



PHCC | Working
Together
Peel-Harvey Catchment Council

Natural Assets Project

Program and Project Prioritisation Methodology

Version 5

Incorporates Banksia Woodlands of the Swan Coastal Plain ecological community, in effect under the EPBC Act from 16-Sep-2016,

We acknowledge the Noongar people as Traditional Custodians of this land and pay our respects to all Elders past and present



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Acronyms

ECD	Ecological Character Description (of Ramsar site)
EWAW	Eucalypt Woodlands of the Western Australian Wheatbelt
NLP	National Landcare Program
PHCC	Peel-Harvey Catchment Council
SCP	Swan Coastal Plain
TEC	Threatened ecological community
WQ	Water quality

1 Introduction

This document summarises the methodology proposed to develop, assess and prioritise projects under the Natural Assets Project (referred to as the prioritisation process in this document). The Project, *Protecting the Peel-Harvey's natural assets*, is funded by the Commonwealth Government as part of the National Landcare Program (NLP) and is due to be completed by mid-2018. . The draft methodology for prioritisation process has been developed in collaboration with the PHCC's Natural Assets Steering Committee, Prioritisation Steering Committee, and staff of the PHCC.

The methodology identifies three main phases of the prioritisation process:

- A. Program development (covered in this document)
- B. Project development and prioritisation (covered in this document)
- C. Project delivery (not covered in this document).

A summary of the Protecting the Peel-Harvey's Natural Assets Project:

“By investing in community capacity building, this project will increase resilience and biodiversity by reducing the loss of natural habitats through activities to protect and conserve endangered species and Matters of National Environmental Significance (including Peel-Yalgorup Ramsar site and Lake Clifton thrombolites). Engagement will encompass community (including farmers and Landcare) industry and indigenous groups via education, training and monitoring. Activities undertaken reflect strategic outcomes of the region’s NRM plan, the Peel-Yalgorup Ramsar management plan, EPBC recovery plans and conservation advice, Australian Government funded Subcatchment Implementation Plans, River Action Plans and the Hotham-Williams NRM draft plan.” (MERIT on-line, 2016)

The desired outcomes of the Project are that by June 30, 2018 the condition of the following are maintained or improved:

- **1292 ha** of ecological character at Ramsar sites.
- **860 ha** of threatened ecological communities
- **30 ha** of threatened species habitat
- **40 ha** of migratory species habitat
- **5 ha** regionally significant species habitat

In achieving these outcomes, *“selected sites and projects are to maintain and improve ecosystem services through sustainable management of local and regional landscapes through habitat protection and restoration”*.

The Project has \$505,600 to allocate to the Project across competitive community grants, direct community grants and PHCC activities, excluding staff salaries.

2 Proposed programs

The proposed prioritisation methodology is based on the following principles:

- Adopts principles of biodiversity conservation (e.g. as in Local Government Biodiversity Planning Guidelines)
- Guides the PHCC to meet short-term and long-term aims.
- Is scientifically and technically sound
- Targets threatening processes to key natural assets
- The process is simple and easy to communicate to the catchment community
- Repeatable, but with flexibility to adapt to new circumstances
- Intuitive and informative for decision-makers.

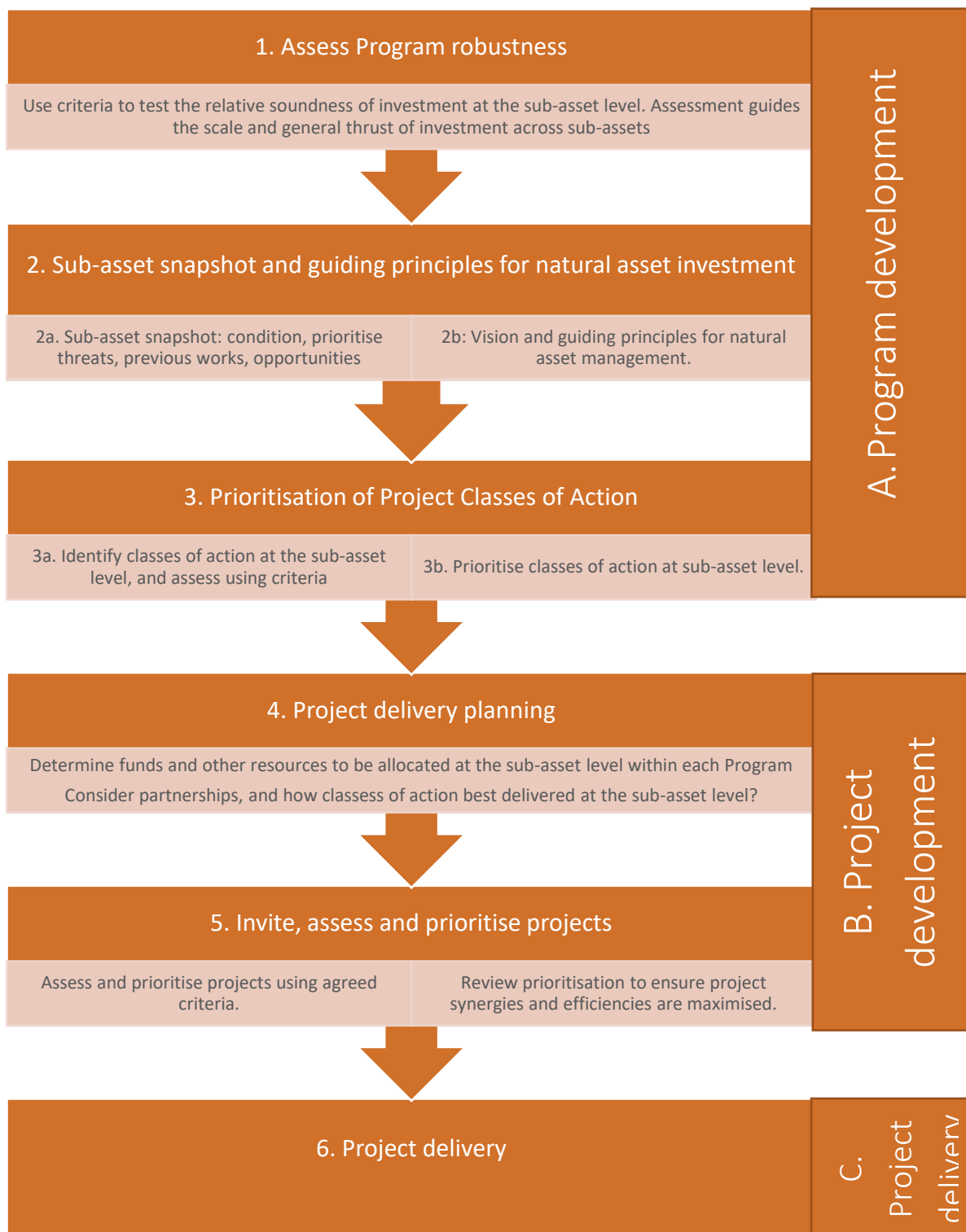
These principles were supported by the Natural Assets Steering Committee and Prioritisation Steering Committee at their meeting of 4 May 2016. The committees also supported the formation of five programs, one for each outcome of the NLP Natural Assets Project:

1. Maintaining and restoring the ecological Character of the Peel-Yalgorup Ramsar Site (1292 ha over 18 sites).
2. Maintaining and restoring federally-listed threatened ecological communities in the Peel-Harvey Catchment (860 ha)
3. Maintaining and restoring the habitat of threatened species (30 ha)
4. Maintaining and restoring habitat of migratory species (40 ha)
5. Maintaining and restoring habitat of regionally significant species (5 ha)

These program titles may only need to be for internal use. External communications may present different program/project titles.

3 Overview of prioritisation methodology

The flowchart below provides an overview of the proposed prioritisation process described in the following sections.



A. PROGRAM DEVELOPMENT

4 Sub-assets

Within each of these Programs, natural asset sub-assets are identified and directly linked to the Program Outcome. A focus on sub-assets is important as this identifies potential locations of where projects may be ultimately located in the landscape.

Table 1 presents the sub-assets that are directly linked to Programs 1 and 2. These are the two major programs to be delivered over the period up to June 2018.

The sub-assets have been identified using the Peel-Yalgorup Ramsar Ecological Character Description (ECD) subsystems and the description of federally listed TECs. The Peel-Yalgorup Ramsar System ECD identifies four sub-systems: Peel-Harvey Estuary, Yalgorup Lakes, Lakes Mealup and McLarty, and Black and Goegrup Lakes. More refined identification of Ramsar sub-assets is to provide greater direction to project prioritisation.

Table 1: Sub-assets included in proposed Programs 1 and 2

	Program	Sub-assets		
Ramsar	Maintaining and restoring the Ecological Character of the Peel-Yalgorup Ramsar Site	1.1 Peel – Harvey Estuary waterbody		
		1.2 Peel – Harvey Estuary foreshore (excluding TEC)		
		1.3 Roberts Bay Swamp		
		1.4 Yalgorup Lakes System – (excluding TEC)		
		1.5 Lake Mealup		
		1.6 Lake McLarty		
		1.7 Goegrup and Black Lakes		
		1.8 Ramsar Offsite and complementary (e.g.WQ, migratory waterbirds)		
		TECs	Maintaining and restoring federally-listed threatened ecological communities in the Peel-Harvey Catchment	2.1 Eucalypt Woodlands of the Western Australian Wheatbelt -Critically Endangered
				2.2 <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils of the SCP (3a)
2.3 <i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal Plain (3c)				
2.4 Claypans of the Swan Coastal Plain - Critically Endangered (SCP 07, 08, 09, 10a)				
2.5 Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)				
2.6 Subtropical and Temperate Coastal Saltmarsh - Vulnerable Community				
2.7 Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)				
2.8 Sedgeland in Holocene dune swales of the southern Swan Coastal Plain				
2.9 Banksia Woodlands of the Swan Coastal Plain ecological community				

STEP 1. ASSESS PROGRAM ROBUSTNESS

5 Assess Program robustness

A broad prioritisation at the sub-asset level was considered important to assess the relative soundness of the PHCC investing across eligible sub-assets identified within each Program. This analysis used a set of criteria based on the 'program-level' criteria that were generally agreed at the Working meeting of 4 May (Appendix B) but were modified to ensure the criteria were relevant to the sub-asset (rather than program).

The modified criteria, and guidance on how they are to be assessed and scored are presented in Table 2.

Prioritisation of the sub-assets was conducted to determine a broad, relative soundness of investing in management of the sub-asset.

It may also be used as one of a number of considerations when apportioning funds across different programs. It is not to be used as a relative assessment of the importance of the asset or the level of threat to the asset.

For each of the criteria, each of the sub-assets under Programs 1 and 2 were scored using a simple 0, 1 or 2 rating as follows:

- 0: does not meet criteria
- 1: partially meets criteria
- 2: strongly meets the criteria

Table 2: Criteria to prioritise investment in sub-assets

	Criterion	Guidance and references
1	Management of the sub-asset contributes to catchment vision and goals	Use catchment vision from PHCC Strategic Directions Use Goals from Binjareb Boodja Landscapes 2025
2	Management of the sub-asset contributes to more than one NLP Natural Asset Project Outcome	0: only contributes to one NLP outcome 1: Contributes to one or two other NLP outcomes 2: Contributes to three or four other NLP outcomes
3	Degree to which sub-asset provides ecosystem services or maintains ecological processes	The contribution of the sub-asset to ecosystem services and ecological processes (See Appendix C for outline of ecosystem services and ecological processes)
4	Management action on the sub-asset is urgent	0: Standard level of urgency 1: Management action is urgent 2: Consequences of not acting are significant
5	Management of the sub-asset is technically feasible within required timeframes	0: feasibility is unclear or meaningful management action not possible in timeframes 1: Moderate level of feasibility 2: Meaningful actions are known and deliverable within timeframes
6	Likelihood of management improving the sub-asset	Is the PHCC investment likely or unlikely to improve the sub-asset's condition?

Criterion	Guidance and references
7 Usefulness of PHCC investing in management of the sub-asset	<p>How significantly will investment contribute towards Project Outcomes? (incl. hectares)</p> <p>Will the investment in this sub-asset lever other investment?</p> <p>Will the PHCC investment displace other investment/other's responsibilities?</p> <p>Will the investment build a strategic partnership?</p>

The modified criteria are used in Table 3 to assess and prioritise the sub-assets at the Program level.

