain natural or manmade waterbodies that require regular maintenance including weed control, vegetation and water monitoring and revegetation activities to maintain their ecological function.

Prior to 2016, City was managing populations of *Typha orientalis* (Bullrush) as a weed with the overall aim of eradication, particularly in areas where remnant vegetation did not incorporate this species originally. Given recent reclassification of *Typha orientalis* from naturalised to native, the City is seeking a clearing permit from the Department of Water and Environmental Regulation (DWER) to actively manage *Typha* populations within various waterbodies and drainage infrastructure throughout the City. This is particularly important as the occurrence of *Typha orientalis* has been increasing over the years in response to drying conditions which reduce water levels in the wetlands making it easier for *Typha* to establish. The fast growth of this species and the lag time since the species was actively controlled (early 2016), has resulted in some waterbodies to be now overgrown with *Typha* reducing their overall capacity to detain and convey stormwater runoff posing potential for localised flooding as well as put pressure on the survival and establishment of other species (both flora and fauna).

The City is aware of the habitat value of *Typha orientalis and T. domingensis* for native fauna such birds and the long necked turtle, and therefore seeks a permit to manage populations in a targeted way to reduce the rate of spread, maintain conveyance and detention function of waterbodies, allow natural recruitment of other native species and maintain species and habitat composition of remnant vegetation previously lacking this species.

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

The purpose of this document is to quantify the overall coverage of *Typha orientalis* in the City's waterbodies/reserves. While *T. orientalis* was previously classified as naturalised in Western Australia, Keighery and McCabe (2015) concluded that *Typha orientalis* is a native species alongside *T. domingensis*. This reclassification was based on the early collection (1839) of *T. orientalis* specimen, the lack of historical listings as a weed and the use of the plant by Noongar people as a significant food source. Both *Typha* species were previously observed within the City's reserves although the dominance of *T. orientalis* is much higher.

Given the *Typha* species native status, under *Part V of the Environmental Protection Act 1986* the Local Governments must apply for either an Exemption (Regulation 5, Item 15) – for manmade drains; Exemption (Regulation 5, Item 22) – for roadside drains within 'maintenance zone' or Clearing Permit – for natural areas managed by the City.

The objective of this document is to provide supporting documentation for the Clearing Permit Application for management of *Typha* across the City's nature reserves and parks. More specifically, the assessment was to focus on following waterbodies/wetlands:

- Sir James Mitchel Park Lakes:
    - Lake Hurlingham;

  - Lake Douglas; and
  - Lake Tondut.
- Melaleuca Swamp;
- Millers Pool;
- Lake McDougall;
- Collier Park Golf Course (3 lakes);
- Lake Gillon;
- Doneraile Reserve Basin;
- Bodkin Park (2 Lakes: North and South);
- Elderfield Wetlands (including drain and foreshore);
- Andrew Thompson Reserve; and
- Cygnia Cove (6 Lakes incorporating manmade and natural waterbodies).

The location of each waterbody, as listed above, is presented in Figure 1.

The scope of works was to carry out site assessment of each water body and provide a map and a description of current distribution and population extent of *Typha* species.

Figure 1. Location of City of South Perth waterbodies assessed for *Typha* spp.

1.2 BIOLOGY AND MANAGEMENT OF *TYPHA*

Typha species (*T. orientalis* and *T. domingensis*) are aggressive native invaders that can modify natural ecosystems by displacing native sedges via their extensive rhizomes, tall growth habit and often dense mats of dead material that can stop recruitment of other species. Of the two species, *T. oreintalis* appears to be more vigorous in growth producing a slightly larger amount of dead leaf matter

The rapid growth and dense clusters of *Typha* populations can lead to restricted water flow, siltation and an increased risk of flooding, particularly in manmade drains and lakes. Decaying stems and leaf matter can also lead to anaerobic conditions which may negatively impact a number of species including frog larvae (Stephens et al., 2013). The dry leaf litter also contributes to fuel loads and is undesirable in fire prone areas such as Cygnia Cove and Andrew Thompson Conservation Reserve.

Despite being associated with a range of negative impacts on natural systems, *Typha* species can provide a variety of ecosystem services under certain conditions such as bioremediation (mostly for metals and nutrients like P and N and denitrification process), provisioning of biomass (to help offset global carbon dioxide (CO_2) emissions), as well as a variety of traditional cultural uses (Bansal et al., 2019). Therefore, *Typha* invasion needs to be considered against other ecosystem services it provides.

Separating the two species is difficult as population samples of inflorescences and their microscopic observation are required. However about 90 per cent of plants can be allocated to species by the leaves, which in *T. domingensis* are narrow and grass green, ageing yellow to light brown at senescence, while *T. orientalis* has broad bluish-green leaves that age dull grey and the sheathing base of the leaves is at a straight slope in *T. domingensis* but with a distinct bump in *T. orientalis* (Keighery, 2016). Given both species are native and invasive, controlling their populations would be the key objective to their management (e.g. regular annual or biennial harvest of biomass dependant on the size of the wetland/*Typha* population). Where only few individual plants exist, particularly in small channels and manmade WSUD basins or where remnant vegetation is in very good condition and did not contain *Typha* previously, a more stringent control can be applied (e.g. mechanical and chemical control).

