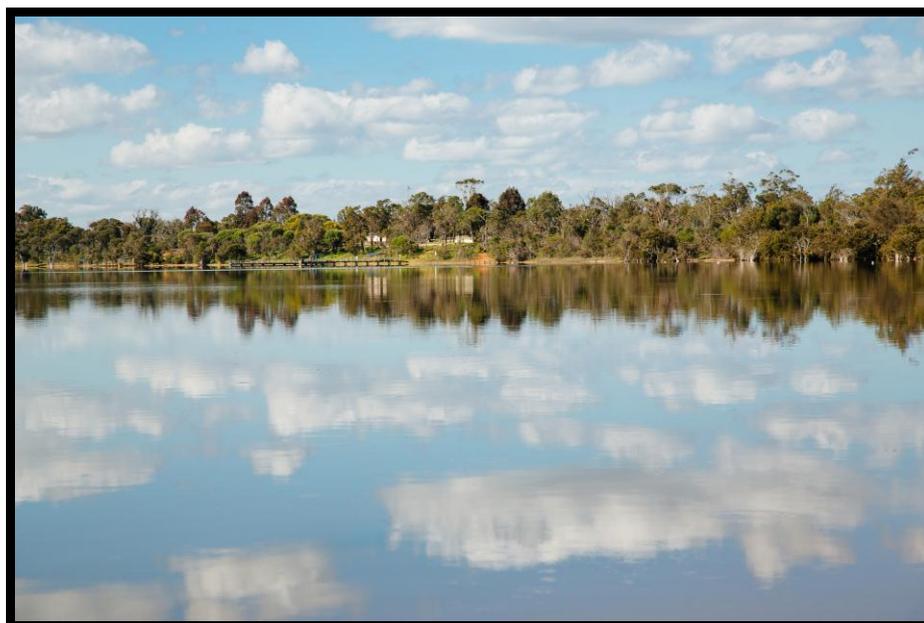




LAKE TOWERRING

STRATEGIC MANAGEMENT PLAN



Shire of West Arthur
Reviewed by Kerryn Chia
August 2016

LAKE TOWERRINNING STRATEGIC PLAN

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Cover Photos

Top: Lake Towerrinning late 1960's.

Bottom: Lake Towerrinning 2014 (Photo: Astrid Volzke)

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1.0 INTRODUCTION

1.1 Location

Lake Towerrinning is located 32km south of Darkan Figure 1 within the Shire of West Arthur in the Towerrinning Nature Reserve (24917). It is approximately 180ha of permanent brackish water (Cale et al., 2004) which is vested in the Conservation Commission of Western Australia and is managed by the Department of Parks and Wildlife (DPaW). However, because of the significance of the Lake as a recreational facility, the Shire of West Arthur has for many years leased part of the reserve and used the water as a gazetted ski area. Public facilities have been provided by the Shire on land owned by the Shire adjacent to the Lake, for use by the community and tourists who visit this area.

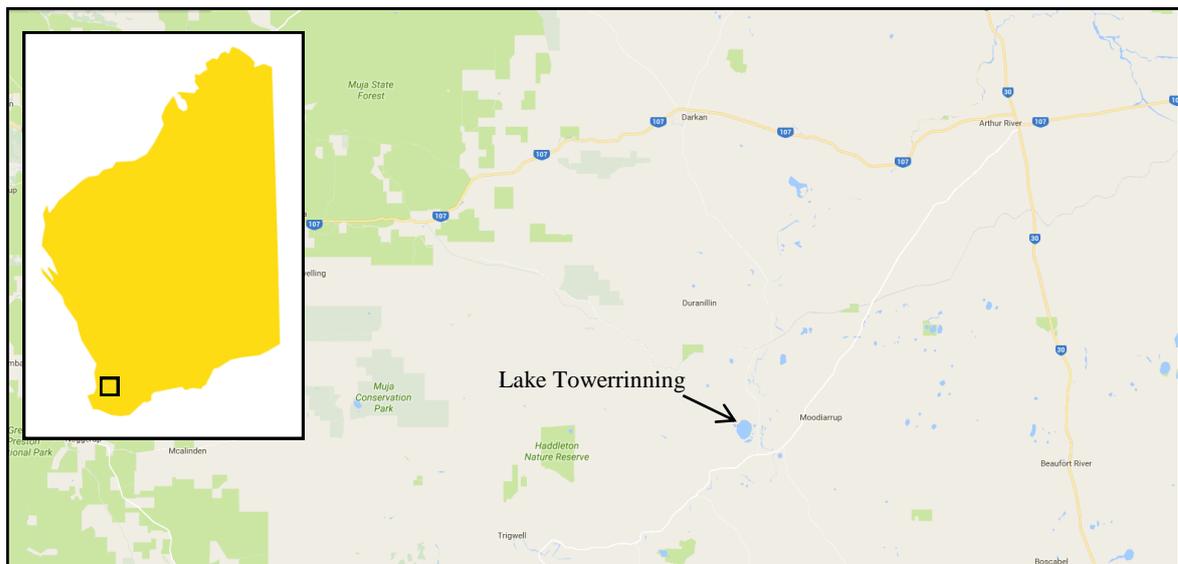


Figure 1: Location of Lake Towerrinning

The Lake Towerrinning catchment covers an area of approximately 15,700ha (Raper and van Wyk, 2009) which includes the Capercup Nature Reserve. The Lake sits at the bottom of the catchment and discharges into the Arthur River (Figure 2). Water coming into the Lake comes in through an inlet swamp on the north western side and is released to the Arthur River through an Outlet swamp located to the south of the main water body of the Lake.