Table 3: Relative soundness of investing in management of sub-assets to achieve the outcomes of the NLP Natural Assets Project

		Criteria								
Program		Sub-asset	1. Contribute to catchment vision and goals	2. Contribute to other NLP Natural Asset Outcomes	3. Provides ecosystem services	4. Action on sub-asset is urgent	5. Technical feasibility within timeframes	6. Likelihood of improving asset	7. Program is complementary or synergistic	Total score
1. Ramsar	1.1	Peel – Harvey Estuary waterbody	2	2	2	1	1	1	0	9
	1.2	Peel-Harvey Estuary foreshore (excluding TEC)	2	2	2	1	2	2	2	13
	1.3	Roberts Bay Swamp	2	2	NA	NA	NA	NA	NA	4
	1.4	Yalgorup Lakes System (excluding TEC)	2	2	2	1	1	1	1	10
	1.5	Lake McLarty	2	2	1	2	0	NA	NA	7
	1.6	Lake Mealup	2	2	1	1	1	1	1	9
	1.7	Goegrup and Black Lakes	2	2	2	2	2	1	0	11
	1.8	Ramsar Offsite and complementary (e.g.WQ, migratory waterbirds)	2	2	2	0	1	1	2	10
2. TECs	2.1	SCP Claypan SCP 07,08,09, 10a	2	1	1	2	2	1	1	10
	2.2	SCP – Marri-Kingia SCP 3a	2	1	1	2	1	0	1	8
	2.3	SCP –Marri-Balga SCP 3c	2	1	1	2	1	0	1	8
	2.4	Wheatbelt –Eucalypt Woodland	2	1	2	1	1	1	2	10
	2.5	Peel-Harvey - Subtropical and Temperate Coastal Saltmarsh	2	2	2	1	1	0	1	9
	2.6	Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)	2	2	1	2	0	0	1	8
	2.7	Sedgeland in Holocene dune swales of the southern Swan Coastal Plain	NA	NA	NA	NA	NA	NA	NA	0
	2.8	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	NA	NA	NA	NA	NA	NA	NA	0
	2.9	Banksia Woodlands of the Swan Coastal Plain ecological community	2	1	2	1	2	2	1	11

NA : Not assessed

STEP 2A. SUB-ASSET SNAPSHOT

6 Sub-asset snapshot and landscape/ecosystem vision

6.1 Sub-asset snapshot

The next step in developing each Program is to conduct a brief analysis for each sub-asset of:

- resource condition
- threat analysis
- current and past projects
- opportunities for management responses.

This analysis can be viewed as a health check and management snapshot to be used as a reference at subsequent stages of the prioritisation process.

The results of the analysis are summarised in Table 4 (Ramsar System) and Table 6 (threatened ecological communities).

In addition to listing the threats in Tables 4 and 6, a rating of threats is presented in Section 6.2 and Table 8.

6.1.1 Program 1: Peel-Yalgorup Ramsar Site

The sub-asset snapshot for the Ramsar Site is presented in Tables 4 and 5.

The Peel-Yalgorup Ramsar Site is recognised as a Wetland of International Importance under the Ramsar Convention and is an icon of the Peel region. The Region's NRM Strategy states:

'The 26 530 ha System meets multiple criteria for listing under the Convention. It supports a huge number and diversity of residential and migratory waterbirds. It provides habitat for fish breeding and nursery grounds for fish, crustacea and birds and rare living 'rocks' known as thrombolites. The System comprises the Peel-Harvey Estuary, the lands and lakes of Yalgorup National Park, Lake McLarty, Lake Mealup and Roberts Bay Swamp.

The Peel-Yalgorup Ramsar System requires careful management as residential areas continue to grow. Buffers to the wetlands and bushlands need to be protected and recreational use of waterways and foreshores must recognise the principles of Wise Use of Wetlands (Article 3.1 of the Ramsar Convention). Boating and fishing need to be carefully managed.

Increases in salinity and reductions in groundwater flows due to bores and declining rainfall are threatening natural assets such as Lake Clifton and its ancient thrombolites. The thrombolites are listed as a critically endangered threatened ecological community for which a Recovery Plan has been prepared.

*Complementing the wetlands of the Ramsar System are woodlands of tuart, WA peppermint and other vegetation types that provide habitat for a variety of terrestrial fauna. These include the western ringtail possum (*Pseudocheirus**

occidentalis), a threatened species which had become locally extinct and has been successfully re-introduced into Yalgorup.'

(PHCC, 2015)

In addition to the overarching criteria for prioritising investment in the Peel-Yalgorup Ramsar Site, the following references have been used to guide program and project development:

- Peel-Harvey Catchment Council (2009) Peel-Yalgorup Ramsar Site Management Plan, Peel-Harvey Catchment Council, Mandurah.
- Hale J and Butcher R (2007) Ecological Character Description of the Peel-Yalgorup Ramsar Site, Report to the Department of Environment and Conservation and the Peel-Harvey Catchment Council, Perth, Western Australia.

A listing of potential future projects in the Peel-Yalgorup Ramsar System is provided in Appendix D.

Table 4: Sub-asset snapshot: Ramsar System

Peel-Yalgorup Ramsar Site sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
1.1 Peel – Harvey Estuary waterbody (Part of Peel – Harvey Estuarine System)	Water pollution control flood control representative wetland type supports biological diversity, including estuarine biodiversity Iconic species: crabs, dolphins and waterbirds waterbird habitat nursery an refuge areas recreation and tourism spiritual and inspirational scientific and educational Commercial fishing Commercial tourism	See Table 5 below. The condition of the P-H Estuary waterbody is significantly linked to changes in water quality, recreational use including fishing and boating, and climate change (incl. sea level rise).	From PYSMP: decline in water quality climate change agriculture (nutrient management) urban &peri-urban development Recreation Commercial and recreational fishing (PHCC, 2009)	Projects to improve catchment water quality occur in some subcatchments and local catchments as funding permits. Dept. of Water WQ monitoring program in estuary and lower rivers. Dept. of Transport and Department of Fisheries responsible for boating and fishing respectively. Responsible fishery management for blue swimmer crab and sea mullet in progress. The local community is working to raise broader community awareness of the Estuary’s values and	Projects to improve catchment water quality require long-term and extensive commitments to be effective. More appropriate to resource under other PHCC programs. DoT and DoF have legal responsibilities over waterbody and its natural assets. The degree of impact of recreational use (fishing, crabbing, and boating) are unknown but likely to be measurable. Opportunities to improve management of the Estuary through influencing behaviours may exist (behaviours of fishers, crabbers, boaters, general public etc.). But linking these to a distinct area (XX
References:					
<ul style="list-style-type: none"> Hale J. and Butcher R. 2007 <i>Ecological Character Description of the Peel-Yalgorup Ramsar Site.</i> Peel-Harvey Catchment Council (2009) <i>Peel-Yalgorup Ramsar Site Management Plan.</i> 					

(Taken from P-Y Man Plan)

change behaviour (e.g. Dudley Dolphin).

hectares) of habitat maintained or improved is challenging.

Opportunities for direct management of the Estuary waterbody under the NLP Natural Assets Project may be limited (within the next 2 years).

Projects could be developed and delivered with community groups, peak tourism/business groups or relevant departments

1.2 Peel-Harvey Estuary foreshore and riparian habitats, exposed mudflats and transitional zones, including Murray River Delta (excluding TEC)

Bank stabilisation and erosion control representative wetland type supports biological diversity, including estuarine biodiversity waterbird habitat spiritual and inspirational scientific and educational

The Estuarine foreshores and riparian habitats provide a transition zone between the Estuary waterbody and upland habitats. Important in stabilising soils and moderating the effects of storms. Habitat values of these areas are high and include tidal mudflats, saltmarshes, and feeding and resting areas for waterbirds, including migratory species.

Many foreshore areas are used for recreation, either designated or unauthorised use.

Conservation advice for Coastal Saltmarsh TEC states threats as: Clearing and fragmentation 'Land-claim' or infilling - Altered hydrology/tidal restriction Invasive species Climate change Recreation Pollution/litter Eutrophication Acid Sulfate Soils

Local government manage foreshore reserves as funds permit. Unclear level of management by DoP/WAPC and DPaW of reserves/freehold land in control of state government.

The local community is working to raise broader community awareness of values of foreshores and

There are likely to be numerous opportunities to actively manage foreshore areas, enhancing existing management sites, or new sites.

Management of recreational use may be an important priority, and include controlled access projects, awareness-raising projects etc.

Restoration and revegetation of areas may be another important priority.

Level of impact of recreation on migratory waterbirds is not well documented, and may be important

References:

- Hale J. and Butcher R. 2007 *Ecological Character Description of the Peel-Yalgorup Ramsar Site.*
- Peel-Harvey Catchment Council (2009) *Peel-*

<p><i>Yalgorup Ramsar Site Management Plan.</i></p>		<p>Most foreshore areas with native vegetation are regionally significant (PRSNA) and areas of saltmarsh are TEC.</p>	<p>Grazing Insect control - Inappropriate fire regimes</p>	<p>change behaviour (e.g. Dudley Dolphin).</p>	<p>to demonstrate effectiveness of works.</p>
		<p>Current management of foreshore areas varies according to location, vested purpose and managing authority (local and state governments and others). There is a moderate (?) amount of management activity occurring on foreshores, and coordination is patchy.</p>	<p>ECD (recreation and commercial fishing)</p>		<p>Litter is a growing concern.</p>
<p>1.3 Roberts Bay Swamp</p>					
<p>1.4 Yalgorup Lakes System</p> <p>Reference: Department of Conservation and Land Management (1995) Yalgorup National Park Management Plan 1995 – 2005 Management Plan No. 29</p>	<p>Water pollution control representative wetland type supports biological diversity, including waterbird habitat refuge areas tourism spiritual and inspirational</p>	<p>The Yalgorup Lakes System (Lakes Yalgorup and Clifton and surrounding lands) support two large linear coastal wetlands, tuart woodlands, and habitat for a number of threatened species. The System is encompassed within the Yalgorup National Park. Groundwater catchments to the lakes include large areas of private land mostly to the east (?), with associated issues for</p>	<p>Climate change Agriculture (nutrient management) Urban & peri-urban development Groundwater extraction Recreation (PHCC, 2009)</p>	<p>Restoration and rehabilitation of buffers to lakes Restoration of uplands (e.g. tuart forest) Controlled access to lands in National Park.</p>	<p>Opportunities to maintain or improve the condition of wetlands and uplands (e.g. tuart forest) within this sub-component of the Ramsar Site may exist, but would need to be determined with DPaW. e.g. habitat improvement projects, controlled access.</p> <p>Projects to maintain or improve the Ecological character of the thrombolites community require a</p>

	scientific and educational Commercial tourism	water quality and water levels (abstraction). A key asset is the thrombolites TEC within Lake Clifton, with concerns that negative trends in the thrombolites condition is due to decreasing freshwater inflow into the lake (reduced rainfall and recharge and abstraction) and increasing nutrient levels. Rehabilitation of tuart woodlands, weeds control and access control have occurred in the Park in recent years and the outcomes of this work are generally positive.			long-term approach, and require consideration of how effectively projects can manage the threats to the TEC. Projects could include works to increase vegetative buffers to the thrombolites and influence landholder behaviour to reduce impacts on water resources.
1.5 Lake Mealup	Water pollution control representative wetland type supports biological diversity, including waterbirds, waterbird habitat nursery and refuge areas recreation and tourism	Wetland provides important waterbird habitat and support other values. Lack of water (reduced rainfall and recharge) is a significant issue, but has been addressed through diversion of nearby drain water into Lake Mealup since 2013. Risk of ASS formation has reduced, increased nutrient input due to WQ of drain water. Diversion has restored diversity of habitats in	Climate change Agriculture (nutrient management) Urban & peri-urban development Groundwater extraction Recreation (PHCC, 2009)	Lake Mealup Diversion Weir constructed to increase water availability to Lake, and reduce risk of ASS formation and Typha expansion	There may be some need for follow-up activities in Lake Mealup ecosystem post Weir construction (e.g. weed control, habitat enhancement). Lake Mealup is vested with LM Pres Society and DPaW. TAG coordinated by DPaW for Lake Mealup

	spiritual and inspirational scientific and educational	and around lake including habitat for waterbirds.			
1.6 Lake McLarty	Water pollution control	Wetland provides important waterbird habitat and support other values. Lack of water (reduced rainfall and recharge) is a significant issue. Low water levels and encroachment of Typha into Lake McLarty to reduce mudflats etc. is of concern (?)	Climate change Agriculture (nutrient management) Urban & peri-urban development Groundwater extraction Recreation (PHCC, 2009) (Note: ASS not a risk due to different wetland stratigraphy (e.g. shells)	Lake McLarty Typha control (ongoing) Weed control and restoration of fringing vegetation Fencing (dog exclusion) Cattle now excluded	See Recommendations in McLarty NR Management Plan Lake McLarty is vested with DPaW. Friends of Lake McLarty formed. Augmenting water supply to Lake McLarty has been suggested (not proven)
References: Peel-Harvey Catchment Council (2009) <i>Peel-Yalgorup Ramsar Site Management Plan</i> .	representative wetland type supports biological diversity, including a range of habitats for a diversity of waterbirds (habitat differentiation), waterbird nursery and refuge areas recreation and tourism spiritual and inspirational scientific and educational				
1.7 Goegrup and Black Lakes	Water pollution control flood control	(774 ha – waterbodies and vegetation, GBLAP, 2006)	Climate change Agriculture (nutrient management)	Not known	Not known?

