

Plan of Management

Botany Wetlands
2018 - 2028

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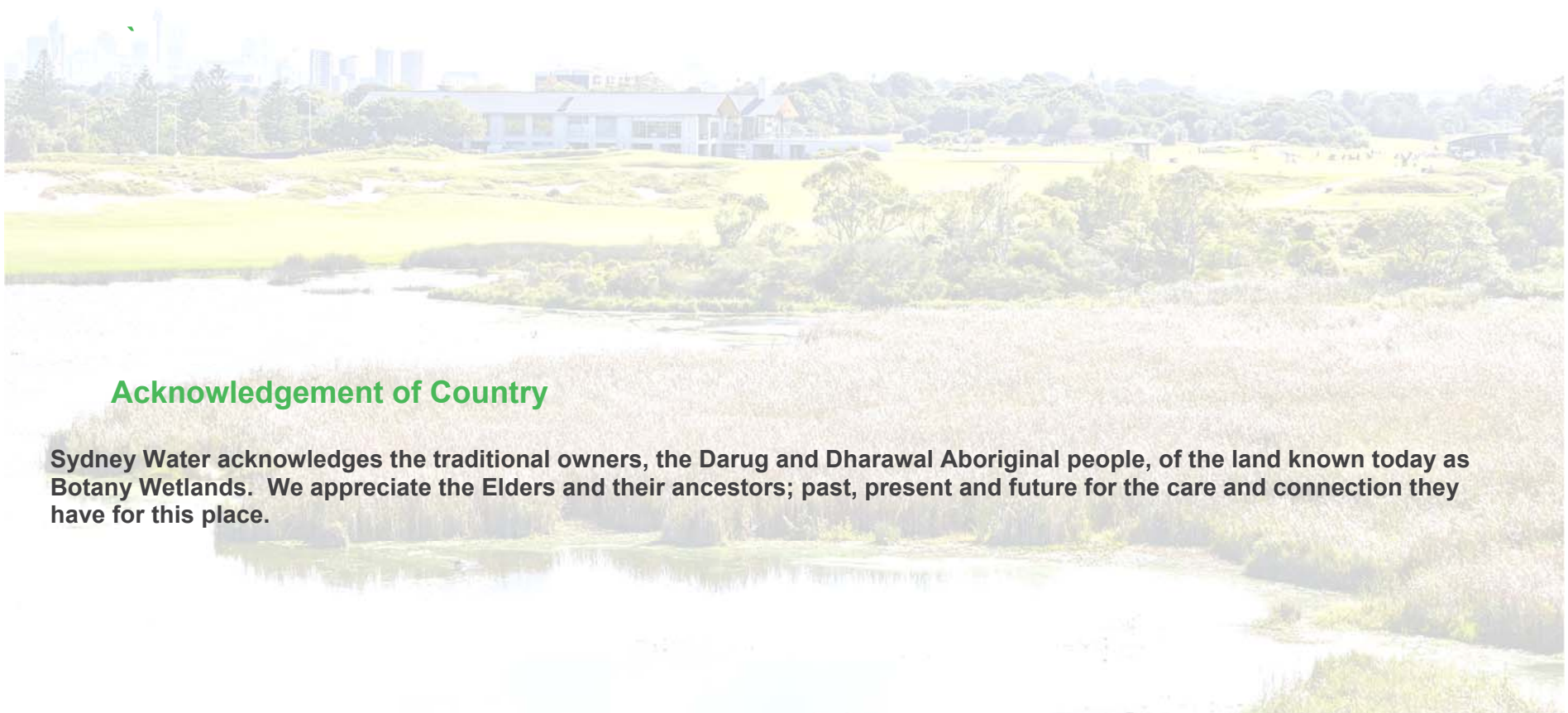
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Our Vision

Botany Wetlands will make a unique and important contribution to the liveability of Sydney through its significant natural environment, recreational and heritage values. The values of the wetland are protected and enhanced by infrastructure that is sustainably planned, operated and maintained.



Acknowledgement of Country

Sydney Water acknowledges the traditional owners, the Darug and Dharawal Aboriginal people, of the land known today as Botany Wetlands. We appreciate the Elders and their ancestors; past, present and future for the care and connection they have for this place.

1 Introduction

The Botany Wetlands (the ‘wetlands’) are the largest coastal freshwater wetlands in the Sydney region. They are comprised of 13 interconnected ponds that span over a 4.5 km corridor in Sydney’s eastern suburbs. The wetlands have significant ecological value, providing an extensive refuge to both migratory birds and other wetland flora and fauna, as well as providing important recreational, educational and scientific amenity to the community. The wetlands are listed on the State Heritage Register because the original Botany Swamps Water Supply Scheme (1858-1886) provided drinking water to early settlers of Sydney. The ponds and historic water supply weirs are now a flood mitigation resource, receiving and treating stormwater run-off from a large urban catchment in Sydney’s eastern suburbs. Sydney Water holds a ‘water supply works approval licence’ under the *Water Management Act 2000* issued by the Department of Industries – Water (DoI – Water) for the wetlands. This licence requires Sydney Water to implement a Plan of Management (PoM) for the wetlands.

1.1 Purpose of the plan

This PoM outlines how Sydney Water, as the land owner, will manage the Botany Wetlands as a flood mitigation resource, as an environmental asset, to meet legislative requirements and for the benefit of the community both now and into the future. This PoM sets the direction and priorities for on-ground works and management actions in Sydney Water’s Plan of Operations for the wetlands.

Most of the land owned by Sydney Water is currently leased to three separate golf clubs; The Lakes, Bonnie Doon and East Lake Golf Clubs and Bayside Council for Astrolabe Park (**Figure 1**). This PoM guides land management of the golf courses and Astrolabe Park, to ensure we protect the values of the wetlands and meet all legislative requirements. The golf course operators must also have Environmental Management Plans that address and are consistent with this PoM.

1.2 Land to which the plan applies

The wetlands which Sydney Water own and manage extend from Gardners Road, Eastlakes to Botany Road, Botany as shown in **Figure 1** and encompass an area of 173 hectares. Astrolabe Park and Bonnie Doon Golf Course, located to the east are also included in the PoM. Sydney Water manages all the ponds, wetlands and significant parcels of adjoining land between Gardeners Road and Botany Road. Downstream sections of Botany Wetlands are located on Commonwealth land and are managed by the Sydney Airports Corporation Ltd (SACL). The wetlands eventually discharge to Botany Bay. Upstream sections of Botany Wetlands and surrounding catchment areas are owned and managed by the Centennial Parklands, Bayside Council and Randwick City Council.