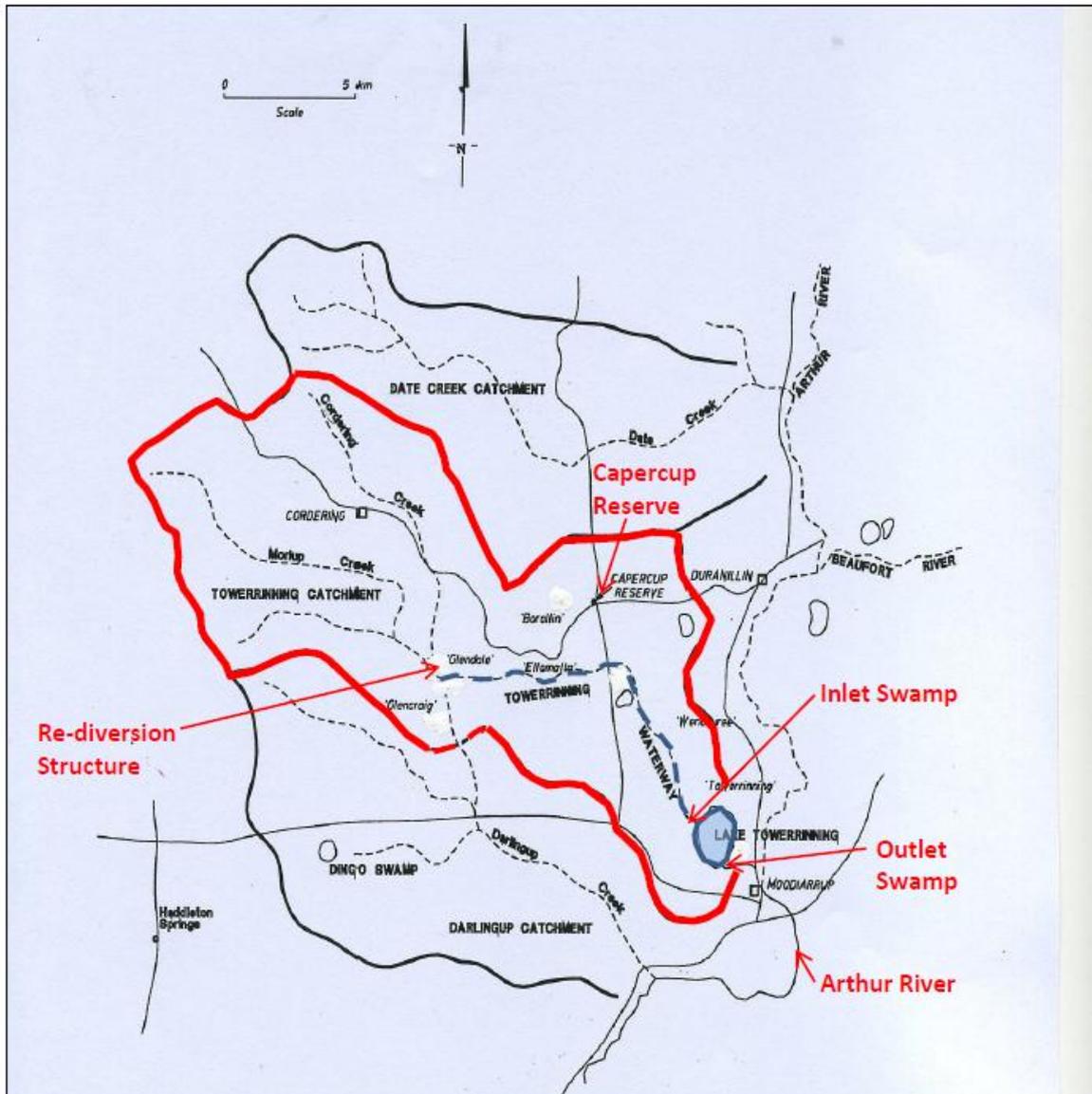


Figure 2: Lake Towerrinning catchment (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012b).

1.2 History of Lake Management

1.2.1 Local Management

Lake Towerrinning Catchment Landcare Group formed in 1989 to improve water quality in Lake Towerrinning by diverting fresher water into the Lake from the catchment area (George et al., 1995). This led to the construction of the Lake re-diversion at the confluence of the Cordering and Morlup Creeks in 1993 which allows saltier water to bypass the lake and fresher water to be redirected through a 12km waterway into the Lake. The incorporation of boards at the outlet of the Lake controls Lake levels and enables

flushing of the Lake to be controlled manually. Since that time water quality has remained below 2500mS/m based on van Wyk and Raper 2008 (Raper and van Wyk, 2009). Even in 2015 (a well below average rainfall year), Lake salinity was still below 2500mS/m at 2300mS/m in December 2015.

Prior to the lease being renewed in 1999, the Shire of West Arthur, at the then Department of Conservation and Land Management's (CALM) request, organised a public meeting in August 1998 at Moodiarrup. The meeting discussed issues concerning the Lake and formed a management plan for the future direction of Lake Towerrinning. The need for management had arisen because of the pressures that were being put on the Lake by skiers, sailboats, commercial businesses and other recreational users of the Lake. The management plan would have a dual purpose in that it would ensure that CALM's (now DPaW) interest of conservation in this reserve would be secured and it would give the Shire Council some direction in terms of what facilities and measures are required to satisfy all interested parties.

A committee was assembled to develop the Strategic Plan based on the issues raised at the public meeting and the first management plan was developed. This management plan has been reviewed a number of times over the years and this current review was undertaken in September 2016.

It is expected that after each update, and following public approval of the Plan, the Council will adopt the Plan as the official Strategic Management Plan for Lake Towerrinning. By doing this Council will have satisfied DPaW's requirements and can implement any directions that are listed in the Plan.

1.2.2 Living Lakes Project

In addition to the management plan, the Department of Regional Development (DRD) identified Lake Towerrinning as wetland worthy of inclusion in the Living Lakes Project in 2011. The aim of the Living Lakes Project was to identify three existing lake systems in the Wheatbelt that would be suitable for investing government funds for enhancement in order to create permanent and accessible water bodies (JDA Consultant Hydrologists, 2011). This project resulted in detailed environmental surveys being undertaken including flora, fauna (Bamford Consulting, 2012), Aboriginal heritage, soils and landforms.

Following the surveys a feasibility study was undertaken to identify engineering Enhancement Options that would "future proof" the Lake (JDA Consultant Hydrologists, 2012). This report contains comprehensive details on water quality within Lake Towerrinning. The engineering enhancement options outlined in this report were:

- Increase the capacity of the re-diversion structure through the addition of an extra culvert which would result in more rapid filling of the Lake during early winter, greater flushing of salt from the Lake and a longer period of high Lake levels (ET1).
- A drain from Capercup Nature Reserve to the Lake in order to manage salinity within the reserve (ET2).
- Dredging of the Lake to create an island (ET3)
- Groundwater replenishment to increase water flow into the Lake (ET4)
- Rehabilitation of the re-diversion structure to reshape the 12km drain and the possible upgrade of the culverts under the roads that cross the drain (ET5).
- Refine outlet from outlet swamp to the Arthur River which involved and excavated drain to connect the outlet swamp more efficiently to the Arthur River (ET6).
- Modified outlet structure from the Lake to the outlet swamp to allow higher Lake water levels to be maintained (ET7).

Of these options the rehabilitation of the re-diversion structure through reshaping of the 12km of drains and increasing water flow beneath the roads (ET5) was considered to be the option that met the project objectives of increasing the Lake hydro-period and improving water quality. The estimated cost of construction for this option was \$137,000¹ and ongoing maintenance was \$13,770.

The Capercup Nature reserve drain (ET2), whilst not meeting the Living Lakes project objectives was noted as an opportunity to prevent further degradation of Capercup Nature Reserve. It was estimated that this would cost \$24,300¹ to construct and annual maintenance would be in the order of \$2,430.

Neither option (ET5 or ET2) was pursued due to lack of funding from the state government.

Finally, a land use concept plan was developed by DRD for each of the lakes included in the Living Lakes Project including Lake Towerrinning (EPCAD Pty Ltd, 2016) with the aim of enhancing visitor experiences. Opportunities for enhancement identified in this report included:

- improved signage at the entrance of the Lake;
- reconstruction of the boat ramp to enable improved public access to the Lake;
- improvements to connectivity (in terms of revegetation) between the carpark and Lakeside Camping;
- installation of viewing towers;
- installation of a walking trail;
- development of land based recreation (e.g. BMX and mountain biking track);
- promotion of the Moodiarrup Sporting Complex to Lake visitors; and
- development of corporate-retreat facilities or lifestyle villas.

¹ This estimate was made in 2012.

At this stage, there is no funding available for development of any of the concepts developed by DRD for Lake Towerrinning from the Living Lakes Project. Note that these options were developed by DRD and are not necessarily reflective of the opinions and ideas of the local community or the Shire of West Arthur.