<p>Includes Proposed extensions to Ramsar site</p> <p>(Note: also includes lower Serpentine River area, and areas of Saltmarsh TEC).</p> <p>References: Ecoscape (Australia) Pty Ltd & O'Connor R & E Pty Ltd (2006) <i>Goegrup and Black Lake Action Plan</i></p>	<p>representative wetland type supports biological diversity, including waterbirds waterbird habitat nursery and refuge areas recreation and tourism spiritual and inspirational scientific and educational</p>	<p>Areas or wetlands and upland of environmental, cultural and recreational significance. Goegrup Lake directly receives flows from Serpentine River and Nambeelup Brook; both wetlands experiencing water quality issues. Enclosed within DPaW estate, other public lands (some private lands). Current management efforts not known, and extent of other management threats not known.</p>	<p>Urban & peri-urban development – re-subdivision and intensification Structure Plan. Including road through interface between Goegrup and Black. Groundwater extraction Recreation (PHCC, 2009)</p>
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<p>1.8 Ramsar Offsite and complementary (e.g. WQ, migratory waterbirds)</p>	<p>Complementary habitat for fauna including migratory species; Water quality improvement</p>	<p>Generally coastal catchment condition is poor wrt water quality management. Nutrient discharge from catchment is high to very high (moderate in some subcatchments). Paucity of knowledge of use of palusplain wetlands by migratory species (ref: Kim Wilson reference)</p>	<p>Drainage management Uncontrolled stock access to wetlands Clearing</p>	<p>Catchment management Streamlining Wetland management Drainage intervention Fertiliser management</p>	<p>Numerous opportunities for further drainage intervention, fertiliser management. Land access/land manager cooperation a significant issue (i.e. catchment management)</p>
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Table 5: Condition snapshot – Peel-Yalgorup Ramsar System

Estuary and lower river—condition snapshot (PHCC, 2011)

Asset/indicator	Status	Trend	Reference
Estuary nutrient levels	Good	Likely deterioration	Rogers, Hall & Valesini (2010)
Lower river nutrient levels	Of concern	Likely deterioration	
Estuary algae levels	Average	Likely deterioration	
Lower river algae	Of concern	Likely deterioration	
Fisheries—Estuary	Average	Likely deterioration	
Fisheries—lower rivers	Of concern	Likely deterioration	
Dolphins	Measures not available	Measures not available	
Foreshore vegetation	Measures not available	Measures not available	

Ramsar site environmental assets—condition snapshot (PHCC, 2011)*

Asset	Status	Trend	Reference
Waterbirds – including migratory waterbirds	Average	Steady	Hale & Butcher (2007)
Yalgorup Lakes hydrology, and water quality (salinity and nutrients)	Of concern	Likely deteriorating	Peel-Harvey Catchment Council, 2009)
Lake Clifton Thrombolites	Of concern	Likely deteriorating	Environmental Protection Authority (2010a)
Lake Clifton—fish	Of concern	Measures not available	Hale & Butcher (2007)
Lake McLarty—hydrology	Of concern	Measures not available	Hale & Butcher (2007)
Lake Mealup—hydrology	Of concern	Likely deteriorating	Hale & Butcher (2007)
Goegrup and Black Lakes	Measures not available	Measures not available	Hale & Butcher (2007)

*For more information on the Peel-Yalgorup Ramsar System see Section 3.3

6.1.2 Program 2: Maintaining and restoring federally-listed threatened ecological communities in the Peel-Harvey Catchment

There are nine (9) threatened ecological communities listed in the EPBC Act with occurrences in the Peel-Harvey Region. Details are provided in Table 6.

The sub-asset snapshot for each of these nine (9) TECs that can be managed in Program 2 is presented in Table 7.

Of note:

1. The most widely occurring TEC in the Region is the Eucalypt Woodlands of the Western Australian Wheatbelt (EWWAW) (all occurrences in the Hotham-Williams, and the only TEC in the Hotham-Williams). This TEC covers 44, 588 ha of the Hotham-Williams Catchments. Appendix E provides a summary of key threats to the EWWAW and guidance on assessing impacts and priorities for recovery, management and funding.
2. Occurrences of TECs SCP 3a, 3b, 07, 08, 09, and 10a often occur in close association with each other (but not always). An exception to this is that many occurrences of SCP 07 are located in the Peel-Yalgorup Ramsar Site.
3. Occurrences of Subtropical and Temperate Coastal Saltmarsh occur mostly within the Peel-Yalgorup Ramsar Site.
4. As at the time of preparing Version 4 of this report in 2015 (original report), the nomination of the Banksia Woodlands of the Swan Coastal Plain as a TEC was under consideration by the Federal Department for the Environment.
5. Version 5 (this version), has been revised to include the *Banksia Woodlands of the Swan Coastal Plain ecological community*, that was gazetted under the EPBC Act in September 2016.

Table 6: TEC characteristics

TEC	EPBC Status	Conservation Advice and Recovery Plan	Catchment occurrences	Notes
2.1 Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Threatened Species Scientific Committee (2015) <i>Approved Conservation Advice – Eucalypt Woodlands of the Western Australian Wheatbelt</i> . Recovery Plan not required; strategies, plans and other initiative are already available or under way.	44, 588 ha in over 6000 occurrences (Mean = 7.2ha, std dev 78)	Only EPBC Act TEC in Hotham Williams Catchment.
2.2 <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils of the Swan Coastal Plain -(SCP 3a)	Endangered	Threatened Species Scientific Committee (2012) <i>Approved Conservation Advice for Clay Pans of the Swan Coastal Plain</i> . English and Blyth (2000a) INTERIM RECOVERY PLAN NO. 59 <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soil (Swan Coastal Plain Community type 3a.	145 ha in 19 occurrences (average 7.6 ha)	Occurrences often in association with SCP3c, SCP 07, 08, 09, 10a
2.3 <i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal Plain - (SCP 3c)	Endangered	Threatened Species Scientific Committee (2012) <i>Approved Conservation Advice for Clay Pans of the Swan Coastal Plain</i> . English and Blyth (2000b) INTERIM RECOVERY PLAN NO. 60 <i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands (Swan Coastal Plain Community type 3c	15 ha in 7 occurrences (average 2.1 ha average)	Occurrences often in association with SCP3a, SCP 07, 08, 09, 10a
2.4 Claypans of the Swan Coastal Plain - (SCP 07, 08, 09, 10a)	Critically Endangered	Threatened Species Scientific Committee (2012) <i>Approved Conservation Advice for Clay Pans of the Swan Coastal Plain</i> . Recovery Plan required, although most components of the ecological community are listed as threatened by the Western Australian government.	209 ha in 34 occurrences (average 6 ha)	Occurrences often in association with SCP3a and SCP 3c. SCP07 occurs largely in Ramsar Site, small amount in eastern SCP
2.5 Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Critically Endangered	Department of the Environment (undated) <i>Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain</i> , Advice to the Minister for the Environment and Heritage.	1 occurrence of 0.74 ha, Oldbury	Occurrence in Oldbury on freehold land? Labelled as DuckpondSpring01, Love01 in TEC database.

TEC	EPBC Status	Conservation Advice and Recovery Plan	Catchment occurrences	Notes
		Department of Conservation and Land Management (2006) <i>Community of Tumulus (organic mound) springs of the Swan Coastal Plain Interim Recovery Plan No. 198</i>		
2.6 Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Threatened Species Scientific Committee (2013) <i>Approved Conservation Advice for Subtropical and Temperate Coastal Saltmarsh</i> ecological community. Recovery Plan recommended but not yet prepared.	616 ha in 79 occurrences	Most occurrences within Ramsar Site or extensions.
2.7 Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton) Critically Endangered	Critically Endangered	Threatened Species Scientific Committee (2009) <i>Approved Conservation Advice for Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)</i> .	504 ha, one occurrence, Lake Clifton	Occurs entirely within Ramsar Site
2.8 Sedgeland in Holocene dune swales of the southern Swan Coastal Plain	Endangered	Department of Environment and Conservation (2011) Interim Recovery Plan No. 314 Sedgeland in Holocene Dune Swales Recovery Plan	Map on DoE website indicates 3 occurrences between Lake Yalgorup and coast. (Not in PHCC's 2014 GIS dataset of TECs)	Occurrences in Ramsar site?
2.9 Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Threatened Species Scientific Committee (2016). Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community. Canberra: Department of the Environment and Energy.	4978 occurrences totalling 22,117 ha	Occurrences across Swan Coastal Plain

Table 7: Sub-asset snapshot - Threatened ecological communities

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
Hotham-Williams	2.1 Eucalypt Woodlands of the Western Australian Wheatbelt (occurs within Avon Wheatbelt AW2 IBRA Subregion)	Representation - remnant vegetation in significantly cleared landscape Habitat for a diversity of flora and fauna, including threatened species. Support sustainable agriculture Erosion control Benefits to water resources	TEC covers 44,588 ha in over 6000 occurrences (Mean = 7.2ha, std dev 78). GIS data exists on condition trend (PH DSS Toolbox) and value of occurrences as climate refugia. Conservation advice provides condition thresholds for occurrences. Generally, condition varies according to occurrence. Generally larger occurrences will be in better condition and more ecologically viable	See Appendix E for details: <ul style="list-style-type: none"> • Clearance of native vegetation. • Loss of habitat for key native species. • Fragmentation into smaller, disconnected patches. • Weed invasion. • Impacts from pest animals. • Inappropriate application of chemicals, fertilisers or pesticide/herbicide spray drift. • Grazing pressure by domestic stock and native fauna. 	Dryandra Woodlands in State Forest managed by DPaW for conservation, in particular conservation of threatened small-medium mammals. Feral animal control. Many occurrences of this TEC on private land.	Significant opportunities exist for work on this TEC. Continuation of the R2R Landholder Grants program (i.e. Round 3); Feral animal control to complement DPaW programs H-W NRM Plan identified landholder interest in fencing remnants, and fire and feral management opportunities. Complementary projects to DPaW's Dryandra projects; i.e. working with landholders to maintain and improve habitat associated with Dryandra State Forest (proposed National Park).

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
				<ul style="list-style-type: none"> Increased salinity and waterlogging of the landscape. Soil acidification. Altered fire regimes, notably altered fire frequency Potential impact of plant diseases such as <i>Phytophthora</i> sp. on species diversity and structure. Potential impacts of climate change, including altered fire and flooding regimes, 		<p>Fire management/controlled burning to enhance habitat and favour native animals over ferals.</p> <p>Make recipients of funding aware that they have a Federally listed TEC on their property in ways which address any landholder concerns and foster improved management.</p>
Coastal Plain	2.2 <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils of the Swan Coastal Plain - Endangered (SCP 3a)	Representation Rare ecological community Habitat for rare and threatened flora (and Fauna?) recreation and tourism	145 ha in 19 occurrences (average 7.6 ha) GIS data exists on condition trend (PH DSS Toolbox) and	TEC SCP 3a and 3c(Recovery Plans are out of date): Threats: Clearing Altered fire regimes Weed invasion Hydrological changes	Moderate amount of previous work and investment. Occurrences generally located in isolated public reserves, or small	Small, usually isolated important remnants. Good opportunities for further investment to continue previous investments.

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
	Note: SCP3a, 3c, 07, 08, 09 and 10 often occur in association with each other	spiritual and inspirational scientific and educational	value of occurrences as climate refugia. Generally, condition varies according to occurrence. Generally larger occurrences will be in better condition and more ecologically viable	Salinization Grazing Introduction of disease Erosion by wind and water	occurrences on private lands. Long-term viability at risk due to small isolated occurrences. Dieback an issue and mapped in some occurrences. Altered drainage and hydrology due to climate change another significant threat	Won't yield significant hectare contributions towards the NLP outcomes. Only natural assets on coastal plain (other than the Claypan TEC and other Marri TEC) Weeds, fire management and dieback important on-site Buffering and connection important priorities
	2.3 <i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal Plain - Endangered (SCP 3c)	Representation Rare ecological community Habitat for rare and threatened flora (and Fauna?) recreation and tourism	15 ha in 7 occurrences (average 2.1 ha average) GIS data exists on condition trend (PH DSS Toolbox) and	TEC SCP 3a and 3c(Recovery Plans are out of date): Threats: Clearing Altered fire regimes Weed invasion Hydrological changes	Moderate amount of previous work and investment. Occurrences generally located in isolated public reserves, or small	Small, usually isolated important remnants. Good opportunities for further investment to continue previous investments.