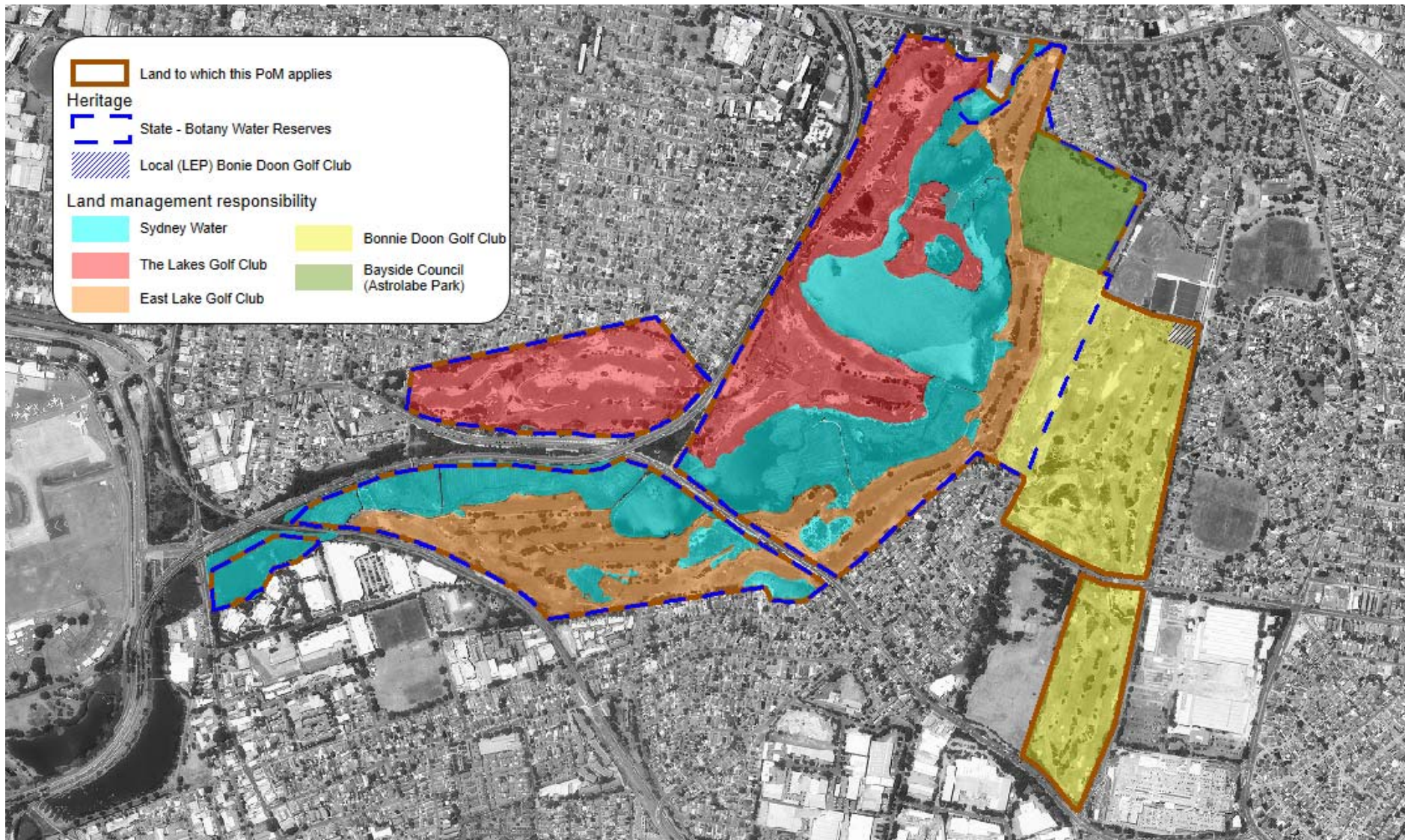


Figure 1 Land to which the Plan of Management applies and State heritage boundary

1.3 Legislative and policy context

The key legislation and policies relevant to the wetlands and their management are summarised in **Table 1**. This shows the flow of legislative and policy requirements that underpin the PoM and other management documents for the wetlands.

Table 1 Key Legislation and policy context

Hierarchy	Legislation/ Policy	Relevance to Botany Wetlands
International	International Agreements: <ul style="list-style-type: none"> • Japan- Australia Migratory Bird Agreement • China-Australia Migratory Bird Agreement • Republic of Korea-Australia Migratory Bird Agreement 	Botany Wetlands is a known habitat for migratory birds protected under these international agreements.
Commonwealth	<i>Environmental Protection and Biodiversity Conservation (EPBC) Act 1999</i>	Proposed works (or actions) that are likely to have a significant impact on a matter of national environmental significance require approval from the Commonwealth Minister for the Environment. Matters of national environmental significance relevant to Botany Wetlands include: <ul style="list-style-type: none"> • wetlands of international importance (listed under the Ramsar Convention) – Botany Wetlands is listed on the Directory of important wetlands in Australia • <i>Eastern Suburbs Banksia Scrub</i>, listed as an endangered ecological community under this Act – occurs at Botany Wetlands • migratory species protected under international agreements – occur at Botany Wetlands.
State	<i>Water Management Act 2000</i>	Sydney Water holds a Water Supply Works (WSW) approval with the Department of Industry (DoI) – Water. This approval permits us to install, maintain, repair, alter or extend the dams in accordance with the WSW approval, and use the dams for recreational and flood mitigation purposes. The Approval also requires us to implement a Plan of Management for Botany Wetlands and monitor and report on the ecological health of the wetlands. Sydney Water does not extract water, each golf club holds a licence for groundwater extraction and monitors and reports as required by their licence and approvals.

Hierarchy	Legislation/ Policy	Relevance to Botany Wetlands
	<p><i>National Parks and Wildlife Act 1974 (NP&W Act)</i></p>	<p>This Act provides for the protection of Aboriginal objects and heritage. It prescribes offences for harming or desecrating Aboriginal objects or places. The aeolian sand dunes at Botany Wetlands are considered a high-risk landscape which may indicate the existence of previously unidentified Aboriginal objects. However, much of the land surrounding the wetlands has been previously disturbed from past activities which is likely to have removed the possibility of Aboriginal objects being present.</p> <p>All proposed activities that are likely to disturb the ground in previously undisturbed areas must be assessed using the <i>Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (Office of Environment and Heritage (OEH), 2010)</i> to determine if Aboriginal objects or areas likely to contain Aboriginal objects will be impacted by the works.</p>
	<p><i>Heritage Act 1977</i></p>	<p>Botany Wetlands is listed on the <i>State Heritage Register</i> as 'Botany Water Reserves' (#01317; gazette date 18 November 1999). It is also listed on Sydney Water's <i>Heritage and Conservation Register</i> under section 170 of the Act (#415101).</p> <p>All proposed activities involving ground disturbance, or which are likely to disturb a heritage item must be assessed by an appropriately qualified heritage consultant/ archaeologist for potential impacts to heritage items or areas likely to contain relics.</p>
	<p><i>Environmental Planning and Assessment Act 1979 (EP&A Act)</i></p>	<p>This Act provides the framework for land use planning and the consent and approval process for undertaking activities. It also includes environmental impact assessment and community consultation requirements. It contains guiding principles for assessing environmental impacts of a proposal that planning authorities, such as Councils and state-owned corporations, must consider when deciding whether to approve an activity or development.</p> <p>Any development for the purpose of golf course on land which is leased by the golf clubs will require development consent from Council, unless the works are exempt under another Act or Policy. In this instance, any works by the golf clubs must be undertaken in accordance with the environmental assessment and development approval obtained, in addition to Sydney Water landowner consent.</p>
	<p><i>State Environmental Planning Policy (SEPP) Infrastructure (2007)</i></p>	<p>If Sydney Water is the proponent and determining authority under the EP&A Act, the Infrastructure SEPP permits development by or on behalf of a public authority for wastewater/ water supply/ stormwater without consent on any land in a prescribed zone, if it is unlikely to have a significant effect on the environment. Therefore, most activities carried out by Sydney Water for the purpose of stormwater and environmental management at Botany Wetlands will be permissible without consent.</p>

Hierarchy	Legislation/ Policy	Relevance to Botany Wetlands
	<i>Sydney Water Act 1994</i>	<p>Works and their impacts must comply with the standard of service and environmental performance prescribed by this Act.</p> <p>This Act establishes the Sydney Water Corporation and outlines three principal objectives, to:</p> <ul style="list-style-type: none"> • be a successful business • protect the environment • protect public health.
	<i>Protection of the Environment Operations Act 1997 (POEO Act)</i>	Any works must have safeguards to ensure there will be no pollution of the surrounding environment.
	<i>Biodiversity Conservation Act 2016 (BC Act)</i>	Two threatened ecological communities (Eastern Suburbs Banksia Scrub and Sydney Freshwater Wetlands) occur at Botany Wetlands and many fauna species that inhabit the wetlands are listed under the BC Act. All proposed activities must be assessed by an appropriately qualified environmental specialist for potential impacts, including listed key threatening processes to species, populations ecological communities and/or areas of outstanding biodiversity value in accordance with Part 7 of the Act.
	<i>Fisheries Management Act 1994 (FM Act)</i>	Provides for the protection of fish and their habitats – including aquatic vegetation. This PoM, is consistent with the FM Act objectives, by keeping fish passage open and maximizing water quality. Activities in the wetlands must consider impact on Key Fish Habitat (KFH) areas (Figure 3) and management of pest species. Any dredging or reclamation activities within KFH would require notification to DPI (NSW Fisheries).
	<i>Biosecurity Act 2015</i>	Requires landowners to control invasive weeds on their land, where there is a biosecurity risk. The wetlands contain several priority and environmental weeds which need to be actively managed by Sydney Water and the golf clubs to prevent their spread.
	<i>Contaminated Land Management Act (1997) (CLM Act)</i>	<p>This Act establishes a process for investigating and remediating contaminated land. Astrolabe Park is a former landfill site.</p> <p>On-going contamination monitoring and management of Astrolabe Park is undertaken in accordance with the provisions of the CLM Act and associated guidelines.</p>