1.3 Legislation and relevant documents

Management of Lake Towerrinning needs to be undertaken in accordance with various Federal and state legislation including the following:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth)
- *Native Title Act 1993* (Commonwealth)
- *Aboriginal Heritage Act 1972* (State)
- *Bushfires Act 1954* (State)
- *Biosecurity and Agriculture Management Act 2007* (State)
- *Conservation and Land Management Act 1984* (State)
- *Emergency Management Act 2005* (State)
- *Fire and Emergency Services Act 1998* (State)
- *Heritage of Western Australia Act 1990* (State)
- *Land Administration Act 1997* (State)
- *Wildlife Conservation Act 1950* (State)
- *Planning and Development (Local Planning Scheme) Regulations 2015*.

In addition, other documents, guidelines and policies relevant to management of Lake Towerrinning include:

- Australia and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) Guidelines for Recreation Water Quality: Primary Contact
- Wetlands Conservation Policy of Western Australia 1997
- Wetlands Policy of the Commonwealth Government of Australia 1997
- National Health and Medical Research Council (NHMRC) 2008, Guidelines for Managing Risks in Recreational Water
- Department of Parks and Wildlife lease document signed by the Shire of West Arthur in 2009
- Bushfire Risk Management Planning – Guidelines for preparing a Bushfire Risk Management Plan (2015)
- Shire of West Arthur Bush Fire Risk Management Plan 2016
- Shire of West Arthur Local Emergency Management Arrangement (EMA) 2016

2.0 PHYSICAL ENVIRONMENT

2.1 Climate

Lake Towerrinning is located in an area with a Mediterranean climate (hot dry summers and wet winters). Rainfall at Duranillin (the closest rainfall station to the Lake) has decreased in recent years. An average of 561mm was recorded pre-1975 and this has reduced by 14% to 484mm post 1975 (Raper and van Wyk, 2009). More notably the winter rainfall (May-October) has fallen by 18%.

Climate change is expected to result in increases to average temperatures in all seasons and less rainfall in winter and spring months in the South west of Western Australia (<http://www.swrmstrategy.org.au/climate-change-in-the-region/sw-projections/> accessed November 2016) which may impact on water inflow into Lake Towerrinning.

2.2 Soils and Landscape

The Lake catchment landscape is characterised by gently undulating rises, low hills, narrow incised valleys and broad flats. Soils are largely duplex sandy gravels within the Darkan System (gently undulating to rolling rises and low hills, and narrow alluvial plains of the Blackwood, Arthur and Hillman Rivers) (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012a).

There has been some work done to identify issues associated with increasing salinity in the catchment and the Lake (Raper and van Wyk, 2009). In 2009, salinity was estimated to cover 12% of the Lake Towerrinning catchment area and was estimated to rise to 20-25% by 2028 if no further action was taken. At the time local land holders agreed to contain salinity to 15% of the catchment by 2028.

2.3 Hydrology

Lake depth varies with seasonal rainfall and as part of the Living Lakes Project a number of measurements were made and average depth was recorded as 2.55m in February 2012. The water temperature in February averaged 24.9°C and was fully mixed throughout the water column.

Water quality in Lake Towerrinning has been highly variable over the years. Prior to the construction of the re-diversion structure, salinity levels ranged from <2000-10,000 mS/m. Since the construction of the re-diversion salinity levels have stabilised and range from <1,000-2,500 mS/m even in low rainfall years such as 2015. Water salinity in the outlet swamps is higher with average salinity in the outlet swamp approaching sea water (JDA Consultant Hydrologists, 2012). The owner of the Caravan Park has indicated in the past

that the smell emanating from the decomposition of sediment and restriction of water flow through the swamps is an issue. An investigation was undertaken by the then Landcare Officer at the Shire of West Arthur in 2008 (Shire of West Arthur, 2008a). There has been no resolution to this issue to date.

Detailed water quality analysis of the Lake was undertaken as part of the Living Lakes Project (JDA Consultant Hydrologists, 2012), and only Selenium (Se) was identified as being elevated above guidelines and it was recommended that sampling be undertaken during winter months to determine levels of Se.

Algal levels were also identified as exceeding guidelines however no toxigenic cyanobacteria species were identified.

3.0 NATURAL ENVIRONMENT

3.1 Vegetation and Flora

Lake Towerrinning is located within the Beaufort Vegetation System which is dominated by marri (*Corymbia calophylla*) and wandoo (*Eucalyptus wandoo*) on undulating country and swamp yate (*E. occidentalis*) on clay valley floors (Beard, 1981). Large areas of land around Lake Towerrinning have been cleared in the past for agricultural purposes. The vegetation remaining around the Lake was mapped as part of the Living Lakes Project and ten major vegetation formations were identified (Figure 3) (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012a). These vegetation associations consist of:

- woodlands around the main water body of the Lake of either flooded gums (*E. rudis*), rock sheoak (*Allocasuarina huegeliana*), mixed flooded gum/wandoo (*E. wandoo*), acorn banksia (*B. prionotes*), or freshwater paper bark (*Melaleuca rhapsiophylla*) with two small pockets of marri (*C. calophylla*) woodland.
- woodlands around the back swamps of saltwater paperbark (*M. cuticularis*), saltwater sheoak (*Casuarina obesa*), freshwater paperbark (*M. rhapsiophylla*), acorn banksia (*B. prionotes*), or flood gum (*E. rudis*); and
- freshwater paper bark (*M. rhapsiophylla*), rock sheoak (*A. huegeliana*), samphires (*Tecticornia* spp.), flooded gum (*E. rudis*), wandoo (*E. wandoo*) around the diversion drain entering the Lake.

None of the vegetation associations mapped around Lake Towerrinning are considered to be Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC). Some of these communities may however be susceptible to dieback, in particular the *Banksia* communities.

A total of 50 species was recorded in the immediate vicinity of Lake Towerrinning during the flora surveys undertaken for the Living Lakes Project (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012b) and these are listed in Appendix 1. There are no known Declared Rare Flora (DRF) Threatened or Priority species that occur around the Lake.