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
	Note: SCP3a, 3c, 07, 08, 09 and 10 often occur in association with each other	spiritual and inspirational scientific and educational	value of occurrences as climate refugia. Generally, condition varies according to occurrence. Generally larger occurrences will be in better condition and more ecologically viable	Salinization Grazing Introduction of disease Erosion by wind and water	occurrences on private lands. Long-term viability at risk due to small isolated occurrences. Dieback an issue and mapped in some occurrences. Altered drainage and hydrology due to climate change another significant threat	Won't yield significant hectare contributions towards the NLP outcomes. Only natural assets on coastal plain (other than the Claypan TEC and other Marri TEC) Weeds, fire management and dieback important on-site Buffering and connection important priorities
Coastal Plain	2.4 Claypans of the SCP; SCP07,08,09, 10a) Note:	Representation Rare ecological community Habitat for rare and threatened flora (and Fauna?) recreation and tourism	209 ha in 34 occurrences (average 6 ha) GIS data exists on condition trend (PH DSS Toolbox) and	See Appendix F for details: <ul style="list-style-type: none"> hydrological changes clearing for urban, industrial or rural development; weed invasion 	Moderate amount of previous work and investment. Occurrences generally located in isolated public reserves, or small	Small, usually isolated important remnants. Good opportunities for further investment to continue previous investments.

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
	Large occurrences of SCP07 occur in Ramsar Site. SCP3a, 3c, 07, 08, 09 and 10 often occur in association with each other	spiritual and inspirational scientific and educational	value of occurrences as climate refugia. Generally, condition varies according to occurrence. Generally larger occurrences will be in better condition and more ecologically viable	<ul style="list-style-type: none"> • inappropriate fire regimes. • Feral animals • Construction of tracks and new fence lines • predicted climate change • Inundation from rising saline groundwater • The water mould <i>Phytophthora cinnamomi</i> 	occurrences on private lands.	<p>Won't yield significant hectare contributions towards the NLP outcomes.</p> <p>This TEC only natural assets on coastal plain (other than the two Marri TECs)</p> <p>Weeds, fire management and dieback important on-site</p> <p>Buffering and connection important priorities</p>
Coastal Plain	2.5 Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	Rare ecological community Representation peat mounds Unique assemblages of flora and fauna	Not known	<ul style="list-style-type: none"> Clearing Water levels (flora and fauna dependent on permanent fresh water Water quality Grazing Altered fire regimes 	Not known	One occurrence of 0.74 ha on freehold land, Oldbury?

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
		Cultural significance to Indigenous People		Dieback		
Coastal Plain	2.9 Banksia Woodlands of the Swan Coastal Plain ecological community	Rare ecological community Representation Species diversity, endemism	Very highly fragmented into numerous small and scattered patches (Threatened Species Scientific Committee, 2016)	Clearing and fragmentation Dieback diseases Invasive species Fire regime change Hydrological degradation (groundwater abstraction, eutrophication, soil acidification). Climate change (increasing temperatures, declining rainfall, changing rainfall timing). • Grazing -including overabundance of kangaroos. • Decline in pollinating and seed dispersing fauna	Not known	Yet to be determined
Ramsar sub-system	2.6 Subtropical and Temperate Coastal Saltmarsh - Vulnerable Community	Bank stabilisation and erosion control representative wetland type	The Estuarine foreshores and riparian habitats provide a transition zone between the	Conservation advice for Coastal Saltmarsh TEC states threats as: Clearing and fragmentation 'Land-claim' or infilling -	Local government manage foreshore reserves as funds permit.	There are likely to be numerous opportunities to actively manage foreshore areas, enhancing existing

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
		supports biological diversity, including estuarine biodiversity waterbird habitat spiritual and inspirational scientific and educational	<p>Estuary waterbody and upland habitats. Important in stabilising soils and moderating the effects of storms. Habitat values of these areas are high and include tidal mudflats, saltmarshes, and feeding and resting areas for waterbirds, including migratory species.</p> <p>Many foreshore areas are used for recreation, either designated or unauthorised use.</p> <p>Most foreshore areas with native vegetation are regionally significant (PRSNA)</p>	<p>Altered hydrology/tidal restriction</p> <p>Invasive species</p> <p>Climate change</p> <p>Recreation</p> <p>Pollution/litter</p> <p>Eutrophication</p> <p>Acid Sulfate Soils</p> <p>Grazing</p> <p>Insect control -</p> <p>Inappropriate fire regimes</p> <p>ECD (recreation and commercial fishing)</p>	<p>Unclear level of management by DoP/WAPC and DPaW of reserves/freehold land in control of state government.</p> <p>The local community is working to raise broader community awareness of values of foreshores and change behaviour (e.g. Dudley Dolphin).</p>	<p>management sites, or new sites.</p> <p>Management of recreational use may be an important priority, and include controlled access projects, awareness-raising projects etc.</p> <p>Restoration and revegetation of areas may be another important priority.</p> <p>Level of impact of recreation on migratory waterbirds is not well documented, and may be important to demonstrate effectiveness of works.</p> <p>Litter is a growing concern.</p>

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
			and areas of saltmarsh are TEC. Current management of foreshore areas varies according to location, vested purpose and managing authority (local and state governments and others). There is a moderate (?) amount of management activity occurring on foreshores, and coordination is patchy.			Opportunities to partner with a number of groups exist: 2 x local governments, community groups and State Government departments. Important to ensure NLP complements State Government action and responsibilities.
Ramsar sub-system	2.7 Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)	representative community type rare biodiversity tourism spiritual and inspirational scientific and educational	The condition of the thrombolites ecological community is of concern. Growth of the thrombolites is reduced or has stopped due to decreasing freshwater	Climate change Agriculture (nutrient management) Urban & peri-urban development Groundwater extraction Recreation (PHCC, 2009)	Restoration and rehabilitation of buffers to lakes Restoration of uplands (e.g. tuart forest) Working with landholders to	Projects to maintain or improve the Ecological character of the thrombolites community require a long-term approach, and require consideration of how effectively projects can

Regional Sub-system	Sub-asset	Sub-asset values (benefit, use, service) – (ecological, social, economic)	Resource condition	Key threatening processes	Current management activity	Management opportunities and risks in next 2 years
		Commercial fishing Commercial tourism	inflow into the lake (reduced rainfall and recharge and abstraction) and increasing nutrient levels.		change land management practices	manage the threats to the TEC. Projects could include works to increase vegetative buffers to the thrombolites and influence landholder behaviour to reduce impacts on water resources.
Ramsar sub-system	2.8 Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Rare ecological community Representation Unique assemblages of flora and fauna Cultural significance	Not known (Peel-Harvey occurrences not included in Recovery Plan)	Not known, but may include: Changes in groundwater, grazing, Inappropriate fire regimes, recreational activities	Not known	Not known

6.2 Rating threats

A threat rating exercise has been conducted to inform the prioritisation of classes of action for each sub-asset.

The threat rating combines the likelihood of the threat and the impact of the threat on the sub-asset (Table 8). Impact is defined as severity x scope. Note that this level of threat analysis is to be applied at the Class of Action level, and should be re-assessed at the individual project level.

(As a point of comparison, the Conservation Action Planning process rates threats through assessment of severity, scope, and irreversibility).

Table 8: Rating of threats

		Impact of threat (severity x scope)		
		High	Medium	Low
Likelihood of threat	High	Very High	High	Medium
	Medium	High	High	Medium
	Low	Medium	Medium	Low

Using the above method, threats are rated for each sub-asset in Table 9.

A 'critical threat' is defined as threat having a status of High or Very High.

Table 9: Prioritisation of threats to sub-assets (Very high, High, Medium, Low, NA) (threat level = likelihood of threat X impact of threat)

Program	Sub-asset	Water quality/eutrophication – groundwater	Water quality decline – surface water	Water quantity, hydrology or levels, sea level rise	Clearing of native vegetation	poor planning & management /lack of information	Uncontrolled access – stock or	Other recreational impacts	Dieback and other disease	Impact of weeds (incl. aquatic)	Impact of feral animals	Altered fire regimes	Isolation/fragmentation/viability	Soil acidification/ASS/salinization/sediment mgmt	Wind/water erosion	Litter and illegal dumping	
1. Ramsar	1.1 Peel – Harvey Estuary Waterbody	H	VH	M	NA	H	NA	H	NA	NA	L	NA	NA	VH	M	M	
	1.2 Peel – Harvey Estuary foreshores (excludes TEC)	H	VH	VH	H	VH	VH	VH	L	H*	VH	H	VH	H	VH	M	
	1.3 Roberts Bay Swamp																
	1.4 Yalgorup Lakes System (includes uplands)	VH	NA	VH	H	VH	H	H	H	M	H	H	M	L	M	M	
	1.5 Lake Mealup	H	VH	VH	M	H	M	M	H	VH	VH	H	M	H	M	M	
	1.6 Lakes McLarty	H	H	VH	M	VH	H	M	H	H	VH	H	H	VH	M	M	
	1.7 Goegrup and Black Lakes	M	VH	VH	M	VH	H	H	H	H	H	H	H	H	M	M	
	1.8 Ramsar Offsite and complementary	VH	VH	H	H	H	M	M	H	M	H	M	M	H	H	M	
	Eucalypt Woodlands of the WA Wheatbelt	VH	H	VH	VH	H	VH	H	H	H	VH	VH	VH	VH	H	L	
	<i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils of the SCP (3a)	VH	VH	H	VH	M	VH	M	VH	H	H	VH	VH	VH	M	M	
	<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal Plain (3c)	M	VH	H	VH	M	VH	M	VH	H	H	VH	VH	VH	M	M	
	Claypans of the Swan Coastal Plain - (SCP 07, 08, 09, 10a)	M	VH	VH	VH	H	VH	M	H	VH	H	VH	VH	H	M	M	
	Communities of Tumulus Springs (Organic Mound Springs, SCP)	VH	H	VH	VH	VH	VH	L	?	?	?	VH	VH	?	?	M	
	Subtropical and Temperate Coastal Saltmarsh	L	VH	H	VH	H	VH	VH	L	H	M	H	M	VH	VH	H	
	Thrombolite Community of a Coastal Brackish Lake (Lake Clifton)	VH	H	H	VH	VH	H	M	NA	NA	L	L	NA	L	H	H	
	Sedgeland in Holocene dune swales of the southern SCP	H	NA	H	VH	VH	VH	H	L	M	?	VH	?	L	H	H	
	Banksia Woodlands of the Swan Coastal Plain	L	M	VH	VH	VH	VH	H	VH	H	H	VH	VH	L	L	H	
	2. TECs																

STEP 2B. GUIDING PRINCIPLES FOR NATURAL ASSET INVESTMENT

6.3 Vision and guiding principles for natural asset management

The following catchment vision encapsulates the vision for natural assets:

‘The Peel-Harvey catchment is once again a flourishing network of interconnected, productive landscapes, with diverse, healthy and resilient ecosystems, globally and locally recognised, acknowledged and embraced for its environmental significance. It is wisely managed by a community that values it – people working together for a healthy environment.’

(Peel-Harvey Catchment Council, 2014)

In addition to achieving the outcomes of NLP funding (See Section 1), programs and projects should deliver on the following landscape-scale outcomes:

- Ecosystem, species and genetic diversity should be protected across the Region in all sub-systems. The subsystems are Hotham-Williams, Forest and Scarp, Coastal Plain, and Ramsar and Nearshore. Any trade-offs in investment between sub-assets, ecosystems or species should be transparent and justified on scientific grounds.
- Ecosystem services and ecological processes across the Region are managed and improved through all investments. Key ecosystem processes are listed in Appendix C. It is noted that knowledge of ecosystem services and ecological processes across the region is limited.
- Investments are designed to protect rare and threatened biodiversity features as well as keeping the common, common.

Investment within a sub-asset (see Table 1) should be in accordance with following guiding principles:

1. Retention of at least 30% of the pre-European extent of each ecological community is required to prevent an exponential loss of species and failure of ecosystem processes
2. Biodiversity is best conserved in-situ – protect what you have before revegetating
3. Regeneration is a higher priority than revegetation
4. Prioritise protection and management of the highest biodiversity value natural areas
5. Prioritisation of investment within a sub-asset should consider the ecological viability of each site of investment, and where possible prioritise sites according to viability.
6. Community involvement in helping conserve biodiversity
7. Biodiversity values must be made transparent in decision-making processes
8. Site-specific field survey is essential to understand biodiversity value
9. Natural area conservation is a legitimate land use

(adapted from WALGA & PBP, 2004)

STEP 3. PRIORITISATION OF PROJECT CLASSES OF ACTION

7 Prioritising classes of action

7.1 Identification of classes of Action

Based on the threats listed in Table 8, Classes of Action are presented in Table 10. A Class of Action is a broad description of types of activities that may be undertaken to address a threat or threatening processes. To assist the PHCC with NLP Reporting, each Class of Action has been related to an 'Output Target'.