Hierarchy	Legislation/ Policy	Relevance to Botany Wetlands
	<i>Coastal Management Act (2016)</i>	This Act outlines controls for various coastal management areas including coastal wetlands, littoral rainforests and coastal use areas, which are mapped in the SEPP (Coastal Management) (2018). The management of the wetlands should be consistent with the management objectives of coastal wetlands, listed in this Act.
	<i>State Environmental Planning Policy (SEPP) Coastal Management (2018)</i>	Clause 8(4) allows the provisions of the Infrastructure SEPP which permit emergency works or routine maintenance works without consent or exempt development to prevail over clauses 10 and 11 of SEPP (Coastal Management) (2018) if the works are carried out with minimal possible disturbance to the land. Proposed activities within the mapped 'coastal wetlands' (Figure 3) that do not meet emergency or maintenance work criteria will require consent in accordance with this SEPP.
Regional	<i>Greater Sydney Regional Plan: A Metropolis of Three Cities (GSC, 2018a)</i>	The Greater Sydney Regional Plan recognises that the landscape of Greater Sydney is characterised by waterways, and that improving the health of waterways is essential to the sustainability and liveability of Greater Sydney. Implementing this PoM will help protect and enhance the Botany Wetlands, an integral part of the landscape of eastern Sydney.
	<i>Eastern City District Plan (GSC, 2018b)</i>	This plan outlines the Greater Sydney Green Grid which is a long-term vision for a network of high quality green spaces that connect communities to the natural landscape. The Mill Stream and Botany Wetlands Open Space Corridor has been identified in this plan as a priority corridor which aims to improve public use and access along this corridor. The Greater Sydney Green Grid will be delivered incrementally over decades as opportunities and connections progressively become available.
Local	<i>Botany Bay Local Environment Plan (LEP) 2013</i>	The entire site is within the Bayside local government area, however, due to the ISEPP provisions, development consent under the LEP 2013 is not required for Sydney Water works. Development for the purpose of golf, requires consent by Council, under part 4 of the EP&A Act, unless the proposal meets exempt development.

1.4 Sydney Water's Environment Strategy

Caring for the environment is a core value in everything we do. Sydney Water 's goal is to aspire to provide water services for our city that sustain and enhance the lifestyle of our customers, now and in the future, increasing our standing in the community as a trusted environmental steward by 2030. The priority outcomes and targets from our Environment Strategy 2018-2030 which are relevant to the management of Botany Wetlands are outlined

below in **Table 2**. These have been considered when identifying opportunities and developing management for Botany Wetlands. A summary of the basis for management for Botany Wetlands is provided in **Figure 2**.

Table 2 Sydney Water Environment Strategy priority outcomes and targets relevant to Botany Wetlands

Priority outcomes	Targets
Conserve natural environments and cultural heritage in our care.	Consolidate and renew our strategic plans of management for cultural heritage and natural environments (including riparian lands and wetlands).
Reveal and restore natural waterways and landscapes.	Implement programs to reinstate more natural conditions in highly modified waterways. Achieve net gain in area of native vegetation restored year on year.
Include learnings from Aboriginal knowledge of country in our programs to improve conservation outcomes and build relationships.	Enhance our strategic engagement with recognized knowledge holders to inform our planning and community projects.
Share our land and heritage in our care with the community to support liveable places.	Increase the availability of our land for agreed community use or public open space year on year.

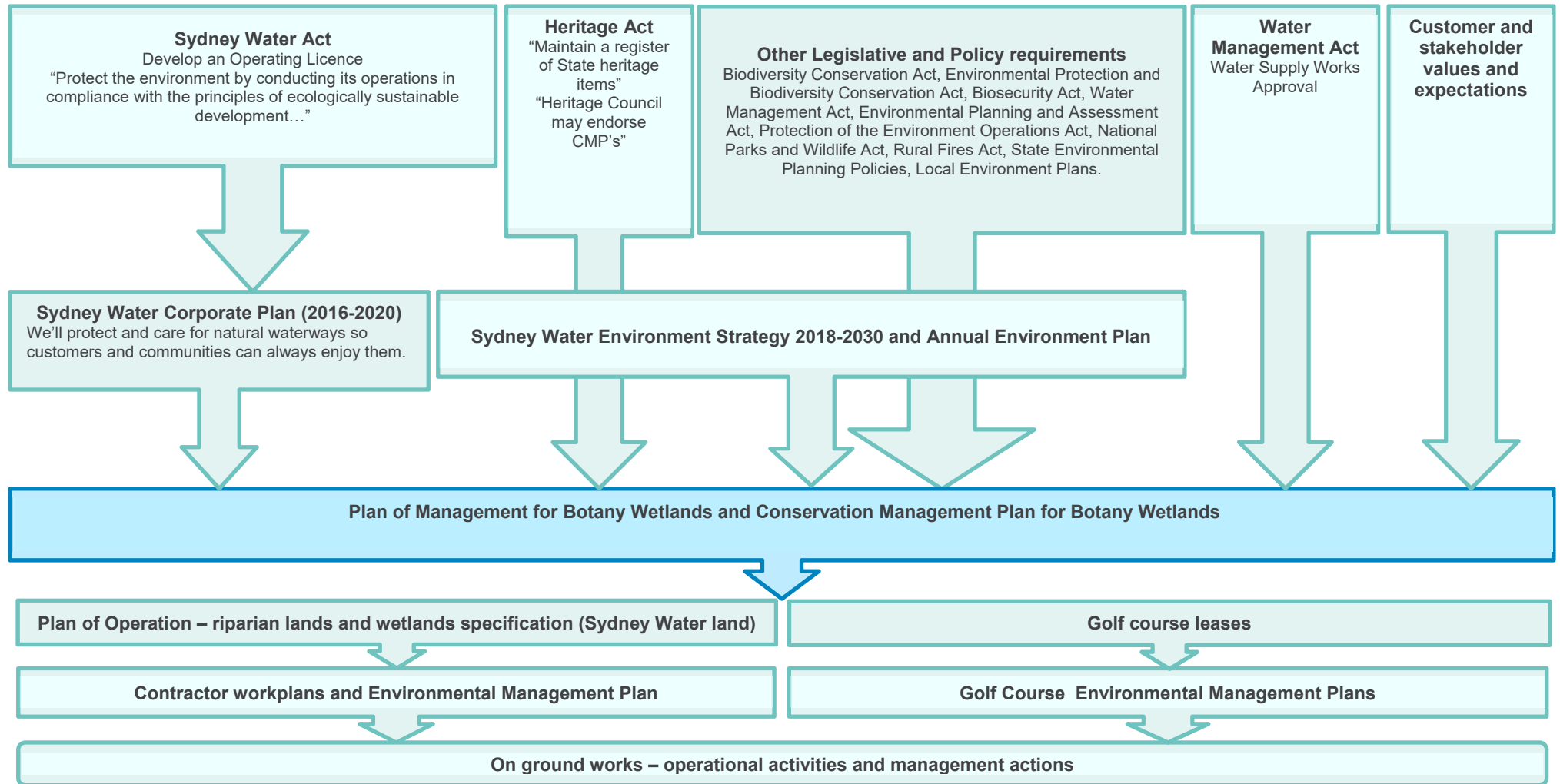
1.5 Development of this Plan of Management

A key component of the PoM process has been the review and evaluation of previous reports and studies along with current planning and corporate policies. Of relevance has been the previous PoM for the wetlands (2007-2011 and draft (2014), along with several reports and plans published by the former Botany Bay City Council (now Bayside Council) and Sydney Water.