2.0 ASSESSMENT METHODOLOGY

Each waterbody listed in Section 1.1 was visited on 01st September 2020 and notes and photographs of each waterbody taken with a primary focus of documenting *Typha* infestation. Notes included:

- Location of *Typha* infestation (Marked by GPS);
- Extent of infestation; and
- *Typha* species present (by visual assessment of leaves and growth habit).

2.1 LIMITATIONS

The detailed assessment was limited by senescent nature of the plants, their accessibility (the survey was completed during high water levels within each waterbody) and lack of microscopic observation of female florets (again limited by the age of the plants) to distinguish specifically between the two

species of *Typha*. Nonetheless, the assessment is deemed sufficient for the purpose of the permit application.

3.0 SURVEY FINDINGS

3.1 SIR JAMES MITCHELL PARK LAKES

Sir James Mitchel Park (SJMP) Lakes incorporate three manmade lakes which serve as detention basins for urban stormwater, irrigation lakes and provide habitat for waterbirds. An artesian bore, located near Lake Tondut in Clydesdale Park, is also utilised to maintain water levels in the lakes and to provide the bulk of the irrigation requirements (City of South Perth, 2004). The outline of the drainage network in relation to the lakes is provided in Figure 2.

Given their function and location, the lakes are depauperate in native vegetation. However, more recently City has undertaken steps to increase fringing vegetation with the aim of improving water quality and provide habitat for a number of waterbirds that use the lakes.

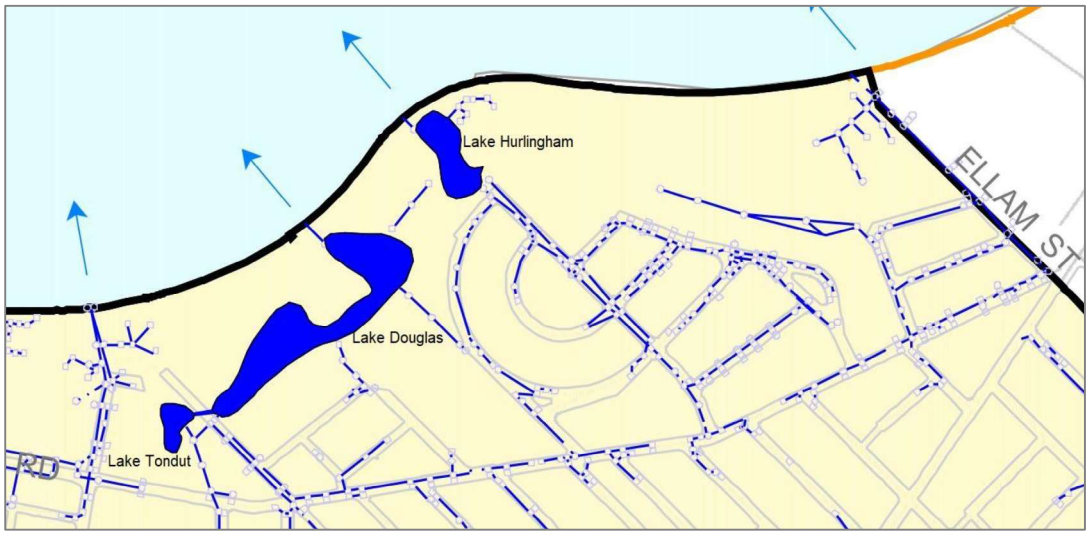

Figure 2. Drainage system surrounding SJMP Lakes (Source: City of South Perth 2004)

3.1.1 Lake Hurlingham

Lake Hurlingham is a shallow manmade lake constructed in the late 1980s alongside Lake Douglas and Lake Tondut. The lake receives stormwater runoff from the residential properties to the southeast and is likely to have a limited groundwater interaction also.

The lake is surrounded by planted trees and sedges, including *Casuarina obesa, Eucalyptus rudis,* and *Melaleuca rhaphiophylla* with occasional *Melaleuca teretifolia* tall shrubs over patchy *Juncus kraussii and Ficinia nodosa*. Small patches of *Schoenoplectus tabernaemontani* (previously *S. validus*) are also present. While the vegetation bordering the lake is patchy especially to the north, efforts are being made through revegetation to increase the shoreline vegetation cover in hope to improve water quality of the lake.

No *Typha* was recorded during the site inspection. Given the size of the waterbody and its use by several water bird species, there is a possibility for *Typha* to be introduced into the lake. Introduction of *Typha* into the wetland without active management would likely result in its permanent establishment, decreasing the lake's capacity to store stormwater runoff, reducing the area required for Swans and other water bird landing and take-off and cause amenity issues with nearby residents. The images showing current lake vegetation are shown in Plate 1.

