12 – Avoca Basin Terminal Lakes System and Creeklines

Regional Catchment Strategy Implementation Plan

Mallee Regional Catchment Strategy 2013-19

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Section 1 - Overview

Catchment Asset Significance

The Catchment Asset known as Avoca Basin Terminal Lakes System & Creeklines rises from the southern boundary of the Mallee region and extends into the Tyrrell Basin to surround Lake Tyrrell, Lake Wahpool and Lake Timboram. The asset boundary takes in the Tyrrell and Lalbert Creeks which are ephemeral, north flowing distributaries of the Avoca River. Tyrrell Creek terminates into Lake Tyrrell while Lalbert Creek terminates in Lake Timboram. Covering an area of approximately 160 square kilometres, Lake Tyrrell is Victoria's largest salt lake and the largest saline groundwater discharge lake in the Murray Darling Basin.

The margins and islands of the terminal lake systems are often surrounded by extensive plant communities of saltbush grasslands and samphire shrublands. The asset area as a whole contains many good examples of saline wetlands which support distinctive flora and fauna including Lobed Bluebush (Maireana lobiflora), Salt Paperbark (Melaleuca halmaturorum), Yakka Grass (Sporobolus caroli), Lined Earless Dragon (Tympanocryptis lineata) and Samphire Skink (Morethia adelaidensis).

The creek systems and their wetlands provide a number of important environmental use values within a largely cleared landscape. These include their use as wildlife corridors, areas of aesthetic beauty and as a source of community recreation opportunity. The creek lines incorporate a number of depleted, vulnerable and endangered ecological vegetation classes (EVCs) including Riverine chenopod woodland, Lignum swampy woodland, Plains grassland, Plains woodland and Semi-arid woodland. The area provides important habitat for endangered species such as the Carpet Python (Morelia spilota variegata) and Grey-Crowned Babbler (Pomatostomus temporalis temporalis).

Away from the defined creek lines, the asset area is one of the strongholds for Pine-Buloke Woodlands in Victoria. This remnant vegetation community once occupied a broad band of landscape across the southern half of the asset area. However, agricultural development fragmented the community and its remnants are now scattered across the area in a patchy network that is distributed along roadsides, small public reserves and numerous patches on private land. These remnant areas form part of the nationally listed ecological community, 'Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions' which is listed as 'endangered' under the Environment Protection and Biodiversity Conservation Act 1999.

The Catchment Asset area is widely developed for agriculture, predominantly cereal and oil seed cropping but also grazing of livestock for food and fibre. This area receives more rainfall than most other catchment areas and has heavier soil types that are better at retaining moisture than the more open soils to the north and west. As a result, this asset area is important to the dryland agricultural sector in the Mallee region and a significant contributor to the Mallee' agricultural production as a whole.

The asset area is home to some 2,600 people according to the 2011 Census. Sea Lake (616 people) in the north and Birchip (661 people) in the south are the predominate towns. The smaller towns of Nandaly in the north, Berriwillock and Culgoa in the centre and Watchem in the south support decentralised communities that account for the remaining population. The asset area contains eight functional Landcare groups which means that this is one of the best represented asset areas in the Mallee region when it comes to Landcare.

Numerous cultural heritage sites are located within this asset area. Identified Indigenous sites are concentrated around the lakes in the north of the asset area and around Birchip in the south of the asset area. There are also a number of heritage overlays in place to the north west of Lake Timboram that are associated with the areas agricultural history and development.

Catchment Asset Value

This section examines the relative values of the Regional Assets that lie within this Catchment Asset. It provides an overview of the asset analysis in order to inform prioritisation of management actions that

are intended to minimise the impact of the threatening processes upon Regional Assets and improve the status or quality of the Regional Assets within the Catchment Asset Area.

The asset value indicates the relative importance of the Regional Asset within the Catchment Asset Area. The valuation is determined from a range of indicators, many specific to each of the Regional Assets that describe the importance of the Asset relative to social, economic and environmental values.

Table 1 below provides a summary of the value of each of the Regional Assets in this Catchment Asset. Greater detail about each of the Regional Assets in this Catchment Asset can be found in Section 2 – Regional Assets in this Catchment Asset

Table 1: Value of Regional Assets in this Catchment Asset

Regional Asset	Value
Rivers	HIGH
Wetlands	VERY HIGH
Threatened Species and Communities	HIGH
Terrestrial Habitat	MEDIUM
Soils	HIGH
Agricultural Land	HIGH
Groundwater	NONE
Cultural Heritage	HIGH
Community Capacity	HIGH

A detailed explanation of how these values were defined and applied can be found in Appendix 1. The Value of Regional Assets within a Catchment Asset.

Threatening Processes

This section examines the threatening processes that may be impacting upon Regional Assets that lie within this Catchment Asset. It provides an overview of each of the threatening processes in order to inform prioritisation of management actions that are intended to minimise their impact upon Regional Assets and improve the status or quality of the Regional Assets within the Catchment Asset Area.

Table 2 below provides a summary of the threat level posed by each of the threatening processes that are active in this Catchment Asset. Greater detail about each of the threatening processes and their scope, scale and relative impact within this Catchment Asset can be found in *Section 3 – Threatening Processes in this Catchment Asset.*

Table 2: Threat Priority across this Catchment Asset

Threatening Process	Priority of Action
Land & Water Salinisation	HIGH
Invasive Plants	HIGH
Invasive Animals	HIGH
Altered Hydrological Regimes	HIGH
Soil Erosion	HIGH

Inappropriate Water Use Practices	MEDIUM
Recreational Pressures	MEDIUM
Land Use Change	HIGH
Direct off-site interactions	LOW
Misaligned community perceptions	MEDIUM
Inappropriate fire regimes	MEDIUM
Constrained regenerative capacity	HIGH

A detailed explanation of how these threat levels were defined and applied can be found in Appendix 2. Categorising Threatening Processes.

Management Plans

This Catchment Asset Area is subject to a diverse range of natural resource management instruments that are intended to protect, preserve and enhance the area's natural resources for the benefit of the Mallee region. These instruments can be either broad in their focus (covering many regional assets), focused on a particular area of interest (such as an individual Regional Asset) or tightly focused on a specific location or species. These management plans are prepared and owned by range of entities such as local government, statutory authorities, community groups and government departments at both State and Federal levels. Responsibility for their implementation can rest with a single entity or it may be divested across a broad range of organisations and groups. Some management plans are prepared to satisfy a legislative requirement while others are prepared to provide direction towards an organisational goal. Regardless of the reason and purpose of the management plan, they all have a common feature – they typically contain specific management direction or actions that are to be delivered through the implementation of the plan.

The identified existing management plans have been listed in Appendix 3. *Management Plans Relevant to this Catchment Asset*

Management Actions

Actions within the management plans in the table above are typically diverse in their wording, structure and complexity. However, they are broadly similar in terms of their intent. As a result, they can usually be easily classified into broad categories. Within each of these categories are a range of common management actions. Each of these common management actions can also be said to target specific threatening processes. These management categories, the management actions within each of them, their definitions and the targeted threatening processes are shown in Appendix 4. *Management Action Definitions*

The result of the classification process of the actions within Appendix 3. Management Plans Relevant to this Catchment Asset is contained in Appendix 5. Management Actions from Existing Management Plans. The classification table includes some detail about each action to support the classification. It is advised that if more information about a specific management action within a management plan is required then the original management plan should be consulted rather than relying specifically on the data in that classification table.

Priorities

This section examines the potential management action groups from the management plans relevant to this Catchment Asset Area that are listed in the Management Plans section above and summarised

Appendix 5. Management Actions from Existing Management Plans. The intent is to prioritise these potential management actions in terms of:

- The priorities of the regional asset within the catchment asset area (outlined in the Catchment Asset Value section above);
- section above);
- the priority to address a threatening process (outlined in the Threatening Processes section above);
- the capacity of the management action to address the threatening process; and
- the level of investment (in both of time and money) required to exercise that capacity.

The individual management actions from the plans listed in the Management Plans section were grouped and scored by consensus against agreed criteria and then each potential management action group within the Catchment Asset was assigned to a category that defines the prospective priority to the implementation. Further information regarding the definition and application of each of these categories can be found in Appendix *6. Prioritising Potential Management Actions*.

The findings of the analysis are summarised in Table 3 below. The detailed priority matrices from which the summary table is taken can be found in Appendix 7. Management Action Priorities.

Table 3: Summary of the Priority of Potential Management Actions

Management Action	Priority	Threatening Processes Addressed
Pest Plant Control	**High**	Invasive Plants; Constrained Regenerative Capacity
Pest Animal Control	**High**	Invasive Animals; Soil Erosion; Constrained Regenerative Capacity
Habitat Protection	**Medium**	Invasive Animals; Soil Erosion; Recreational Pressure; Land Use Change; Direct Off-Site Interactions; Constrained Regenerative Capacity
Habitat Restoration	**Medium**	Land & Water Salinisation; Soil Erosion; Recreational Pressure; Direct Off-Site Interactions; Constrained Regenerative Capacity
Revegetation	**Medium**	Land & Water Salinisation; Soil Erosion; Recreational Pressure; Direct Off-Site Interactions; Constrained Regenerative Capacity
Environmental Watering	**High**	Altered Hydrological Regimes; Constrained Regenerative Capacity
Soil Erosion Control	**High**	Soil Erosion
Threatened Species Interventions	**High**	Constrained Regenerative Capacity
Enhancing Land Management Regimes	**Medium**	Land & Water Salinisation; Soil Erosion; Inappropriate Water Use Practises; Land Use Change; Direct Off-Site Interactions
Supporting Human Capacity for NRM	**Medium**	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity

Supporting Institutional Capacity for NRM	**Medium**	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Supporting Social Capacity for NRM	**Medium**	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Institutional Planning for NRM	**Medium**	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Community Driven Planning for NRM	**Medium**	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Landholder Driven Planning for NRM	**Medium**	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Research to improve knowledge	**Medium**	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Asset condition monitoring and assessment	**Medium**	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity

Regional Delivery Partners

The individuals and organisations listed below have various roles to play within the Catchment Asset area in delivering and implementing the management actions described in previous sections that will in turn contribute to the aims and expected outcomes of the Mallee RCS. This list is not considered exhaustive and can be expected to change over time. More detail about the specific role and responsibilities of these entities with respect to the RCS can be found below.

- Catchment Management Authorities – Mallee (VIC), North Central CMA (VIC), Wimmera CMA (VIC)
- Department of Environment and Primary Industries (VIC)
- Parks Victoria
- Office of Aboriginal Affairs Victoria
- Buloke Shire Council
- Gannawarra Shire Council
- Swan Hill Rural City Council
- Landcare Groups – Berriwillock; Birchip; Culgoa; Lalbert; Manangatang; Nullawil; Nyah West; Sea Lake; Waitchie & Swan Hill West; Woomelang Lascelles.
- Private Land Managers
- Aboriginal Communities (Traditional Owners & Organisations)
- Birchip Cropping Group
- Regional Development Australia Loddon Mallee
- Research Bodies – Arthur Rylah Institute, Invasive Animals CRC
- VicRoads
- Birchip and District Fishing Club Inc
- VR Fish
- Waterwatch

Community NRM Groups

This section provides a summary of these stakeholder groups that are active within this Catchment Asset. This is not an exhaustive list and will be updated on a regular basis. Further detail on the community NRM groups can be found in Attachment 1 – Mallee NRM Interest Groups.

Landcare Groups

The Landcare movement has been active in the Mallee since the late 1980s, with 23 active Landcare groups operating today. From our first group, Millewa-Carwarp (established 1989), to the newest, Cabarita (established 2012), Landcare has been instrumental in harnessing and promoting the interests of local communities in natural resource management.

Many groups initially formed due to the issues of rabbits and weeds. Salinity, soil conservation and biodiversity issues have evolved and continued to propel the Landcare movement into the 21st century. Our Landcare groups are keen to ensure that the legacy of Landcare continues and actively support a range of Junior Landcare Groups activities across the region.

Eastern Landcare Consortium

- Manangatang
- Nyah West
- Sea Lake
- Swan Hill West
- Waitchie

South Eastern Landcare Consortium

- Berriwillock
- Birchip
- Culgoa
- Lalbert
- Nullawil
- Ultima

Western Landcare Consortium

- Woomelang-Lascelles

Other Groups

There are a broad range of community, industry, indigenous and specialist groups that have a role to play in NRM within this catchment asset. The tables in this section provide a listing of the groups currently known to be active within the asset area.

Traditional owner groups provide opportunities for our local indigenous communities to have input into how the regions landscapes are managed; and to enhance regional awareness of the cultural values inherent within these landscapes.

A wide range of special interest groups provide the means for individuals to become engaged in activities and programs which reflect their particular concerns. They also provide the region with a vital source of knowledge and understanding on specific issues.

The region's industry based groups have an important role in developing and promoting best practice for competitive and sustainable agricultural sectors.

Advisory groups to statutory bodies like CMA's and water authorities are important forums for both the community and the authorities involved. These groups provide management advice and community feedback to the convening authority while at the same time communicating with the wider community about the activities of the advisory group and the organisation in general.

Registered Aboriginal Parties

- Barengi Gadjin Land Council

Special Interest and Recreational Groups

- Mid-Murray Field Naturalists
- Birchip & District Fishing Club
- Tchum Lake South Committee of Management
- Advance Sea Lake Inc

Industry Groups

- Victorian Farmers Federation (VFF)
- Victoria No-Till Farmers Association (VNTFA)
- National Gypsum Miners Association (NGMA)
- Birchip Cropping Group Inc (BCG)

Advisory Groups

- Aboriginal Reference Group (ARG)
- Mallee CMA Land and Water Advisory Committee (LWAC)
- Mallee CMA Technical Advisory Committees (TACs)
- GWMWater Customer Committees
- Goulburn-Murray Water Services Committees (WSCs)
- GWMWater Wetland Evaluation Team

Section 2 – Regional Assets in this Catchment Asset

Regional Assets in the Mallee NRM region were defined and applied in accordance with guidelines provided by DSE to support the Victorian Catchment Management Council RCS Guidelines. Each of the following sub-sections provides a background to these Regional Assets and the available information about their significance within this Catchment Asset. This follows on to an assessment of the relative value of the Regional Asset based on the criteria contained in Appendix 1. *The Value of Regional Assets within a Catchment Asset*

Rivers

The catchment asset is dominated by the Tyrrell and Lalbert Creeks that are north flowing ephemeral distributaries of the Avoca River (which lays outside the regional boundary). Combined, they make up approximately 110 kilometres of creek frontage within the asset area. Both only run after sufficient local rain or as a result of flooding in the Avoca system itself. Tyrrell Creek terminates in Lake Tyrrell while Lalbert Creek terminates in Lake Timboram. Index of Stream Condition (ISC) analysis in 2004 found that while there was insufficient data to give a complete ISC score, the reaches in both creeks had high scores for their physical form and the quality of the riparian zone indicating that, for these important factors at least, the creeks were good condition.

The channel of both Tyrrell and Lalbert Creeks are part of a much more substantial listing in the Directory of Important Wetlands. Their inclusion reflects their ephemeral nature and their intimate connection to a much greater floodplain and wetland system. Due to its nature and significance this listing is discussed in greater detail in the Wetlands Asset section.

The Mallee Waterway Strategy (2014-22) identifies priority reaches for future management using an Asset Based Approach; facilitating targeted planning and implementation processes to deliver greatest social, cultural and economic returns on our efforts. Each River asset occurring within this Catchment Asset is ascribed a priority of ‘high’, ‘medium’, ‘low’, or ‘additional’ under this framework.

Based on the available data concerning their extent, quality and policy significance within this landscape, the Rivers within this Catchment Asset are considered to be of **high** value.

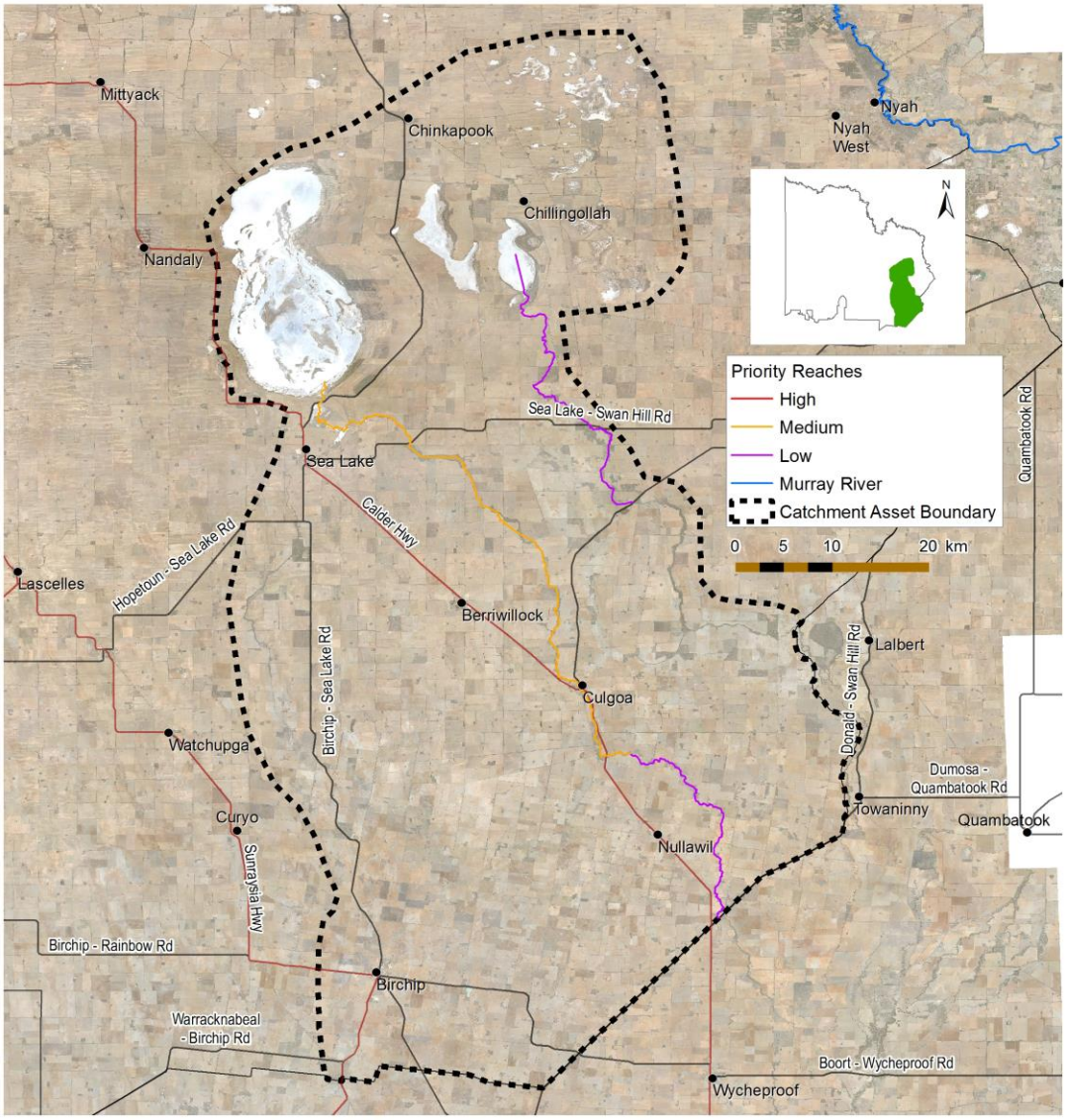

Figure 1: River Reaches

Wetlands

This catchment asset contains a significant number of wetland systems, most of which are typically associated with either Tyrrell Creek or Lalbert Creek and their floodplains.