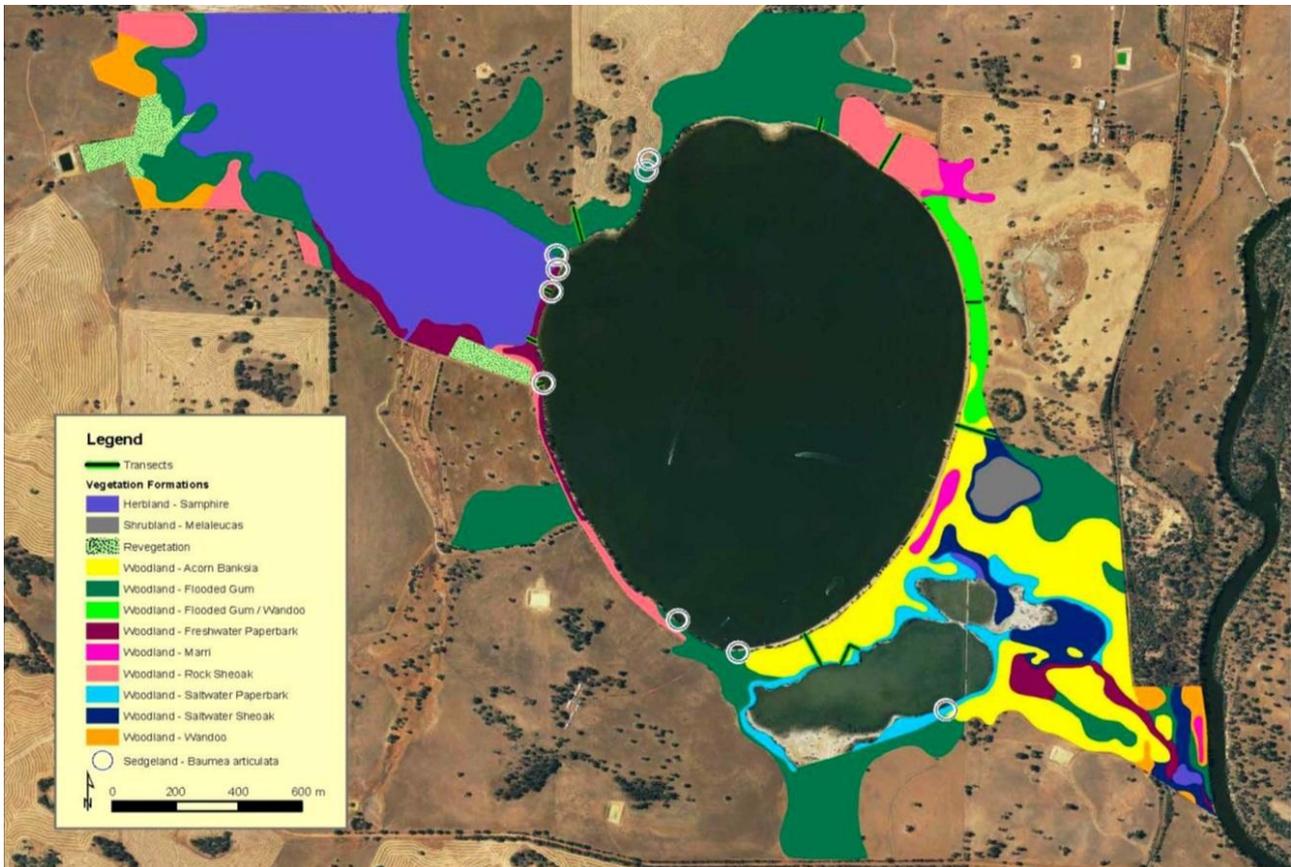


Figure 3: Vegetation associations around Lake Towerrinning (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012a)

3.2 Weeds

A number of introduced species were identified as occurring at Lake Towerrinning (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012b). *Asparagus asparagoides* (bridal creeper) was identified as occurring in the native vegetation adjacent to the fence line near private land at the northern end of the boat ramp car park (pers. obs.). Bridal creeper is listed as a Declared Pest in the *Biosecurity and Agriculture Management Act 2007* and is listed in the control category “C3 – Management” (i.e. organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism).

Wild turnip is also known to be present at Lake Towerrinning and is considered to be a weed of agricultural crops (Shire of West Arthur, pers. obs.).

Ruppia megacarp is a native submerged aquatic plant that occurs in Lake Towerrinning. On occasions it has become quite dense and become a problem for recreational users of the Lake. High levels of nutrients and lower water levels (increased light availability ensure perfect growing conditions for weeds. Such conditions were evident in 2015 when rainfall and runoff was particularly low.

3.3 Dieback

Phytophthora dieback refers to the introduced plant disease caused by *Phytophthora cinnamomi*. Phytophthora dieback spends its entire life in the soil and in plant tissue and causes root rot in susceptible plants, thereby limiting or stopping the uptake of water and nutrients. The pathogen is able to survive within plant roots during the dry soil conditions commonly experienced during the summer months. *Banksia prinoites* (a species that occurs around Lake Towerrinning is highly susceptible to dieback. There have been no surveys undertaken to determine if dieback is present at Lake Towerrinning.

3.4 Fauna

A complete fauna survey has never been undertaken at Lake Towerrinning however a list of 252 species that could potentially occur at the Lake has been compiled by Bamford Consulting (specialist fauna consultants) as part of the Living Lakes Project. One fish species, 14 frog species, 43 reptile species, 171 bird species and 23 mammal species could potentially occur in or around Lake Towerrinning (Bamford Consulting, 2012). Of these species, a total of 14 are listed as significant (either Threatened or Priority Fauna) and are considered to be wetland dependant or reliant on fringing vegetation of wetlands (Appendix 2). All 14 of these species are considered to be resident or regular visitors to Lake Towerrinning.

Lake Towerrinning provides regionally significant habitat for birds by (Bamford Consulting, 2012):

- being part of an Important Bird Area (IBA) identified by Birdlife Australia because it supports more than 1% of the global population of the Blue billed Duck (*Oxyura australis*);
- providing significant habitat for diving waterbirds in the form of extensive areas of deep water;
- supporting regionally significant numbers of waterfowl (in the top 15 of 1017 wetlands in the south western Australia)
- providing a breeding ground for 14 different bird species.

4.0 SOCIAL ENVIRONMENT

4.1 Aboriginal Heritage

All of Lake Towerrinning including the inlet and outlet swamps is a registered Aboriginal Site (ID 964). This site is listed as a Ceremonial and Mythological site. The Lake was used as a meeting place, for camping, a hunting place and water source (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012b).

DIA advise that (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012a); *Lake Towerrinning is a place where traditional Aboriginal ceremony was practised and is associated with a sacred narrative. The site is described as ‘winnaitch’ (dangerous) due to events which occurred during the Dreaming at this place. It is also known as a place where corroborees used to be practised. As such it has previously been determined to be a place to which section 5(b) of the Aboriginal Heritage Act 1972 (AHA) applies. DIA is unaware of any Aboriginal heritage surveys which have been undertaken over the area of the Lake and there may be currently unrecorded Aboriginal heritage values which relate to the area of the Lake and its immediate surrounds.*

Lake Towerrinning is located within the Gnaala Karla Booja native title claim area. As part of the Living Lakes Project, the consultants met with Gnaala Karla Booja Working Group and Named Applicants. The working group expressed a strong interest in including interpretative signage and for the cultural heritage of the Lake to be acknowledged (JDA Consultant Hydrologists, 2012)

There is evidence of a connection between the Aboriginal people and the Lake. There have been reports of finding camp sites, hunting grounds and burial sites. Last recorded evidence of aboriginal settlement was in 1938 where temporary camps were set up to hunt for local bush food (Shire of West Arthur, 2008b).

4.2 European heritage

Lake Towerrinning was discovered by Captain Bannister in 1832 and it was described as a “rushy lagoon”. By the 1940’s modern agricultural practices in surrounding areas had seen a reduction in natural vegetation causing water tables to rise. This resulted in an increase in surface area run-off and low lying areas became increasingly inundated with water, forming an almost permanent freshwater Lake. Local residents came to increasingly enjoy the opportunity for recreation in the area. By the 1960’s the Lake had become more saline causing a decline in the health of the Lake and the death of many of the reeds and rushes on the Lake’s edge. The locals proceeded to remove more of the reeds and rushes to construct a boat ramp in the area (Pers. comm. B. Smith nee Whitaker). This decline in Lake health resulted in the idea for a re-diversion Project which was finally implemented by the Lake

Towerrinning Catchment Group (formed by local landholders with technical support from the then named Department of Agriculture and Water Authority) in 1993. The group's approach and positive impact was the subject of a State Landcare Award in 1993 and a National Landcare Award in 1994. The Lake is now used for by the local community and others for water skiing and other recreational pursuits.