Table 10: Threats, Classes of Action and Output Targets

Threat	Class of Action	NLP Natural Asset Output Target
Water quality/eutrophication – groundwater		
Water quality decline – surface water	Water resource management	Area(ha) managed for water values
Water quantity, hydrology, water levels, sea level rise		
Clearing of native vegetation	Protection from clearing	No. of protection mechanisms implemented Area (ha) covered by agreement mechanisms
		Total no of plants grown and ready for planting Total area prepared for follow-up treatment actions (ha)
	Restoration and regeneration (in existing bushland and natural areas)	Total new area treated (ha) weeds Area of revegetation works (ha)
Isolation/fragmentation/viability of occurrences	(For purpose of buffering and linkage)	Kilograms of seed sown (kg) No. plants planted Total no. of plants surviving with mature height >2m Total no. of reveg monitoring activities undertaken Total seed collected (kg) Average survivability of tubestock/seedstock Total no of plants grown and ready for planting
	Revegetation	Total area prepared for follow-up treatment actions (ha)
Isolation/fragmentation/viability of occurrences	(for purpose of buffering and linkage)	Total new area treated (ha) weeds Area of revegetation works (ha) Kilograms of seed sown (kg) No. plants planted

Threat	Class of Action	NLP Natural Asset Output Target
		Total no. of plants surviving with mature height >2m
		Total no. of reveg monitoring activities undertaken
		Total seed collected (kg)
		Average survivability of tubestock/seedstock
Inappropriate/poor planning or management/Lack of information	Survey, monitoring and management planning	No of fauna surveys undertaken No. of flora surveys undertaken
Uncontrolled access – stock or people	Access control	No. of activities implementing access control works (counts no. of forms in project) Total no. of structures installed for access management Length of fence (km) Area protected by fence (ha) Area managed with conservation grazing (ha)
Other recreational impacts – (behaviour change)	Recreational use behaviour change	??
Debris/litter, rubbish dumping	Litter management	Weight of debris removal (t) Volume of debris removed (m3)
Dieback and other disease (uplands)	Disease management	Total area (ha) treated/quarantined
Impact of weeds (incl. aquatic weeds)	Weed control	Total new area treated (ha) No. of activities undertaking weed monitoring
Impact of feral animals	Feral animal control	No. of individual animals or colonies killed/removed Area covered by pest treatment (ha) No. of pest species monitoring activities undertaken
Altered fire regimes	Fire management	Burnt area (ha) Area of fire ground (ha)
Soil acidification/ASS/salinization	Soil management	No widgets found?? Erosion area treated (ha)
Wind/water erosion	Erosion control	Length of stream/coastline treated (km) Total no. of erosion control structures installed

7.2 Criteria to prioritise classes of action

For each sub-asset, Classes of Action are to be prioritised to determine which are the most important to support. The criteria used to conduct this prioritisation are presented in Table 11, and related back to the criteria used to assess program robustness.

Each of the criteria are applied to each sub-asset.

The table also lists the information resources and references that are to be considered when assessing a sub-asset against each criteria

Table 11: Criteria to prioritise Classes of Action

Criteria to assess Program robustness		Criteria to prioritise Classes of Action		Guidance or factors to assess Class of Action	Scoring
1	Management of the sub-asset contributes to catchment vision and goals	1	Class of Action on sub-asset contributes to catchment vision and goals	Y/N	0 = No 2 = Yes
2	Management of the sub-asset contributes to more than one NLP Natural Asset Project Outcome	2	Management of the sub-asset contributes to more than one NLP Natural Asset Project Outcome	NLP Project outcomes are: <ul style="list-style-type: none"> • Ramsar Ecological Character • Threatened Ecological Communities habitat • Migratory Species habitat • Threatened species habitat • Regional significant species or communities 	0 = only contributes to one NLP outcome 1 = Contributes to one or two other NLP outcomes 2 = Contributes to three or four other NLP outcomes
3	Degree to which sub-asset provides ecosystem services or supports ecological processes	3	Class of Action on sub-asset will maintain or improve ecosystem services or maintain ecological processes	Class of Action assists climate change adaptation Maintains capacity of sub-asset to provide ecosystem services Class of Action supports ecological processes	0 = moderate contribution to ecosystem services and/or ecological processes 1 = significant contribution to ecosystem services and/or ecological processes 2 = very significant contribution to ecosystem services and/or ecological processes
4	Management action on the sub-asset is urgent	4	Class of Action addresses priority threats to sub-asset	Refer to Table 9: Threat rating to sub-assets	0 for Low (L) 1 for High (H) or Medium (M) 2 for Very High (VH)
5	Management of the sub-asset is technically feasible within required timeframes	5	Class of Action on sub-asset is technically feasible and based on good science and/or evidence.	Is there a measurable outcome? Is the link between the threat and Class of Action supported by evidence and science? Is the outcome able to be measured?	0 = Action is not technically feasible 1 = Action is feasible, but outcome is not easily measurable 2 = Action is feasible and outcome is measurable
		6	Operational ability to deliver Class of Action on sub-asset in timeframes	Consider the ability to mobilise adequate funds, capital, expertise, and human resources in the available timeframe.	0 = not/unlikely to be deliverable in timeframes 1 = delivery in timeframes is possible, but challenging; or not known 2 = delivery in timeframes is relatively straightforward

Criteria to assess Program robustness		Criteria to prioritise Classes of Action	Guidance or factors to assess Class of Action	Scoring
		7	Cost-effectiveness/value for money of Class of Action on sub-asset	<p>\$/ha managed</p> <p>Complementary or multiple benefits from the action</p> <p>0 = costs of action are very high relative to other actions to address this threat</p> <p>1 = costs are high relative to other actions to address threat, or unknown</p> <p>2 = costs are low to moderate, relative to other actions to address this threat</p>
6	Likelihood of management improving the sub-asset	8	Consequences to sub-asset of not acting	<p>Refer to Management Plans or similar</p> <p>Refer to Conservation Advice and Recovery Plans for TECs</p> <p>Provide rationale for urgency</p> <p>Is the threat a critical threat?</p> <p>Are projects in place already to manage this threat?</p> <p>0 = Action addresses a low priority threat, or not recognised in management/recovery plans</p> <p>1=Action addresses a Moderate or High priority threat</p> <p>2= Action is identified in a relative management plan, recovery plan or similar</p>
7	Usefulness of PHCC investing in management of the sub-asset	9	Strategic importance of the Class of Action to NRM in the Region.	<p>Consider how the Class of Action:</p> <ul style="list-style-type: none"> • Encourages collaboration • Increases or supports capacity of NRM organisations, land managers and community • Complements other projects (PHCC and other) • Displaces other investment. <p>0= Action is the responsibility of a government organisation, and/or investment would likely displace other government investment</p> <p>1=Action moderately contributes to community's NRM capacity, or levers other funds</p> <p>2= Action will significantly encourage catchment community's NRM/landcare capacity; Action will level significant other funds</p>

8 Preliminary results of draft prioritisation

The preliminary results of the prioritisation of classes of action are presented in Tables 12 and 13.

The prioritisation has occurred by scoring each criteria (Table 11) for each Class of Action (Table 10) for each sub-asset (Table 1). By totalling the scores for each 'Criteria X Class of Action X Sub-asset', a total score has been used to rank each Class of Action on a sub-asset.

Table 12 ranks all classes of action X sub-asset reacted to Program 1: Ramsar. Table 13 ranks all classes of action X sub-asset reacted to Program 2: Threatened Ecological Communities.

The prioritisation ranking is preliminary and draft and should be only used as one source of information to guide the selection of projects to implement. All scoring of all criteria was carried out by Andrew Del Marco in June 2016 and has not been peer reviewed.

Key documents used to assist scoring of criteria included:

- Peel-Yalgorup Ramsar System Management Plan
- Yalgorup National Park Management Plan
- Goegrup and Black Lakes Action Plan
- Conservation Advice and Recovery Plans for TECS.

The prioritisation may be improved by using more information in the scoring process, and having other expert staff and volunteers score the criteria and compare results.

Table 12: Draft prioritisation of classes of action for Ramsar sub-assets

Draft Rank	Sub-asset	Class of Action	Criteria									Total
			1. Contributes to catchment vision and goals (0, 2)	2. Contribution to other NLP outcomes (0,1,2)	3. Ecosystem services and ecological processes (0,1,2)	4. Addresses critical threats to sub-asset (0,1,2)	5. Technically feasible and based on science/evidence (0,1,2)	6. Operational ability to deliver in timeframes (0,1,2)	7. Cost-effectiveness/value for money (0,1, 2)	8. Consequence to sub-asset of not acting (0,1,2)	9. Strategic importance to NRM in the Region (0,1,2)	
1	Peel – Harvey Estuary foreshores (excl. TEC)	Protection from clearing/ disturbance	2	2	2	2	2	1	2	2	2	17
2	Peel – Harvey Estuary foreshores (excl. TEC)	Access control - stock or people	2	2	2	2	2	2	2	2	1	17
3	Peel – Harvey Estuary foreshores (excl. TEC)	Recreational use management	2	2	1	2	2	1	2	2	2	16
4	Peel – Harvey Estuary foreshores (excl. TEC)	Restoration and regeneration (for buffering and linkage)	2	2	2	2	1	1	1	2	2	15
5	Peel – Harvey Estuary foreshores (excl. TEC)	Erosion control	2	1	2	2	2	1	2	2	1	15
6	Yalgorup Lakes System (incl. uplands)	Restoration and regeneration (for buffering and linkage)	2	2	2	1	2	2	2	1	1	15
7	Goegrup and Black Lakes	Restoration and regeneration (for buffering and linkage)	2	2	2	1	2	2	2	1	1	15
8	Peel – Harvey Estuary foreshores (excl. TEC)	Feral animal control	2	1	2	2	1	1	1	2	2	14
9	Yalgorup Lakes System (incl. uplands)	Erosion control	2	1	2	1	2	1	2	1	2	14
10	Lake Mealup	Weed control	2	1	2	2	2	2	1	1	1	14
11	Lakes McLarty	Disease management	2	1	2	1	2	2	1	2	1	14
12	Goegrup and Black Lakes	Access control - stock or people	2	2	1	1	2	2	2	1	1	14
13	Goegrup and Black Lakes	Fire management	2	2	2	1	2	1	2	1	1	14
14	Peel – Harvey Estuary foreshores (excl. TEC)	Litter control and rubbish dumping	2	1	1	1	2	2	1	1	2	13
15	Yalgorup Lakes System (incl. uplands)	Water resource management	2	2	2	2	1	0	1	1	2	13
16	Yalgorup Lakes System (incl. uplands)	Access control - stock or people	2	2	1	1	2	2	1	1	1	13
17	Lake Mealup	Water resource management	2	1	2	2	1	1	1	2	1	13
18	Lake Mealup	Protection from clearing/ disturbance	2	1	2	1	2	0	2	1	2	13
19	Lake Mealup	Restoration and regeneration (for buffering and linkage)	2	1	2	1	2	1	2	1	1	13
20	Lakes McLarty	Restoration and regeneration (for buffering and linkage)	2	1	2	1	2	2	1	1	1	13
21	Lakes McLarty	Access control - stock or people	2	1	2	1	1	2	2	1	1	13
22	Lakes McLarty	Weed control	2	1	2	1	2	2	1	1	1	13
23	Lakes McLarty	Feral animal control	2	1	2	2	1	2	1	1	1	13
24	Goegrup and Black Lakes	Water resource management	2	2	2	2	1	1	1	1	1	13
25	Goegrup and Black Lakes	Disease management	2	2	1	1	1	2	2	1	1	13
26	Goegrup and Black Lakes	Weed control	2	2	1	1	2	2	1	1	1	13
27	Goegrup and Black Lakes	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	1	2	1	1	1	2	2	1	13
28	Goegrup and Black Lakes	Erosion control	2	1	1	1	2	2	1	2	1	13
29	Ramsar Offsite and complementary	Water resource management	2	1	1	2	2	1	1	1	2	13
30	Ramsar Offsite and complementary	Protection from clearing/wetland prot.	2	1	2	2	2	1	1	1	1	13
31	Ramsar Offsite and complementary	Erosion control	2	1	1	1	2	2	1	2	1	13
32	Peel – Harvey Estuary foreshores (excl. TEC)	Revegetation (for buffering and linkage)	2	2	2	2	1	1	0	1	1	12
33	Yalgorup Lakes System (incl. uplands)	Protection from clearing/ disturbance	2	1	2	1	2	0	2	1	1	12
34	Yalgorup Lakes System (incl. uplands)	Litter control and rubbish dumping	2	1	1	1	2	2	1	1	1	12
35	Yalgorup Lakes System (incl. uplands)	Feral animal control	2	1	1	1	1	2	1	1	2	12
36	Yalgorup Lakes System (incl. uplands)	Fire management	2	2	2	1	1	1	1	1	1	12
37	Lake Mealup	Survey, monitoring and management planning	2	0	1	1	2	2	2	2	0	12
38	Lake Mealup	Access control - stock or people	2	1	1	1	2	2	2	0	1	12
39	Lake Mealup	Feral animal control	2	1	2	2	1	1	1	1	1	12
40	Lake Mealup	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	1	1	1	1	1	1	2	2	12
41	Lakes McLarty	Erosion control	2	1	2	1	1	2	1	1	1	12
42	Goegrup and Black Lakes	Revegetation (for buffering and linkage)	2	2	1	1	1	2	1	1	1	12
43	Goegrup and Black Lakes	Recreational use management	2	2	1	1	1	2	1	1	1	12