The most notable of these is Lake Tyrrell which, at nearly 21,000 hectares, the largest saline groundwater discharge lake in the Murray Basin and part of a much larger boinka system that incorporates Lake Wahpool and Lake Timboram to the east. Lake Tyrrell is listed in the national Directory of Important Wetlands for its geomorphological significance as an ancient salina system dating back some 120,000 years and for the extensive plant communities of saltbush grasslands and samphire shrublands on its margins and islands that supports a range of rare and threaten flora and fauna species. A number of bird species named in migratory bird agreements (JAMBA, CAMBA and ROKAMBA) have been observed on and around Lake Tyrrell.

Both the channel and the floodplain systems of Tyrrell and Lalbert Creeks are listed in the Directory of Important Wetlands. Their listing is included with the Bulunguluke Wetlands and Lake Lalbert which are both part of these systems though they lie outside the regional boundary. Their inclusion is driven by their ecological significance as relatively intact, functional and diverse wetland systems. The portion of the listed system within the boundary of this catchment asset includes extensive Black Box

woodlands and has been identified as home to a range of rare and threatened flora and fauna species. The inclusion of the Tyrrell and Lalbert Creek channels does create an overlap with the River asset described previously. However, given the scale and type of the listing, it has been primarily considered as a wetland asset for the purposes of this paper.

In the west of the catchment asset area is a sequence of small wetlands and wetland complexes that stretches in a discontinuous band northwards from Birchip to Sea Lake. These wetlands include Lake Tchum North & South, Lake Marlbed and Green Lake plus many other unnamed locations in between. These naturally formed, ephemeral basins are low points in the landscape that capture and hold local rainfall and can remain inundated for some time after intensive rainfall. In more recent times, a number have been part of the channelled water supply system that supported agricultural communities. As such, they were more frequently full and formed an important social and recreational resource to the community as well as being of some ecological significance to the local area.

The Mallee Waterway Strategy (2014-22) identifies priority wetlands for future management using an Asset Based Approach; facilitating targeted planning and implementation processes to deliver greatest social, cultural and economic returns on our efforts. Each Wetland asset occurring within this Catchment Asset is ascribed a priority of 'high', 'medium', 'low', or 'additional' under this framework.

Based on the available data concerning their extent, quality and policy significance within this landscape, the Wetlands within this Catchment Asset are considered to be of **very high** value.

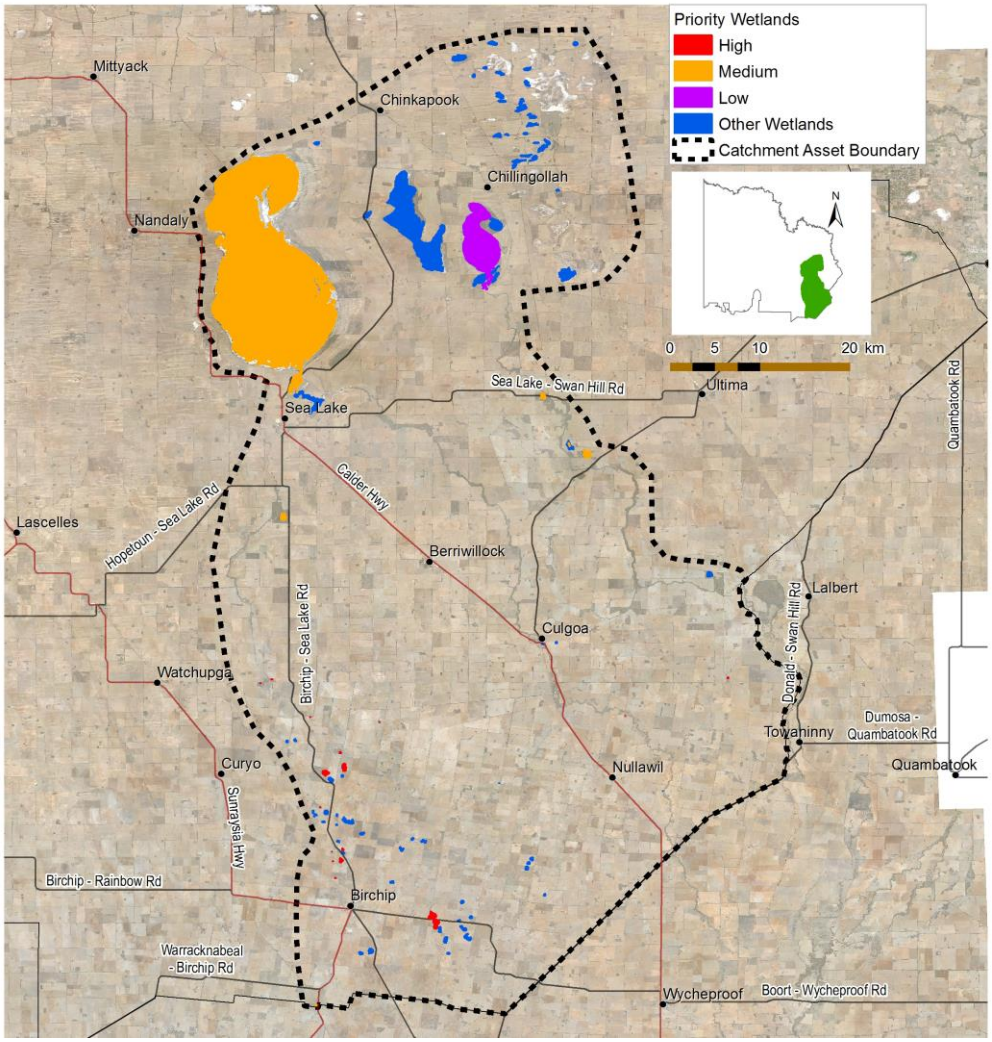

Figure 2: Wetlands

Threatened Species and Communities

A significant range of flora and fauna species that are listed in Federal and State instruments have been observed and recorded within the area of this catchment asset over time. These species are listed in the tables that follow along with their current status as described in the listing instrument. The listing instruments are: Environmental Protection and Biodiversity Conservation (EPBC) Act 1999; Flora and Fauna Guarantee (FFG) Act 1998 and the Victorian Threatened Species Advisory Lists issued by the Department of Environment and Primary Industries (DEPI) (Flora: 2005, Fauna: 2013). The species names included in the following tables (Table 4 & Table 5) may not reflect the full range of threatened flora and fauna species that may inhabit the catchment area. Rather they reflect only species whose presence has been observed and recorded by suitably qualified observers since 1980.

The most notable of these recorded threatened species include the Regent Parrot (Polytelis anthopeplus monarchoides); Plains Wanderer (Pedionomus torquatus); Chariot Wheels (Maireana cheelii); and the Winged Peppercress (Lepidium pseudopapillosum). All of these species are listed in the Federal EPBC Act as 'vulnerable'.

This Catchment Asset is one of a number in the Mallee Region that contain remnant areas of the nationally listed ecological community, 'Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions'. This ecological community is listed as 'endangered' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The Catchment Asset area may also be home to remnant patches of the nationally listed ecological community, 'Natural Grasslands of the Murray Valley Plains'. This ecological community is listed as 'critically endangered' under the EPBC Act. The actual existence of this newly listed ecological community within the Catchment Asset area is not yet confirmed. However, it is most strongly associated with the Plains Grassland EVC which is known to occur within this Catchment Asset.

Both of these ecological communities are more likely to be located in the southern half of this Catchment Asset area.

The Mallee Bird Community is listed under the Victorian Flora and Fauna Guarantee (FFG) Act and so qualifies as a threatened ecological community in this context. However, only a small number of the species in this community have been recorded in this Catchment Asset since 1980 and even these records are small.

Based on the available data concerning their extent, quality and policy significance within this landscape, the Threatened Species and Communities within this Catchment Asset are considered to be of high value.

Table 4: Threatened Flora Species observed since 1980

Scientific Name	Common Name	EPBC	FFG	DSE Advisory List
Acacia melvillei	Yarran			Vulnerable
Allocasuarina luehmannii	Buloke		Listed	
Alternanthera nodiflora	Common Joyweed			Poorly Known
Amaranthus grandiflorus	Large-flower Amaranth			Vulnerable
Amyema linophylla subsp. orientale	Buloke Mistletoe			Vulnerable
Angianthus brachypappus	Spreading Angianthus			Vulnerable
Atriplex acutibractea subsp. karoniensis	Pointed Saltbush			Rare
Atriplex papillata	Coral Saltbush			Rare

Atriplex vesicaria subsp. macrocystidia	Bladder Saltbush			Poorly Known
Austrostipa nullanulla	Club Spear-grass	Vulnerable		Vulnerable
Austrostipa puberula	Fine-hairy Spear-grass			Rare
Austrostipa trichophylla	Spear-grass			Rare
Austrostipa tuckeri	Tucker's Spear-grass			Extinct
Brachyscome debilis s.s.	Weak Daisy			Vulnerable
Brachyscome exilis	Finger-leaved Daisy			Rare
Bromus arenarius	Sand Brome			Rare
Calandrinia volubilis	Twining Purslane			Rare
Centipeda thespidioides s.l.	Desert Sneezeweed			Rare
Chenopodium desertorum subsp. desertorum	Frosted Goosefoot			Rare
Chenopodium desertorum subsp. virosum	Frosted Goosefoot			Poorly Known
Convolvulus angustissimus subsp. omnigracilis	Slender Bindweed			Poorly Known
Dianella porracea	Riverine Flax-lily			Vulnerable
Dissocarpus biflorus var. biflorus	Twin-flower Saltbush			Rare
Elachanthus glaber	Smooth Elachanth			Rare
Eleocharis pallens	Pale Spike-sedge			Poorly Known
Eragrostis australasica	Cane Grass			Vulnerable
Eragrostis setifolia	Bristly Love-grass			Vulnerable
Eremophila maculata subsp. maculata	Spotted Emu-bush			Rare
Eryngium paludosum	Long Eryngium			Vulnerable
Frankenia crispa	Hoary Sea-heath			Rare
Frankenia foliosa	Leafy Sea-heath			Rare
Frankenia serpyllifolia	Bristly Sea-heath			Rare
Frankenia sessilis	Small-leaf Sea-heath			Rare
Glossostigma cleistanthum	Small-flower Mud-mat			Rare
Haegiela tatei	Small Nut-heads			Vulnerable
Haloragis glauca f. glauca	Bluish Raspwort			Poorly Known
Kippistia suaedifolia	Fleshy Minuria			Vulnerable
Lepidium pseudopapillosum	Erect Peppercress	Vulnerable	Listed	Endangered
Maireana aphylla	Leafless Bluebush			Poorly Known
Maireana cheelii	Chariot Wheels	Vulnerable	Listed	Vulnerable
Maireana georgei	Slit-wing Bluebush			Vulnerable

Maireana lobiflora	Lobed Bluebush			Vulnerable
Maireana oppositifolia	Heathy Bluebush			Rare
Maireana sedifolia	Pearl Bluebush			Rare
Melaleuca halmaturorum	Salt Paperbark		Listed	Vulnerable
Mimulus prostratus	Small Monkey-flower			Rare
Minuria cunninghamii	Bush Minuria			Rare
Minuria integerrima	Smooth Minuria			Rare
Muehlenbeckia horrida subsp. horrida	Spiny Lignum			Rare
Poa fax	Scaly Poa			Rare
Podolepis canescens	Grey Podolepis			Rare
Podolepis muelleri	Small Podolepis		Listed	Endangered
Ptilotus erubescens	Hairy Tails		Listed	
Ranunculus pumilio var. politus	Ferny Small-flower Buttercup			Poorly Known
Ranunculus sessiliflorus var. pilulifer	Annual Buttercup			Poorly Known
Rhodanthe polygalifolia	Milkwort Sunray			Rare
Rhyncharrhena linearis	Purple Pentatrope			Vulnerable
Sarcozona praecox	Sarcozona			Rare
Sclerolaena patenticuspis	Spear-fruit Copperburr			Vulnerable
Sclerolaena uniflora	Two-spined Copperburr			Rare
Sida fibulifera	Pin Sida			Vulnerable
Sida intricata	Twiggy Sida			Vulnerable
Sporobolus caroli	Yakka Grass			Rare
Swainsona murrayana	Slender Darling-pea	Vulnerable	Listed	Endangered
Swainsona stipularis	Orange Darling-pea			Endangered
Swainsona swainsonioides	Downy Swainson-pea		Listed	Endangered
Tecticornia lylei	Wiry Glasswort			Rare
Tecticornia moniliformis	Ruby Glasswort			Rare
Tecticornia nitida	Shining Glasswort			Rare
Tecticornia pterygosperma subsp. pterygosperma	Whiteseed Glasswort			Rare
Templetonia egena	Round Templetonia			Vulnerable
Teucrium albicaule	Scurfy Germander			Poorly Known
Teucrium sessiliflorum	Camel Bush			Poorly Known
Tragus australianus	Small Burr-grass			Rare
Trichanthodium skirrophorum	Woolly Yellow-heads			Vulnerable

Triraphis mollis	Needle Grass			Rare
Vittadinia condyloides	Club-hair New Holland Daisy			Rare
Vittadinia cuneata var. hirsuta	Fuzzy New Holland Daisy			Rare
Vittadinia pterochaeta	Winged New Holland Daisy			Vulnerable
Zygophyllum simile	White Twin-leaf			Rare

Table 5: Threatened Fauna Species observed since 1980

Scientific Name	Common Name	EPBC	FFG	DSE Advisory List
Anas rhynchotis	Australasian Shoveler			Vulnerable
Ardea intermedia	Intermediate Egret		Listed	Endangered
Ardea modesta	Eastern Great Egret		Listed	Vulnerable
Aythya australis	Hardhead			Vulnerable
Biziura lobata	Musk Duck			Vulnerable
Burhinus grallarius	Bush Stone-curlew		Listed	Endangered
Calamanthus campestris	Rufous Fieldwren			Near Threatened
Chlidonias hybridus javanicus	Whiskered Tern			Near Threatened
Chrysococcyx osculans	Black-eared Cuckoo			Near Threatened
Cinclosoma castanotus	Chestnut Quail-thrush			Near Threatened
Circus assimilis	Spotted Harrier			Near Threatened
Climacteris picumnus victoriae	Brown Treecreeper (south-eastern ssp.)			Near Threatened
Dromaius novaehollandiae	Emu			Near Threatened
Falco subniger	Black Falcon			Vulnerable
Geopelia cuneata	Diamond Dove		Listed	Near Threatened
Grus rubicunda	Brolga		Listed	Vulnerable
Hirundapus caudacutus	White-throated Needletail			Vulnerable
Ixobrychus minutus dubius	Little Bittern		Listed	Endangered
Leipoa ocellata	Malleefowl	Vulnerable	Listed	Endangered
Lichenostomus cratitius	Purple-gaped Honeyeater			Vulnerable
Lophocroa leadbeateri	Major Mitchell's Cockatoo		Listed	Vulnerable
Melanodryas cucullata cucullata	Hooded Robin		Listed	Near Threatened
Morelia spilota metcalfei	Carpet Python		Listed	Endangered

Neophema elegans	Elegant Parrot			Vulnerable
Nycticorax caledonicus hillii	Nankeen Night Heron			Near Threatened
Oxyura australis	Blue-billed Duck		Listed	Endangered
Pedionomus torquatus	Plains-wanderer	Vulnerable	Listed	Critically Endangered
Phalacrocorax varius	Pied Cormorant			Near Threatened
Platalea regia	Royal Spoonbill			Near Threatened
Polytelis anthopeplus monarchoides	Regent Parrot	Vulnerable	Listed	Vulnerable
Pomatostomus temporalis temporalis	Grey-crowned Babbler		Listed	Endangered
Porzana pusilla palustris	Baillon's Crake		Listed	Vulnerable
Sminthopsis crassicaudata	Fat-tailed Dunnart			Near Threatened
Stagonopleura guttata	Diamond Firetail		Listed	Near Threatened
Stiltia isabella	Australian Pratincole			Near Threatened
Todiramphus pyrropygia pyrropygia	Red-backed Kingfisher			Near Threatened
Tringa nebularia	Common Greenshank			Vulnerable
Turnix velox	Little Button-quail			Near Threatened
Tympanocryptis lineata	Lined Earless Dragon		Listed	Critically Endangered

Table 6: Mallee Bird Community as listed under FFG Act (including individual species listing and number of records since 1980 from Victorian Biodiversity Atlas)

Species Name	Common Name	Records since 1980	EPBC	FFG	DSE Advisory List
Leipoa ocellata	Malleefowl	1	Vulnerable	Listed	Endangered
Pachycephala rufogularis	Red-lored Whistler	No Records	Vulnerable	Listed	Endangered
Pachycephala inornata	Gilbert's Whistler	No Records			
Cinclosoma castanotus castanotus	Chestnut Quail-thrush	1			Near Threatened
Drymodes brunneopygia	Southern Scrub-robin	No Records			
Hylacola cautus cautus	Shy Heathwren	1			
Amytornis striatus striatus	Striated Grasswren	No Records			Near Threatened
Stipiturus mallee	Mallee Emu-wren	No Records	Endangered	Listed	Endangered
Manorina melanotis	Black-eared Miner	No Records	Endangered	Listed	Critically Endangered

Terrestrial Habitat

Much of the Avoca Basin Terminal Lakes System & Creeklines Catchment Asset area has been developed for dryland agriculture with just 16% of the Catchment Asset area remaining covered by native vegetation. This amounts to a little over 60,000 hectares. This remnant terrestrial habitat is mostly held within the network of naturally saline basins in the northern end of the asset area. The remainder is mostly confined to narrow roadside reserves and small patches on both public and private land in the south. The catchment asset lies mostly within the Victorian portion of the Interim Biogeographic Regionalisation for Australia (IBRA) sub-region known as the Murray Mallee. A small area in the south western corner around Birchip lies within the Wimmera sub-region which extends further southward. Both sub-regions are part of the larger Murray Darling Depression IBRA bioregion which extends across north western Victoria, the riverlands of South Australia and most of south western New South Wales.