4.3 Infrastructure

A privately owned and operated caravan park, located on the southern side of the Lake, commenced operation in 1982. Other facilities at the Lake are owned and maintained by the Shire of West Arthur and include:

- a picnic area with barbeques, picnic tables a playground (installed in 2009) and public amenities (toilets, shower and change rooms) located in a terraced recreation area on the top eastern wall of the Lake
- two wooden jetties built around 1964-65 by Civil Defence (Pers. comm. B. Smith),
- permanent shade structures erected in 2009;
- car parking areas; and
- a boat ramp on the eastern side of the Lake.

DPaW have advised that any further developments should be submitted for its approval to ensure there are no negative impacts on the nature reserve or nature conservation values (Land Assessment Pty Ltd and Woodgis Environmental Consultants, 2012b).

3.0 STRATEGIC MANAGEMENT PLAN

The development of a strategic management plan will result in better management and decision making, identification of priorities, future planning and funding arrangements across a full range of issues that arise at Lake Towerrinning.

The Plan has been developed by establishing the issues at Lake Towerrinning through an extensive consultation process involving Council, community organisations, locals, government departments, and public meetings.

The Plan will be reviewed regularly and following the review there will be the opportunity for community input into the proposed management strategy.

A schedule for activities to be undertaken by the Shire of West Arthur is provided in Appendix 3.

The following definitions are provided to clarify the terms used in this plan.

- Goal: Is the overall aim of that component of the plan
- Objective: The outcomes that are to be achieved by the implementation of the plan
- Strategies: Means/methods by which the objective can be achieved
- How: Specific directives or tasks to be carried out to achieve the Objective
- When: Timing for these tasks or directives to be undertaken
- Who: The relevant person or authority required to undertake the tasks.

VISION, MISSION AND VALUES

In order to develop management goals, objectives and strategies a clear vision is required to ensure that these goals, objectives and strategies are aiming to create the environment that is expected by the local community. The vision, mission and values of the original committee established to manage Lake Towerrinning are listed below.

Vision

To maintain an aquatic environment, that is able to sustain a natural ecosystem as well as human recreational activity.

Mission

To create a sustainable recreational environment for use by everyone

Values

In determining this management plan the committee set itself certain considerations, here known as values, which are to be taken in account when assembling the plan.

Friendly
Family orientated
Consider the Environment
Low key
To community benefit

GOAL ONE: Conservation of the Lake Towerrinning environment

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
To conserve the natural vegetation and flora found within the Lake Towerrinning Nature Reserve.	Management of human movement through terraced areas on the eastern side of the Lake to prevent damage to natural vegetation.	<ul style="list-style-type: none"> Maintain pathways from terraced BBQ area through the vegetation on the lake banks to the swim area Develop defined pathways from boat parking area to local ski area (see map in Appendix 4). Investigate opportunities for funding for construction of pathways. 	<ul style="list-style-type: none"> Ongoing As soon as funding is available 	Shire
	Continued education of the public on minimising disturbance to Lake vegetation.	<ul style="list-style-type: none"> Signage to direct public to use pathways and avoid disturbance to vegetation Maintenance of pathways through the Lake banks (see above) Signage on prevention of spread of dieback (see below). 	As soon as funding is available	Shire
	Prevent the introduction or spread of dieback through the native vegetation surrounding the Lake.	<ul style="list-style-type: none"> Construction of defined pathways for the public to move through the vegetation Ensuring all machinery, equipment and footwear that will be entering areas of natural vegetation around the Lake is clean (through washing down and removal of all mud and soil. Avoiding soil movement during wet periods Use of certified dieback free construction materials (such as soil, mulch or plant material) 	<ul style="list-style-type: none"> As soon as funding is available Ongoing 	Shire
	Re-vegetation of Lake banks to stabilise banks, reduce weed invasions and ensure an aesthetically pleasing environment.	<ul style="list-style-type: none"> Plant seedlings (species selected should be selected from the suite of plants that naturally occur at the Lake) on the banks near the BBQ area and around the boat ramp. Implement weed control on the banks of the Lake (see below). 	When funding or personnel are available	Shire/local community

Goal one cont'd

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
	Prevent the introduction of weeds and minimise the spread of current weeds.	<ul style="list-style-type: none"> • Remove/spray bridal creeper plants found on the terraced areas. • Monitor Lake banks for weed invasions and control weeds as soon as noticed. • Ensure that all construction materials such as mulch or plant material is weed free. • Revegetate the bank areas with natural vegetation to minimise weed invasion. 	<ul style="list-style-type: none"> • Immediate • Ongoing 	Shire
To conserve fauna and fauna habitats found within the Lake Towerrinning Nature Reserve	Maintain a boat prohibited area (conservation area) to protect wildlife and some shoreline habitats.	<ul style="list-style-type: none"> • Maintain buoys that define the ski area within the Lake. • Maintain signage at the boat ramp and at the camping ground identifying the ski area. • Ensure all visitors to the camping area are aware that skiing is restricted in the area for conservation of fauna. 	Ongoing	<ul style="list-style-type: none"> • DoT • DoT • Lakeside camping
	Management of the Lake environment to ensure that habitats important for threatened fauna species that are resident or regularly present at Lake Towerrinning. The important habitat characteristics are salinity, shallows, open water, bare shoreline and fresh water sedges and seeps.	<ul style="list-style-type: none"> • Monitor salinity within the Lake to ensure that fringing vegetation is protected. • Monitor and maintain water levels (through the use and maintenance of the re-diversion structure) to ensure shallows and deep open water remains available for water birds. • Remove the boards at the Lake outlet to ensure that Lake levels are maintained and that water quality is maintained through regular flushing. 	<ul style="list-style-type: none"> • Bi-monthly • Regularly in summer particularly in low rainfall years • When levels reach the base level of the original Lake outlet (generally following winter rainfall) 	<ul style="list-style-type: none"> • Lakeside camping • Shire • Lakeside camping in consultation with other land owners.