Draft Rank	Sub-asset	Class of Action	Criteria									Total
			1. Contributes to catchment vision and goals (0, 2)	2. Contribution to other NLP outcomes (0,1,2)	3. Ecosystem services and ecological processes (0,1,2)	4. Addresses critical threats to sub-asset (0,1,2)	5. Technically feasible and based on science/evidence (0,1,2)	6. Operational ability to deliver in timeframes (0,1,2)	7. Cost-effectiveness/value for money (0,1, 2)	8. Consequence to sub-asset of not acting (0,1,2)	9. Strategic importance to NRM in the Region (0,1,2)	
44	Goegrup and Black Lakes	Feral animal control	2	2	1	1	1	2	1	1	1	12
45	Peel – Harvey Estuary Waterbody	Recreational use management	2	1	1	1	2	1	1	1	1	11
46	Peel – Harvey Estuary Waterbody	Litter control and rubbish dumping	2	1	1	1	1	2	1	1	1	11
47	Peel – Harvey Estuary Waterbody	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	0	2	2	1	0	1	2	1	11
48	Yalgorup Lakes System (incl. uplands)	Recreational use management	2	2	1	1	1	2	1	1	0	11
49	Yalgorup Lakes System (incl. uplands)	Weed control	2	1	1	1	2	2	1	1	0	11
50	Yalgorup Lakes System (incl. uplands)	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	2	1	1	1	1	1	1	1	11
51	Lake Mealup	Revegetation (for buffering and linkage)	2	1	1	1	2	1	1	1	1	11
52	Lake Mealup	Litter control and rubbish dumping	2	1	1	1	1	2	1	1	1	11
53	Lake Mealup	Disease management	2	0	2	1	1	2	1	1	1	11
54	Lakes McLarty	Water resource management	2	1	2	2	1	0	1	1	1	11
55	Lakes McLarty	Protection from clearing/ disturbance	2	1	1	1	1	1	2	1	1	11
56	Lakes McLarty	Recreational use management	2	1	1	1	1	2	1	1	1	11
57	Goegrup and Black Lakes	Litter control and rubbish dumping	2	1	1	1	1	2	1	1	1	11
58	Ramsar Offsite and complementary	Restoration and regeneration (for mig. Bird habitat)	2	1	2	1	1	1	1	1	1	11
59	Ramsar Offsite and complementary	Feral animal control	2	1	1	1	1	2	1	1	1	11
60	Peel – Harvey Estuary foreshores (excl. TEC)	Survey, monitoring and management planning	2	0	0	0	2	2	1	1	2	10
61	Yalgorup Lakes System (incl. uplands)	Revegetation (for buffering and linkage)	2	1	2	1	2	1	1	0	0	10
62	Yalgorup Lakes System (incl. uplands)	Survey, monitoring and management planning	2	0	1	1	2	1	1	1	1	10
63	Lake Mealup	Recreational use management	2	1	1	1	1	1	1	1	1	10
64	Lake Mealup	Fire management	2	1	2	1	1	1	1	1	0	10
65	Lakes McLarty	Revegetation (for buffering and linkage)	2	1	1	1	1	2	0	1	1	10
66	Lakes McLarty	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	1	1	2	0	1	1	1	1	10
67	Goegrup and Black Lakes	Protection from clearing/ disturbance	2	2	2	1	1	1	1	0	0	10
68	Yalgorup Lakes System (incl. uplands)	Revegetation (for buffering and linkage)	2	1	2	1	2	1	1	0	0	10
69	Yalgorup Lakes System (incl. uplands)	Survey, monitoring and management planning	2	0	1	1	2	1	1	1	1	10
70	Peel – Harvey Estuary foreshores (excl. TEC)	Fire management	2	1	2	1	1	1	1	0	0	9
71	Lakes McLarty	Fire management	2	1	2	1	1	1	1	0	0	9
72	Ramsar Offsite and complementary	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	0	1	1	1	1	1	1	1	9
73	Peel – Harvey Estuary foreshores (excl. TEC)	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	1	1	1	1	1	0	0	1	8
74	Lake Mealup	Erosion control	2	1	0	1	1	1	1	1	0	8
75	Lakes McLarty	Survey, monitoring and management planning	2	0	1	1	1	1	1	1	0	8
76	Ramsar Offsite and complementary	Access control - stock or people (e.g. migr. bird habitat)	2	1	1	1	1	1	1	0	0	8
77	Ramsar Offsite and complementary	Recreational use management	2	1	0	1	1	1	1	1	0	8
78	Ramsar Offsite and complementary	Disease management	2	1	1	0	1	1	1	0	1	8
79	Peel – Harvey Estuary Waterbody	Survey, monitoring and management planning	2	0	0	1	2	1	0	1	0	7
80	Peel – Harvey Estuary foreshores (excl. TEC)	Water resource management	2	1	1	2	0	0	0	0	1	7
81	Goegrup and Black Lakes	Survey, monitoring and management planning	2	0	1	0	1	1	1	0	1	7
82	Ramsar Offsite and complementary	Revegetation (for buffering and linkage)	2	1	1	1	1	1	0	0	0	7
83	Ramsar Offsite and complementary	Litter control and rubbish dumping	2	1	0	0	1	2	0	0	1	7
84	Ramsar Offsite and complementary	Weed control	2	1	1	0	1	1	1	0	0	7
85	Ramsar Offsite and complementary	Fire management	2	1	2	1	0	1	0	0	0	7
86	Peel – Harvey Estuary Waterbody	Water resource management	2	1	2	1	0	0	0	0	0	6
87	Ramsar Offsite and complementary	Survey, monitoring and management planning	2	0	0	0	1	1	1	0	1	6
88	Peel – Harvey Estuary foreshores (excl. TEC)	Weed control	2	1	1	1						5
89	Peel – Harvey Estuary foreshores (excl. TEC)	Disease management	2	0	0	0	0	2	0	0	0	4

Table 13: Draft prioritisation of classes of action for TEC sub-assets

Program	Sub-asset	Class of Action	Criteria									Total	Notes
	Sub-asset	Class of action	1. Contributes to catchment vision and goals (Y/N)	2. Contribution to other NLP outcomes	3. Ecosystem services and ecosystem processes	4. Addresses critical threats to sub-asset	5. Technically feasible and based on science/evidence	6. Operational ability to deliver in timeframes	7. Cost-effectiveness/value for money	8. Consequence to sub-asset of not acting	9. Strategic importance to NRM in the Region		
2	Thrombolite Community - Lake Clifton	Protection from clearing/ disturbance	2	2	2	2	2	1	2	2	2	17	Protection from clearing includes management agreements
2	Banksia Woodlands of the SCP	Disease management	2	1	2	2	2	2	2	2	2	17	
2	Euc. Woodlands of wheatbelt	Access control - stock or people	2	1	2	2	2	2	2	1	2	16	Identified as a priority in H-W NRM Plan
2	Euc. Woodlands of wheatbelt	Feral animal control	2	1	2	2	2	2	1	2	2	16	DPaW may be looking for complementary project on private lands
2	Banksia Woodlands of the SCP	Protection from clearing/ disturbance	2	1	2	2	2	2	2	2	1	16	
2	Banksia Woodlands of the SCP	Access control - stock or people	2	1	2	2	2	2	2	1	2	16	
2	Banksia Woodlands of the SCP	Weed control	2	1	1	2	2	2	2	2	2	16	
2	Banksia Woodlands of the SCP	Fire management	2	1	2	2	1	2	2	2	2	16	
2	Marri - Kingia SCP 3a	Fire management	2	1	2	2	2	1	2	1	2	15	
2	Marri - Xanthorrhoea SCP 3c	Disease management	2	1	2	2	2	1	2	2	1	15	
2	Marri - Xanthorrhoea SCP 3c	Fire management	2	1	2	2	2	1	2	1	2	15	
2	Claypans (SCP 07, 08, 09, 10a)	Protection from clearing/ disturbance	2	2	2	2	1	1	2	2	1	15	Contribution to other NLP outcomes has assumed that Claypans are linked to Ramsar Site (not true in all occurrences)
2	Claypans (SCP 07, 08, 09, 10a)	Fire management	2	2	2	2	1	2	2	1	1	15	
2	Subtropical & Temperate Coastal Saltmarsh	Access control - stock or people	2	2	2	2	2	1	2	1	1	15	
2	Subtropical & Temperate Coastal Saltmarsh	Recreational use management	2	2	2	2	1	1	2	1	2	15	
2	Thrombolite Community - Lake Clifton	Water resource management	2	1	2	2	1	1	2	2	2	15	
2	Banksia Woodlands of the SCP	Restoration and regeneration (for buffering and linkage)	2	1	2	2	2	2	1	1	2	15	
2	Banksia Woodlands of the SCP	Recreational use management	2	1	2	1	2	2	2	1	2	15	
2	Banksia Woodlands of the SCP	Feral animal control	2	1	1	2	2	2	2	1	2	15	
2	Euc. Woodlands of wheatbelt	Restoration and regeneration (for buffering and linkage)	2	1	2	2	1	2	2	1	1	14	

Program	Sub-asset	Class of Action	Criteria									Total	Notes
	Sub-asset	Class of action	1. Contributes to catchment vision and goals (y/n)	2. Contribution to other NLP outcomes	3. Ecosystem services and ecosystem processes	4. Addresses critical threats to sub-asset	5. Technically feasible and based on science/evidence	6. Operational ability to deliver in timeframes	7. Cost-effectiveness/value for money	8. Consequence to sub-asset of not acting	9. Strategic importance to NRM in the Region		
2	Euc. Woodlands of wheatbelt	Disease management	2	1	2	1	2	1	2	2	1	14	Table 2 in Dryandra MP provides info on veg susceptibility to fungal invasion. No map found on disease distribution
2	Euc. Woodlands of wheatbelt	Fire management	2	1	2	2	1	2	1	1	2	14	Fire management in remnant vegetation identified in H-W NRM Plan as a priority
2	Euc. Woodlands of wheatbelt	Erosion control	2	1	2	1	2	2	2	1	1	14	Extent of erosion risk areas not known
2	Euc. Woodlands of wheatbelt	Management of inorganic fertiliser movement and spray drift from paddocks to bush (Threatened Species Scientific Committee, 2015)	2	1	2	2	1	2	2	1	1	14	Identified as a key threat in the Approved Conservation Advice.
2	Marri - Kingia SCP 3a	Protection from clearing/ disturbance	2	1	1	2	2	1	2	2	1	14	This TEC is on wetter ground than TEC 3c
2	Marri - Kingia SCP 3a	Disease management	2	1	2	2	1	1	2	2	1	14	Preventative disease measures higher priority than treatment measures
2	Marri - Xanthorrhoea SCP 3c	Protection from clearing	2	1	1	2	2	1	2	2	1	14	This community occurs on the driest of the soils, and the lowest rainfall sites of the group of Marri dominated communities that occur on the heavy soils on the eastern side of the Swan Coastal Plain (Gibson et al. 1994). Soils on which the community occurs are still relatively wet, however.
2	Claypans (SCP 07, 08, 09, 10a)	Restoration and regeneration (for buffering and linkage)	2	2	2	1	2	1	2	1	1	14	
2	Claypans (SCP 07, 08, 09, 10a)	Access control - stock or people	2	2	1	2	2	1	2	1	1	14	
2	Claypans (SCP 07, 08, 09, 10a)	Weed control	2	1	2	2	2	2	1	1	1	14	
2	Claypans (SCP 07, 08, 09, 10a)	Feral animal control	2	2	2	1	1	2	1	1	2	14	
2	Subtropical & Temperate Coastal Saltmarsh	Water resource management	2	2	2	2	1	1	2	1	1	14	Water resource management includes stormwater management.
2	Subtropical & Temperate Coastal Saltmarsh	Protection from clearing/ disturbance	2	2	2	1	1	1	2	2	1	14	
2	Subtropical & Temperate Coastal Saltmarsh	Litter control and rubbish dumping	2	2	1	1	2	2	1	1	2	14	
2	Subtropical & Temperate Coastal Saltmarsh	Weed control	2	2	2	1	1	1	2	2	1	14	Invasive problem species (e.g. Juncus acutus and Baumea juncea) may have high flammable fuel loads, putting Coastal Saltmarsh at risk (TSSC, 2013)
2	Subtropical & Temperate Coastal Saltmarsh	Fire management	2	2	2	1	1	1	2	2	1	14	
2	Subtropical & Temperate Coastal Saltmarsh	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	2	2	2	1	1	2	1	1	14	
2	Subtropical & Temperate Coastal Saltmarsh	Erosion control	2	2	2	2	1	1	2	1	1	14	