The northern and mid-western portions of the asset area are home to remnant areas of Samphire Shrubland (Least Concern) around the saline lake systems and Woorinen Mallee and Semi-arid Woodland (both Vulnerable) on the higher ground. The map demonstrates that the majority of the endangered EVC's are to be found in the southern portion of the asset area. Most notable of these are the Ridged Plains Mallee, Plains Grassland and Plains Savannah. These EVCs are all considered to be 'endangered' in terms of their bioregional conservation status. They are also notable as these same EVCs have been identified as being components of two ecological communities listed under the national EPBC Act: 'Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions' (listed as 'endangered'); and the 'Natural Grasslands of the Murray Valley Plains' (listed as 'critically endangered').

Table 7: Area of Ecological Vegetation Classes and their Bioregional Conservation Status

Ecological Vegetation Class	IBRA Subregion	Conservation Status	Area (hectares)
Cane Grass Wetland	Wimmera	Vulnerable	24.16
Chenopod Mallee	Murray Mallee	Vulnerable	696.86
Lake Bed Herbland	Murray Mallee	Depleted	25.55
Lignum Swampy Woodland	Murray Mallee	Vulnerable	2,563.18
	Wimmera		94.35
Low Chenopod Shrubland	Murray Mallee	Depleted	3,212.6
Low Rises Woodland	Murray Mallee	Endangered	666.89
	Wimmera		184.27
Parilla Mallee	Murray Mallee	Endangered	53.91
Plains Grassland	Murray Mallee	Endangered	168.65
	Wimmera		94.10
Plains Savannah	Murray Mallee	Endangered	2,800.51
	Wimmera		1,639.60
Plains Woodland	Murray Mallee	Endangered	212.08
	Wimmera		91.01
Ridged Plains Mallee	Murray Mallee	Endangered	10,274.32
	Wimmera		547.44

Riverine Chenopod Woodland	Murray Mallee	Depleted	3,544.71
Saline Lake Aggregate	Murray Mallee	Least Concern	16,848.88
Samphire Shrubland	Murray Mallee	Least Concern	3,477.74
Samphire Shrubland/Saline Lake Mosaic	Murray Mallee	Least Concern	2,162.25
Semi-arid Chenopod Woodland	Murray Mallee	Vulnerable	1,847.65
Semi-arid Woodland	Murray Mallee	Vulnerable	3,782.32
Woorinen Mallee	Murray Mallee	Vulnerable	5,033.60
	Wimmera		113.52
Woorinen Sands Mallee	Murray Mallee	Depleted	66.94

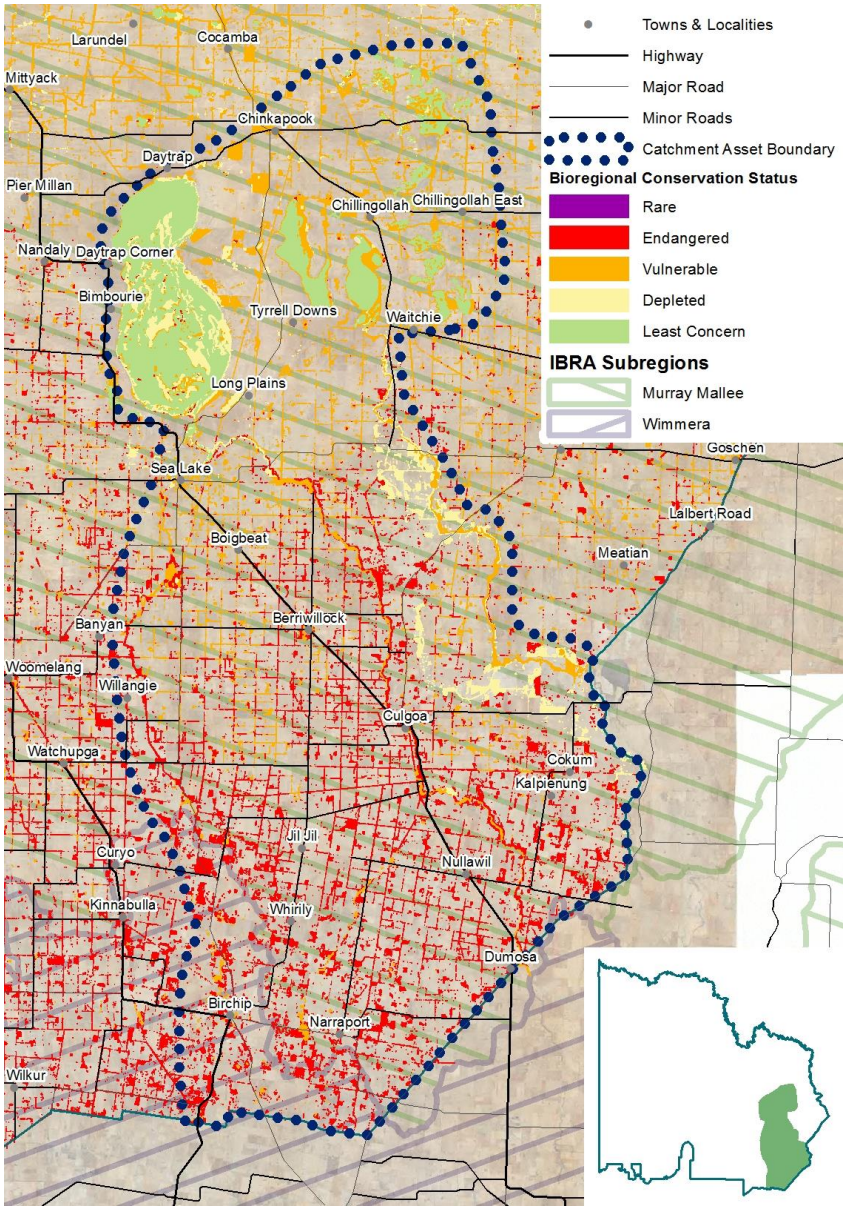

Figure 3: Bioregional conservation status of EVCs and IBRA sub-regions

DEPI's NaturePrint model is a landscape scale spatial planning mechanism that provides an analysis of biodiversity values across Victoria and combines the available information about biodiversity values, threatening processes and ecosystem function. It provides an analysis of the ecological value of a portion of landscape compared across the entire Victorian landscape. It is based on the following measures:

- Mathematical models of species distributions and habitats;
- The condition of these habitats;
- Pathways for connectivity across landscapes;
- Connectivity potential and recoverability;
- Threats to species persistence.

For background information about the model, its output and its significance, refer to: http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/natureprint.

The NaturePrint model considers that over 22% of this Catchment Asset contains terrestrial habitat that is of the highest ecological value to Victoria and therefore high priority for protection and conservation.

Based on the available data concerning their extent, quality and policy significance within this landscape, the Terrestrial Habitat within this Catchment Asset is considered to be of **medium** value.

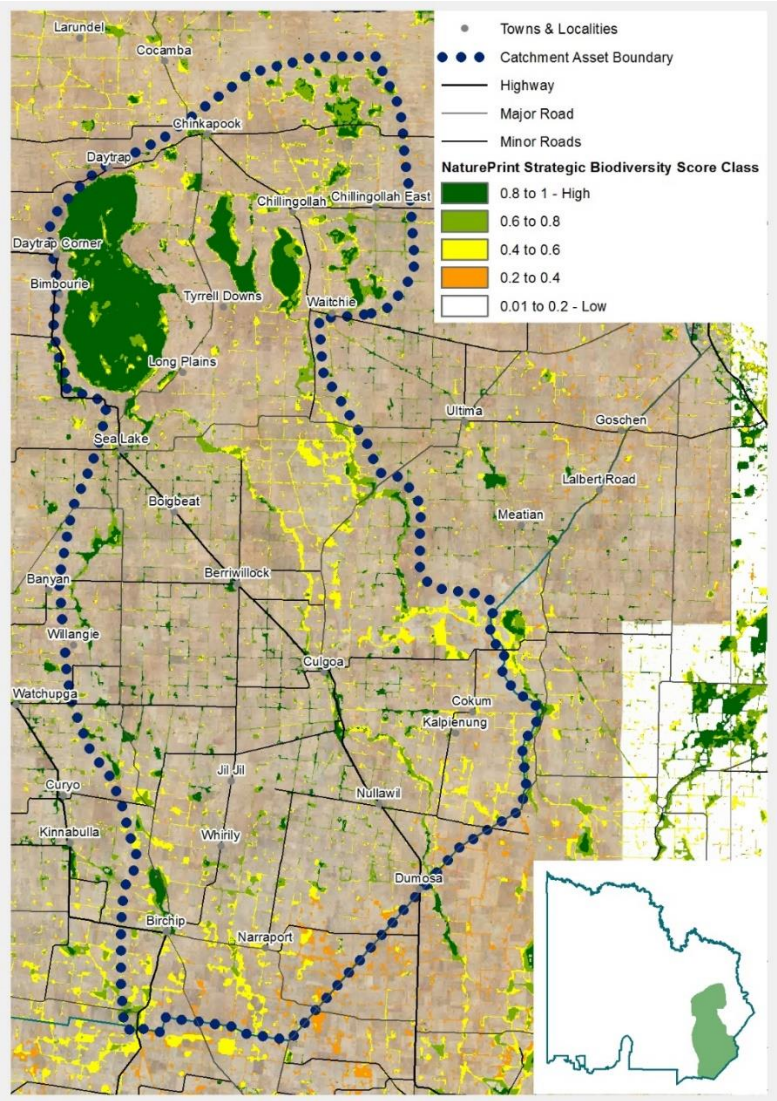

Figure 4: Terrestrial Habitat given high ecological value by NaturePrint Version 3

Soils

The soils within the catchment asset area are mostly Calcarosols which are the predominant Mallee soil type. These are sandy clay soils that are the preferred agricultural soil type in the region. However, in the northern most portion of the asset area (near Chinkapook) there is an area of Vertosols. These are the grey cracking soils that are thought to be derived from sedimentary deposition on lakebeds. To the east of these Vertosols and extending southwards towards Waitchie is a large area where Hydrosols predominate as part of the saline groundwater discharge zone on the eastern edge of the Tyrrell Basin. Finally, narrow bands of Sodosols predominate along the creek channels that are found in the far south.

The soils of this Catchment Asset area are predominantly valued for their capacity to provide for terrestrial habitat and the support the production of food and fibre. However, there is also an understanding that the structure of the soil and its natural capacity to resist threatening processes such as wind erosion is also of substantial value.

There is currently no accepted framework to categorise our soil asset in terms of value from lower to higher based purely upon the social, economic and environmental values and services they provide. Such a framework has only been considered to date in terms of the threatening processes that may impinge on the capacity of our soils asset to provide the services we have come to expect. This will be discussed later in this document. Despite this limitation, the most appropriate course of action is to consider the relative value of the soil asset according to its intrinsic capacity to support the other regional assets within this catchment asset as the basis for applying a value category.

Therefore, the Soils within this Catchment Asset are considered to be of **high** value.

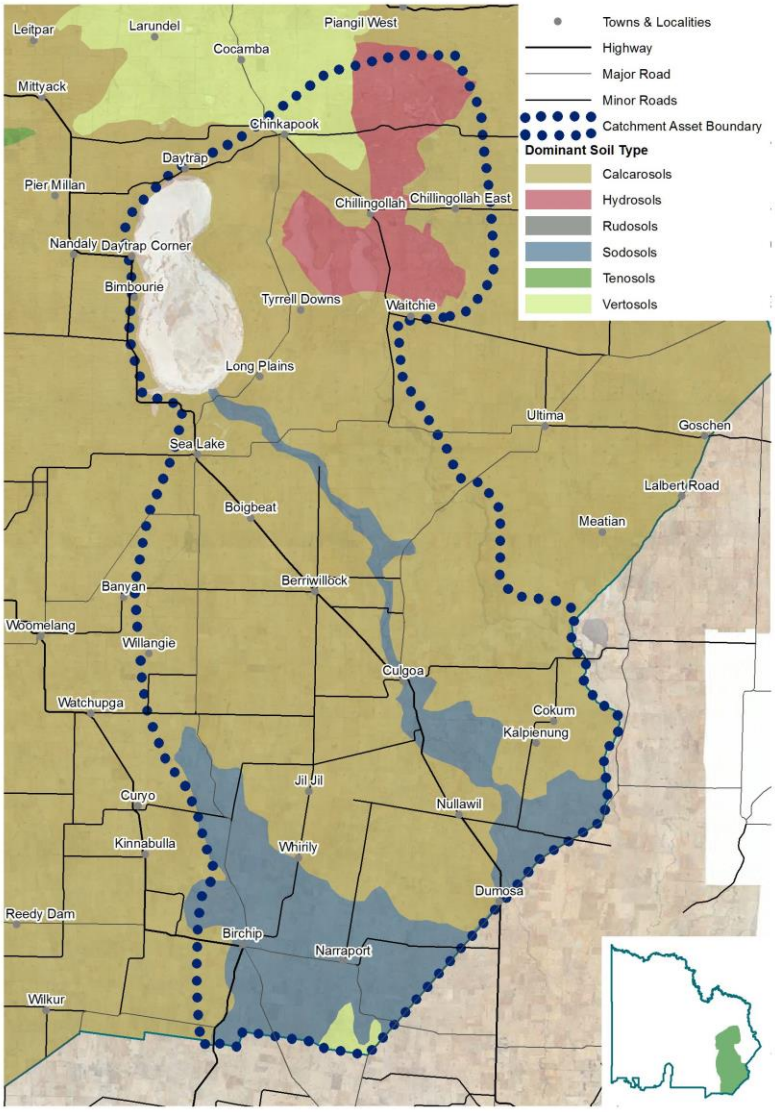

Figure 5: Dominant Soil Types

Agricultural Land

Almost 93% (over 350,000 hectares) of the catchment asset area is given over to agricultural activities. Virtually all of this is dryland agriculture, predominantly seasonal cropping and grazing.

The agricultural land of this Catchment Asset area is mainly valued for its capacity to support the production of food and fibre. This in turn provides for a range of other social and economic services that are important to the Mallee region. In addition, when these services are available, they support the local community in its efforts to maintain and enhance not only their agricultural land but other other regional assets.

There is currently no accepted framework to categorise our agricultural land asset in terms of value from lower to higher based purely upon the social and economic values and services they provide. Such a framework has only been considered to date in terms of the threatening processes that may impinge on the capacity of our agricultural land asset to provide the services we have come to expect. This will be discussed later in this document. As a result, the most appropriate course of action is to consider the relative value of the agricultural land asset at a regional scale rather than at a catchment asset scale and in accordance to its capacity to provide and support social and economic values.

Therefore, the Agricultural Land within this Catchment Asset and across the region is considered to be of **high** value.

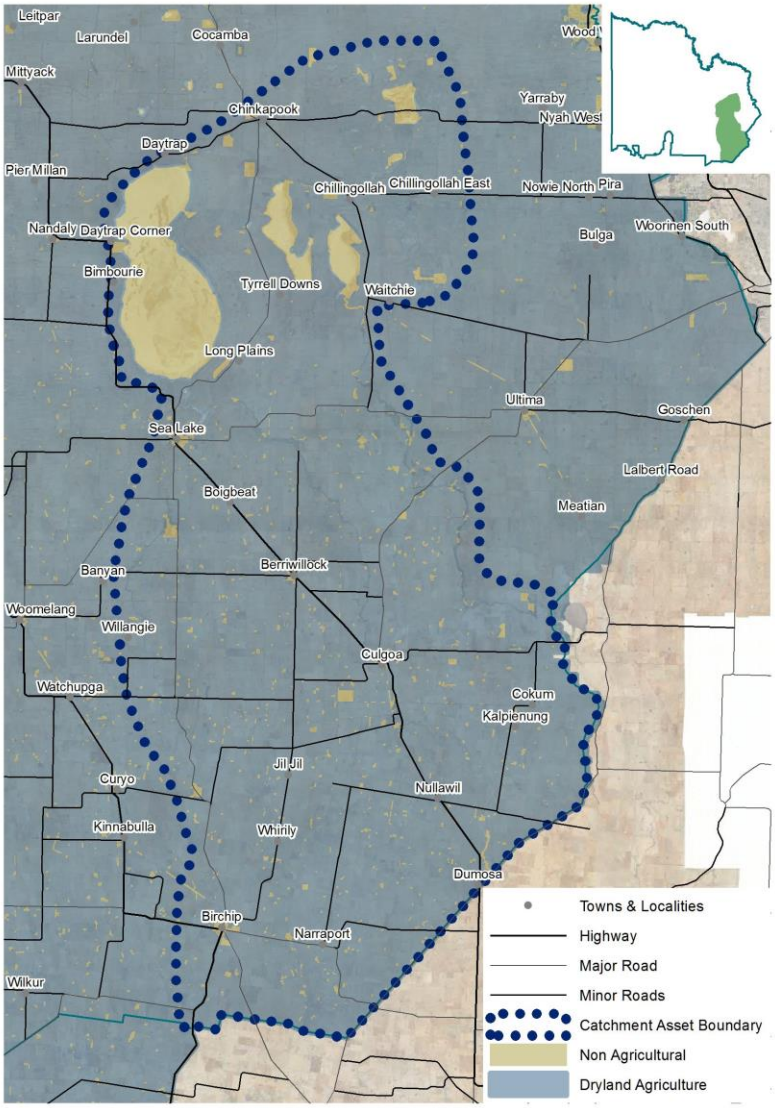

Figure 6: Agricultural land use

Groundwater

Groundwater aquifers that lie underneath this Catchment Asset area are not known to be utilised to provide a water resource for human uses. Therefore, the Mallee's groundwater asset is not of significance to this Catchment Asset.