We held various community and stakeholder workshops in 2013 to help develop this PoM. Stakeholders included residents, golf course managers/ members and guest users, local Councils, Aboriginal community/ heritage representatives, catchment land managers (Centennial Park and Sydney Airport), OEH, Department of Industry – Water, bird watching groups, and bushcare volunteers. These workshops helped develop the vision for the wetlands as well as collect, organise and prioritise the actions in this PoM. We also sent letters to local residents, updated website information and conducted a web-based survey targeting local residents and golf course to gather community views about the management of the wetlands.

Vegetation mapping presented in this PoM was originally surveyed by Narla in 2013. Following consultation on the draft PoM, the mapping of ESBS was re-confirmed by Ensure and endorsed by OEH in 2018.

Figure 2 Basis for management - Botany Wetlands



2 Values, threats and opportunities

This section summarises the values, threats and opportunities identified during consultation with stakeholders, research and field surveys.

Table 3 Values, threats and opportunities - Social

Social Values	Threats	Opportunities
<p>Recreation Botany Wetlands has a long history of recreation. In the past, Aboriginal people met and gathered and well-worn routes were described by early colonials between the wetlands and Sydney Cove. Today, recreational activities continue, with golf being the major use. Bird watchers also visit the wetlands to appreciate the bird diversity, and visitors walk and jog through the wetlands.</p>	<ul style="list-style-type: none"> • Poor water quality. • Informal recreation and walking tracks may impact on sensitive areas such as threatened ecological communities. • Bushland and inappropriate planting may impact on visibility along fairways for players sighting the green from the tees. 	<ul style="list-style-type: none"> • The wetland holds further potential to provide more significant recreational amenity such as kayaking, fishing, picnicking and model boating. • Formalise safe walking/jogging/cycling trails.
<p>Public access There are limited formal public access routes through the wetlands. Greater public access through the wetlands is a frequent recurring request from the community and stakeholders, and is identified in the Eastern District Plan and Sydney's Green Grid Report. Increasing public access is considered the key element in better engaging the community and showcasing the wetlands values.</p>	<ul style="list-style-type: none"> • Potential risk of golf ball strike and vandalism. • Inappropriate pathway design through native vegetation communities. • Potential damage to golf course fairways. 	<ul style="list-style-type: none"> • Provide additional publicly accessible open space to help offset growth in the local area. • Creating new public access paths would allow for ecological and heritage features to be highlighted using interpretive signs. • Improve local and regional movement connectivity through collaboration with local council in open space and pathway network design.
<p>Education and research Being close to universities and research institutes, Botany Wetlands is an excellent place for educational opportunities around environmental science and heritage. There is scope for greater acknowledgement of traditional knowledge of the wetlands held by Aboriginal people and a greater appreciation of past environments and the history of our water supply.</p>	<ul style="list-style-type: none"> • Impacts to sensitive flora/fauna and heritage items/areas if not appropriately managed. 	<ul style="list-style-type: none"> • Facilitated or self-guided walks. • Online interactive media education opportunities – data, photos and stories. • A showcase for best practice urban environmental management. • Academic research and study opportunities for cultural heritage, social science, archaeological, ecological, geological and hydrological fields.

Economic

The wetlands have potentially been a place of trade for Aboriginal people for thousands of years, as well as the establishment of some of the Colony’s earliest industries (refer to the Conservation Management Plan).

Today, direct revenue mainly comes from the three golf clubs which lease the land from Sydney Water, attracting both local and international golfers. These natural areas and wetland services are highly valued by the community and contribute to the economy of the city.

- Environmental degradation.
- Loss of natural aesthetics.
- Poor water quality.

- Collaborate with academics and tertiary institutions in land management activities (eg. vegetation and species conservation management, weed and pest management).

- The high aesthetic value of the wetlands, together with the substantial number of birds means wetland tourism could be a growth area; especially given proximity of the wetlands to Sydney Airport.
- Potential to better utilise the wetlands and adjacent areas to mitigate flooding and reduce annual damages to residents in the catchment.

Table 4 Values, threats and opportunities - Environmental

Environmental values	Threats	Opportunities
<p>Geology and soils The Botany Wetlands area and surrounding landscape lies on the Tuggerah Soil Landscape, which is underlain by aeolian (windblown) fine to medium marine quartz sand (Chapman and Murphy, 1989). The white sands, referred to as Botany Sands, can easily be seen in the wetlands as this area is within the former sand dunes and coastal swamps of the Botany Basin. The natural soil profile is heavily leached infertile sand with minimal organic material.</p>	<ul style="list-style-type: none"> • Soils (sands) are highly erodible and therefore constant use of the site and degradation of the vegetation cover can lead to soil erosion. • Contaminated soils can lead to polluted leachate and contribute to poor water quality, ecological damage and threats to public health. • Importation of contaminated or inappropriate soils, rock or fill material. • Disturbance of potentially contaminated land leading to pollution or health impacts. 	<ul style="list-style-type: none"> • In some areas with suitably gentle slopes and a northerly aspect, riparian banks can be left with exposed sands to provide areas for native fauna, such as turtles, to lay eggs. • Maintain and improve vegetation cover to reduce the risks of soil erosion.
<p>Hydrology and catchment The wetlands are the receiving water body for urban stormwater from its 20km² catchment, extending from Centennial Park in the north to Botany Bay in the south. The wetlands are the basins in which catchment stormwater runoff accumulates and travels through before reaching the estuary of Botany Bay.</p>	<ul style="list-style-type: none"> • Erosion and scouring impacts from stormwater pollution from stormwater inputs. • Increase in high intensity storms and longer periods of drought associated with climate change. 	<ul style="list-style-type: none"> • Look for further opportunities to develop the wetlands as an integral part of a regional green corridor in an otherwise dense urban and industrial landscape where over 70% of the catchment area is hard-surface.

Environmental values	Threats	Opportunities
<p>There is a complex interaction between surface water run-off and the Botany Sands Aquifer, with water levels in the wetlands often remaining high long after rainfall events.</p>	<ul style="list-style-type: none"> • Increase in development and resulting runoff in the upstream catchment. 	<ul style="list-style-type: none"> • Implement water sensitive urban design (WSUD) and flood mitigation capital and operating improvements as appropriate.
<p>Water quality Having abundant clean water is part of the natural and cultural significance of the wetlands, supporting plants, animals and people. The wetlands function as an important natural filter for the catchment pollutants, yet water quality and aquatic macro-invertebrate monitoring over the past 15 years still indicate a highly impacted urban waterway.</p>	<ul style="list-style-type: none"> • Point source water pollution, eg. wastewater overflow or illegal discharge. • Diffuse source water pollution: stormwater run-off with multiple input from urban catchment, and nutrients from the golf courses. • Polluted groundwater and aquifer inflows from golf courses, parks and surrounding industrial land uses (current and former) • Erosion of banks of the wetland channels and ponds. • Blue green algae blooms have become more regular in the past decade, and threaten flora, fauna and human health. • Limited complete catchment governance as well as limited drivers, capacity and funding making adoption of catchment-wide WSUD difficult. • Loss of vegetation and its filtering capacity. • European carp disturb bed sediments causing increased turbidity, resuspension of nutrients and loss of dissolved oxygen. 	<ul style="list-style-type: none"> • Implement WSUD within the surrounding wetland catchment. • Influence Council's Development Control Plans to better reduce pollution from private development. • Require industry best practice for fertiliser/ nutrient use for waterway protection by the golf clubs. • Optimise the use, design and maintenance of existing stormwater quality improvement devices within the wetlands. • Continue water quality and ecological monitoring in the wetlands. • Increase the ratio of dense aquatic vegetation to open water, and slow flow paths to maximise contact time with plants. • Improve riparian vegetation density to help stabilise banks.
<p>Biodiversity The biodiversity of the wetlands is rich and highly valued, providing:</p> <ul style="list-style-type: none"> • diversity of native aquatic plants and wetland types • habitat for migratory water birds • refuge and habitat for native animals such as water dragons, blue wrens and macro-invertebrates • habitat and corridors for plant and mobile species such as native fish, eels and birds 	<ul style="list-style-type: none"> • High priority weeds that threaten the native biodiversity of the wetlands, such as, Lantana, Privet, Pampas Grass, Green Cestrum, Blackberry and exotic grasses such as Cobblers Pegs, Fleabane, Purpletop, African Love Grass and Kikuyu. • Aquatic weeds that threaten native biodiversity include Ludwigia, Alligator 	<ul style="list-style-type: none"> • Link corridors of vegetation and areas of core habitat of sufficient size to increase resilience and encourage native fauna. • Control weeds through weed management and bush regeneration contracts. • Delineate areas of high biodiversity from golf course activities.