Program	Sub-asset	Class of Action	Criteria									Total	Notes
	Sub-asset	Class of action	1. Contributes to catchment vision and goals (y/n)	2. Contribution to other NLP outcomes	3. Ecosystem services and ecosystem processes	4. Addresses critical threats to sub-asset	5. Technically feasible and based on science/evidence	6. Operational ability to deliver in timeframes	7. Cost-effectiveness/value for money	8. Consequence to sub-asset of not acting	9. Strategic importance to NRM in the Region		
2	Thrombolite Community - Lake Clifton	Survey, monitoring and management planning	2	1	1	2	2	1	1	2	2	14	
2	Thrombolite Community - Lake Clifton	Erosion control	2	2	2	1	2	2	2	1	0	14	
2	Euc. Woodlands of wheatbelt	Water resource management	2	1	2	2	1	0	1	2	2	13	
2	Claypans (SCP 07, 08, 09, 10a)	Water resource management	2	2	2	2	1	1	1	1	1	13	There are 600 ha of this TEC remaining (English and Blyth, 2000b)
2	Subtropical & Temperate Coastal Saltmarsh	Restoration and regeneration (for buffering and linkage)	2	2	2	2	1	1	1	1	1	13	
2	Subtropical & Temperate Coastal Saltmarsh	Feral animal control	2	2	2	1	1	1	2	1	1	13	
2	Thrombolite Community - Lake Clifton	Restoration and regeneration (for buffering and linkage)	2	2	2	1	1	1	1	1	2	13	
2	Thrombolite Community - Lake Clifton	Access control - stock or people	2	2	1	1	1	1	2	1	2	13	
2	Marri - Kingia SCP 3a	Restoration and regeneration (for buffering and linkage)	2	1	1	2	1	1	1	1	2	12	
2	Marri - Kingia SCP 3a	Access control - stock or people	2	1	0	2	2	1	2	1	1	12	
2	Marri - Kingia SCP 3a	Weed control	2	1	1	1	2	2	1	1	1	12	
2	Marri - Xanthorrhoea SCP 3c	Restoration and regeneration (for buffering and linkage)	2	1	1	2	1	1	1	1	2	12	
2	Marri - Xanthorrhoea SCP 3c	Access control - stock or people	2	1	0	2	2	1	2	1	1	12	
2	Marri - Xanthorrhoea SCP 3c	Weed control	2	1	1	1	2	2	1	1	1	12	
2	Claypans (SCP 07, 08, 09, 10a)	Disease management	2	1	1	1	1	1	2	2	1	12	
2	Claypans (SCP 07, 08, 09, 10a)	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	1	1	1	1	2	1	2	1	12	Erosion not identified as a key threat in Conservation Advice (TSSC, 2012)
2	Thrombolite Community - Lake Clifton	Recreational use management	2	2	1	1	1	1	2	1	1	12	
2	Banksia Woodlands of the SCP	Survey, monitoring and management planning	2	1	1	1	2	2	1	1	1	12	
2	Euc. Woodlands of wheatbelt	Protection from clearing/ disturbance	2	1	2	2	1	0	2	1	0	11	Protection mechanisms take time to implement. Requires land manager consent. Placing protection mechanisms over H-W remnant veg not considered strategically important at this stage with landholders.
2	Marri - Kingia SCP 3a	Feral animal control	2	1	1	1	1	1	1	1	2	11	

Program	Sub-asset	Class of Action	Criteria									Total	Notes
	Sub-asset	Class of action	1. Contributes to catchment vision and goals (y/n)	2. Contribution to other NLP outcomes	3. Ecosystem services and ecosystem processes	4. Addresses critical threats to sub-asset	5. Technically feasible and based on science/evidence	6. Operational ability to deliver in timeframes	7. Cost-effectiveness/value for money	8. Consequence to sub-asset of not acting	9. Strategic importance to NRM in the Region		
2	Marri - Xanthorrhoea SCP 3c	Feral animal control	2	1	1	1	1	1	1	1	2	11	
2	Claypans (SCP 07, 08, 09, 10a)	Survey, monitoring and management planning	2	1	1	1	2	1	1	1	1	11	
2	Claypans (SCP 07, 08, 09, 10a)	Erosion control	2	1	1	1	2	1	1	1	1	11	Erosion not identified as a key threat in Conservation Advice (TSSC, 2012)
2	Subtropical & Temperate Coastal Saltmarsh	Survey, monitoring and management planning	2	0	1	2	2	0	1	1	2	11	Baseline surveying of this ecological community is important given exposure to seas level rise.
2	Thrombolite Community - Lake Clifton	Revegetation (for buffering and linkage)	2	2	1	1	1	1	0	1	2	11	
2	Thrombolite Community - Lake Clifton	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	2	2	1	1	1	1	1	0	11	
2	Banksia Woodlands of the SCP	Water resource management	2	1	1	2	1	1	2	1	0	11	
2	Euc. Woodlands of wheatbelt	Revegetation (for buffering and linkage)	2	1	2	1	1	1	1	1	0	10	Revegetation was not ranked highly by H-W community (H-W NRM Plan)
2	Euc. Woodlands of wheatbelt	Recreational use management	2	1	1	1	1	1	1	1	1	10	Rec Mgmt. applies to Woodlands in public ownership (e.g. Dryandra blocks). Need for Rec management in Dryandra detailed in Dryandra MP
2	Euc. Woodlands of wheatbelt	Weed control	2	1	1	1	1	1	1	1	1	10	Need to conduct weed survey and mapping first
2	Marri - Kingia SCP 3a	Revegetation (for buffering and linkage)	2	1	1	2	1	1	0	1	1	10	
2	Marri - Xanthorrhoea SCP 3c	Revegetation (for buffering and linkage)	2	1	1	2	1	1	0	1	1	10	
2	Claypans (SCP 07, 08, 09, 10a)	Revegetation (for buffering and linkage)	2	2	1	1	1	0	1	1	1	10	
2	Thrombolite Community - Lake Clifton	Litter control and rubbish dumping	2	1	1	1	1	2	1	0	1	10	
2	Thrombolite Community - Lake Clifton	Feral animal control	2	1	1	1	1	1	1	1	1	10	Introduced fish species are a potential threat
2	Marri - Kingia SCP 3a	Water resource management	2	1	1	2	1	0	1	1	0	9	There are 83.3 ha of TEC 3c remaining (English and Blyth, 2000a)
2	Marri - Kingia SCP 3a	Litter control and rubbish dumping	2	1	0	1	1	2	0	1	1	9	
2	Marri - Xanthorrhoea SCP 3c	Litter control and rubbish dumping	2	1	0	1	1	2	0	1	1	9	
2	Claypans (SCP 07, 08, 09, 10a)	Recreational use management	2	1	1	1	1	0	1	1	1	9	
2	Claypans (SCP 07, 08, 09, 10a)	Litter control and rubbish dumping	2	0	0	1	1	2	1	1	1	9	
2	Thrombolite Community - Lake Clifton	Fire management	2	1	2	0	1	1	1	1	0	9	Fire management has a indirect relationship to water quality (soil stabilisation)

Program	Sub-asset	Class of Action	Criteria									Total	Notes
	Sub-asset	Class of action	1. Contributes to catchment vision and goals (y/n)	2. Contribution to other NLP outcomes	3. Ecosystem services and ecosystem processes	4. Addresses critical threats to sub-asset	5. Technically feasible and based on science/evidence	6. Operational ability to deliver in timeframes	7. Cost-effectiveness/value for money	8. Consequence to sub-asset of not acting	9. Strategic importance to NRM in the Region		
2	Banksia Woodlands of the SCP	Litter control and rubbish dumping	2	0	1	0	1	2	1	1	1	9	
2	Euc. Woodlands of wheatbelt	Survey, monitoring and management planning	2	0	1	0	1	2	1	1	0	8	Major knowledge gaps were not identified as a priority in H-W Plan.
2	Euc. Woodlands of wheatbelt	Litter control and rubbish dumping	2	1	1	0	1	2	1	0	0	8	Litter and rubbish dumping not identified as a management issue in MP. Just take rubbish home message.
2	Euc. Woodlands of wheatbelt	Soil management (e.g. ASS, MBO, salinisation, acidification, sediment management)	2	1	1	2	0	0	0	1	1	8	Acidification is the key soil management issue (apart from waterlogging and salinisation caused by rising groundwater)
2	Marri - Kingia SCP 3a	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	1	1	1	0	0	1	1	1	8	Salinisation identified in Recovery Plan as a threat.
2	Marri - Kingia SCP 3a	Erosion control	2	1	1	1	1	0	1	1	0	8	Erosion control not a priority threat, unless linked to specific siteworks
2	Marri - Xanthorrhoea SCP 3c	Water resource management	2	1	1	1	1	0	1	1	0	8	There are 43 ha of TEC 3c remaining (English and Blyth, 2000b)
2	Marri - Xanthorrhoea SCP 3c	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	1	1	1	0	0	1	1	1	8	
2	Marri - Xanthorrhoea SCP 3c	Erosion control	2	1	1	1	1	0	1	1	0	8	Erosion control not a priority threat, unless linked to specific siteworks
2	Marri - Kingia SCP 3a	Recreational use management	2	1	1	1	1	0	1	0	0	7	
2	Marri - Xanthorrhoea SCP 3c	Recreational use management	2	1	1	1	1	0	1	0	0	7	
2	Marri - Kingia SCP 3a	Survey, monitoring and management planning	2	0	0	1	1	0	1	1	0	6	
2	Marri - Xanthorrhoea SCP 3c	Survey, monitoring and management planning	2	0	0	1	1	0	1	1	0	6	
2	Banksia Woodlands of the SCP	Revegetation (for buffering and linkage)	2	1	1	0	0	1	0	0	0	5	
2	Subtropical & Temperate Coastal Saltmarsh	Revegetation (for buffering and linkage)	2	0	1	1	0	0	0	0	0	4	
2	Banksia Woodlands of the SCP	Soil management (e.g. ASS, MBO, salinisation, sediment management)	2	0	0	1	0	0	0	0	0	3	
2	Subtropical & Temperate Coastal Saltmarsh	Disease management	2	0	0	0	0	0	0	0	0	2	Conservation advice does not cite plant diseases such as a s Phytophthora as a threat.
2	Thrombolite Community - Lake Clifton	Disease management	2	0	0	0	0	0	0	0	0	2	
2	Thrombolite Community - Lake Clifton	Weed control	2	0	0	0	0	0	0	0	0	2	
2	Banksia Woodlands of the SCP	Erosion control	2	0	0	0	0	0	0	0	0	2	

Program	Sub-asset	Class of Action	Criteria									Total	Notes
	Sub-asset	Class of action	1. Contributes to catchment vision and goals (y/n)	2. Contribution to other NLP outcomes	3. Ecosystem services and ecosystem processes	4. Addresses critical threats to sub-asset	5. Technically feasible and based on science/evidence	6. Operational ability to deliver in timeframes	7. Cost-effectiveness/value for money	8. Consequence to sub-asset of not acting	9. Strategic importance to NRM in the Region		
2	Communities of Tumulus Springs	Water resource management										0	
2	Communities of Tumulus Springs	Protection from clearing/ disturbance										0	
2	Communities of Tumulus Springs	Restoration and regeneration (for buffering and linkage)										0	
2	Communities of Tumulus Springs	Revegetation (for buffering and linkage)										0	
2	Communities of Tumulus Springs	Survey, monitoring and management planning		0								0	
2	Communities of Tumulus Springs	Access control - stock or people										0	
2	Communities of Tumulus Springs	Recreational use management										0	
2	Communities of Tumulus Springs	Litter control and rubbish dumping										0	
2	Communities of Tumulus Springs	Disease management										0	
2	Communities of Tumulus Springs	Weed control										0	
2	Communities of Tumulus Springs	Feral animal control										0	
2	Communities of Tumulus Springs	Fire management										0	
2	Communities of Tumulus Springs	Soil management (e.g. ASS, MBO, salinisation, sediment management)										0	
2	Communities of Tumulus Springs	Erosion control										0	
2	Sedgelands in Holocene dune swales	Water resource management										0	
2	Sedgelands in Holocene dune swales	Protection from clearing/ disturbance										0	
2	Sedgelands in Holocene dune swales	Restoration and regeneration (for buffering and linkage)										0	
2	Sedgelands in Holocene dune swales	Revegetation (for buffering and linkage)										0	
2	Sedgelands in Holocene dune swales	Survey, monitoring and management planning		0								0	
2	Sedgelands in Holocene dune swales	Access control - stock or people										0	
2	Sedgelands in Holocene dune swales	Recreational use management										0	
2	Sedgelands in Holocene dune swales	Litter control and rubbish dumping										0	
2	Sedgelands in Holocene dune swales	Disease management										0	

Program	Sub-asset	Class of Action	Criteria									Total	Notes
	Sub-asset	Class of action	1. Contributes to catchment vision and goals (Y/n)	2. Contribution to other NLP outcomes	3. Ecosystem services and ecosystem processes	4. Addresses critical threats to sub-asset	5. Technically feasible and based on science/evidence	6. Operational ability to deliver in timeframes	7. Cost-effectiveness/value for money	8. Consequence to sub-asset of not acting	9. Strategic importance to NRM in the Region		
2	Sedgelands in Holocene dune swales	Weed control										0	
2	Sedgelands in Holocene dune swales	Feral animal control										0	
2	Sedgelands in Holocene dune swales	Fire management										0	
2	Sedgelands in Holocene dune swales	Soil management (e.g. ASS, MBO, salinisation, sediment management)										0	
2	Sedgelands in Holocene dune swales	Erosion control										0	

9 Concluding remarks

The above prioritisation process has been undertaken to inform the development of Projects for the 2015-2018 NLP Natural Assets Project. The prioritisation is draft and to be used as one of a number of information sources in the project planning process.