Cultural Heritage

The catchment asset area has important Indigenous and non-Indigenous cultural value. Aboriginal people have had a connection to this area for tens of thousands of years. A significant number of cultural heritage sites occur in this area, ranging from small sites and earth features to larger sites containing artefacts, ovens and midden sites. From a European perspective, the area contains a number of heritage overlays that encompass sites of historical significance. Figure 7 provides a visualisation of where sites of indigenous and European cultural significance have been recorded.

Cultural heritage sites in this Catchment Asset area are predominantly valued for the connection they provide to the community between the social and cultural landscape that we currently enjoy and the stories, ideas and history of how that came to be. These sites provide individuals and families with a physical representation of their connection to the Mallee landscape and their place in it. These connections are extremely important to these people and, in turn, can reflect upon how they value and relate to the Mallee landscape that they are familiar with today. Therefore it is important to all that these sites are managed and protected in a manner that is sympathetic to those connections and values. Heritage significance is typically assessed under a three-tier legislative system that determines the local, state, national or commonwealth significance of an item. Heritage items can also be included on non-statutory listings (such as the National Trust classifications). However, there is no single and simple approach to categorise our cultural heritage asset in terms of value to the region. Tradition distinctions between different types of value (such as economic, social and environmental values) can be determined but this data is only patchily available given the number and range of cultural heritage sites across the Mallee. The most appropriate course of action at this point is to give equal value to all recognised cultural heritage sites in the Mallee regardless of their age, form and historical background.

Therefore, Cultural Heritage within this Catchment Asset and across the region is considered to be of **high** value. Any further processes undertaken to prioritise and target management actions will rely on assessments of risk likelihood and impact to those sites.

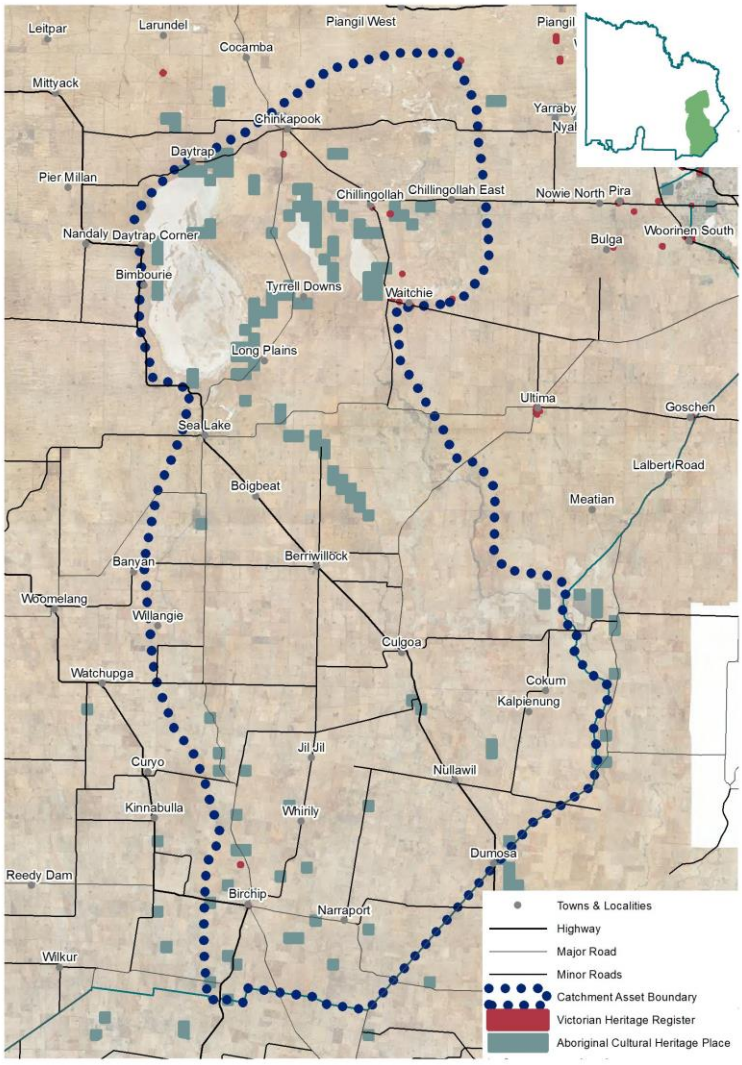

Figure 7: Areas of Cultural Value

Community Capacity

Community capacity is an important asset as positive and long-lasting NRM outcomes are dependent on an active, willing and capable community. In order to achieve regional scale NRM outcomes, people have to play a major role, often in partnership with government and industry, in the ongoing conservation and sustainable use of our Regional Assets This requires Mallee communities to have the capacity to work cooperatively, apply economic resources, use networks and acquire and use relevant knowledge and information to achieve NRM outcomes. Maintaining and improving this capacity is dependent not only on the financial, physical and natural resources contained within or available to a community but also its social resources.

Community capacity therefore requires ongoing development, conservation and management as its relative condition can influence the achievement of all other biophysical goals and actions outlined within the RCS.

Our communities' capacity is defined by their characteristics and resources which, when combined, determine their ability to identify, evaluate and address key issues.

Characteristics of strong regional community capacity include:

- Individuals within the community being aware of regional NRM issues, and understanding the link between these issues and the long-term viability of the community
- Natural resource managers and users being able and willing to access the necessary information, data and science – biophysical, social and economic – to make sound NRM decisions
- Natural resource managers and users being equipped with or having access to, the necessary technical, people management, project management and planning skills to Social, participate in the development and implementation of sustainable NRM at the property, local and regional scales
- Community being engaged and motivated, and exercising ownership over NRM decision making processes and effectively implementing actions arising from these processes (DAFF 2006).

The major communities of this catchment asset are the towns of Sea Lake and Birchip. According to the 2011 Census, Sea Lake in the north is home to 616 people while Birchip in the south is home to 661 people (ABS, 2013). The remaining population of the catchment asset area is spread across a further seven State Suburbs whose areas are partially contained within the catchment asset area; Berriwillock; Culgoa; Manangatang; Nandaly; Piangil; Ultima and Watchem.

This catchment asset area is very well supported in terms of community NRM organisations. There are eleven active Landcare groups whose areas of influence lie partially or wholly within the asset area. This is probably the best serviced catchment asset area in the Mallee in terms of Landcare.

The asset area is also home to the Birchip Cropping Group, a highly respected not-for-profit agricultural and research and extension organisation that is led by and works for cropping farmers in the southern half of the Mallee and much of the Wimmera.

Overall, this catchment asset area is extremely well serviced by community driven NRM organisations which reflects well on the capacity of the local community to contribute to effective NRM outcomes. A complete listing of all the known community NRM organisations within the catchment asset can be found in the Community NRM Groups section.

Whilst there are a number of methods available to evaluate the relative 'condition' of our community's capacity for NRM there is currently no accepted framework to categorise the community capacity asset in terms of value from low to high based upon the values and services it may provide. As a result, the most appropriate course of action is to consider the relative value of community capacity for NRM in terms of its potential contribution to NRM outcomes at a regional scale and what those

NRM outcomes might be (and how sizeable the resources required to achieve them) if that contribution was not forthcoming. Under those circumstances, it is relatively easy to come to the conclusion that, without the communities' investment into NRM through exercising that community capacity asset, the scale and success of our NRM outcomes will be curtailed while their cost in resources increases. Such a situation would not benefit the Mallee region or its Regional Assets.

Therefore, Community Capacity within this Catchment Asset and across the region is considered to be of **high** value.

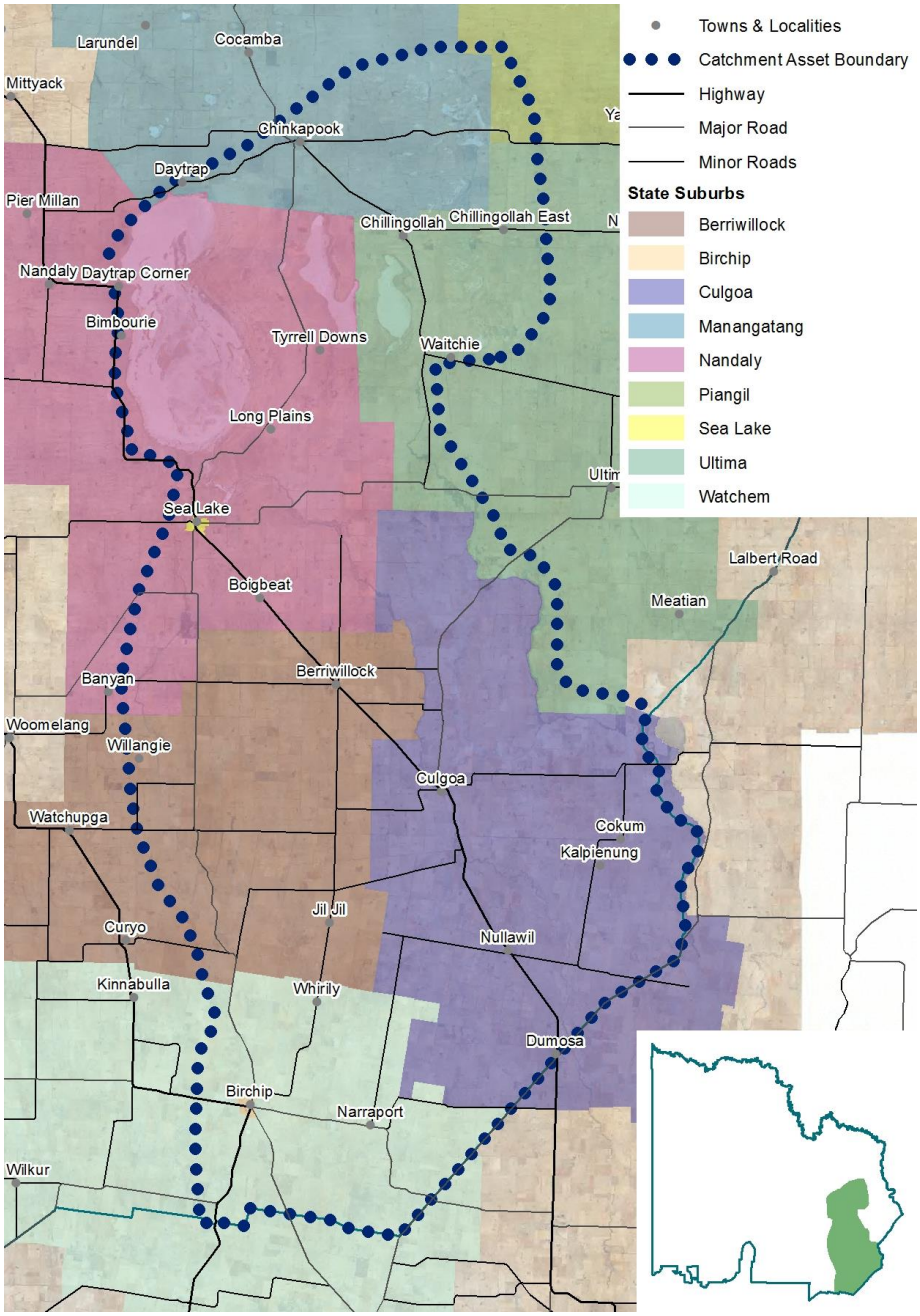

Figure 8: State Suburbs

Section 3 – Threatening Processes in this Catchment Asset

Threatening processes in the Mallee NRM region were defined and applied as part of the development of Mallee Regional Catchment Strategy by the Regional Catchment Strategy Steering Committee. Each of the following sub-sections provides a background to these threatening processes, available information about their form within this Catchment Asset and some discussion regarding the impact of these processes on our regional assets. This follows on to an assessment of the relative threat level posed by each the threatening processes based on the criteria contained in Appendix 2. *Categorising Threatening Processes*.

Land & water salinisation

Land and water salinisation is defined as: "Salinisation of the soil and water resources through the displacement of salt as a result of natural and human induced drivers."

Salinisation of soils is caused by discharge of groundwater to the atmosphere by direct transpiration of groundwater by vegetation or by capillary rise from the water table through the soil profile to either the soil surface (evaporation) or the bottom of the plant root zone. Salt contained in the water that is evaporated and/or transpired is left behind and accumulates in the soil. High rates of groundwater discharge, and hence salt accumulation, only occur in areas where water tables are shallow (typically less the 10 m, with the most severe effects when the water table is less than 5 m).

There are many naturally saline wetlands and wetland complexes in the Mallee that are situated in areas where the underlying water tables are naturally shallow. Better known examples of these natural systems include the Tyrrell Basin, Raak Plain and the Pink Lakes. These are natural saline systems that have historically developed and been maintained in a balance that provided for stable ecological communities. However, agricultural development in the last century has altered the long term balance of these systems. The removal of much of the Mallee vegetation and the use of land management techniques that were comparatively inefficient users of rainfall (compared to Mallee woodlands) allowed deep drainage past the root zone. Depending on the location, this deep drainage either manifest itself as localised discharge zones in dune swales or contributed to further shallowing of the regional water table. As water tables came closer to the surface, more wetlands and wetland ecosystems were threatened by increasing salinity and increasing areas of salinised landscape.

The incremental improvement in agricultural land management techniques to maximise water use efficiency and minimise through drainage over the last two decades coupled with the broad scale effect of the so-called Millennium Drought have begun to swing the balance back towards a more neutral status. Water table depths have fallen and correspondingly so have salinity impacts in the landscape.

Despite these recent advances, the risks remain. Many of the triggers in the landscape that created the salinisation problem still remain. Most notable of these are the altered flow regimes in our watercourses and wetlands and the large, open areas cleared of perennial Mallee vegetation. These are historical landscape modifications that are not expected to be rectified since they have provided for the bulk of the Mallee's resultant economic and social activity. Lapses in our current regimes of effective land and water management coupled with a changing climate can easily contribute to the return of a significant period of land and water salinisation.

This catchment asset includes the Tyrrell Basin which is one of the most significant naturally saline areas in Victoria, if not south eastern Australia. However, as already mentioned, induced salinity has impacted on this system in recent decades. Classification of induced and natural saline surfaces in 2009 indicates there is 10,845 hectares of induced saline surfaces in the northern portion of the catchment asset area (Mock & Grinter, 2009). This induced salinity is particularly prevalent in areas surrounding the naturally saline waterbodies of Lakes Tyrrell, Timboram and Wahpool (which in themselves account for nearly 22,000 hectares of naturally saline surfaces). These areas of induced saline surfaces represent an almost 50% increase in the area of saline surfaces over and above that which would be considered 'natural'.

Depth to the regional watertable and the general trends in groundwater levels were modelled in 2010 throughout the Mallee based on analysis of available groundwater data.

Throughout the southern two thirds of the catchment asset area, depth to the watertable is estimated to be typically greater than 5 metres below ground level so the relative risk of regional scale salinity remains low in this area. However, depth to the watertable in the Tyrrell Basin is often less than 5m and local scale induced salinity remains a possibility in the event of poor land and water management techniques being in place.

Given the current status of land and water salinisation in the Catchment asset area and consideration of the future potential of this threatening process to produce negative impacts within the area, the priority of action with respect to each Regional Asset has been determined.

They are listed in Table 8 below.