Goal one cont'd

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
		<ul style="list-style-type: none"> • In the event of fauna injury contact local volunteer qualified wildlife carer (Robyn Quill). (In accordance with Lease Schedule Item 8, Section 4.2) • In the event of fauna death, the resultant animal will be disposed of appropriately. (In accordance with Lease Schedule Item 8, Section 4.2) 	<ul style="list-style-type: none"> • As required • As required 	<ul style="list-style-type: none"> • Shire • Shire
<p>To ensure that the Lake environment is protected from fire.</p>	<p>Prevent visitors from lighting fires</p>	<ul style="list-style-type: none"> • Maintain signage advising that there are no fires allowed in the public area of Lake Towerrinning. • Regular slashing of grasses and work on a grass eradication program on the public reserve through control burning procedures. • Regular assessment of fire fuel loads within the reserve, and implementation of appropriate control measures in accordance with relevant management policies and guidelines. • Maintain records of fire locations, intensity and similar are kept to assist with tracking changes within the reserve over time. • Notify DPaW in the event of a fire as per lease requirements. • Include procedures to be carried out in the event of a dangerous or uncontrolled fire and/or significant environmental impacts as per lease requirements in the Shire Bush Fire Management Plan. 	<ul style="list-style-type: none"> • Ongoing • Ongoing • Ongoing • As required • Annually 	<ul style="list-style-type: none"> • Shire • Community Emergency Services Manager • Shire • Shire

GOAL TWO: Maintain a high quality of facilities at Lake Towerrinning

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
To maintain the present infrastructure at a level that is considered to be of a high standard.	Maintain and restore jetties which are considered to be an iconic structure within the Shire.	<ul style="list-style-type: none"> Inspect jetties at the commencement of the summer season for repairs. Investigate funding opportunities for restoration and improvements of jetties. Document history of the jetties through the Municipal Heritage Inventory 	<ul style="list-style-type: none"> At commencement of the summer season each year Within the next 12 months At next Heritage Inventory review 	Shire
	Extend and maintain boat ramp and investigate improvements to boat ramp	<ul style="list-style-type: none"> High pressure clean algae off the boat ramp to reduce the risks associated with slips and trips for users. Investigate options for improving boat ramp (Recreational Boating Facilities Scheme (RBFS)) including extending it further into the Lake. Prepare a grant application for ramp extension that would be ready for submittal when Lake level is low and the work is able to be undertaken. 	<ul style="list-style-type: none"> On request or on an as required basis RBFS has regular grant rounds throughout the year As soon as possible 	Shire
	Maintain ablution facilities (including pressure pump), BBQ's, car park and playground.	<ul style="list-style-type: none"> Inspect and maintain facilities on a regular basis and in particular before major events held at the Lake such as the Australia Day breakfast. Weekly refuse removal with more service in peak season (October – March). Repair any broken playground equipment. 	Ongoing but more frequently during summer months	Shire
	Management of lawn area to ensure adequate grass coverage	Continue watering and maintenance programme as currently implement.	Ongoing	Shire
	Provide an attractive entrance to the Lake	Ensure trees are trimmed and weeds slashed at the entrance of the Lake.	At the commencement of the summer season.	Shire

Goal two cont'd

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
	Provide report to DPaw regarding state of current facilities.	Prepare a report outlining the following points to comply with Lease conditions: <ul style="list-style-type: none"> • State and repair of any man-made structures at or within the lease area (which includes boat ramp and jetties). • Maintenance and repairs undertaken by the Shire • The condition of the leased premises in respect to known hazards and safety situations • Water quality and suitability for human contact and aquatic activity. 	Annually as required by lease arrangements (i.e. seven days after the end of the lease year that is by the 7 th of October).	Shire
Continue to develop facilities at the Lake for the use of the general public.	Provide access to shore line for everyone within the community (including those with limited abilities).	Construct an all-access pathway from the top terrace to both the swimming and ski area.	When funding is available	Shire
	Provide additional shelters at the boat ramp	Investigate funding opportunities for construction of additional shade shelters at the boat ramp.	As soon as possible	Shire

GOAL THREE: Maintain watercraft regulation and safety on the waters of Lake Towerrinning

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
To ensure boat and user safety at Lake Towerrinning through the regulation of boat movements on the Lake.	Implement boat usage plan: <ul style="list-style-type: none"> • Ski in anticlockwise direction only. • Skiing permitted between sunrise and sunset only. • Skiing prohibited within 30m of shoreline except within designated take-off and landing areas. • Take-off and landing is restricted to the two designated areas only • Motorised Personal Water Craft (i.e. jet skis) are not permitted unless towing a skier. • In case of an emergency or incident dial 000 or contact the Shire on 9736 2222. 	<ul style="list-style-type: none"> • Include Boat usage plan and map on Shire Website • Prepare a brochure on Lake Towerrinning that is available on the Shire website and also in the Shire office that includes the Boat usage plan and other important information for visitors • Distribute boat usage plan to campers and other users of Lake Towerrinning • Direct complaints to the DoT using Marine Safety Form on the Departments website: http://www.transport.wa.gov.au/mediaFiles/marine/MAC_F_MarineSafetyComplaint.pdf 	<ul style="list-style-type: none"> • Ongoing • As soon as possible 	Shire/Lakeside camping
	Implement a safety education program to ensure all users are aware of safety issues at Lake Towerrinning.	<ul style="list-style-type: none"> • Update information and map on Shire website including the Boat Usage Plan as outlined above • Remind local boat users via Shire Facebook page at the beginning of the summer season of boating safety. • Information to be distributed to all campers regarding boat safety including boat usage plan. 	Ongoing but ensuring that the information is prominently available during summer months	Shire/Lakeside camping
	Ban on water craft when water levels are extremely low as per DoT recommendations of 1.6m depth.	<ul style="list-style-type: none"> • Measure water levels particularly during the summer months and during seasons of low rainfall. • Use signage at boat ramp and on the beach to close the Lake if required. • Communicate issues including closure of the Lake via the Shire website and Facebook page ensuring that public comments cannot be made on any posts. 	When required	DoT/Shire

GOAL FOUR: Maintain water quality and levels of Lake Towerrinning

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
Maintain the water levels to ensure that fauna habitats are protected, to prevent aquatic weed build up within the water body of the Lake and ensure that the Lake can continue to be used for recreational purposes.	Monitor the Cordering Creek re-diversion dam and associated re-diversion channels to ensure integrity of structures.	<ul style="list-style-type: none"> A visual inspection to be undertaken on a regular basis by the landowner. Should issues be identified, the landowner is required to contact the Shire for further inspections 	Following heavy rainfall events or on a regular basis (3 monthly)	Landowner/ Shire
	Maintain and repair Cordering creek re-diversion dam and drainage system so that it effectively drains fresh water into Lake Towerrinning.	<ul style="list-style-type: none"> Undertake a site visit with an engineer to determine the degree of damage inflicted by recent (January 2016) summer rainfall and identify repairs to be undertaken. Undertake repairs required Clean sediment or silt out of the re-diversion dam structure during summer months 	<ul style="list-style-type: none"> Prior to the next wet season As soon as possible 	Shire
	Investigate means of ensuring Shire has access to the re-diversion system in order to future-proof Lake Towerrinning.	<ul style="list-style-type: none"> Investigate possibility of creating an easement. Investigate possibility of a formal agreement with current land owner. 	As soon as possible	Shire
Maintain salinity levels in the Lake at <1200ms/m during winter months (Raper and van Wyk, 2009)	Monitor quality of water passing through the re-diversion system during the summer months.	<ul style="list-style-type: none"> Monitor the salinity annually at the road crossing on Scott Road (see Appendix 5). 	Once during winter	Shire
	Monitor salinity levels in the Lake.	<ul style="list-style-type: none"> Continue to monitor salinity at bimonthly intervals at 3m from the edge and at 30cm deep and provide results to the Shire annually. 	As soon as possible	Lakeside camping
Contain salinity to 15% of the Lake Towerrinning catchment in 2028 (Raper and van Wyk, 2009)	Encourage conservation measures further up the system before water enters Cordering creek.	<ul style="list-style-type: none"> Use the Blackwood Basin Group Landcare Strategy document currently being prepared to seek funding to assist local land holders to reduce salinity within the catchment. 	As soon as possible	Shire of West Arthur