Approximate waterbody size with surrounding vegetation:	0.86 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

Plate 1. Lake Hurlingham

3.1.2 Lake Douglas

Largest of the three manmade lakes at Sir James Mitchel Park, Lake Douglas has a very narrow and sparse belt of vegetation on the margins of the lake most of which was planted within the last three years (see Plate 2).

Plate 2. Lake Douglas

The northern edge of the wetland is more vegetated than the southern edge. Some of the commonly planted species include *Juncus pallidus, Baumea juncea* and *Baumea articulata* with scattered shrubs

of *Melaleuca lateritia* and *Regalia ciliata* and trees of *Melaleuca raphiophylla* and *Casuarina obesa*. Older plantings of **Callistemon* sp. are present near bridge crossings and **Washingtonia* sp. (Cotton Palm) clump is located within the waterbody near Douglas Avenue. Two floating islands (~15m^2 each) of sedges were installed in May 2020 in the north-eastern section of the wetland with the aim of providing breeding habitat for Black Swans and other water birds.

Lake Douglas is fed by stormwater from the residential properties to the south and is also likely to interact with groundwater. The lake is connected via pipe network to Lake Tondut, and the water levels in the lake are topped up from this lake in summer.

No *Typha* was recorded during the survey. As with Lake Hurlingham, there is a high possibility of *Typha* establishing in the future given the shallow water body profile and the number of water birds utilising the area.	
Approximate waterbody size with surrounding vegetation:	3.10 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

3.1.3 Lake Tondut

Lake Tondut in Clydesdale Park is the smallest of the three lakes and functions as both the stormwater detention basin and a settling 'pond' for iron particulates generated by groundwater abstraction from the nearby bore. It is also the main irrigation lake for the SJMP area.

The vegetation surrounding this lake is relatively dense, and this is mainly to restrict views to the rusty water which is considered as unsightly by some of the residents. It also masks the artesian bore infrastructure from the parkland beyond. The key species include *Melaleuca rhaphiophylla, Melaleuca cuticularis, *Eucalyptus camaldulensis *Callistemon* sp. and **Phoenix dactylifera* palm. The southern edge of the lake has a dense strand of *Baumea preissii* sedges and to the east *Ficinia nodosa*. The examples of vegetation for Lake Tondut are shown in Plate 3.

Plate 3. Lake Tondut vegetation

No *Typha* was recorded during the survey of the area; however, its introduction is possible. This plant is undesirable in this lake due to its size and function.	
Approximate waterbody size with surrounding vegetation:	0.29 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

3.2 MELALEUCA SWAMP

Melaleuca Swamp is a remnant vegetation wetland of good condition containing a dense strand of *Melaleuca rhaphiophylla* over *Bolboschoenus caldwellii, Baumea articulata*, *Centella asiatica,* and *Parietaria debilis*. *Lemna* sp. is found in small patches over water in the areas adjacent to the walkway (Plate 4) where greater access to sunlight is available.

No *Typha* plants were recorded during the survey, and no evidence of the previous infestation was present. Relatively thick vegetation cover and the isolation of this wetland from the stormwater pipe network is likely to have prevented the establishment of *Typha* sp. in this area. Water birds also do not frequent the wetland and therefore, reduce the possibility of spread.	
Approximate waterbody size with surrounding vegetation:	0.62 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

Plate 4. Melaleuca Swamp vegetation

3.3 MILLERS POOL

This manmade wetland was constructed in 2001 during duplication, and train line works on Narrows Bridge. Later in 2017 landscape upgrade works have extended the vegetation around the wetland and created beaches at the river foreshore. Originally the site of the inlet and the surrounding land all the way to the river was part of a larger lagoon that got infilled in 1935.

Vegetation is in very good condition due largely to regular maintenance efforts and the suitable plant selection. While the vegetation surrounding the pool is varied for purposes of providing points of interest and providing diversity in challenging infill conditions, the pool itself has a simpler assemblage comprised of *Juncus kraussii, Suaeda australis, Salicornia quinqueflora, Samolus repens,* and isolated planted trees of *Melaleuca cuticularis, Melaleuca rhaphiophylla* and **Melaleuca lanceolata*.

No *Typha* species were recorded at Millers Pool. Given the history of the site and the connectivity between the pool and the Swan River via a pipe, the water conditions within the wetland are largely saline and generally not favourable to establishment of *Typha*.

Approximate waterbody size with surrounding vegetation:	0.19 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

Plate 5. Millers Pool

3.4 LAKE MCDOUGALL

Lake McDougall is a manmade wetland created on the site of a much larger natural sumpland that was filled in sections between 1966-68 to create the current lake shape and the surrounding park. The lake serves as a stormwater infiltration basin for the surrounding catchment and is not connected to river or other waterbodies within the City.

While few remnant trees are still found within the parkland, most are planted and include *Eucalyptus rudis* and *Melaleuca rhaphiophylla* (Plate 6). Intermittent planting of sedges like *Juncus kraussii* and *Baume preissii* was completed in recent years; however, large areas of the lake's edge remain as turf. The northern section of the lake that faces Henley Street shows a greater diversity of planting. In addition to species endemic to site, several introduced species is also present including willows, paperbarks and various shrubs and herbs.