Table 8: Prospective Priority of Action to address Land and Water Salinisation upon Regional Assets

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	**To be documented**
Wetlands	MEDIUM	**To be documented**
Threatened Species and Communities	HIGH	**To be documented**
Terrestrial Habitat	MEDIUM	**To be documented**
Soils	HIGH	**To be documented**
Agricultural Land	HIGH	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	**NONE**	**To be documented**
Community Capacity	**NONE**	**To be documented**

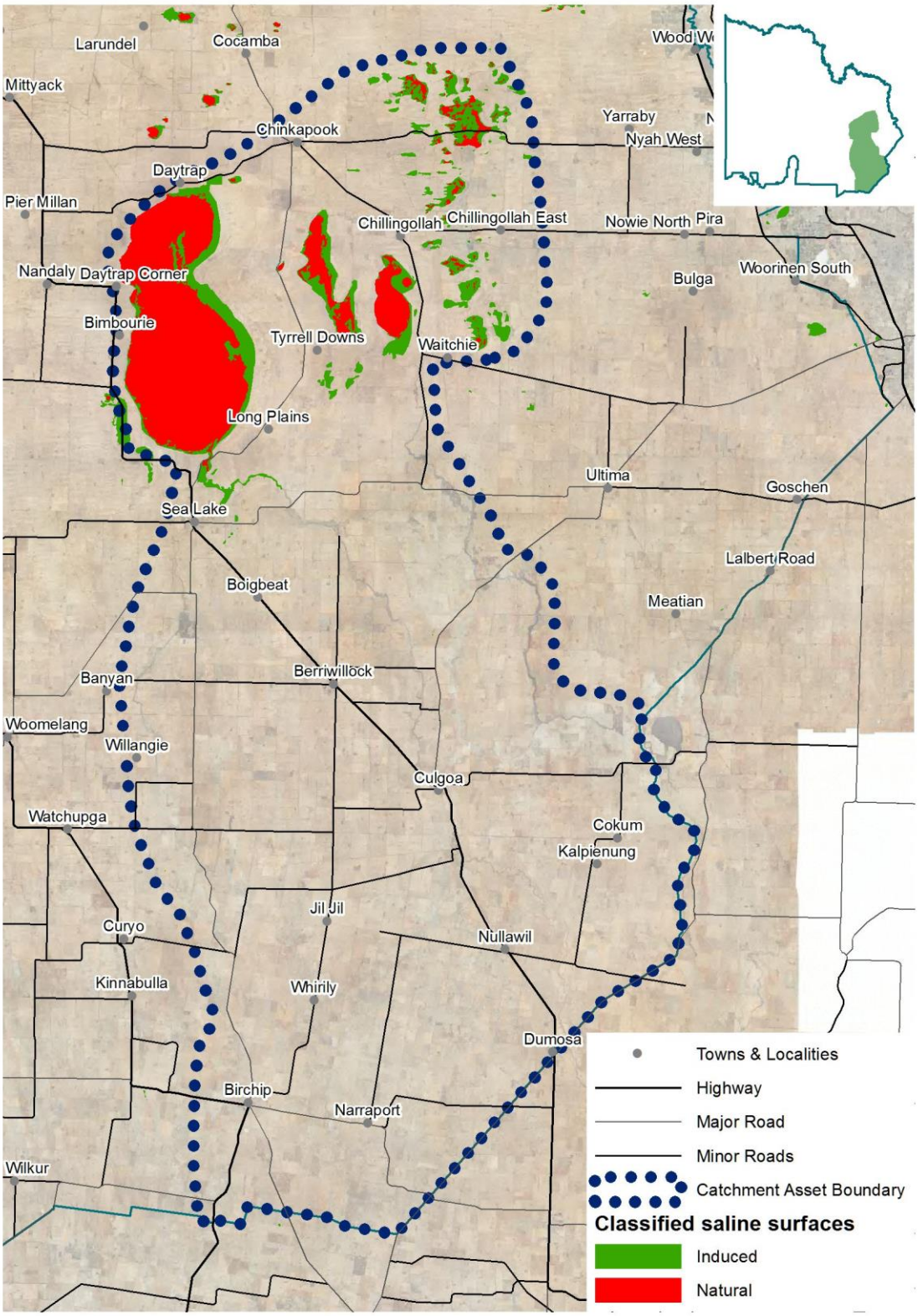

Figure 9: Natural and Induce Saline Surfaces

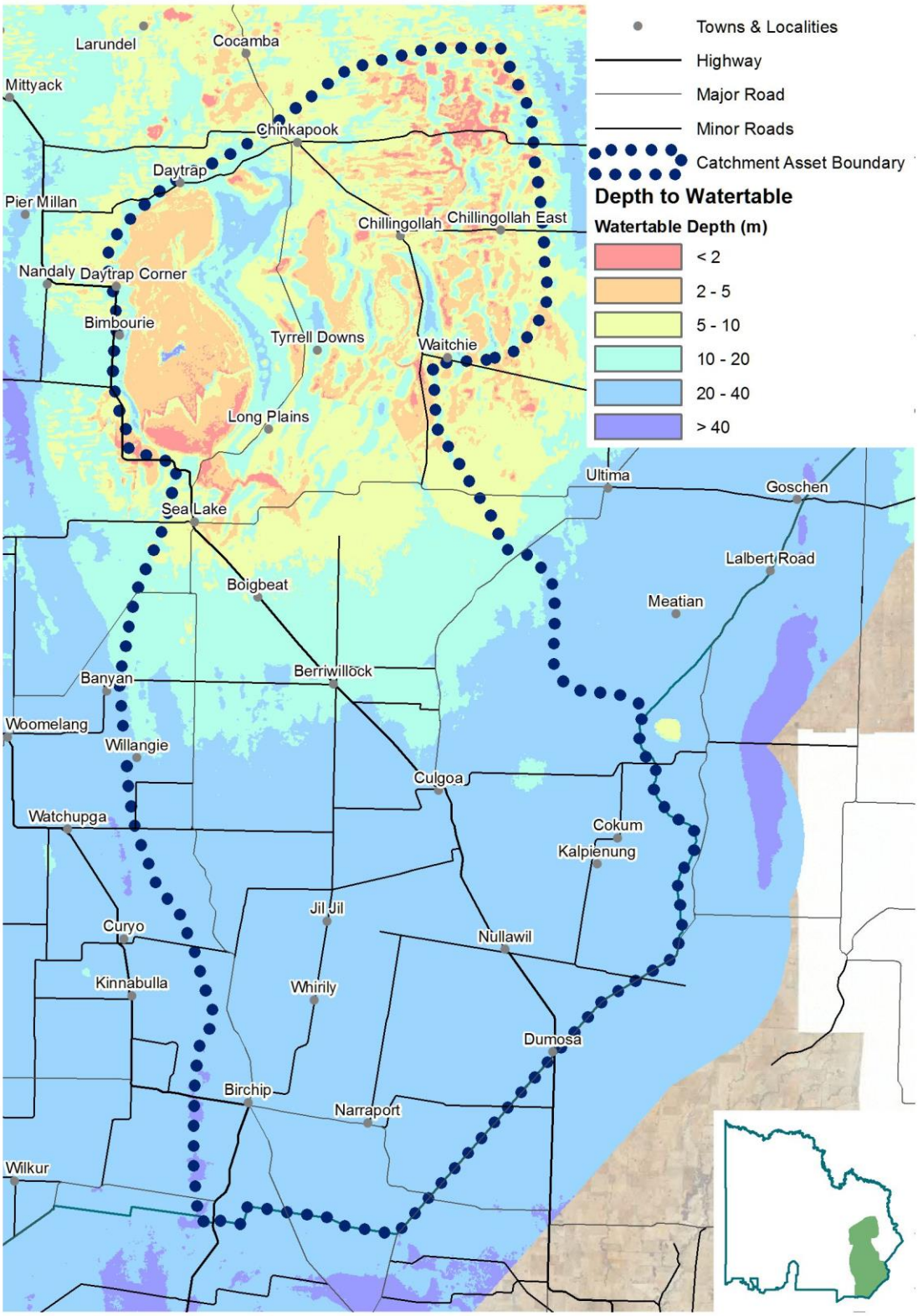

Figure 10: Estimated Depth to the Water table

Invasive Plants

Currently there are 25 State Prohibited Weeds, 4 Regionally Prohibited Weeds and 14 Regionally Controlled Weeds listed under the Catchment and Land Protection (CaLP) Act for the Mallee region. In addition to the conventional ways that weeds spread (e.g. wind and water) in the Mallee, disturbance from pest animals such as rabbits, goats and pigs also create good conditions for weed growth and contribute to weed spread.

Invasive plants in the Mallee threaten both biodiversity and the productive capacity of land. In many cases, weed infestation has changed the composition and character of the ecological landscape. Weed infestations also impact on the use of popular recreational spots in riparian areas, affecting aesthetic values and limiting access. Environmental weeds compete with established and regenerating indigenous species, threatening the quality and extent of native vegetation and reducing the diversity and availability of habitat. Environmental weeds present a significant risk to remnant roadside vegetation, as the 'edge effect' is particularly difficult to manage in these long, thin areas.

Agricultural weeds cause significant losses for horticulture and dryland farming through competition with crops and by reducing the quality of produce. Their control increases the cost of production and, in extreme cases, can diminish the productive capability of the land.

While the presence of recognised weed species in the asset area is almost certain, there is insufficient data available to adequately describe the current scope and scale of pest plant populations for the purposes of effective regional control. The available spatial data on invasive plant infestations dates back to 2007 and was generated as part of the Priority Weed Mapping project in 2008. This information is obviously now far out of date. The current information and response capacity relies heavily on local activity at a local scale in response to local weed infestations. This approach, while often very successful, tends to preclude centralised management and control at a regional scale. Therefore, the priority of action to address invasive plants is strongly influenced by local scale data derived from local planning instruments and informal community consultation at the local level. On the other hand, limited knowledge and understanding of the vulnerability of the Mallee landscape to future weed incursions is available given the current listing of known invasive plants, the current understanding of their biological requirements and the planning and response framework provided by regional scale plans such as the Mallee Invasive Plants and Animals Management Strategy (IPAWS).

The IPAWS identifies 21 regional assets (based on geographic areas) across the Mallee region. This Catchment Asset area contains four of these geographic assets: Agricultural Land; Tyrrell Creek and Lake Tyrrell; Lalbert Creek and Lake Timboram; and the Southern Buloke Woodland Community. Of these, only the Southern Buloke Woodland Community was considered to be a high priority for on-ground action to manage invasive plants and animals. The remaining three assets were identified as areas where monitoring for future action and maintaining previous management gains was considered sufficient.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with invasive plants with respect to each Regional Asset has been determined. They are listed in the Table 9 below.

Table 9: Prospective Priority of Action to address Invasive Plants upon Regional Assets

Regional Asset	Priority of Action	Summary Logic
Rivers	**HIGH**	To be documented
Wetlands	**HIGH**	To be documented
Threatened Species and Communities	**HIGH**	Buloke woodlands are an endangered ecological community and lie within the high priority IPAWS asset area

Terrestrial Habitat	**HIGH**	Most remnant habitat in asset area is small and linear in shape; much lies within the high priority IPAWS asset area
Soils	**HIGH**	To be documented
Agricultural Land	**HIGH**	To be documented
Groundwater	**NONE**	This regional asset is not present within this catchment asset
Cultural Heritage	**HIGH**	To be documented
Community Capacity	**NONE**	Invasive plants do not pose a significant threat to community capacity at this time

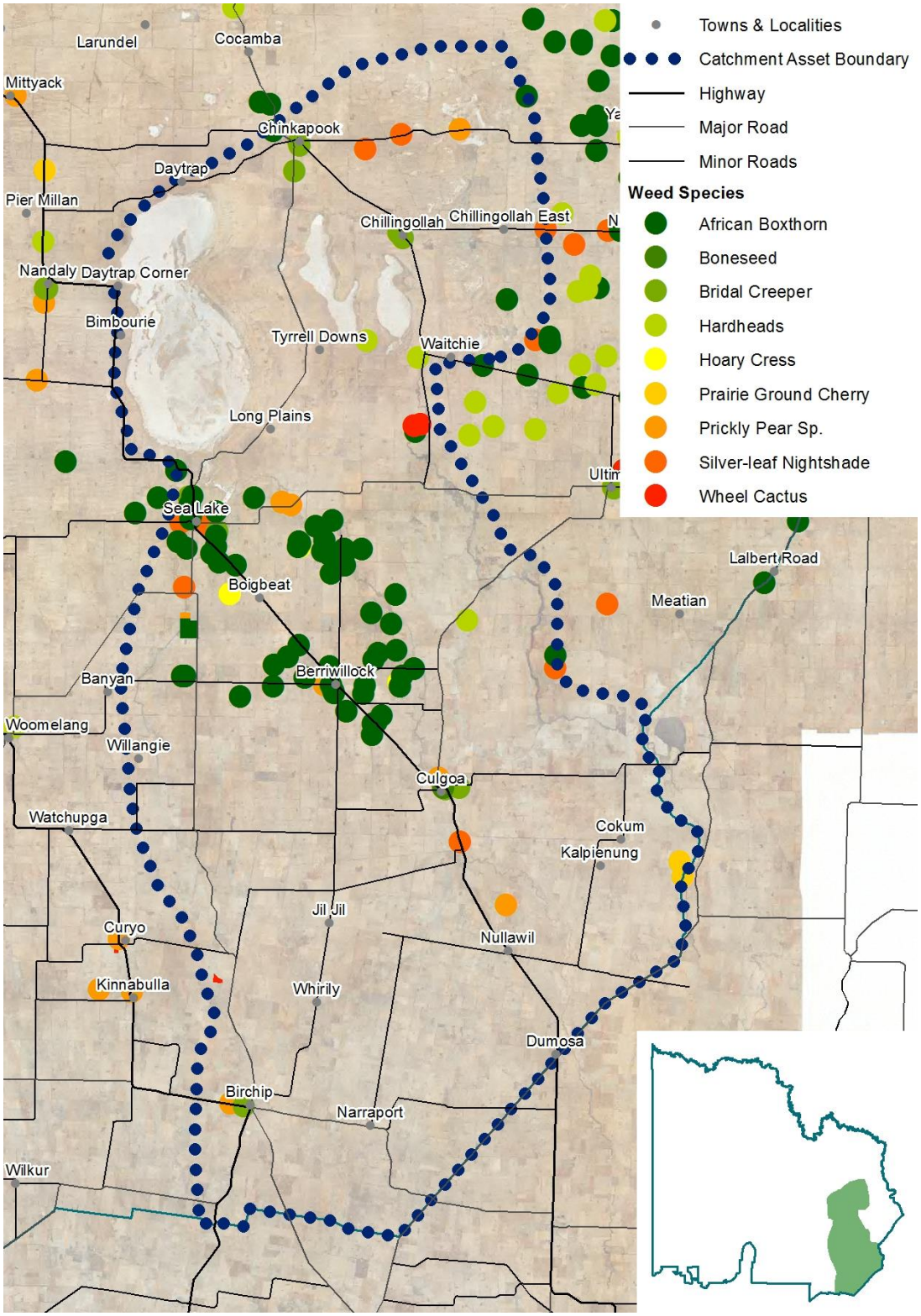

Figure 11: Priority Weed Infestations Recorded Between 2005 and 2007

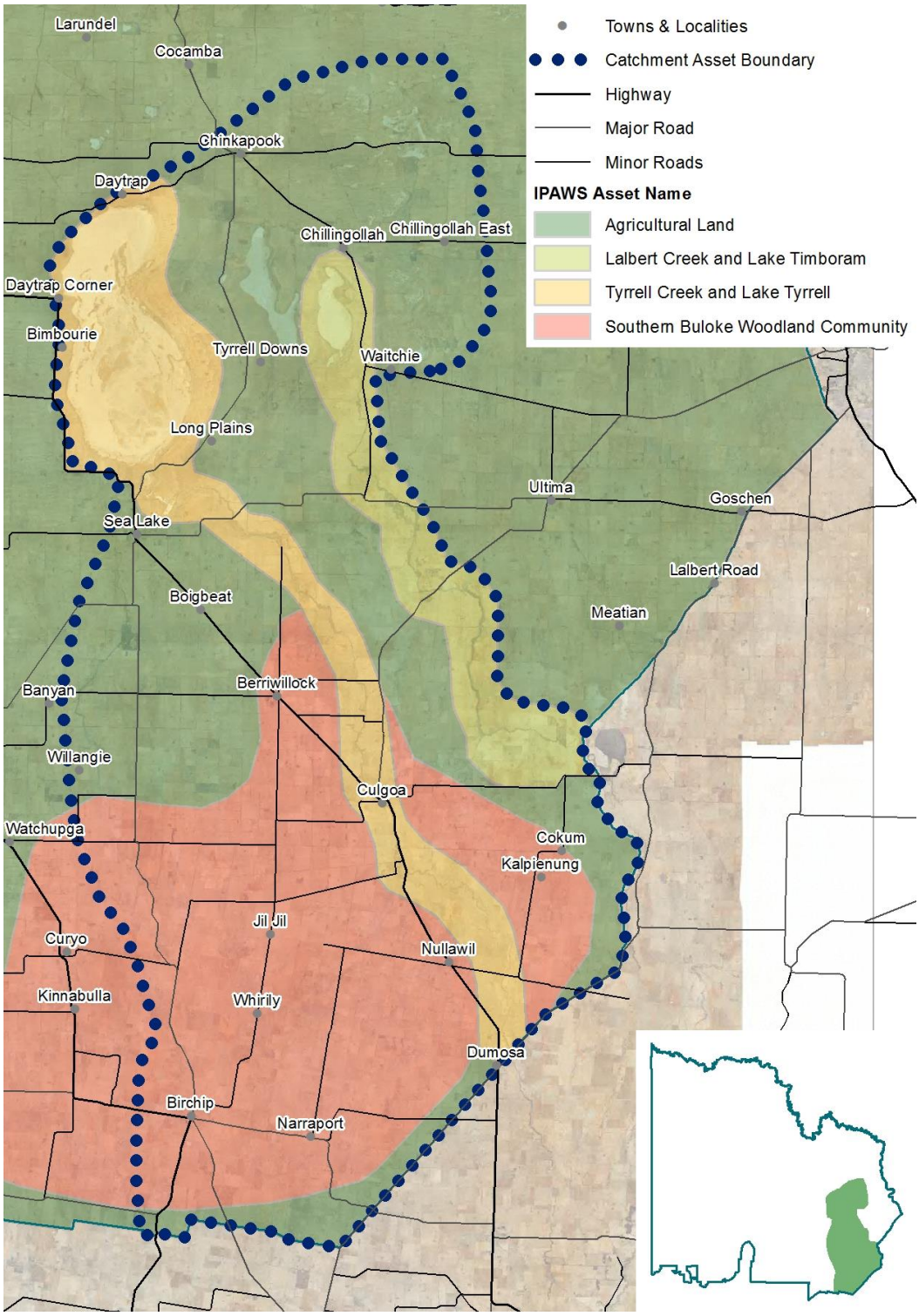

Figure 12: Regional Assets from the Mallee Invasive Plants and Animal Strategy

Invasive Animals

Invasive animals in terms of the Mallee RCS are regarded as those established invasive pest animals as defined in Part 8 of the CaLP Act 1994

Australia is host to 56 invasive vertebrate animal species. Of these, the ones with the most impact (in order of damage estimates) are: European Red Fox, feral cats, rabbits, feral pigs, wild dogs, the house mouse, carp and goats. The Mallee region hosts populations of all of these species. However,

of most significance to the Mallee is the European Red Fox and Rabbits – both are declared under the Catchment and Land Protection (CaLP) Act 1994.