Goal four cont'd

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
To develop a database of information in relation to water quality at Lake Towerrinning	Develop a database of all references and studies associated with Lake Towerrinning.	<ul style="list-style-type: none"> Maintain a list of references as part of this Management Plan and keep a copy of all references in the Shire office. 	Ongoing	Shire
	Document changes in Lake water levels and quality.	<ul style="list-style-type: none"> Continue to sample water quality and measure water levels in Lake Towerrinning. Including sampling: <ul style="list-style-type: none"> ✓ Phosphorus (beginning of summer) ✓ Hydrocarbons (end of summer) Collate a database of all information relating to water quality and levels over time. In the event of an incident or emergency dial 000 which will activate emergency services in accordance with the Local Emergency Management Arrangement or contact the Shire on 9736 2222. 	Ongoing	DPaW Shire
To manage the water inflow and outflow through the outlet swamp to minimise smell associated with this area.	Ensure that water from the outlet swamp is able to drain to the Arthur River to ensure regular flushing of the outlet swamp.	<ul style="list-style-type: none"> Examine road culverts located on public land to ensure that they are not blocked but silt or debris. Slash weeds that may block water flow through the area. 	<ul style="list-style-type: none"> Following heavy rainfall and regularly throughout the year. As required. 	Shire
	Ensure regular flushing of the outlet swamps.	<ul style="list-style-type: none"> Removal of boards from the outlet structure from Lake to outlet swamps. Investigate a method of removing boards safely and automatically (someone has to enter the water to remove boards at the moment). 	<ul style="list-style-type: none"> When levels reach the base level of the original Lake outlet (generally following winter rainfall) When funding is available 	<ul style="list-style-type: none"> Lakeside camping Shire

GOAL FIVE: Implement a programme for the management of all visitors to Lake Towerrinning.

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
To manage visitors and visitor movement at the public area of the Lake to ensure that the Lake environment is protected and that visitors have a positive experience.	Prevent camping on Shire owned land	<ul style="list-style-type: none"> Shire to maintain appropriate signage indicating that camping is not allowed Inform public of alternative arrangements at Lakeside Camping or Darkan Caravan Park. Information to be provided on Shire website. Collie Shire Ranger to visit on an ad hoc basis and enforce. 	Ongoing	Shire
	Provide the public with information relevant to the Lake and surrounds	<ul style="list-style-type: none"> Maintain information in the information bay on an as required basis. Pre-visit information available to the public on Shire website. Produce pamphlet style brochure that is available from the Shire and other relevant places which is to include the boat usage plan, and historical and environmental notes. Update sign business sign at the BBQ area as many businesses have now changed owners. 	<ul style="list-style-type: none"> Ongoing Update as soon as possible As soon as possible As soon as possible 	Shire
	Determine levels of visitor satisfaction with facilities at the Lake.	<ul style="list-style-type: none"> Obtain feedback from visitors in relation to facilities, future improvements etc. through the Shire website and Facebook page. 	Ongoing	Shire
	Minimise the impact on natural environment by visitors	<ul style="list-style-type: none"> Provision of rubbish bins and removal of refuse at least once a week and sometimes more during peak season Enforce no vehicles on beaches with signs 	Ongoing	Shire
To ensure that visitors are aware of risks associated with swimming or recreating in a natural water body	Provide public with information on water quality at Lake Towerrinning, particularly during low rainfall years.	<ul style="list-style-type: none"> Provide information on general signs around the public areas of the Lake Monitor levels of bacteria in accordance with Health Department Guidelines http://ww2.health.wa.gov.au/Articles/A_E/Bacterial-water-quality 	<ul style="list-style-type: none"> Ongoing Fortnightly Nov-May 	Shire

Goal Five cont'd

OBJECTIVE	STRATEGY	HOW	WHEN	WHO
		<ul style="list-style-type: none"> • Advise public if levels are considered dangerous through Shire website, signage and Shire Facebook page. • In the event of a medical emergency, dial 000 which will activate emergency services in accordance with the Local Emergency Management Arrangement. 	<ul style="list-style-type: none"> • As required • Annually 	

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APPENDIX 1 - FLORA LIST – LAKE TOWERRINNING

ASTERACEAE	<i>Angianthus preissianus</i>
ASTERACEAE	<i>Cotula coronopifolia</i>
ASTERACEAE	<i>Sonchus asper</i>
CARYOPHYLLACEAE	* <i>Cerastium comatum</i>
CARYOPHYLLACEAE	<i>Spergularia marina</i>
CASUARINACEAE	<i>Allocasuarina huegeliana</i>
CASUARINACEAE	<i>Casuarina obesa</i>
CHENOPODIACEAE	<i>Atriplex prostrata</i>
CRASSULACEAE	<i>Crassula natans</i>
CYPERACEAE	<i>Baumea articulata</i>
CYPERACEAE	<i>Baumea juncea</i>
CYPERACEAE	<i>Chorizandra enodis</i>
CYPERACEAE	<i>Ficinia nodosa</i>
CYPERACEAE	<i>Isolepis cernua</i> var. <i>setiformis</i>
CYPERACEAE	<i>Lepidosperma longitudinale</i>
CYPERACEAE	<i>Schoenus subfascicularis</i>
FABACEAE	<i>Eutaxia ?empetrifolia</i>
IRIDACEAE	<i>Romulea rosea</i>
JUNCACEAE	* <i>Juncus bufonius</i>
JUNCACEAE	<i>Juncus kraussii</i> subsp. <i>australiensis</i>
JUNCACEAE	<i>Juncus pallidus</i>
JUNCAGINACEAE	<i>Triglochin mucronata</i>
LOBELIACEAE	<i>Lobelia anceps</i>
LOBELIACEAE	<i>Monopsis debilis</i>
MIMOSACEAE	<i>Acacia acuminata</i>
MIMOSACEAE	<i>Acacia saligna</i> subsp. <i>lindleyi</i>
MYRTACEAE	<i>Corymbia calophylla</i>
MYRTACEAE	<i>Eucalyptus marginata</i>
MYRTACEAE	<i>Eucalyptus rudis</i>
MYRTACEAE	<i>Eucalyptus wandoo</i>
MYRTACEAE	<i>Eucalyptus wandoo</i> subsp. <i>orthostemon</i> x <i>wandoo</i>
MYRTACEAE	<i>Kunzea glabrescens</i>
MYRTACEAE	<i>Melaleuca cuticularis</i>
MYRTACEAE	<i>Melaleuca preissiana</i>
MYRTACEAE	<i>Melaleuca raphiophylla</i>
MYRTACEAE	<i>Melaleuca viminea</i> subsp. <i>viminea</i>
PHORMIACEAE	<i>Dianella revoluta</i>
POACEAE	* <i>Ehrharta longiflora</i>
POACEAE	* <i>Puccinellia ciliata</i>
POACEAE	<i>Bromus diandrus</i>