Environmental values	Threats	Opportunities
<ul style="list-style-type: none"> ecosystems with diverse bio-chemical processes and microbial activity a place where threatened ecological communities are protected and enhanced. <p>This biodiversity (Figure 4) is particularly valuable given the location of the wetlands in a highly urbanised and industrialised area close to the Sydney CBD.</p>	<ul style="list-style-type: none"> Weed, Salvinia, Mexican Water Lily and Cabomba. Predation, competition and habitat impacts from pest species including fox, rabbit, carp and gambusia. Disturbances caused by golfers, public access and maintenance staff and contractors. Unauthorised vegetation clearance. Illegal dumping and arson. 	<ul style="list-style-type: none"> Supplement key habitat features such as fish passage, tree hollows, ephemeral wetlands, wader bird habitat and turtle laying zones.
<p>Eastern Suburbs Banksia Scrub <i>Eastern Suburbs Banksia Scrub</i> (ESBS) is a critically endangered ecological community. ESBS patches within Botany Wetlands covered over 13 ha and make up over 9% of the total remaining stands of ESBS in Sydney (Narla, 2013, ENSure, 2018). Significant stands are found adjacent to the wetland water bodies, as well as fragmented between fairways on the golf courses (as mapped in Figure 4).</p>	<ul style="list-style-type: none"> Competition from weed species such as African Love Grass, Bitou Bush and Lantana. Inappropriate fire regimes. Inappropriate landscape planting adjacent to native vegetation communities. Removal, under-scrubbing, mowing, slashing and the inappropriate use of herbicides. Trampling and associated damage. Loss of pollinators (small birds, native bees etc). Fragmentation by pathways. Loss of isolated species such as Monotoca, Grass Tree, Banksias. Prolific growth of individual species – such as Coastal Wattle. Dumping of rubbish. 	<ul style="list-style-type: none"> Maintain up to date mapping and monitor condition of all ESBS patches. Continue to implement a bush regeneration and weed management program to maintain and enhance and expand ESBS patches. Identify and care for high diversity hotspots. Identify, protect and expand linkages between isolated patches and plants. Protect patches from disturbance by golfers and walkers through education and use of physical barriers. Raise staff/ contractor and public awareness of ESBS and encourages active community participation in its conservation. Consider soil disturbance to promote seed germination.
<p>Sydney Freshwater Wetlands The endangered ecological community Sydney Freshwater Wetlands (SFW) is present in most ponds of Botany Wetlands (see Figure 4). Open water areas have not been mapped as SFW, however</p>	<ul style="list-style-type: none"> Polluted water. Inappropriate water regimes. Weed invasion. 	<ul style="list-style-type: none"> Effective weed management that supports the retention and expansion of a diversity of native aquatic species and identified biodiversity hotspots.

Environmental values	Threats	Opportunities
<p>vegetation cover can change and the open water areas are part of the wetland. The diversity of SFW at Botany Wetlands include dense fern-lands which are in semi-saturated soil to those that are frequently in saturated soil such as the Melaleuca and Carex forest. Ideally water would flow through these vegetated areas rather than around on all but the high-flow storm events.</p>	<ul style="list-style-type: none"> • Sedimentation. • Physical removal and damage of vegetation. • Herbicide damage. • Loss of diversity from interspecies competition (eg from Typha). 	<ul style="list-style-type: none"> • Identify, protect and enhance the diversity of wetland types, including open water, riffles, runs, pools, areas with dense vegetation and shaded area. • Retain and expand aquatic edge vegetation into designated areas. • Improve the engagement of wetland vegetation in water flows – that is, manipulate flows such that water moves through rather than around vegetation.
<p>Trees Trees are an important part of the natural landscape, contributing essential aesthetic and biodiversity benefits to the wetland and surrounding area.</p> <p>In 2013, baseline mapping of all trees in the wetland area recorded over 5,500 trees, of which 845 were exotic and many more non-local native and planted nursery hybrids of native species. The main exotic species is the Radiata pine, these pines provide a food source for native birds such as black cockatoos.</p>	<ul style="list-style-type: none"> • Unauthorised removal of trees. • Lightning strikes, arson and high winds. • Inappropriate land use within tree dripline impacting roots and creating a perceived or actual safety threat. 	<ul style="list-style-type: none"> • Protect all trees on Sydney Water’s land. • Enhance landscaping with additional tree planting, to contribute to shade, cooling and amenity. • Develop a Tree Management Strategy that outlines the process for tree removal and replacement and identifies appropriate areas for additional canopy tree planting.
<p>Native fauna (birds, reptiles and mammals) Botany Wetlands provides important habitat for a wide range of native birds and animals, in a densely populated urban area, including:</p> <ul style="list-style-type: none"> • frogs such as Common Eastern Froglet, Striped Marsh Frog, Eastern Dwarf Tree Frog and Bleating Tree Frog • migratory species from the northern hemisphere such as Lathams Snipe, Cattle Egret, Common Sandpiper and Little Tern. Australia is responsible for habitat protection for these species under various international agreements (Japan- Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea Migratory Bird Agreement (ROKAMBA)) • local water birds such as Azure Kingfishers, Herons, Spoonbills and Egrets and other birds such as Superb Fairy Wren and Regent Honey Eater 	<ul style="list-style-type: none"> • Pest species (rabbit, foxes) which compete with native animals. • Mosquito Fish are a predator of some frog species and limit the frog’s ability to establish their young in open water. • Habitat loss and degradation. 	<ul style="list-style-type: none"> • Continued monitoring of aquatic macro-invertebrates as an indicator of water quality. • Improving water quality to improve diversity and abundance of macro-invertebrates. • Active control of rabbits and foxes by the golf clubs, Sydney Water, and adjacent land owners (Sydney Airport, Bayside Council, Centennial Parklands Trust). • Supplement and improve key habitat features and areas so that wetland native species such as frogs, native fish and macro-invertebrates can thrive.

Environmental values

- several endangered species such as the Grey-headed Flying Fox
- turtles, reptiles, skinks and dragons
- ring-tail possums, brush-tail possums
- invertebrates which are a key part of any ecosystem.

Fish

A variety of native fish Australian Bass, Australian Smelt, Freshwater Catfish, Short-finned Eel, Longfin Eel, Flathead Gudgeon, Yellow-fin Bream and Toadfish, have been recorded in the wetlands during fish surveys.

Adult eels occupy Botany Wetlands for a large part of their life before heading downstream and out of Botany Bay to their spawning grounds thousands of kilometres away, (near New Caledonia). Young eels then migrate from these spawning grounds back to the wetlands.

The wetlands contain Key Fish Habitat (**Figure 3**), as mapped by Department of Primary Industries under the *Fisheries Management Act 1994*.