No *Typha* plants were recorded in the lake. As with other lakes, there is a high likelihood of the *Typha* introduction. Given that the lake must retain its capacity for stormwater storage and infiltration (it does not have an outlet to other drainage basins or the river), any substantial *Typha* growth would significantly reduce the capacity of the lake to store stormwater particularly during high rainfall events.

Approximate waterbody size including island:		2.28 ha
***Typha* occurrence and distribution:**	0 m^2	
Percentage of the waterbody covered by *Typha*:	0 %	

Plate 6. Lake McDougal

3.5 COLLIER PARK GOLF COURSE LAKES

Collier Park Golf Course has three manmade lakes. Two of the lakes were constructed on sites of historical wetlands in 1982 by deepening the basin profile and leaving the central part of the wetland as an island of remnant vegetation. The entrance lake (see Lake 1 in Figure 3) was created in 1995 to serve as a compensation basin for the urban runoff from the Hayman Road, Technology Park and the Curtin University and forms the head of the Collier Main Drain. This drain subsequently flows into Gillon Lake and Bodkin Lakes to the south prior to discharge into Canning River via Andrew Thompson Reserve. The largest of the lakes (Lake 2) has undergone an upgrade in 2011 to improve water quality and biodiversity of the lake.

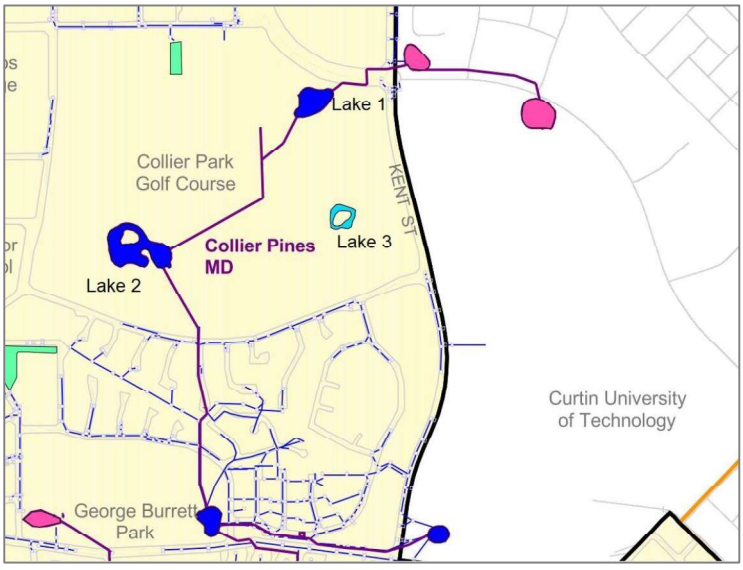

Figure 3 Collier Park Lakes showing drainage network (Source: City of South Perth, 2004)

3.5.1 Collier Park Lake 1 – Entrance lake

This lake is largely surrounded by turf with the south-eastern side of the lake vegetated with *Baumea juncea* and *Hypocalymma angustifolium / robustum* mix. To the north a small strip of *Baumea articulata, Juncus pallidus* and *Ficinia nodosa* are present. The main function of the lake is that of a water compensation basin and entrance amenity statement for the golf course.

No *Typha* was detected in the lake. Lake has had *Typha orientalis* (as singular plants) in the past (prior to 2016) at the northern end of the lake, however, these occurrences were managed by timely removal. Not *Typha* species were recorded in the lake since 2016.	
Approximate waterbody size with surrounding vegetation:	0.64 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

Plate 7. Collier Park Lake 1 – Entrance Lake (facing south)

3.5.2 Collier Park Lake 2 – Main Lake

This is the largest of the three lakes within the Collier Golf Course area and serves as a compensation basin and an irrigation lake. The surrounding vegetation is varied and mostly comprised of planted sedges and trees. The eastern part of the lake forms a large stormwater infiltration area and is densely vegetated whereas the western part is used as water storage for irrigation. The central island contains remnant vegetation dominated by *Melaleuca preissiana* trees and *Astartea scoparia* and *Hypocalymma angustifolium* shrubs. Several groundcover species including orchids are also found on the island. The general appearance of the lake as viewed from the south eastern side is shown in Plate 8.

No *Typha* plants were recorded in the lake; however, *Typha orientalis* was observed in the eastern (vegetated) section of the lake in the past. No recent occurrences of *Typha* were recorded; however, the potential for the new infestation is very likely given the nature of the wetland (stormwater fed, shallow and visited by water birds).	
Approximate waterbody size with surrounding vegetation:	2.41 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

Plate 8. Collier Park Lake2 – Main Lake

3.5.3 Collier Lake 3 – Small Lake

This small lake is isolated from the main drain and is largely natural in its appearance due to good vegetation cover on the island and patches of native shrubs at the edges of the lake. As with Lake 2, the vegetation is dominated by *Melaleuca preissiana* and *Astartea scoparia* (see Plante 8).