Invasive species are considered to be pests when they have, or have the potential to have, an undesirable economic, environmental or social/cultural impact. Such impacts may include damage to agricultural crops, livestock predation, indigenous fauna predation, soil erosion and land degradation, spread of weeds, pasture/food and habitat competition, and the potential spread of disease. Gong et al. (2009) estimated the overall direct economic impact of several pest animal species (foxes, rabbits, wild dogs, feral pigs, birds and mice) in Australia to be $740 million annually. This included $620.8 million of production losses in agriculture (including horticulture) and $122.7 million on expenditure on pest animal management, administration and research in Australia. Some of the social impacts of pest animals include damage to infrastructure or cultural/historical sites, being 'a nuisance', causing traffic accidents, as well as significant social/psychological impacts on primary producers; for example, through distress of wild dog predation on livestock.

Other non-declared pest animals present in the Mallee include feral Bees, European Wasps, Hares, Starlings, Snails, Rats, Mice and Locusts.

Some of the remnant vegetation that fringes the river corridor and wetlands are susceptible to rabbit activity. 2,650 hectares (7%) of the catchment asset area is considered highly susceptible to rabbit activity. A further 16,600 hectares (44%) is considered susceptible to rabbit activity. However, there is little available data to describe the impact rabbits are currently having on the asset area.

The asset area is also known to be home to populations of foxes, goats and cats. As with rabbits, there is little concrete data available to scale of threat these populations pose this asset

As with invasive plants, the presence of invasive animals like rabbits and foxes in the asset area is recognised. However, there is only limited data available to adequately describe the current scope and scale of pest animal populations for the purposes of effective regional control. The current information and response capacity relies heavily on local activity at a local scale. This approach, while often very successful, tends to preclude centralised management and control at a regional scale. Therefore, the priority of action to address invasive animals is strongly influenced by local scale data derived from local planning instruments and informal community consultation at the local level. On the other hand, knowledge and understanding of the vulnerability of the Mallee landscape to future incursions or outbreaks is available for some species given the current understanding of their biological requirements and the planning and response framework provided by regional scale plans such as the Mallee Invasive Plants and Animals Management Strategy (IPAWS).

The IPAWS identifies 21 regional assets (based on geographic areas) across the Mallee region. This Catchment Asset area contains four of these geographic assets: Agricultural Land; Tyrrell Creek and Lake Tyrrell; Lalbert Creek and Lake Timboram; and the Southern Buloke Woodland Community. Of these, only the Southern Buloke Woodland Community was considered to be a high priority for on-ground action to manage invasive plants and animals. The remaining three assets were identified as areas where monitoring for future action and maintaining previous management gains was considered sufficient.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with invasive plants with respect to each Regional Asset has been determined. They are listed in Table 10 below.

Table 10: Prospective Priority of Action to address Invasive Animals upon Regional Assets

Regional Asset	Priority of Action	Summary Logic
Rivers	HIGH	**To be documented**
Wetlands	HIGH	**To be documented**

Threatened Species and Communities	MEDIUM	**To be documented**
Terrestrial Habitat	MEDIUM	**To be documented**
Soils	HIGH	**To be documented**
Agricultural Land	HIGH	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	HIGH	**To be documented**
Community Capacity	**NONE**	**To be documented**

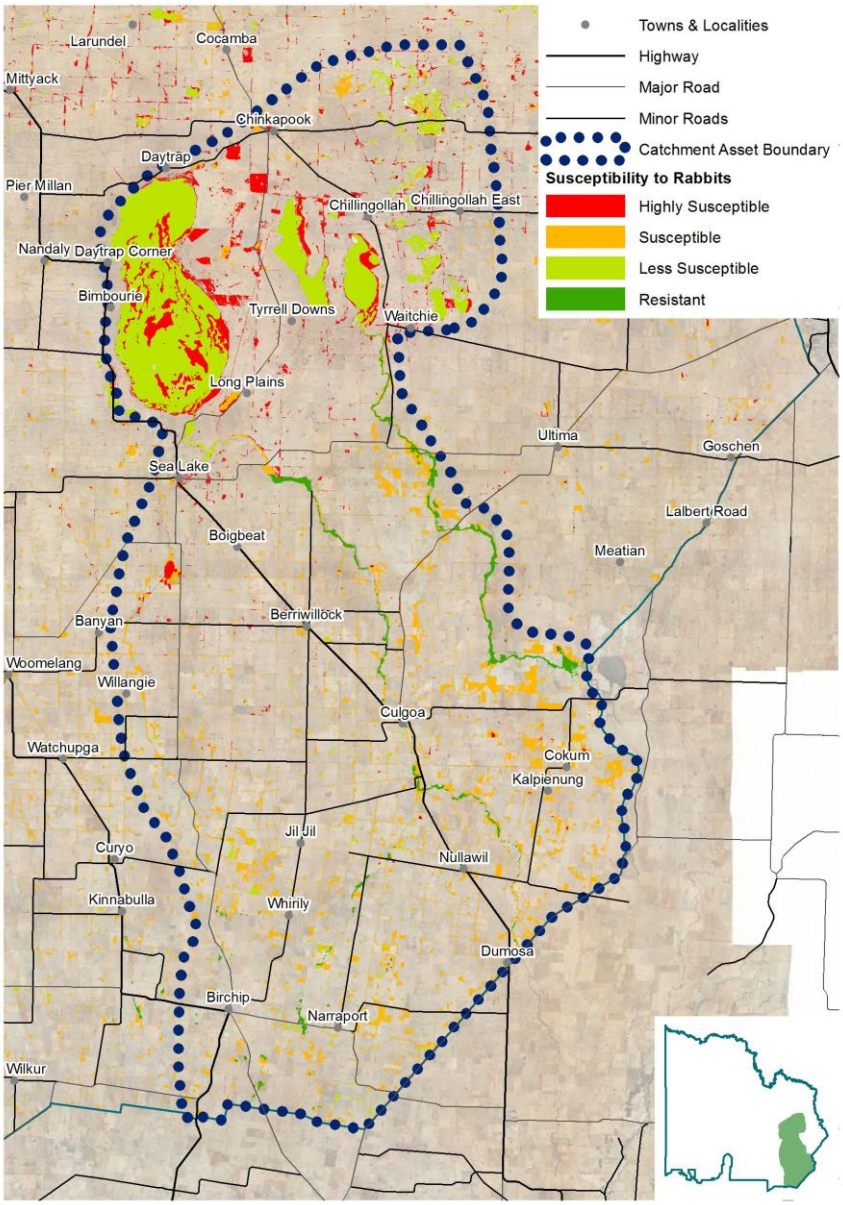

Figure 13: Susceptibility of Remnant Native Vegetation to Rabbits

Altered Hydrological Regimes

Modification of the natural flow regimes in our river systems has occurred over time to meet the various needs of navigation, agriculture and urban water use. Flow regulation has resulted in changes in the frequency, magnitude and duration of flows, and the restriction of small to medium flood events. River regulation, including the effect of locks, weirs and dams, has altered wetting and drying phases of many wetlands and ephemeral anabranches, by either permanently inundating the area, or restricting flows. Engineering works, such as the building of levees, have alienated large areas of floodplain which alters flood conveyance and flood storage. These changes have great significance for: fringing and floodplain forest communities: populations of fish, macroinvertebrates, algae, macrophytes; nutrient cycling; water quality; and channel shape and form.

Wetlands across the Mallee region have also been subject to modification of natural flow regimes which poses a threat to all priority wetland units. The flow regime, or hydrology, of a wetland is typically determined by climactic conditions and the inflows and outflows of surface and groundwater. Changes in hydrology affect most aspects of wetland ecology, including nutrient cycling; water quality; wetland shape and form; biodiversity; vegetation health, type and extent; and the composition and size of faunal communities. A wetland's flow regime has three main components: frequency, duration and seasonality of inundation. Any activity that changes one or more of these components will alter the natural hydrological regime of a wetland. Examples of these activities include: changes the flow regime of the wetland's water source; interference with flows in and out of, or even within, the wetland; water disposal to or extraction from the wetland; and modification of wetland depth (which alters evaporation rates and affects inundation duration).

The creeks and wetlands of this Catchment Asset are typically ephemeral systems that derive much of their water from flood events in the Avoca River system, local catchment runoff and, in the case of some of the northern most wetlands, from saline groundwater discharges from regional groundwater aquifers. More recently, many wetlands were fed by the Wimmera Mallee stock and domestic channel system and functioned as water storages within the system. This channel system has been rendered obsolete by the new Wimmera Mallee Pipeline and these wetlands face yet another new flow regime whose potential impact is yet to be determined.

Catchment processes, rather than river regulation, are behind much of the changed hydrology in this Catchment Asset. The Avoca River is one of the least regulated rivers in Victoria, however, the construction of levees to restrict and control flooding of adjacent land coupled with activities such as land clearing, land profiling and cultivation have altered runoff patterns across the landscape. This in turn has altered hydrological regimes in the ephemeral distributaries through reductions in the frequency, volume and duration of flow events and the concurrent inundation of wetlands.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with altered hydrological regimes with respect to each Regional Asset has been determined. They are listed in Table 11 below.

Table 11: Prospective Priority of Action to address Altered Hydrological Processes

Regional Asset	Priority of Action	Summary Logic
Rivers	HIGH	**To be documented**
Wetlands	HIGH	**To be documented**
Threatened Species and Communities	HIGH	**To be documented**
Terrestrial Habitat	HIGH	**To be documented**
Soils	HIGH	**To be documented**
Agricultural Land	HIGH	**To be documented**

Groundwater	**NONE**	**To be documented**
Cultural Heritage	**HIGH**	**To be documented**
Community Capacity	**NONE**	**To be documented**

Soil Erosion

Soil erosion in the Mallee is primarily confined to two processes: wind erosion and water erosion. Wind erosion is typically a regional scale process whereas water erosion primarily occurs in discrete locations on the sides and banks of some watercourses.

Wind erosion is the process by which soil particles are detached from the land surface and transported by the wind. Wind erosion occurs when the forces exerted by the wind overcome the gravitational and cohesive forces of soil particles on the surface of the ground. Wind erosion degrades the soil, reducing its capacity to sustain biodiversity and to support agricultural production. It can also have significant off-site impacts on infrastructure, air quality and respiratory health.

The movement of soil particles by the wind occurs in three ways, each of which is dependent on the size of the particles in question. The first method is known as creep. Larger particles (like sand) are generally too heavy to be lifted by the wind, so they are rolled along the surface by wind drag or moved by bombardment by other moving particles. The next method is known as saltation and this is when middling sized soil particles (typically 0.1 to 0.5 mm) are lifted by the wind, and then fall back to the ground, so they move in a hopping or bouncing fashion. This abrades the soil surface and as they hit other particles they break into smaller particles. It is these smaller particles (typically less than 0.1 mm) that form the suspended dust that is carried away from the erosion site by the wind and is typical of a Mallee dust event.

The susceptibility of a soil to erosion is dependent on its erodibility; its exposure to erosive winds; and on its moisture content. Soil erodibility refers to the inherent properties of the soil that make it susceptible to movement should the soil be exposed to strong winds (for example when they have been completely cleared or cultivated). These properties include: surface texture, organic matter content and stability of soil aggregates. The most erodible soil types are those with single grained structure and poor aggregate stability, such soils commonly comprising a large proportion of fine sand particles.

Soil erosion susceptibility in the Mallee can be spatially described due to a recognised relationship between soil type and the terrain. Landform component mapping took advantage of the relationship and served as a basis for predicting soil properties that determine erodibility based on prevailing terrain and soil types. It is an extension of the description and mapping of Mallee land systems in 1963 by Rowan and Downes which provides information about the land, its capabilities and its susceptibilities. The mapping used soil texture as the measure of erodibility and considered the frequency and direction of erodible winds (from south-west to westerly) to be consistent across the study area. The erosion susceptibility map for this Catchment Asset area is presented in Figure 14 below.

Wind erosion susceptibility mapping does not reflect the actual threat (or likelihood) of erosion occurring. Whilst a soil's inherent susceptibility to wind erosion is important, the actual likelihood of erosion occurring also depends on how the land is managed. Land management (such as vegetation cover) and climatic conditions (such as wind strength) play an important role in the occurrence of erosion. Where inappropriate management occurs severe wind erosion can be initiated on soils with low susceptibility and conversely erosion can be minimised on soils with high susceptibility with good management practises (Lorimer, 1985). When predicting the threat of erosion, both the landform component's inherent susceptibility to erode and its current state of management must be considered.

Most of the soil types in the catchment asset area have only moderate or low vulnerability to wind erosion. In this circumstance they are not particularly susceptible to wind erosion even in the event that the correct precursors (such as reduced groundcover) for such erosion exist. However, there are areas of lighter, scalded ground in a band across the north of the asset area that have more open soil types which are more susceptible. These areas of high or very high susceptibility soils account for 29,180 hectares or nearly 8% of the catchment asset. The majority of these susceptible soils are found on private (and therefore agricultural) land which suggests that a greater level of input may be required in order to maintain appropriate soil management regimes.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with soil erosion with respect to each Regional Asset has been determined. They are listed in Table 12 below.

Table 12: Prospective Priority of Action to address Soil Erosion

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	**To be documented**
Wetlands	HIGH	**To be documented**
Threatened Species and Communities	HIGH	**To be documented**
Terrestrial Habitat	HIGH	**To be documented**
Soils	HIGH	**To be documented**
Agricultural Land	HIGH	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	HIGH	**To be documented**
Community Capacity	**NONE**	**To be documented**

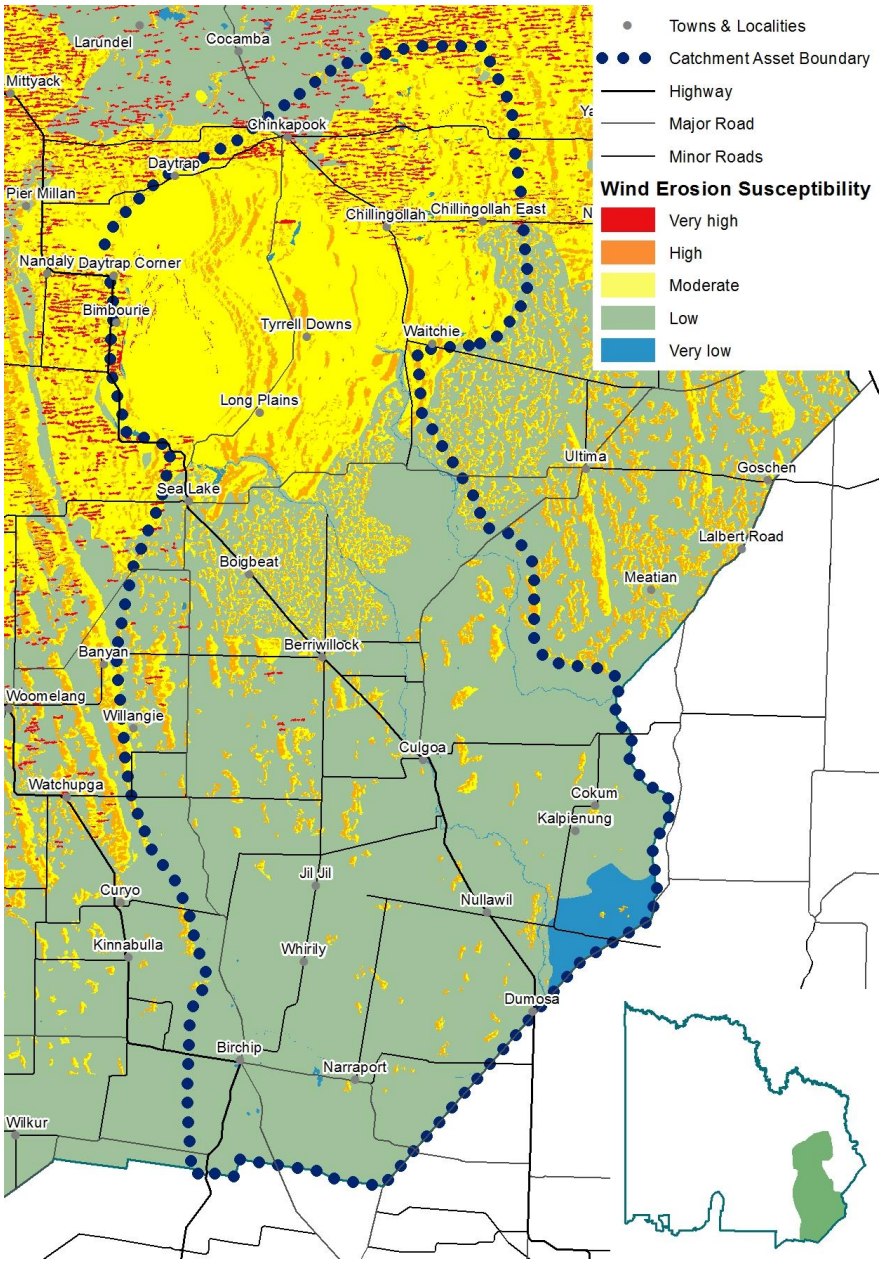

Figure 14: Wind Erosion Susceptibility

Inappropriate Water Use Practices

Inappropriate water use practices in agricultural activities in both the irrigation and dryland zones have been demonstrated to result in excessive volumes of deep drainage past the root zone of crops and pasture and therefore contribute to the raising of local and regional water tables.

Considerable effort has been expended by land managers and support agencies in recent years to substantially improve water management practices in irrigated agriculture throughout the region. This catchment asset area has been one of the major beneficiaries of the improvement process. However, the capacity to adequately describe the extent to which inappropriate water use practises remain in place currently remains elusive. The complexity of irrigated crop types, irrigation systems, water use and practises and the application of best practise benchmarks has, to date, constrained the capacity to reliably and meaningfully determine irrigation efficiency at a district scale and therefore determine the scale of inappropriate water use practises. However, measures are underway to rectify this inadequacy in the life of this RCS.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with inappropriate water use practices with respect to each Regional Asset has been determined. They are listed in Table 13 below.