Threats

- Competition, predation and habitat impact from pest and exotic fish species including European Carp, Goldfish and Mosquito Fish.
- The Mosquito Fish (*Gambusia holbrooki*) is an introduced species that competes with native fish and preys on frog spawn/tadpoles. Fish access to/ from the wetland is restricted due to a blockage in the wetlands between ponds 3 and 5, which is managed by Sydney Airport Corporation.

Opportunities

- Conduct fish surveys combined with electro-fishing programs in the wetlands aim to remove the pest fish species Carp and Mosquito Fish from the wetland.
- Continue to reintroduce Australian Bass to reduce numbers of juvenile Carp and goldfish.
- Enhance fish habitat by increasing overhanging edge vegetation including flowering trees.
- Investigate vertical slot fishways and rocky-ramp fishways which would be suitable for Botany Wetlands.

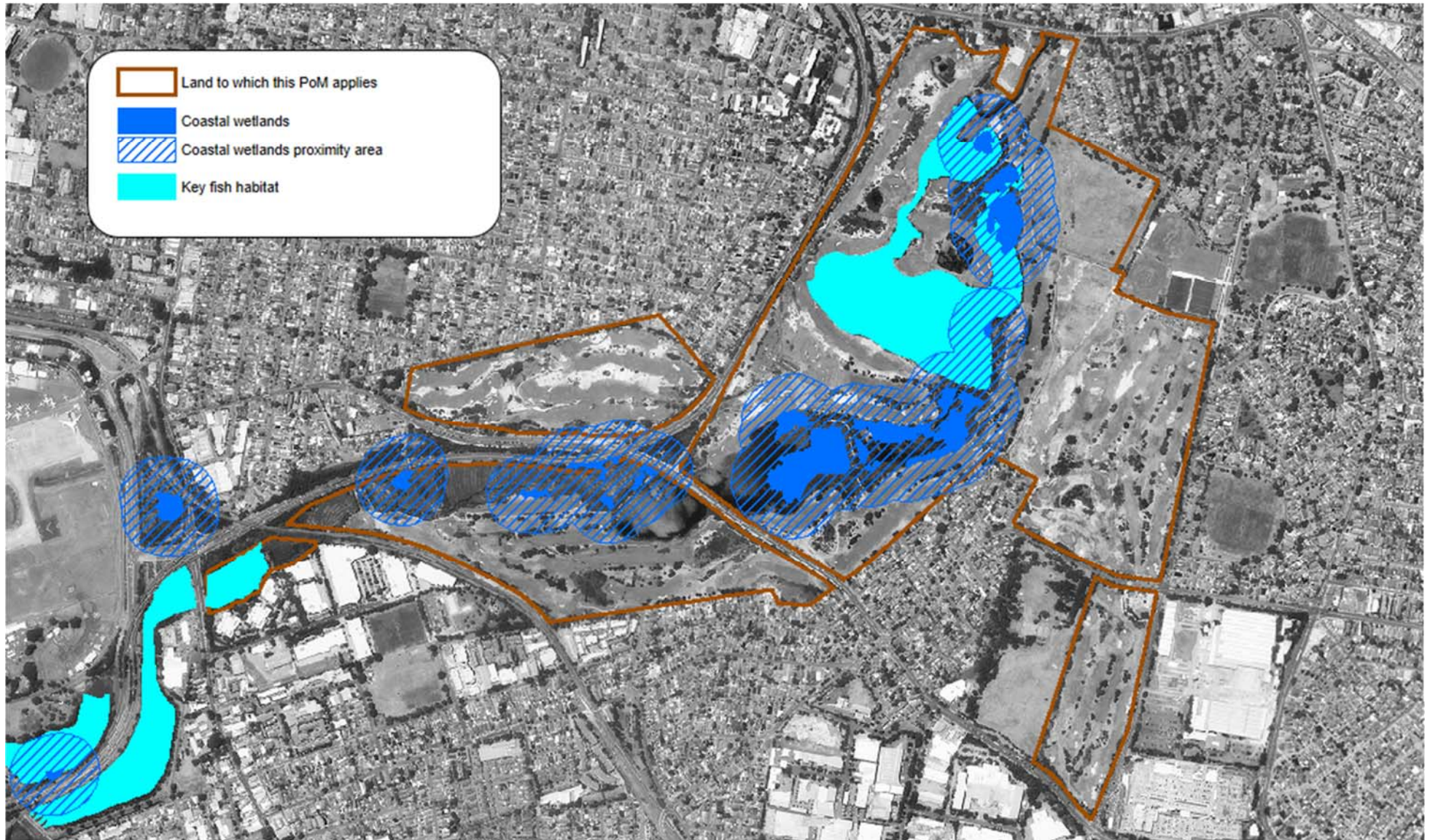


Figure 3 Key Fish Habitat (*Fisheries Management Act 1994*) and Coastal Wetlands (*Coastal Management SEPP, 2018*) mapped in Botany Wetlands

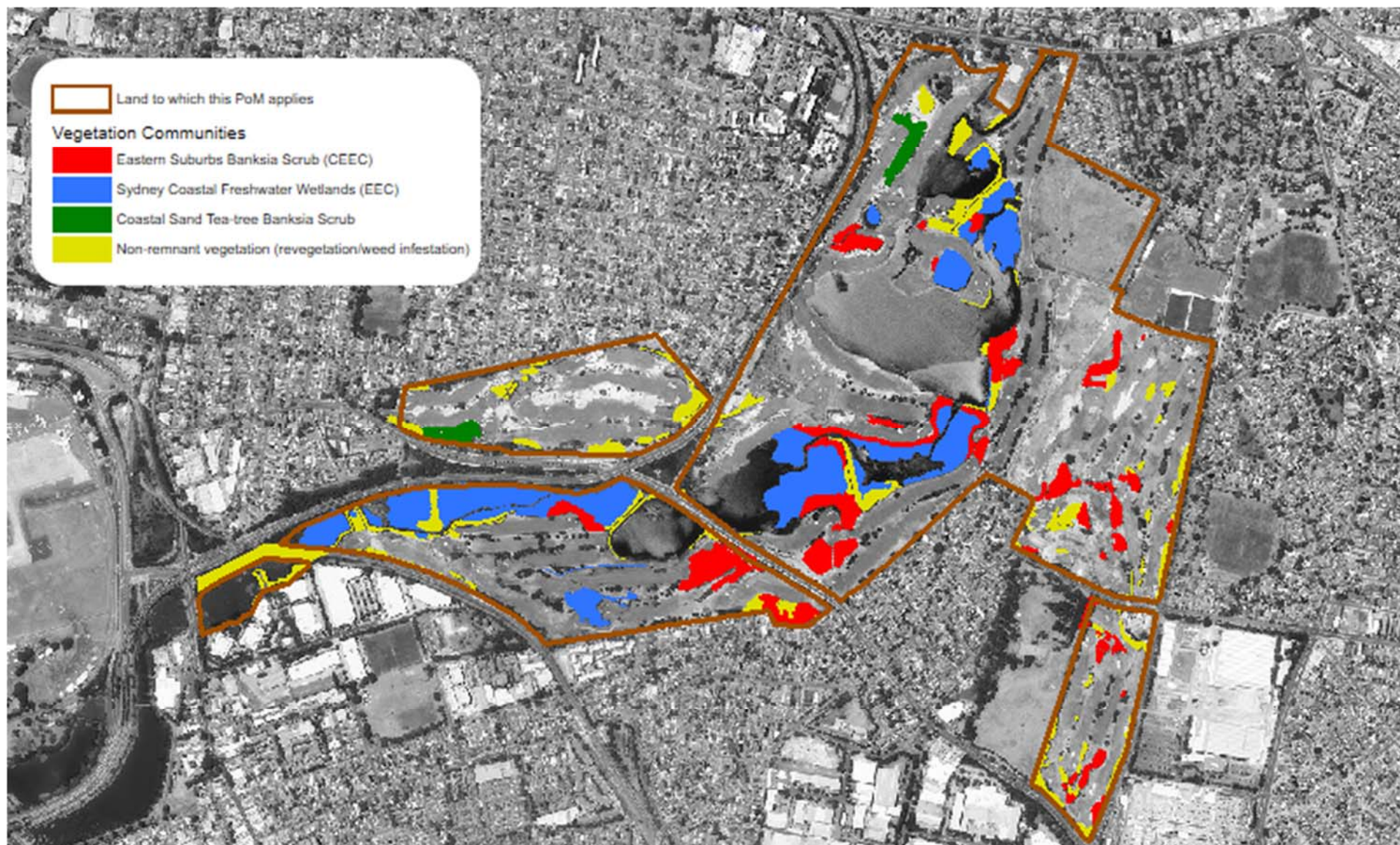


Figure 4 Native vegetation of Botany Wetlands (Narla 2013, ENSure 2018)