No *Typha* plants were recorded in the lake; however, *Typha orientalis* present in the lake between 2011 and 2017 and these were controlled by mechanical cutting and removal of biomass. The occurrence of *Typha orientalis* is highly likely in the future particularly given the predicted low rainfall conditions.	
Approximate waterbody size (island included):	0.6 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

Plate 9. Collier Park Lake 3 – Small Lake

3.6 LAKE GILLON

A manmade wetland created in 1974 has been acting as a stormwater compensation basin on the Collier Main Drain *en route* to Bodkin Park Lakes. The lake largely remained as an open turf grassland with some planted *Eucalyptus camaldulensis* trees until 2001 when significant revegetation of the lake and the embankments was completed.

Currently, the lake edge is planted with a relatively thick band of *Baumea articulata* surrounded by a woodland of *Melaleuca rhaphiophylla, Eucalyptus camaldulensis*, *Eucalyptus rudis* and *Acacia saligna*. The understory incorporates several species of tall shrubs including *Adenanthos sericeus* and *Calothamnus quadrifidus*.

Typha orientalis was noted in three small patches on the lake margins, as shown in Figure 4 and Plate 10. *Typha* occurred within the lake in the past and was actively managed to maintain its storage capacity and maintain downstream flows.	
Approximate waterbody size:	0.41 ha
***Typha* occurrence and distribution:**	14 m^2
Percentage of the waterbody covered by *Typha*:	0.34 %

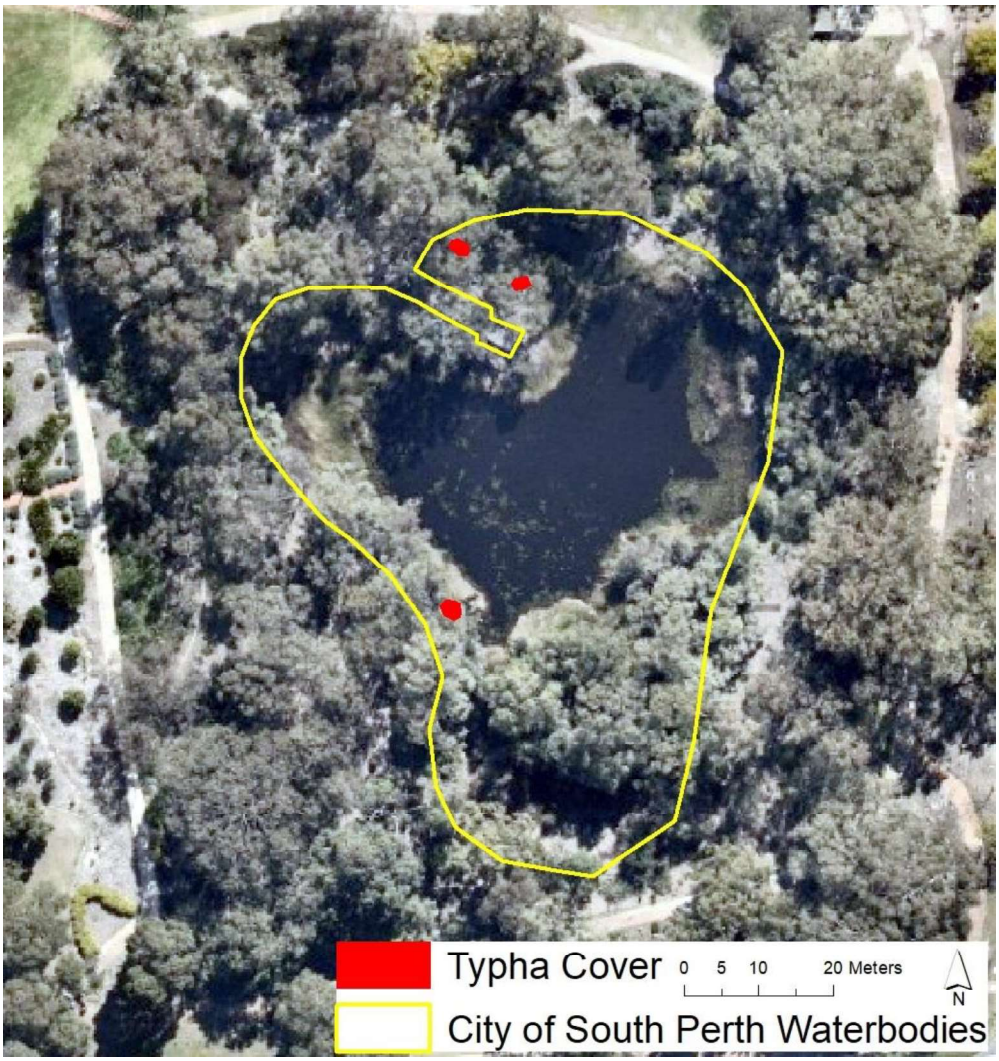

Figure 4. Location and extent of *Typha orientalis* populations within Lake Gillon

Plate 10. Gillion Lake (a) showing small *Typha* infestations (b, and c)

3.7 DONERAILE RESERVE BASIN

Created in the early 1990s and retrofitted in 2015 to improve water quality outcomes, this manmade basin forms part of the stormwater drainage network in the Waterford area. Until 2016, a careful maintenance regime had ensured that no *Typha orientalis* is established within the waterbody due to its small size.