Importantly, the prioritisation process can be used in a modified form to assist future prioritisation exercises by the PHCC (e.g. for future NLP programs or other major natural asset management projects). This would involve using the existing process structure, and substituting sub-assets as appropriate to the investor's requirements. A minor review of the prioritisation criteria would also be required to ensure that they reflect any changes in the PHCC's regional strategy or funding body's priorities.

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Appendix A: Timeline of development of prioritisation methodology

Date	Session
4 May 2016	Working meeting of the PHCC's Prioritisation and Natural Assets Committees. The primary purpose of the meeting was to provide direction on the methodology and criteria to prioritise projects under the NLP Natural Assets Project.
4 May 2016	Meeting of Andrew Del Marco and Steve Fisher to refine prioritisation criteria and program development.
16 May 2016	Meeting of Andrew Del Marco and Steve Fisher to further develop the draft prioritisation methodology
19 May 2016	Review meeting of Andrew Del Marco and Jane O'Malley, Confirmation of general direction of prioritisation methodology
23 May 2016	Meeting of Jane O'Malley, Kim Wilson and Steve Fisher to revise sub-asset categories. Trial prioritisation of four classes of action for P-H estuarine foreshore by Kim Wilson and Steve Fisher.
7 June 2016	Meeting of Jane O'Malley, Kim Wilson, Steve Fisher, Luke Rodgers, Thelma Crook and Jo Garvey to review draft prioritisation results for Program 1: Ramsar and Program 2: TECs.
1 July 2016	Finalisation of Prioritisation Report

Appendix B: Original proposed program-level criteria

Table 14: Program-level criteria as generally agreed at the Working Meeting of 4 May 2016

	Criteria	Scoring
1	How strongly is the theme likely to contribute to the catchment community's vision and goals of the NRM strategy?	0,1,or 2
2	How strongly is the theme likely to contribute to one or more of the 5 NLP outcomes for 2015-2018	0, 1,or 2
3	Landscape scale effectiveness/maintains and improves ecosystem services?	0,1,or 2
4	How well does the theme address key threats for the natural asset, and is there an urgency to address these threats	0,1,or 2
5	How technically feasible is the theme's delivery within the required timeframes	0,1,or 2
6	Likelihood of the theme improving the asset	
7	How well with the theme complement other themes in the catchment, or lever other projects/capacity increases	0,1,or 2

Appendix C: Ecosystem services and ecological processes

Ecosystem services

Ecosystem services are the benefits people obtain from ecosystems. These include:

- provisioning services such as food and water;
- regulating services such as regulation of floods, drought, land degradation, and disease;
- supporting services such as soil formation and nutrient cycling; and
- cultural services such as recreational, spiritual, religious and other nonmaterial benefits

(Hassan, Scholes & Ash (eds) (2005)

Ecological processes

Ecological processes are the interactions and connections between living and non-living systems, including movements of energy, nutrients and species. Or in lay terms: The natural machinery that connects living and non-living things and keeps nature healthy (Trail, undated)

Soule *et al.* 2004 provide a list of seven key types of ecological processes that apply over large distances in terrestrial systems in Australia:

1. Strongly interactive species - For example the interactions between mycophagous mammals and their environment, pollinators and animal dispersers of seeds and fungal spores
2. Hydro-ecology - This describes the role that vegetation plays in regulating surface and subsurface hydrological flows at local and regional scales, and the importance of water availability to ecosystems and animal habitat.
3. Long-distance biological movement – both vertebrates and invertebrates can have stages in their life cycles that are associated with large-scale movement. For example, anywhere between 30 and 60% of Australian woodland and open forest birds are non-residents and their persistence in a region may depend on large-scale movements that occur either seasonally (migratory) or from year to year (episodic or dispersive).
4. Disturbance regimes at local and regional scales – Many categories of disturbance, both natural and anthropogenic, affect landscape permeability. The management of fire and other disturbances is a critical consideration.
5. Climate change & variability –In coming decades, it is likely that human induced global climate change will have a significant impact on the dispersal, distribution and survival of species and ecosystems. Maintaining connectivity in the face of major climate changes will be an important challenge to address.
6. Coastal zone fluxes – The movement and fluxes of freshwater, matter and animals in coastal zones.
7. Maintaining evolutionary processes – Biodiversity protection must attend to the conditions necessary for continuing evolution, particularly the potential for adaptation to changing environmental conditions.

Appendix D: Past and possible future projects in Ramsar site

Table 12 was compiled through discussions with Kim Wilson and Thelma Crook, May 2016).

Table 15: Peel-Yalgorup Ramsar Site - current, past and possible future projects

	Project or site
1.	Works in Block between White Hills and Tim's Thicket, Yalgorup N.P.
2.	Egg Island
3.	Lake Clifton Eastern foreshore, public and private lands (incl. weed mapping and control)
4.	Island Point, western Estuary foreshore, City of Mandurah
5.	Other foreshore works, western Estuary Foreshore, City of Mandurah
6.	Lake McLarty, Priority Action Plan, weed management
7.	Lake Mealup - weed control
8.	Robert's Bay Swamp – DPaW managed reserve (+ surrounding private lands)
9.	Black and Goegrup Action Plan – future management actions
10.	Boggy Bay Estuary Eastern foreshore
11.	Austin Bay, Estuary eastern foreshore
12.	Kooljerrenup (within Nature Reserve)
13.	Murray River Delta, Shire of Murray
14.	Fairy Tern habitat Project
15.	Lower Harvey Delta Project
16.	Yalgorup N.P, kangaroo exclusion fencing

Appendix E: Eucalypt woodlands of the WA Wheatbelt TEC

Excerpts from Approved Conservation Advice,

Summary of key threats

(Threatened Species Scientific Committee, 2015, p38)

The key threats to the WA Wheatbelt Woodland ecological community are ongoing and outlined below:

- Clearance of native vegetation.
- Loss of habitat for key native species.
- Fragmentation into smaller, disconnected patches.
- Weed invasion.
- Impacts from pest animals.
- Inappropriate application of chemicals, including inorganic fertilisers to create improved pastures; or pesticide/herbicide spray drift from agricultural lands adjacent to a patch.
- Grazing pressure: including inappropriate grazing regimes by domestic stock and grazing of regrowth by native fauna.
- Increased salinity and waterlogging of the landscape largely due to modification of the landscape and hydrology through over-clearing.
- Soil acidification.
- Altered fire regimes, notably altered fire frequency, but also changes to fire intensity and season, such as occurs during prescribed burning. It covers both wildfires and prescribed burning.
- Potential impact of plant diseases such as *Phytophthora* sp. on species diversity and structure.
- Potential impacts of climate change, including altered fire and flooding regimes, decline in tree health due to prolonged drought and heat stress, and poor regeneration and recruitment.

Guidance on assessing impacts and priorities for recovery, management and funding

(Threatened Species Scientific Committee, 2015, p15)

In the context of actions that may have ‘significant impacts’ and require approval under the EPBC Act, it is important to consider the environment surrounding patches that meet the condition thresholds. Some patches that meet the condition thresholds occur in isolation and require protection, as well as priority actions, to link them with other patches. Other patches that are interconnected to other native vegetation associations that may not, in their current state, meet the condition thresholds have additional conservation value.

In these instances, the following indicators should be considered when assessing the impacts of actions or proposed actions under the EPBC Act, or when considering priorities for recovery, management and funding (Threatened Species Scientific Committee, 2015, p 25-26):

- Large size and/or a large area to boundary ratio – patches with larger area/boundary ratios are less exposed and more resilient to edge effect disturbances such as weed invasion and human impacts.

- However, patches may occur in areas where the ecological community has been most heavily cleared and degraded, or that are at the natural edge of its range, particularly due to genetic significance or absence of some threats.
- Good faunal habitat as indicated by patches containing diversity of landscape, diversity of plant species, diversity of post-disturbance age class, mature trees (particularly those with hollows), contribution to movement corridors, logs, natural rock outcrops, watercourses, etc.;
- High species richness, as shown by the variety of native plant species, or high number of native fauna species.
- Presence of listed threatened species or vegetation associations regarded as the most threatened elements of the ecological community's range.
- Areas of minimal weeds and feral animals or where these can be managed efficiently.
- Evidence of recruitment of key native plant species (including through successful assisted regeneration or management of sites). It is acknowledged, however, that the recruitment of many species may not occur unless there is some disturbance, such as a fire or flood.
- Patches that meet, or are closest to, any benchmarks of ecological quality. These may be based on on-site observations or known past management history.
- Connectivity to other native vegetation patches or restoration works (e.g. native plantings). In particular, a patch in an important position between (or linking) other patches in the landscape.
- Unique variants of the ecological community, e.g. with a unique flora and/or fauna composition.

Appendix F: Threats to Claypans of the Swan Coastal Plain TEC

Excerpt from: *Approved Conservation Advice for Clay Pans of the Swan Coastal Plain (s266B of the Environment Protection and Biodiversity Conservation Act 1999)*. This Conservation Advice was approved by the Minister on 6 March 2012.

The main and ongoing threats to the Clay Pans of the Swan Coastal Plain include:

- Hydrological changes and clearing for urban, industrial or rural development, weed invasion, inappropriate fire regimes and feral animals (predation and soil disturbance). Changes to the natural hydrology of the wetlands are the most significant threat to the ecological community, as the vegetation suite is dependent on the wetlands filling and drying at appropriate times of the year.
- Weed invasion is a significant threat to the clay pans, especially by bulbs of South African origin which naturally occur in similar habitats and climates (*Watsonia meriana* var. *bulbillifera*, *Sparaxis bulbifera* and *Tribolium uniola*) as well as bridal creeper (*Asparagus asparagoides*), kikuyu (*Pennisetum clandestinum*; formerly *Cenchrus clandestinus*) and annual and perennial grasses. *Watsonia* in particular is a major threat because it forms dense monocultures in clay pan communities. Some of the geophytes can spread very rapidly in sheet water flow across these wetlands (Brown et al., 2008; Brown and Brookes 2003; Brown and Clark 2009).
- Several tree species can be invasive within the drier patches in the community, including invasive eucalypts such as the river red gum (*Eucalyptus camaldulensis*) and eastern Australian wattles (e.g. *Acacia melanoxydon*, *Acacia baileyana*).
- Fire is a significant threat to integrity of the community, especially the impact of inappropriate fire regimes. Fire is not a part of the ecology of this wetland community and is the greatest threat to the survival of the fauna in the clay pan wetlands. Arson fires can and do occur frequently, depending on the proximity of an occurrence to urban areas. Frequent fire can facilitate weed invasion, but conversely can be a useful tool in weed control restoration of clay-based wetlands (Brown et al., 2008). Planned fire regimes are often dominated by the requirement to protect adjoining assets and land values (Mitchell et al., 2002).
- Feral animals (foxes (*Vulpes vulpes*), rabbits (*Oryctolagus cuniculus*), cats (*Felis catus*) and increasingly in the south, pigs (*Sus scrofa*) are not controlled in any but the largest reserves. The ecological community suffers effects of overgrazing by rabbits. Foxes, pigs and cats predate native animals, and rabbits and pigs disturb the vegetation by burrowing and rooting behaviours.
- Construction of tracks and new fence lines within remnant patches degrades the ecological community by direct damage, increasing fragmentation, and providing easier pathways for weeds and feral animals to access parts of the community. Fencing of blocks of natural bushland that contain clay pans generally ameliorates active threats such as rubbish dumping and off-road vehicle use. The main potential threats to the Clay Pans of the Swan Coastal Plain include:
 - Observed and predicted climate change may significantly impact the ecological community and individual species in each clay pan as winter rainfall declines over the Swan Coastal Plain. The winter-spring inundation that the clay pan community is dependent on is likely to be

significantly reduced. The driest winter on record was recorded in 2010 and the majority of clay pans remained free of surface water. Southwestern Australia's significant drying trend is forecast to worsen under climate change with up to 80 per cent more droughts in southwestern Australia by 2070 (Department of Climate Change, 2010).

- Inundation from rising saline groundwater may prove to be a serious threat to the community in the medium term. Due to the widespread clearance of native perennial vegetation and its replacement with annual crops and urbanisation, rising ground water in the surrounding region may flow overland into clay-based wetlands (Gibson et al., 2005). Salinity risk mapping indicates that almost all of the known clay pans occur on susceptible land systems (NLWRA, 2001); and
- The water mould *Phytophthora cinnamomi* occurs in parts of the Marri woodlands community1 that surround some clay pans. Species in the plant families Proteaceae and Myrtaceae (as occur in community types SCP08 and SCP09) can be considered at risk (Gibson, 2010).