Eastern Suburbs Banksia Scrub – Botany Wetlands (source: Dragonfly Environmental)



Sydney Freshwater Wetlands (source: Sydney Water)



Eastern dwarf tree frog– Pond Botany Wetlands (source: Dragonfly Environmental)



Yellow-tailed black cockatoo on banksia (source: Callum Duffy)

Figure 5 Examples of biodiversity at Botany Wetlands

Table 5 Values, threats and opportunities - Heritage

Heritage Values	Threats	Opportunities
<p>European heritage Botany Wetlands are highly valued as part of Australia’s cultural landscape and heritage. A series of dams were built in the Wetlands during 1810 and 1820 to provide water power to industrial mills. In the 1850s, dams were built in the precinct, known as the ‘Mill Pond and Engine Ponds’, now owned by the Sydney Airport, to make the third water supply to Sydney. The dams, weirs and associated storages are part of Sydney’s early settlement and industrial history.</p> <p>The cultural heritage of the wetlands is well recognised through its listing on the NSW State Heritage Register, as well as Sydney Water’s s170 Heritage Conservation Register. Sydney Water has a Conservation Management Plan (Sydney Water, 2003) for the wetlands which provides an extensive account of the history and heritage values of the wetlands and how they are to be protected for future generations.</p>	<ul style="list-style-type: none"> • Inadvertent impact to archaeological relics. • Dilapidation of heritage items/ relics over time. • Collapse of dams or weirs. • Inappropriate land use that impacts the heritage values of the site. 	<ul style="list-style-type: none"> • Actively share the story of the history of Botany Wetlands to encourage better understanding, appreciation, protection and engagement with the community through site tours, signage, videos, brochures and other publications. • Update the Botany Wetlands Conservation Management Plan. • Ensure all heritage items are on Sydney Water’s asset register. • Restoration of dam wall.
<p>Aboriginal heritage Botany Wetlands are highly important to Aboriginal people as a place of abundant resources with permanent fresh water, food, medicines and raw materials. The wetlands were also a likely place for ceremony and gathering with importance to both local people and those from other ‘countries’ (or clan areas) who came there for meeting and ceremony. The wetlands are important for social, cultural and spiritual reasons and provide an important sense of place to the community, despite currently having limited access.</p> <p>The Botany Wetlands contain no registered Aboriginal objects (sites) on OEH’s Aboriginal Heritage Information Management System (AHIMS). This is likely to be due to the land being ‘locked up’ for the purposes of water supply for over 150 years and little development occurring in the area. However, despite disturbance to most surface sands, artefacts and other physical evidence of Aboriginal use are likely to be present within the dunes and remnant vegetation, as well as along watercourses.</p>	<ul style="list-style-type: none"> • Impact to unidentified Aboriginal sites through land disturbance and golf course development. • Loss of traditional cultural knowledge about the wetlands. • Loss of natural character and aesthetics. 	<ul style="list-style-type: none"> • Potential new archaeological information may be discovered, particularly from sites from thousands of years ago buried in raised terraces near the original watercourse. • Engage with Aboriginal community to capture traditional cultural knowledge about the wetlands. • Actively share Botany Wetlands Aboriginal Heritage and cultural stories to encourage better understanding, appreciation, protection and engagement with the community through site tours, signage, videos, brochures and other publications.

Table 6 Values, threats and opportunities - Civil infrastructure

Infrastructure assets	Threats	Opportunities
<p>Existing civil assets There are extensive civil assets in Botany Wetlands to assist in its function for stormwater management, flood mitigation, golf course operations and public access, including:</p> <ul style="list-style-type: none"> • hard structures such as spillways, pipes, culverts, sealed roads, golf clubhouses and maintenance sheds • soft civil structures such as earthen dams, berms, unsealed tracks, rock headwalls, floodways, constructed wetlands and golf fairways and tees • maintenance infrastructure eg. floating booms, sediment and trash racks • heritage structures/ works – some are still operational. <p>Sydney Water owns and maintains most of the infrastructure. All assets related to the golf courses are the responsibility of the golf courses. There are some shared assets such as access tracks, and council assets such as roads and public amenities.</p>	<ul style="list-style-type: none"> • Assets are not adequately maintained leading to poor function and/ or safety risks and/or environmental impacts. • Inappropriate additional or upgraded/enlarged assets. • Conflicting or inappropriate asset location or functionality. • Breach of Water Supply Works (WSW) approval. 	<ul style="list-style-type: none"> • Regularly inspect assets for structural integrity and functionality to proactively plan works. • Allocate adequate budgets for effective asset maintenance program. • Include asset management for golf courses in OEMPs.
<p>Golf course management Significant portions of Sydney Water’s land next to the wetlands is leased to the Lakes Golf Club, East Lake Golf Club and Bonnie Doon Golf Club.</p>	<ul style="list-style-type: none"> • Golf course development and operation next to wetlands and threatened ecological communities presents a risk of environmental damage. 	<ul style="list-style-type: none"> • Ensure the golf course has an up to date Environmental Management Plan detailing key environmental constraints/ sensitive areas and management measures. • Ensure compliance with and fulfilment of the Botany Wetlands PoM is incorporated into leasing contracts requirements.
<p>Astrolabe Park management This park is in the northern portion of the wetlands and is licensed to Bayside Council for open space public recreation.</p>	<ul style="list-style-type: none"> • Maintenance and upgrades to the park not undertaken in accordance with the contaminated land management plan, presents a contamination risk to the wetlands. 	<ul style="list-style-type: none"> • Ensure Bayside Council have an up to date contaminated land management plan and are adhering to it. • Sydney Water will continue bi-annual sampling to monitor contamination levels.

3 Management actions

In consideration of the wetlands values, threats and opportunities explored above, we will commit to the following management actions in **Table 7**. These actions will help us achieve our vision and maintain or enhance the values of the wetlands. These actions have been allocated a priority:

- High priority - Action is required to avoid possible breach of legislation and prosecution (at a minimum a non-compliance).
- Medium priority - Action may not be required to avoid breach of legislation, however action is required to avoid significant site degradation and greater maintenance costs in the long term.
- Low priority - Action is not required to avoid breach of legislation. Action is an opportunity and may require collaboration with adjacent land owners/ regulatory agencies as appropriate.

A timeframe is also allocated to high and medium priority action. Low priorities are not given timeframes, these low priority actions will be implemented if the opportunity arises. Where the action is already being implemented, the timeframe is ongoing. The PoM sets out the actions for the next 10 years. Some aspects of the vision will go well beyond the 10 years of this PoM.