Currently, the waterbody is almost completely covered by sedges with almost 30% of this coverage attributed to *Typha* species (see Figure 5 and Plate 11). Both *Typha orientalis* and *Typha domingensis* are present with a greater cover and distribution of *T. orientalis*.

Other native species include *Melaleuca rhaphiophylla, Casuarina obesa, Eucalyptus rudis, with Baumea preissii Schoenoplectus tabernaemontani and Baumea juncea.* Shrubs like *Melaleuca lateritia, Regelia ciliata and Hypocalymma angustifolium* are found on the embankments.

Approximate waterbody size:	0.09 ha
***Typha* occurrence and distribution:**	255 m^2
Percentage of the waterbody covered by *Typha*:	28 %

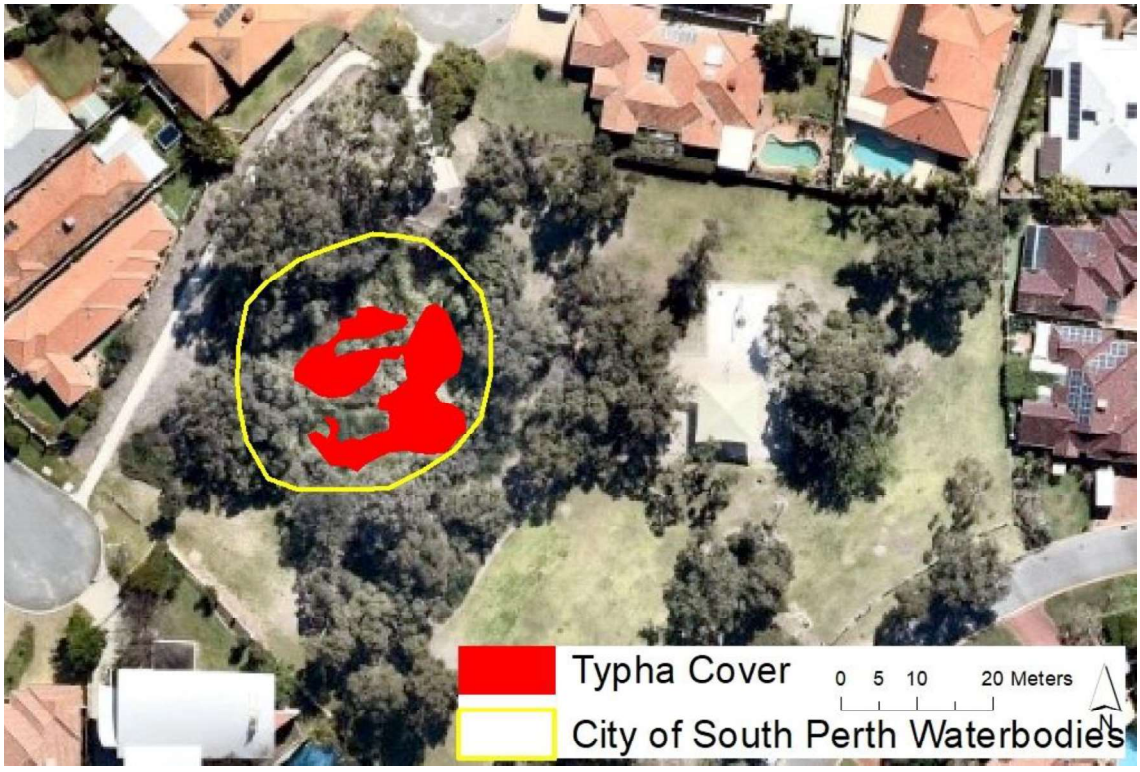

Figure 5. Location and extent of *Typha* population at Doneraile Reserve Basin


Plate 11. Doneraile Drain/Wetland *Typha* infestation

3.8 BODKIN PARK LAKES

Bodkin Park lakes are manmade water compensation basins constructed in 1980 as part of the Collier Main Drain works. The basins are connected by a wood lined channel surrounded by lawn and scattered native tree planting. As part of water quality improvement strategy, the City has implemented revegetation works at the southern basin and the southern section of the drain whereas the northern basin /lake and the drain remain largely as turf areas with clumps of native tree plantings.

3.8.1 Northern Lake

The vegetation of the Bodkin Lake North is limited to *Melaleuca rhaphiophylla* and *Casuarina obesa* trees over Kikuyu lawn and **Bacopa monnieri* on the banks. The lake surface is currently largely covered by algae growth.

No *Typha* was recorded in the northern lake.

3.8.2 Southern Lake

The current vegetation around the lake consists of *Melaleuca rhaphiophylla, Casuarina obesa*, *Baumea rubiginosa, Juncus kraussii, Centella asiatica* and *Baumea articulata*. *Melaleuca preissiana, Eucalyptus rudis* and *E. camaldulensis* are found in the surrounding area alongside with a sparse native shrub planting.