Table 13: Prospective Priority of Action to address Inappropriate Water Use Practices

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	**To be documented**
Wetlands	MEDIUM	**To be documented**
Threatened Species and Communities	MEDIUM	**To be documented**
Terrestrial Habitat	MEDIUM	**To be documented**
Soils	MEDIUM	**To be documented**
Agricultural Land	MEDIUM	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	MEDIUM	**To be documented**
Community Capacity	**NONE**	**To be documented**

Recreational Pressures

Recreational pressure can contribute to impacts including littering, track proliferation, fishing pressures, firewood collection, soil compaction and site erosion. The nature of the impacts is typically localised around the particular site and is highly dependent on the accessibility, popularity and sensitivity of the site along with the level of management that the location receives.

Popular recreational areas within this this catchment asset include the Green Lake Regional Park (south of Sea Lake) and the Tchum Lakes (east of Birchip). Other less informally used areas include the foreshore of Lake Tyrrell and accessible sections of the Tyrrell and Lalbert Creek corridors. When water is present in the lakes and creeks of the asset area then water sports, such as swimming and boating, are the predominant recreational activity that utilise Regional Assets. Off road driving around Lake Tyrrell is popular with an annual off road race meeting garnering considerable support.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with recreational pressures with respect to each Regional Asset has been determined. They are listed in Table 14 below.

Table 14: Prospective Priority of Action to address Recreational Pressures

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	**To be documented**
Wetlands	MEDIUM	**To be documented**
Threatened Species and Communities	MEDIUM	**To be documented**
Terrestrial Habitat	MEDIUM	**To be documented**
Soils	**NONE**	**To be documented**
Agricultural Land	**NONE**	**To be documented**
Groundwater	**NONE**	**To be documented**

Cultural Heritage	HIGH	**To be documented**
Community Capacity	**NONE**	**To be documented**

Land Use Change

Land use change as a threatening process in this context is considered to be the change of land management or use practices from either a steady state or from accepted best practice management system. Examples include the removal of native vegetation, conversion of dryland property to irrigation development (or the reverse), change from no-till cropping to traditional fallow techniques, conversion from perennial pasture to cropping (or the reverse)

There is insufficient quality and quantity of data available to adequately describe the nature and level of impact resulting from this threatening process on this catchment asset at this time.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with land use change with respect to each Regional Asset has been determined. They are listed in Table 15 below.

Table 15: Prospective Priority of Action to address Land Use Change

Regional Asset	Priority of Action	Summary Logic
Rivers	HIGH	**To be documented**
Wetlands	HIGH	**To be documented**
Threatened Species and Communities	HIGH	**To be documented**
Terrestrial Habitat	HIGH	**To be documented**
Soils	HIGH	**To be documented**
Agricultural Land	HIGH	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	HIGH	**To be documented**
Community Capacity	**NONE**	**To be documented**

Direct Off-site Interactions

Direct off-site interactions are the direct physical impacts from land management activities on neighbouring off-site assets such as areas of remnant native vegetation or wetlands. Such interactions may include chemical spray drift; parking or storage of machinery and equipment; or incremental drift of cultivation into the asset.

There is insufficient quality and quantity of data available to adequately describe the nature and level of impact resulting from this threatening process on this catchment asset at this time.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with direct off-site interactions with respect to each Regional Asset has been determined. They are listed Table 16 below.

Table 16: Prospective Priority of Action to address Direct Off-site Interactions

Regional Asset	Priority of Action	Summary Logic

Rivers	LOW	**To be documented**
Wetlands	LOW	**To be documented**
Threatened Species and Communities	LOW	**To be documented**
Terrestrial Habitat	LOW	**To be documented**
Soils	LOW	**To be documented**
Agricultural Land	LOW	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	LOW	**To be documented**
Community Capacity	**NONE**	**To be documented**

Misaligned Community Perceptions

Misaligned community perceptions are community opinions, approaches & values that run counter to the messages & knowledge available about natural resource management AND threaten the success of the wider communities' efforts to enhance their environment. Such perceptions include 'right of unfettered access' that results in removal of traffic management infrastructure installed near river banks; and 'we are doing no harm' where individuals are not aware of the cumulative and incremental harm of some of their actions (along with those of the rest of the community) when they are making use of our assets

There is insufficient quality and quantity of data available to adequately describe the nature and level of impact resulting from this threatening process on this catchment asset at this time. However, there is a range of anecdotal information from a range of sources that suggest the threat is present and ongoing.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with misaligned community perceptions with respect to each Regional Asset has been determined. They are listed in Table 17 below.

Table 17: Prospective Priority of Action to address Misaligned Community Perceptions

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	**To be documented**
Wetlands	MEDIUM	**To be documented**
Threatened Species and Communities	MEDIUM	**To be documented**
Terrestrial Habitat	MEDIUM	**To be documented**
Soils	MEDIUM	**To be documented**
Agricultural Land	MEDIUM	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	MEDIUM	**To be documented**
Community Capacity	MEDIUM	**To be documented**

Inappropriate Fire Regimes

Fire is an ongoing challenge for land managers and communities alike. Fire is also a major force determining the structure, function and sustainability of Australia's ecosystems. A substantial proportion of Australia's unique biota is dependent, to varying degrees, on fire and the variety of fire regimes for its continued existence and development. In this context, inappropriate fire regimes can mean either too little or too much fire

There is insufficient quality and quantity of data available to adequately describe the nature and level of impact resulting from this threatening process on this catchment asset at this time.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with inappropriate fire regimes with respect to each Regional Asset has been determined. They are listed in Table 18 below.

Table 18: Prospective Priority of Action to address Inappropriate Fire Regimes

Regional Asset	Priority of Action	Summary Logic
Rivers	**NONE**	**To be documented**
Wetlands	**NONE**	**To be documented**
Threatened Species and Communities	**MEDIUM**	**To be documented**
Terrestrial Habitat	**MEDIUM**	**To be documented**
Soils	**NONE**	**To be documented**
Agricultural Land	**NONE**	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	**NONE**	**To be documented**
Community Capacity	**NONE**	**To be documented**

Constrained Regenerative Capacity

The decline in vegetation cover and habitat complexity within remnant native vegetation can constrain or prevent regeneration which can lead to loss of habitat in the longer term. There are many contributors to this threatening process including weed invasion, excess grazing pressure, and habitat fragmentation. Loss of understorey flora and associated fauna are a possible outcome, also leading to a reduction in the capacity of the remnant to support flora and fauna species or maintain current population numbers, thus impacting on the biodiversity value of the asset.

Habitat fragmentation is one useful indicator of constrained regenerative capacity. A high level of fragmentation will severely limit the capacity of a vegetation community and the ecology it supports to maintain its health and reproductive capacity. It will also hamper our efforts to improve the health and condition of remnant landscapes at a broad scale due to the level of additional resources that each remnant patch would require (such as restoration or revegetation) rather than being able to simply protect the remnant (through fencing and invasive species control) and then rely upon its own internal regenerative resources to bring about an improvement in health and condition.

Modelling of habitat fragmentation using a spatial tool (Vogt, et al. 2007) can demonstrate the level of habitat fragmentation of a landscape. Using a combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with constrained regenerative capacity with respect to each Regional Asset has been determined. They are listed in Table 19 below.

Table 19: Prospective Priority of Action to address Constrained Regenerative Capacity

Regional Asset	Priority of Action	Summary Logic
Rivers	HIGH	**To be documented**
Wetlands	HIGH	**To be documented**
Threatened Species and Communities	HIGH	**To be documented**
Terrestrial Habitat	HIGH	**To be documented**
Soils	**NONE**	**To be documented**
Agricultural Land	**NONE**	**To be documented**
Groundwater	**NONE**	**To be documented**
Cultural Heritage	**NONE**	**To be documented**
Community Capacity	**NONE**	**To be documented**

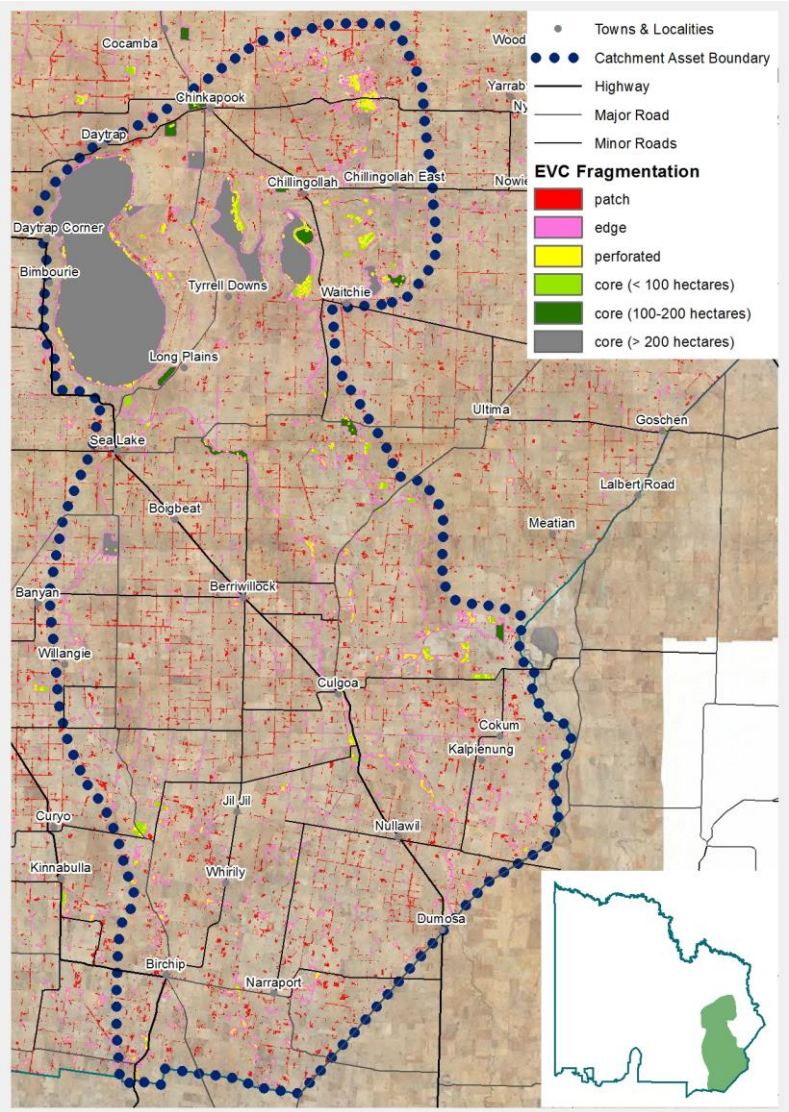

Figure 15: Habitat Fragmentation

Section 4 – References & Appendices

References

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Vogt, P., K. Riitters, C. Estreguil, J. Kozak, T. Wade, and J. Wickham. “Mapping spatial patterns with morphological image processing.” Landscape Ecology 22, 2007: 171-177.

1. The Value of Regional Assets within a Catchment Asset

The Regional Asset value indicates the relative importance of the Regional Asset within the Catchment Asset Area. The valuation is determined from a range of indicators, many specific to each of the Regional Assets, that describe the importance of the Asset relative to social, economic and environmental values. One common example of an indicator of asset value is legislative significance which provides an indication of whether part or all of a Regional Asset is of significance at a local, regional, State, National or international level. These indicators were grouped and scored by consensus against agreed criteria and then each Regional Asset within the Catchment Asset was assigned a category that defines the prospective asset value and relative importance of and priority for maintaining or improving the value of the Asset.

Five category levels were identified:

None – indicates that the Regional Asset is unknown or not present within the Catchment Asset area.

Low – indicates that the Regional Asset is of relatively low status or importance within the Catchment Asset area. It may also indicate that there is insufficient knowledge or data available to define or quantify the asset value and therefore prioritise it with confidence. Further research may be required to rectify this situation.

Medium – indicates that the Regional Asset is locally or regionally important but relatively well known or secure at the Catchment Asset scale. This may be due in part to previously successful management interventions. Ongoing monitoring may be required as will some level of intervention (particularly at a local scale) to ensure previous management gains are not lost.

High – indicates that the Regional Asset within the Catchment Asset Area is of significance at a regional, State or National scale and that action is likely required over the life of the RCS in order to maintain or improve the value of the Regional Asset within the Catchment Asset Area.

Very High - indicates that the Regional Asset within the Catchment Asset Area is of significance at a National or international scale and that action is likely required over the life of the RCS in order to maintain or improve the value of the Regional Asset within the Catchment Asset Area.

2. Categorising Threatening Processes

The categorisation of the threatening processes in order to prioritise management actions was based on the current scope and scale of the impacts arising from the threatening process along with consideration of potential future impact of the threatening process. The categorisation was based on consensus against agreed criteria. Each threatening process acting upon each Regional Asset was assigned a category that defines the prospective priority of action to address that threatening process.

Four category levels were identified:

None – indicates that either the threatening process, or the regional asset itself, is unknown or not present within the catchment Asset area.

Low – indicates that, while the threatening process is known to be present, it is at a low level or the Regional Asset itself is not overly susceptible to or impacted by the threat. It may also indicate that there is insufficient knowledge or data available to define or quantify the interaction between the asset and the threatening process and therefore prioritise it with confidence. Further research may be required to rectify this situation.

Medium – indicates that the threatening process is real but that the Regional Asset is not under immediate threat at the Catchment Asset scale. This may be due to previously successful

interventions. Ongoing monitoring will be required as will some level of intervention (particularly at a local scale) to ensure previous management gains are not lost.

High – indicates that: there is a high level of potential harm to the Asset as a result of the threatening process; there are a variety of management actions available that are known to be successful at reducing harm and which are generally supported by land managers; and that action is required over the life of the RCS in order to prevent further impact as a result of the threatening process.

3. Management Plans Relevant to this Catchment Asset

Table 20: Management Plans Relevant to this Catchment Asset

Name	Type	Author/Owner	Year
North West Region Mildura Fire District Fire Protection Plan	Management Plan	Department of Sustainability & Environment	2008
Lalbert and Tyrrell Creeks Creek Management Plan	Management Plan	GHD for Mallee and North Central Catchment Management Authorities	2007
Wetland Management Plan for Constructed and Naturally Occurring Wetlands in the Swan Hill Municipality 2006-2008	Management Plan	Swan Hill Rural City Council	2006
Swan Hill Rural City Council Plan 2009-2013	Management Plan	Swan Hill Rural City Council	2009
Swan Hill Rural City Council Roadside Management Plan 2007-2009	Management Plan	Swan Hill Rural City Council	2007
Swan Hill Rural City Council Strategic Linkages Plan 2008 – 2011	Management Plan	Swan Hill Rural City Council	2008
Western Region Sustainable Water Strategy	Strategy	Department of Sustainability & Environment	2011
Mallee River Health Strategy 2005	Strategy	Mallee Catchment Management Authority	2006
Mallee Wetland Strategy 2006-2011	Strategy	Mallee Catchment Management Authority	2006
Native Fish Strategy for the Murray-Darling Basin 2003-2013	Strategy	Murray Darling Basin Authority	2003
Mallee Invasive Plants and Animals Management Strategy	Strategy	Mallee Catchment Management Authority	2011
Buloke Shire Roadside Vegetation Guidelines for the Community 2010-2013	Management Plan	Buloke Shire Council	2010
Berriwillock Landcare Group Action Plan 2012-2017	Action Plan	Berriwillock Landcare Group	2012
Birchip Landcare Group Action Plan 2012-2017	Action Plan	Birchip Landcare Group	2012
Culgoa Landcare Group Action Plan 2012-2017	Action Plan	Culgoa Landcare Group	2012
Lalbert Landcare Group Action Plan 2012-2017	Action Plan	Lalbert Landcare Group	2012
Manangatang Landcare Group Action Plan 2012-2017	Action Plan	Manangatang Landcare Group	2012

Nullawil Landcare Group Action Plan 2012-2017	Action Plan	Nullawil Landcare Group	2012
Nyah West Landcare Group Action Plan 2012-2017	Action Plan	Nyah West Landcare Group	2012
Sea Lake Landcare Group Action Plan 2012-2017	Action Plan	Sea Lake Landcare Group	2012
Waitchie & Swan Hill West Landcare Group Action Plan 2012-2017	Action Plan	Waitchie & Swan Hill West Landcare Group	2012
Woomelang Lascelles Landcare Group Action Plan 2012-2017	Action Plan	Woomelang Lascelles Landcare Group	2012
National Recovery Plan for Buloke Woodlands of the Riverina and Murray Darling Depression Bioregions	National Recovery Plan	Department of Sustainability & Environment (Victoria)	2011
National Recovery Plan for the Chariot Wheels *Maireana cheelii*	National Recovery Plan	Department of Sustainability & Environment (Victoria)	2010
Approved Conservation Advice for *Swainsona murrayana* (Slender Darling-pea)	National Conservation Advice	Department of Sustainability, Environment, Water, Population and Communities (Australia)	2008
Flora & Fauna Guarantee Action Statement Grey-crowned Babbler *Pomatostomus temporalis*	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Plains Wanderer *Pedionomus torquatus*	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Bush Stone-Curlew *Burhinus grallarius*	Action Statement	Department of Sustainability & Environment (Victoria)	2004
Flora & Fauna Guarantee Action Statement Brolga *Grus rubicunda*	Action Statement	Department of Sustainability & Environment (Victoria)	2004
Flora & Fauna Guarantee Action Statement Great Egret *Ardea alba*Intermediate Egret *Ardea intermedia* Little Egret *Egretta garzetta*	Action Statement	Department of Sustainability & Environment (Victoria)	2001
Flora & Fauna Guarantee Action Statement Twelve threatened Swainson-peas and Darling-peas (*Swainsona* species)	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Blue-billed Duck *Oxyura australis*	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Inland Carpet Python *Morelia spilota metcalfei*	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Chariot Wheels *Maireana cheelii*	Action Statement	Department of Sustainability & Environment (Victoria)	2009
Flora & Fauna Guarantee Action Statement Winged Peppercress *Lepidium monoplocoides*	Action Statement	Department of Sustainability & Environment (Victoria)	2009