POACEAE	<i>Hordeum geniculatum</i>
POACEAE	<i>Lolium rigidum</i> complex.
POACEAE	<i>Paspalum vaginatum</i>
POACEAE	<i>Polypogon monspeliensis</i>
POTAMOGETONACEAE	<i>Ruppia megacarpa</i>
PRIMULACEAE	<i>Samolus junceus</i>
PROTEACEAE	<i>Banksia attenuata</i>
PROTEACEAE	<i>Banksia prionotes</i>
PROTEACEAE	<i>Banksia sessilis</i> var. <i>sessilis</i>
ZANNICHELLIACEAE	<i>Lepilaena cylindrocarpa</i>

*indicates weed or naturalised plant species

APPENDIX 2 - SIGNIFICANT FAUNA LIST

Extracted from Bamford Consulting (2012)

Species	Conservation significance*	Wetland Dependence	Distribution and Habitat	Status at Lake Towerrinning
Eastern Great Egret <i>Ardea modesta</i>	Migratory bird (EPBC Act) Schedule 3 (WA Act)	Aquatic	Fresh and occasionally brackish wetlands across much of Australia; highly mobile. Favours wetlands with extensive shallows. Forages on aquatic invertebrates and vertebrates.	Not recorded in large numbers but suitable habitat present.
Peregrine Falcon <i>Falco peregrinus</i>	Schedule 4 (WA Act)	Not dependant on wet land but hunts water fowl	Occurs across Australia, primarily in open woodland and especially where cliffs provide nesting sites.	Present at Lake Towerrinning and abundance of water birds may provide a major food source at times.
Hooded Plover <i>Thinornis rubricollis</i>	P4 (DEC)	Shorebird	Coastline and salt lakes of southern WA; another sub-species on coast of south-eastern Australia. Forages on invertebrates on the shoreline and sometimes shallows.	Not recorded at Lake Towerrinning and low salinity
Sandpipers (7 species)	Migratory (EPBC Act)	Shorebirds	Throughout Australia on marine tidal shorelines, estuaries and wetlands that provide extensive shallows. Forage on invertebrates on the shoreline and shallows.	Not recorded in large numbers but suitable habitat present.
Carnaby's Black Cockatoo <i>Calyptorhynchus latirostris</i>	Endangered (EPBC Act), Schedule 1 (WA Act)	Not dependant but may forage in fringing sheoaks	Forests and woodlands of the South-West, formerly widespread breeding visitor to woodlands n the Wheatbelt.	May utilise the 8ha of sheoak trees in outlet swamp. Likely to be a few nest hollows in Lake fringe.
Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksia naso</i>	Vulnerable (EPBC Act), Schedule 1 (WA Act)	Not dependant but may forage in fringing sheoaks	Forests of the lower South-West.	May utilise the 8ha of sheoak trees in outlet swamp. Likely to be a few nest hollows in Lake fringe.
Rufous Field wren (west) <i>Calamanthus campestris montanellus</i>	Priority 4 (DEC)	Not dependant, but may occur in samphire heaths	Heathlands; patchily distributed across much of southern Australia	Not recorded at Lake Towerrinning. If present likely to reside in samphire heaths and shrublands.

Species	Conservation significance*	Wetland Dependence	Distribution and Habitat	Status at Lake Towerrinning
Rakali <i>Hydromys chrysogaster</i>	Priority 4 (DEC)	Aquatic	Lakes, streams rivers and some coastlines throughout Australia.	Unlikely to in high abundance in immediate vicinity of Lake. More likely to occur east of Lake near the Arthur River where remnant vegetation is more extensive.

*Conservation significance definitions

Conservation Categories used for the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

Extinct: Taxa not definitely located in the wild during the past 50 years.

Extinct in the Wild: Taxa known to survive only in captivity.

Critically Endangered: Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered: Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable: Taxa facing a high risk of extinction in the wild in the medium-term future.

Near Threatened: Taxa that risk becoming Vulnerable in the wild.

Conservation Dependent: Taxa whose survival depends upon ongoing conservation measures.

Data Deficient (Insufficiently Known): Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

Least Concern: Taxa that are not threatened.

Schedules used in the *WA Wildlife Conservation Act 1950* (WA Act)

Schedule 1 Rare and Likely to become Extinct.

Schedule 2 Extinct.

Schedule 3 Migratory species listed under international treaties.

Schedule 4 Other Specially Protected Fauna Define Schedule 4, 3

Priority species listed by Department of Conservation and Environment (DEC)

Priority 1 Taxa with few, poorly known populations on threatened lands.

Priority 2 Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.

Priority 3 Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5 Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

APPENDIX 3- SHIRE OF WEST ARTHUR SCHEDULE OF ACTIVITIES

Immediate

- Undertake a site visit with an engineer to the re-diversion to determine what repairs are required.
- Undertake repairs required at re-diversion
- Update business signs in BBQ area – it is currently out of date

Ongoing

- Weed control
- Dieback management (through hygiene measures)
- Lawn maintenance
- Inspection of visitor facilities (BBQ, toilets, pumps etc)

Annually

- Include Lake Towerrinning in bush fire management plan in accordance with lease conditions
- Assess fuel loads to minimise fire hazards
- Report to DPaW regarding state of current man made facilities and any repairs undertaken and water quality and suitability for human contact. Such a report is required by October 7th of each year.
- Contact Graeme Peirce and get salinity measures for past year and include in Shire database

Prior to summer swim/ski season

- Ensure weeds are slashed for fire prevention where required
- Check signage is in good condition and still relevant
- Inspect jetties and complete report for DPaW
- Ensure entrance from the road to the Lake is tidy (slash weeds and remove branches if required)
- Include boat usage plan on Shire website and Facebook page to remind users about boating safety

Summer

- Monitor water levels
- Clean sediment or silt out of re-diversion structure if required
- Monitor Phosphorous levels in the lake water at the beginning of summer
- Monitor hydrocarbons in the lake water at the end of summer
- Examine road culverts on Darkan Road south to ensure they are not blocked by debris or weeds and to allow the swamps to drain effectively (particularly after heavy summer rainfall)
- Monitor water quality for suitability for human contact in accordance appropriate guidelines (including bacteria) on a fortnightly basis
- Remove rubbish and check facilities on a weekly basis

Winter

- Monitor salinity of water flowing from the re-diversion at Scott Road during winter months to ensure salinity is not above 1200mS/m.
- Sample Se levels to ensure they are within
- Examine road culverts on Darkan Road south to ensure they are not blocked by debris or weeds and to allow the swamps to drain effectively

When required

- Clean algae from boat ramp
- Update map on shire website

When funding available

- All access pathway
- Pathways from boat parking to ski take off area
- Signage to direct people to pathways and off vegetation to prevent vegetation degradation and spread of diseases such as dieback
- Replant lake banks with seedlings
- Look into risk management/possibility of mechanised boards for control of water flow out of the lake
- Investigate funding for restoration of jetties
- Repair boat ramp
- Additional shade shelters at the ski take off area
- Investigate funding for automation of board removal for managing water flow out of the lake.
- Prepare a brochure on lake Towerrinning including boat usage plan and other information for visitors
- Investigate possibility of creating an easement to protect redirection structure and allow shire access
- Seek funding for reducing salinity further upstream as part of Landcare within the Shire

APPENDIX 4 - PROPOSED PATHWAYS NEAR BOAT PARKING AREA



APPENDIX 5 - PROPOSED SALINITY SAMPLING SITE