No *Typha* was recorded in the southern lake.

3.8.3 Drain

Southern part of steam contains *Juncus kraussii, Schoenoplectus tabernaemontani, Baumea rubiginosa* and *Baumea juncea with Centella asiatica.* The upper bank planting includes herbs like *Anigozanthos manglesii, Patersonia occidentalis, Conostylis* spp. and shrubs like *Eremophila glabra*.

No *Typha* was recorded within the drain (within the Bodkin Park boundary).

Approximate waterbody size (both wetlands and the drain):	0.69 ha
***Typha* occurrence and distribution:**	0 m^2
Percentage of the waterbody covered by *Typha*:	0 %

Plate 12. Bodkin Park Lakes: a) Northern Lake and b) Southern lake

3.9 ELDERFIELD WETLANDS

Elderfield wetlands incorporate two waterbodies, a small section of the foreshore and the drain which is the terminal section of the Manning Main Drain. The wetlands are mostly natural with remnant paperbark woodland and in part modified to create the current shape. The major change to the wetlands has occurred in the early 1980's as part of urbanisation which resulted in clearing of large areas of surrounding remnant vegetation. Subsequent revegetation efforts have strengthened the naturalness of the site although several species used for revegetation are not part of a natural flora assemblage (e.g. *Acacia* species). The key species present at all wetlands are *Melaleuca rhaphiophylla, Melaleuca preissii* and Casuarina obesa over various sedges mostly *Juncus kraussii*, *Typha orientalis*, *Lepidosperma longitudinale, Bolboschoenus caldwellii, Baumea juncea, Baumea rubiginosa* and *Centella asiatica*.

The drain and both wetlands have *Typha orientalis* (1500 m^2). A small patch of *Typha domingensis* appears to be present within the largest lake(~60m^2) in the section closest to the foreshore, however, this identification was based on the observation of the dead stalks and leaves only, and it is possible that some mixing with *Typha orientalis* is present also. The areas infested with *Typha* are shown in and the example images provided in Plate 13.

The infestations are connected to drainage inflows, and the patches are very dense and starting to impact on other native sedges and rushes.

Approximate wetland size including surrounding vegetation, foreshore and drain:	1.89 ha
***Typha* occurrence and distribution:**	1600 m^2
Percentage of the waterbody covered by *Typha*:	8 %

Figure 6. Elderfield Wetlands - areas with *Typha* infestations

Plate 13. Elderfield Wetlands *Typha* infestation examples

3.10 ANDREW THOMPSON RESERVE

The largest remnant wetland within the City, this reserve is an excellent example of the more extensive wetland system that once occupied the Waterford area. As such, this reserve has a significant conservation value. While urbanisation and climate change have negatively affected sections of the reserve, a large expanse of the reserve remains intact. This includes distinct *Juncus* rushland communities with Swamp Sheoak for the majority of the reserve and *Melaleuca rhaphiophylla* and *Eucalyptus rudis / Corymbia calophylla* with *Bolboschoenus caldwellii, Baumea juncea* and *Pteridium esculentum* (Bracken Fern) Woodland / Forest to the east.

This inspection has noted presence of *T. orientalis* plants at two locations: one associated with the Bodkin Park drain junction and second in the degraded section of Eucalyptus / Melaleuca woodland to the east. Both infestations are small and do not have seeding material. As such, they should be treated/removed to reduce the possibility of further establishment and spread.

Approximate waterbody size:	12 ha
***Typha* occurrence and distribution:**	12 m^2
Percentage of the waterbody covered by *Typha*:	0.01%

Figure 7. Location of *Typha* orentalis growth at Andrew Thomson Reserve

Examples of vegetation present at Andrew Thomson Reserve and photos of the two *Typha* infestations is shown in Plate 14.

Plate 14. Andrew Thompson Reserve showing remnant vegetation *Juncus kraussii* rushes with *Casuarina obesa* trees (a); *Melaleuca rhaphiophylla* and *Eucalyptus rudis* with *Pteridium esculentum* (b); and small areas of *Typha* infestation at the end of Bodkin Park drain (c) and eastern section (d)

3.11 CYGNIA COVE LAKES

Cygnia Cove Lakes are located on land previously occupied by a large sumpland containing springs. This original wetland had a long history of disturbance that started in the early 1900s with the establishment of Clontarf buildings to the west and more recently in 2010s with the start of Cygnia Cove residential development which resulted in infilling of the eastern portion of the wetland and creation of a number of small modified wetlands. For the purpose of this report, six waterbodies were identified (see Figure 8) that have a potential for *Typha* invasion. While *Typha orientalis* was present on site prior to development, it is unlikely that it was a significant part of the original flora assemblage as generally spring areas were dominated by *Baumea articulata*.

The vegetation of the lakes is largely composed of native species with Lake 2 having a higher population of introduced species most dominant of which is Watercress. Most dominant species in the waterbodies are *Schoenoplectus tabernaemontani, Baumea articulata, Baumea preissii and Juncus krausii.* The surrounding vegetation includes a number of planted native shrubs and trees although non native species such as **Eucalyptus citriodora, Eucalyptus camaldulensis* and **Banksia integrifolia* are also present.