Table 7 Management actions

Values	Actions	Priority and timeframe
Social		
Recreation and public access	Look for opportunities to increase safe community access to Botany Wetlands, such as strategic viewpoints and walking paths and consider establishing a 'Botany Wetlands Trail'.	Medium/ 2023
	Design and install signs for the public and golf course patrons that interprets and provides information on the natural and cultural heritage values of the Botany Wetlands system.	Medium/ 2023
	Work with local councils, Greater Sydney Commission and other agencies to enable increased public access to open space within the wetland area.	Medium/ 2023
	Increase local community and users' awareness, knowledge and appreciation for the wetlands.	Low
Education and research	Partner with universities and other research agencies when the opportunity arises for further research and monitoring.	Low
	Provide up to date information about Botany Wetlands on relevant websites, develop fact sheet and social media material.	Medium/ 2020

Values	Actions	Priority and timeframe
Economic	Better understand the economic value that the wetlands provide through economic analysis and customer research. Utilise this knowledge to support business cases and management decisions.	Medium/ 2023
Environment		
Soils and geology	Identify areas of erosion and target stabilisation and revegetation.	High/ ongoing
Water quality, hydrology and catchment	Undertake wetland catchment water quality investigation to identify loads and sources of pollution including both stormwater and wastewater. Recommend priority actions to try to avoid ongoing blue green algal blooms, litter and other impacts to the wetlands and its values.	High/ 2022
	Engage and work with Centennial Parklands and Council to improve water quality entering our ponds, such as implementing WSUD and consider pre-treating stormwater connections to the wetlands.	Medium/ ongoing
	Investigate wet weather wastewater overflows entering the stormwater system within the Botany Wetlands catchment and implement corrective actions.	High/ ongoing
	Consider installing floating wetlands and/or underwater aeration devices in Mill Pond to avoid ongoing algal blooms.	Low
	Upgrade Gross Pollutant Traps (GPTs) and implement engineering /naturalisation measures to reduce sedimentation; maintain GPTs and analyse data on litter, sediment and water to target sources.	High/ ongoing
	Upgrade water-level control device in Dam 5 Wall.	Low
	Install water flow monitoring gauges to monitor dry and wet weather flows. Analyse data to assess the wetlands effectiveness to managing water quality.	Low
	Improve water flows through and between ponds by: <ul style="list-style-type: none"> investigating and re-establishing water flow through pipes under berm between Pond 3 and 3A using existing wetland vegetation so that water, even low flows, run through the vegetation rather than around it upgrading the high-flow bypass adjacent to Pond 6. 	Low
Biodiversity – native vegetation	Golf Course EMPs to include best practice management for native vegetation and appropriate land management zones.	High/ ongoing

Values	Actions	Priority and timeframe
	Install protective measures such as signage, colour coded mapping and exclusion fencing or bollards to prevent vehicles, reduce foot traffic and indicate no-go, no-mow and no-spray zones within and around ESBS. Communicate these to golf course users and contractors.	High/ 2019-2020
	Identify areas for potential expansion of existing ESBS, including areas which may contain viable seed bank.	Medium/ 2020
	Undertake a bush regeneration program to remove weeds and plant out buffers and connecting areas; re-introducing native species that have been lost from the EECs.	High/ ongoing
	Collaborate with key stakeholders to develop a Manual of Best Practice Management for Sydney Freshwater Wetlands.	Low/ as required
	Undertake sustainable seed collection and propagation for bush regeneration activities.	High/ ongoing
	Target removal of Ludwigia and other noxious weed species in the ponds.	High/ ongoing
	Increase the cover of wetland vegetation through bank planting, floating islands, and the use of berms to expand existing vegetation.	Medium/ 2028
Biodiversity – native fauna	Restore riparian and in-stream vegetation and habitat including woody debris, and progressively naturalise waterways, where feasible.	Medium/ 2025
	Maximise fish passage with preference given to natural waterways rather than fish ladders.	Medium/ 2023
	Support reopening of fish passage to Botany Bay in partnership with Sydney Airport (SACL).	Low
	Manage Mosquito Fish Gambusia sp. as far as practical through native Bass stocking and genetic control.	Medium/ ongoing
	Identify and create herbicide free zones along the water's edge.	Medium
	Connect frog habitat areas with long native grass, away from mosquito fish.	Low
	Plant out buffers and connecting areas to link, improve resilience and expand native vegetation patches and habitat areas. Include habitat layers (ground, mid and upper for foraging).	High / ongoing

Values	Actions	Priority and timeframe
	Continue reducing numbers of pest fish (European Carp) by electrofishing and gillnetting, and restocking ponds with native fish (re-introduce Australian Bass as a bio-control agent of Carp).	High/ ongoing
	Implement regular feral animal management (foxes, rabbits and cats).	High/ ongoing
	Maintain and /or replace seed bearing trees that are an important yellow-tailed Black Cockatoo food source.	High/ 2020
Heritage	Update and implement CMP to maintain all elements of Botany Wetlands' cultural heritage.	High / ongoing
	Restrict future works to areas already affected by sand extraction, where possible.	High/ adhoc
Infrastructure	Include all infrastructure items on the Sydney Water Asset register – noting responsible agency/area and proposed works.	High/ ongoing
Infrastructure for flood mitigation and water quality	Implement a routine monitoring regime and /or maintenance schedule for all Sydney Water managed infrastructure within Botany Wetlands.	High/ ongoing
	Progress flood mitigation works via capital programs in collaboration with councils.	Medium/ as required
Governance	Adopt a stewardship ethos and a holistic approach to management, based on co-ordinated, multi- agency stakeholder participation (eg. Botany Wetlands Management Steering Committee).	Medium/ ongoing
	Actively participate in council lead flood management process.	Medium/ ongoing
	Review development controls of Bayside and Randwick Councils to achieve better management outcomes for the wetlands: (a) Assessing potential impacts of future developments, (b) Improving stormwater quality and managing invasive species within catchment, and (c) Maintaining high environmental quality standards.	Low
	Review controls and management practices of major landholders upstream (Centennial Parklands, RMS) and downstream (Sydney Airports Corporation, and Lakes Business Park) to achieve a more coordinated approach to stormwater and land management.	Low
	Implement the Botany Wetlands Environmental Monitoring Program (see Section 4.1).	High/ annually

4 Monitoring and review

4.1 Environmental monitoring program

Sydney Water will continue an ongoing environmental monitoring program for Botany Wetlands as summarised in **Table 8**. Collecting and analysing environmental data under the monitoring program helps protect and improve the values of the wetlands, track progress against performance targets and achieve the vision of this PoM. The data collected in the monitoring program includes:

- water quality and cyanobacteria
- water levels
- carp and goldfish removal and native fish surveys
- weed and native vegetation surveys
- frog and bird surveys
- litter and sediment volumes.

This data helps advise ongoing management of the wetlands and forms the basis for an annual compliance report which is required by the WSW approval to be submitted to the Department of Industry – Water.

Table 8 Environmental monitoring program and performance targets

Monitoring programs/ survey	Performance targets	Monitoring frequency
Water quality and cyanobacteria	Maintain water quality. Respond to blue-green algae blooms.	Monthly (fortnightly in summer)
Sediment and litter rates entering wetlands	Remove 30 tonnes of sediment from the GPTs, 500 tonnes of sediment from the open channel and 50m ³ of rubbish per year.	6 monthly
Water levels	Maintain water levels (as per WSW approval).	Monthly
Vegetation monitoring and survey of composition and condition along permanent line transects	Increase native species diversity of ESBS and SFW and vegetation cover relative to 2018 baseline. 30% vegetation cover in each pond and 40% full edge vegetation around ponds.	2018 and 2023
Revise vegetation maps	Maintain or increase native vegetation cover. No increase in extent of hard surfaces or turf within the PoM area.	
Weeds mapping	10% decrease weed density in ESBS and SFW patches by 2028.	2018 and 2023
Carp and goldfish removal and fish surveys	Maintain biomass removal levels above 400 kg per year for Carp and Goldfish. Maintain species diversity and abundance of native fish compared to 2014 baseline.	Monthly Every two years
Feral animal visual monitoring	Reduce rabbits, feral cats and foxes to greatest extent possible.	Monthly
Birds	Maintain or improve species diversity and abundance of native birds compared to 2014 baseline.	Bi-annual (winter / summer)

4.2 Plan of management review

We will review the implementation of the actions outlined in this PoM yearly to measure how successfully we are tracking against our performance targets and delivering our vision. We will update the PoM as required to keep it relevant and accurate, with an interim review after 5 years.

5 References

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OEH (2010), *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW*, Department of Environment, Climate Change and Water, Sydney, 2010

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