Figure 8. Location of Cygnia Cove Waterbodies showing *Typha* infestation locations

Typha was recorded in three of the six waterbodies (Lakes 2, 3 and 4) and in the foreshore area where Lake 4 (infested with *Typha*) discharges into remnant foreshore vegetation. Given this area is hydraulically connected to Lake 5 the infestation area has been assigned to this lake. The overall *Typha* infestation compared to the extent of the waterbodies is outlined below and example images of infestations shown in Plate 15	
Approximate size of all waterbodies at Cygnia Cove	2.42 ha
***Typha* occurrence and distribution:**	36 m^2
Percentage of the waterbody covered by *Typha*:	0 %

A breakdown of infestation per waterbody is shown in Table 1 in Section 4.0.

Plate 15. Cygnia Cove lakes *Typha* infestation: a) Lake 2 and b) foreshore area/Lake 5

4.0 SUMMARY AND RECOMMENDATIONS FOR MANAGEMENT

The overall distribution and cover of *Typha* within the City of South Perth waterbodies are summarised in Table 1 below.

Table 1 Summary of *Typha* infestation areas for City of South Perth Waterbodies

Name	Area (ha)	Area of *Typha* Infestation (ha)	% of waterbody occupied by *Typha*
Lake Douglas	3.10	0	0%
Lake Hurlingham	0.86	0	0%
Lake Tondut	0.29	0	0%
Melaleuca Swamp	0.62	0	0%
Millers Pool	0.19	0	0%
Lake McDougal	2.28	0	0%
Bodkin Park Lake - South	0.23	0	0%
Bodkin Park Drain	0.09	0	0%
Bodkin Park Lake - North	0.38	0	0%
Andrew Thomson Reserve	12.49	0.0012	0.01%
Lake Gillon	0.41	0.0014	0.34%
Collier Park Lake 3	0.60	0	0%
Collier Park Lake 1	0.64	0	0%
Collier Park Lake 2	2.41	0	0%
Elderfield Wetlands	1.89	0.1573	8.34%
Doneraile Reserve Basin	0.09	0.0255	28.02%
Cygnia Cove Lake 1	0.36	0	0%
Cygnia Cove Lake 2	1.67	0.0006	0.04%
Cygnia Cove Lake 3	0.26	0.0001	0.04%
Cygnia Cove Lake 4	0.06	0.0029	5.08%
Cygnia Cove Lake 5	0.06	0.0009	1.45%
Cygnia Cove Lake 6	0.01	0	0%

Investigations show that most of the waterbodies within the City are free from *Typha*. This is largely attributed to the nature of the wetlands themselves and the maintenance of *Typha* populations in the past.

Prior to 2016 Elderfield Wetlands were known to contain populations of both *Typha* species with *T. orientalis* being dominant. Doneraile Reserve basin only had occasional occurrences of *Typha* which was controlled by mechanical and chemical treatments and was otherwise free of the species. This was also the case with other wetlands within the City.

While most reserves are *Typha* free, those that do have it show the need for management due to the following factors:

1. The small size of waterbodies (e.g. Doneraile basin, Cygnia Cove Stormwater Basin (Lake 4) and drainage channels) – *Typha* can cause blocking of the drainage system reducing the capacity of the basins to store and infiltrate stormwater which can result in localised flooding, particularly during high rainfall events.

2. The remnant vegetation in some wetlands like that of Andrew Thomson Reserve and Cygnia Cove foreshore reserve are of high value and do not have *Typha* species as part of their original flora assemblage. In these situations small easy to manage occurrences should be treated immediately to allow indigenous vegetation on site to persist and to maintain important habitats for fauna.

Dependant on the size of the waterbody and the remnant vegetation present, both mechanical (above ground only) and chemical methods of managing *Typha* populations (this includes both *T. orientalis* and *T. domingensis*) should be implemented.

The management of *Typha* should follow DBCA notes outlined on FloraBase website (https://florabase.dpaw.wa.gov.au/browse/profile/99). In general:

1. Where small and new populations of *Typha* are recorded in remnant vegetation of very good condition like that of Andrew Thompson's Reserve or Cygnia Cove foreshore, these plants should be chemically treated and above ground biomass removed before they take hold and start to seed.

2. Any dense growth within narrow drainage channels and in front of inlets and outlets of the water compensation basins should be chemically treated, and above-ground biomass removed mechanically to reduce the chance of occurrence.

3. Dense growth from any small water body particularly those that already contain a good cover of native sedges and rushes (e.g. Doneraile, Lake Gillon,) should be removed at a minimum on an annual basis by mechanical cutting and flooding of the cut stems.

4. For larger wetland areas such as Elderfield Wetlands, above-ground biomass should be cut and removed periodically (suggested annually for *T. orientalis* and possibly biennially for *T. domingensis*) and *Typha* populations sprayed at the boundary with other remnant vegetation to keep population size under check.

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