4. Management Action Definitions

Management Action Category	Management Action	Definition	Threatening Processes Addressed
On-ground Works	Pest Plant Control	Control and eradication of pest plant species	Invasive Plants; Constrained Regenerative Capacity
	Pest Animal Control	Control and eradication of pest animal species	Invasive Animals; Soil Erosion; Constrained Regenerative Capacity
	Habitat Protection	Habitat protection through exclusion fencing or other physical means	Invasive Animals; Soil Erosion; Recreational Pressure; Land Use Change; Direct Off-Site Interactions; Constrained Regenerative Capacity
	Habitat Restoration	Restoration of degraded terrestrial habitat by planting vegetation	Land & Water Salinisation; Soil Erosion; Recreational Pressure; Direct Off-Site Interactions; Constrained Regenerative Capacity
	Revegetation	Re-creation of terrestrial habitat by planting vegetation (e.g. new wildlife corridor plantings)	Land & Water Salinisation; Soil Erosion; Recreational Pressure; Direct Off-Site Interactions; Constrained Regenerative Capacity
	Environmental Watering	Delivering environmental water to wetlands and floodplains; maintaining appropriate watering regimes	Altered Hydrological Regimes; Constrained Regenerative Capacity
	Soil Erosion Control	Control of soil erosion through engineering works and other structures	Soil Erosion
	Threatened Species Interventions	Interventions to improve outcomes for threatened species and ecological communities	Constrained Regenerative Capacity
	Enhancing Land Management Regimes	Interventions to enhance land management regimes on both public and private land (e.g. water use efficiency on irrigated land; maintaining appropriate soil cover in dryland agriculture; improved management or protection regimes)	Land & Water Salinisation; Soil Erosion; Inappropriate Water Use Practises; Land Use Change; Direct Off-Site Interactions
Capacity Building	Supporting Human Capacity for NRM	Provision of new skills and training in NRM; Delivery of publicity and awareness raising paraphernalia	All
	Supporting Institutional Capacity for NRM	Development and support of regional partnerships between institutions with a stake in NRM	All
	Supporting Social Capacity for NRM	Supporting community organisations that have a stake in NRM by aiding	All

		governance and provision of material	
NRM Planning	Institutional Planning for NRM	Development and implementation of NRM planning by regional institutions. Examples include institutional NRM plans, regional asset plans and sub-strategies	All
	Community Driven Planning for NRM	Development and implementation of NRM planning by community based organisations. Examples include Landcare Group Action Plans.	All
	Landholder Driven Planning for NRM	Development and implementation of NRM planning by landholders. Examples include property management plans and conservation agreements	All
Knowledge Building	Research to improve knowledge	Any research or other work delivered to improve or expand current knowledge or fill knowledge gaps in any NRM topic relevant to regional assets	All
Asset Assessment	Asset condition monitoring and assessment	Monitoring and collection of data concerning indicators of regional asset condition and/or threatening processes impacting on regional assets; Efforts to determine and/or evaluate trends in the condition of assets or the scope and scale of threatening processes impacting on regional assets.	All

5. Management Actions from Existing Management Plans

Table 21: Management Actions from Existing Management Plans

Instrument	Management Action	Details
North West Region Mildura Fire District Fire Protection Plan	Supporting Institutional Capacity for NRM	Investing in integrated fire management to balance community needs with ecological requirements
	Research to improve knowledge	Determining appropriate ecological fire regimes
Lalbert and Tyrrell Creeks Creek Management Plan 2007	Pest Plant Control	Priority weed control
	Pest Animal Control	Rabbit and fox control
	Habitat Protection	Exclusion of stock and vehicular access by fencing; management of recreation activities in preferred habitat
	Habitat Restoration	Planting within fenced areas
	Revegetation	Revegetate to link discontinuous remnants along creeks
	Threatened Species Interventions	Numerous interventions to manage priority species esp. Inland Carpet Python and Grey Crowned Babbler
	Supporting Human Capacity for NRM	Enhance community knowledge; reduce firewood collection
	Supporting Institutional Capacity for NRM	Strengthen partnerships with other community groups and organisations by working on joint projects
	Institutional Planning for NRM	Prepare and implement species and location management plans
	Research to improve knowledge	Numerous research topics to improve knowledge on species and its requirements
	Asset condition monitoring and assessment	Species population monitoring; Threat status monitoring
Wetland Management Plan for Constructed and Naturally Occurring Wetlands in the Swan Hill Municipality 2006-2008	Pest Plant Control	Priority weed control
	Pest Animal Control	European Carp, Rabbit and Fox control
	Habitat Protection	Exclusion of stock and recreational access to habitat
Swan Hill Rural City Council Plan 2009-2013	Supporting Institutional Planning for NRM	Support development an implementation of various Council sub-strategies to benefit NRM
	Supporting Institutional Capacity for NRM	Development and support of regional partnerships between institutions with a stake in NRM

	Supporting Human Capacity for NRM	Informing & educating the community on sustainability and NRM issues
Swan Hill Rural City Council Roadside Management Plan 2007-2009	Supporting Human Capacity for NRM	Informing & educating the community on NRM issues associated with roadside management
	Supporting Institutional Capacity for NRM	Provides benchmarks and processes for management of roadsides; partnership arrangements for roadside management
	Institutional Planning for NRM	Preparation and implementation of local plans and laws to manage and protect roadside habitat
Swan Hill Rural City Council Strategic Linkages Plan 2008 – 2011	Habitat Protection	Exclusion of stock and recreational access to priority roadsides (Towan Plains-Nyah West; Meridian)
	Habitat Restoration	Restoration planting within priority roadsides (Towan Plains-Nyah West; Meridian)
	Revegetation	Revegetate to link discontinuous remnants along priority roadsides (Towan Plains-Nyah West; Meridian)
	Supporting Human Capacity for NRM	Informing & educating the community on NRM issues associated with roadside management
	Supporting Institutional Capacity for NRM	Partnership arrangements for roadside management; Development and implementation of local planning arrangements
	Landholder Driven Planning for NRM	Supporting and promoting establishment of covenants on neighbouring habitat to along priority roadsides (Towan Plains-Nyah West; Meridian)
	Asset condition monitoring and assessment	condition of habitat along priority roadsides (Towan Plains-Nyah West; Meridian)
Western Region Sustainable Water Strategy	Supporting Institutional Capacity for NRM	Investing in integrated catchment management to improve waterways
Mallee River Health Strategy 2005	Pest Plant Control	Planning, coordination and implementation of priority weed control programs along Tyrrell and Lalbert Creeks
	Pest Animal Control	Planning, coordination and implementation of priority pest control programs along Tyrrell and Lalbert Creeks
	Supporting Institutional Capacity for NRM	Partnerships between organisaton to improve knowledge about Tyrrell and Lalbert Creeks
	Supporting Social Capacity for NRM	Community education via schools, Landcare and Waterwatch groups
	Research to improve knowledge	Numerous research topics to improve knowledge on Tyrrell and Lalbert Creeks
Mallee Wetland Strategy 2006-2011	Pest Plant Control	Focus on willows and aquatic weeds
	Pest Animal Control	Focus on rabbits & carp
	Habitat Protection	Identification of priority sites; protection from stock grazing

	Habitat Restoration	Identification of priority sites with works to occur at five of them across the region
	Environmental Watering	Determine appropriate water regimes
	Threatened Species Interventions	Identify three prioirty species and implement key recommendations from their Action Statements or Recovery Plans as relevant to wetlands
	Supporting Human Capacity for NRM	Raising awareness and improving knowledge of wetland values and threats in the community; improving knowledge of indigenous wetland values
	Institutional Planning for NRM	preperation and implementation of local planning overlays and wetland management plans
	Research to improve knowledge	improve knowledge of wetland values and threats to those values
	Asset condition monitoring and assessment	Determine wetland condition; monitor responses arising from interventions
Native Fish Strategy for the Murray-Darling Basin 2003-2013	Pest Animal Control	Control of carp and other alien fish
	Habitat Protection	protect key aquatic and riparian habitat; protect key linkages between floodplains and aquatic habitats
	Habitat Restoration	improve fish passage/water quality/key aquatic & riparian habitats
	Institutional Planning for NRM	preperation and implementation of species and fish community recovery plans
	Supporting Institutional Capacity for NRM	enhance knowledge of and partnership support for the Strategy
	Supporting Human Capacity for NRM	enhance knowledge of and support for the Strategy and native fish in general
Mallee Invasive Plants and Animals Management Strategy 2011	Pest Plant Control	prevent new introductions; contain high risk weed species
	Pest Animal Control	prevent new introductions; contain high risk pest animal species
	Supporting Human Capacity for NRM	improve community knowledge and awareness of invasive plants and animals and methods of control
	Supporting Institutional Capacity for NRM	support partnership arrangements between organisations with responsibilities for control and management of invasive plants and animals
	Supporting Social Capacity for NRM	Support community organisations carrying out targeted invasive plant and animal management with information, education, extension, enforcement and the identification of funding opportunities; Actively seek community participation and create partnerships with community groups in all IPA management project and programs

	Asset condition monitoring and assessment	monitor invasive plants and animals against both past interventions and for future actions;
Buloke Shire Roadside Vegetation Guidelines for the Community 2010-2013	Supporting Human Capacity for NRM	Informing & educating the community on NRM issues associated with roadside management
	Supporting Institutional Capacity for NRM	Provides benchmarks and processes for management of roadsides; partnership arrangements for roadside management
	Institutional Planning for NRM	Preparation and implementation of local plans and laws to manage and protect roadside habitat
National Recovery Plan for Buloke Woodlands of the Riverina and Murray Darling Depression Bioregions	Pest Plant Control	Weed management in critical habitat for species likely to significantly alter character of Buloke Woodland
	Habitat Restoration	in planting within degraded remnants; re-introduction of keystone community species
	Supporting Human Capacity for NRM	Raise community awareness of Buloke woodland community; encourage community participation in restoration activites
	Institutional Planning for NRM	prepare and implement management plans for public reserves containing Buloke community
	Landholder Driven Planning for NRM	encourage and support the creation of covenants to protect remnants on private land
	Research to improve knowledge	improve knowledge of ecological requirements
National Recovery Plan for the Chariot Wheels Maireana cheelii	Pest Plant Control	Weed management in critical habitat
	Habitat Protection	Exclusion of stock and vehicular access to habitat
	Threatened Species Interventions	Numerous interventions to manage known populations
	Supporting Human Capacity for NRM	Raise community awareness of species
	Research to improve knowledge	Numerous research topics to improve knowledge on species and its requirements
	Asset condition monitoring and assessment	Species population monitoring
Approved Conservation Advice for Swainsona murrayana (Slender Darling-pea)	Pest Plant Control	Control competing weeds in known populations
	Habitat Protection	Exclusion of stock and vehicular access to known habitat/populations
	Supporting Human Capacity for NRM	Raise community awareness of species
	Institutional Planning for NRM	prepare and implement management plans for public reserves containing species

	Landholder Driven Planning for NRM	encourage and support the creation of covenants to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Grey-crowned Babbler Pomatostomus temporalis	Habitat Protection	Exclusion of stock and vehicular access to known habitat/populations
	Supporting Human Capacity for NRM	Raise community awareness of species
	Supporting Institutional Capacity for NRM	Encorage liasion between various regional organisations with planning, roadsides and vegetation management responsibilities
	Institutional Planning for NRM	prepare and implement management plans for public reserves containing species
	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Plains Wanderer Pedionomus torquatus	Supporting Human Capacity for NRM	Raise community awareness of species
	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Bush Stone-Curlew Burhinus grallarius	Pest Animal Control	Fox control in and near key habitat
	Supporting Human Capacity for NRM	Raise community awareness of species; target golf courses with remnant habitat with specific education and land management material
	Institutional Planning for NRM	Develop or amend planning scheme regulations to protect key habitat areas
	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land

Flora & Fauna Guarantee Action Statement Brolga Grus rubicunda	Supporting Human Capacity for NRM	Raise community awareness of species
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Great Egret Ardea alba Intermediate Egret Ardea intermedia Little Egret Egretta garzetta	Environmental Watering	Maintain appropriate water regimes in wetlands and creeks systems
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Twelve threatened Swainson-peas and Darling-peas (Swainsona species)	Pest Plant Control	Control competing weeds in known populations
	Habitat Protection	Exclusion of stock and vehicular access to known habitat/populations
	Supporting Human Capacity for NRM	Raise community awareness of species
	Institutional Planning for NRM	prepare and implement management plans for public reserves containing species
	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Blue-billed Duck Oxyura australis	Pest Animal Control	Fox control in and near key habitat
	Habitat Protection	Exclusion of stock and vehicular access to known habitat/populations; minimise disturbance through wetland closure etc.
	Supporting Human Capacity for NRM	Raise community awareness of species; target golf courses with remnant habitat with specific education and land management material
	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring

Flora & Fauna Guarantee Action Statement Inland Carpet Python Morelia spilota metcalfei	Habitat Protection	Exclusion of stock and vehicular access to habitat; management of recreation activities in preferred habitat
	Pest Animal Control	Rabbit and fox control
	Threatened Species Interventions	Numerous interventions to manage known populations
	Supporting Human Capacity for NRM	Raise community awareness of species
	Research to improve knowledge	Numerous research topics to improve knowledge on species and its requirements
	Asset condition monitoring and assessment	Species population monitoring
Flora & Fauna Guarantee Action Statement Chariot Wheels Maireana cheelii	Habitat Protection	Exclusion of stock and vehicular access to known populations on private property in Birchip area
	Threatened Species Interventions	Numerous interventions to manage known populations on private property in Birchip area
	Supporting Human Capacity for NRM	Raise community awareness of species
	Research to improve knowledge	Numerous research topics to improve knowledge on species and its requirements
	Asset condition monitoring and assessment	Species population monitoring
	Institutional Planning for NRM	Incorporate actions into relevant park or reserve management plan; provision of information and advice to local government for inclusion in planning processes
	Landholder Driven Planning for NRM	Negotiate voluntary management agreements with private landholder(s) in Birchip area
Flora & Fauna Guarantee Action Statement Winged Peppercress Lepidium monoplocoides	Habitat Protection	Fencing populations and habitat (Stony Plain Bushland Reserve)
	Supporting Human Capacity for NRM	awareness raising of species status and means to minimise harm to species
	Institutional Planning for NRM	adjust Mallee Parks Plan to reflect species importance and ecological needs of the various populations
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
Nulawil Landcare Group Action Plan	Pest Plant Control	Rabbit control
	Habitat Restoration	Planting within Tyrell and Lalbert Creeks

	Community Driven Planning for NRM	Prepare and implement Group Action Plan
Berriwillock Landcare Group Action Plan	Pest Plant Control	African boxthorn control
	Pest Animal Control	Rabbit and fox control
	Habitat Protection	Fencing of Tyrrell Creek
	Habitat Restoration	Planting within fenced areas of Tyrrell Creek
	Supporting Human Capacity for NRM	Interpretive material prepared for Angels Rest Flora Reserve
	Community Driven Planning for NRM	Prepare and implement Group Action Plan
Manangatang Landcare Group Action Plan	Pest Plant Control	Wheel Cactus control
	Pest Animal Control	Rabbit and fox control
	Supporting Social Capacity for NRM	enhance commitment to Junior Landcare
	Supporting Human Capacity for NRM	Improve local knowledge about sustainable farming techniques
	Community Driven Planning for NRM	Prepare and implement Group Action Plan
Culgoa Landcare Group Action Plan	Pest Animal Control	Rabbit and fox control
	Supporting Human Capacity for NRM	Improve local knowledge about sustainable farming techniques
	Habitat Restoration	planting in Culgoa Cemetry; redirection of stormwater from Culgoa to Tyrrell Creek
	Community Driven Planning for NRM	Prepare and implement Group Action Plan
Lalbert Landcare Group Action Plan	Pest Plant Control	African boxthorn control
	Pest Animal Control	Rabbit control
	Habitat Restoration	Restoration of area adjacent to Lalbert Golf Course
	Supporting Social Capacity for NRM	Enhance commitment to Junior Landcare
	Threatened Species Interventions	Interventions to protect Inland Carpet Python Morelia spilota metcalfei
	Community Driven Planning for NRM	Prepare and implement Group Action Plan
Sea Lake Landcare Group Action Plan	Pest Animal Control	Rabbit and fox control

	Supporting Social Capacity for NRM	enhance commitment to Junior Landcare
	Supporting Human Capacity for NRM	Increase participation in Landcare
	Habitat Restoration	Restoration work at Lake Tyrrell; Green Lake; Lions Camp
	Community Driven Planning for NRM	Prepare and implement Group Action Plan
Waitchie & Swan Hill West Landcare Group Action Plan	Pest Plant Control	Wheel Cactus, Prickly Pear and African boxthorn control
	Pest Animal Control	Rabbit control
	Supporting Social Capacity for NRM	Enhance commitment to Junior Landcare
	Supporting Human Capacity for NRM	Improve local knowledge about sustainable farming techniques
	Habitat Restoration	Lalbert Creek; numerous small reserves and heritage sites
	Community Driven Planning for NRM	Prepare and implement Group Action Plan
Birchip Landcare Group Action Plan	Pest Plant Control	African boxthorn & Wheel Cactus control
	Pest Animal Control	Rabbit control
	Threatened Species Interventions	Interventions to protect: Inland Carpet Python Morelia spilota metcalfei; Chariot Wheels Maireana cheelii; Bush Stone-Curlew Burhinus grallarius and the Lace Monitor
	Supporting Social Capacity for NRM	Enhance commitment to Junior Landcare
	Supporting Human Capacity for NRM	Increase participation in Landcare
	Supporting Institutional Capacity for NRM	Strengthen partnerships with other community groups and organisations by working on joint projects
	Community Driven Planning for NRM	Prepare and implement Group Action Plan
Nyah West Landcare Group	Pest Animal Control	Rabbit control
	Pest Plant Control	African boxthorn & Wheel Cactus control
	Supporting Human Capacity for NRM	Improve local knowledge about sustainable farming techniques
	Supporting Social Capacity for NRM	Enhance commitment to Junior Landcare
	Community Driven Planning for NRM	Prepare and implement Group Action Plan

Woomelang Lascelles Landcare Group	Pest Animal Control	Rabbit control
	Pest Plant Control	African Boxthorn, Bridal Creeper & Hudson Pear control
	Supporting Human Capacity for NRM	Improve local knowledge about sustainable farming techniques
	Supporting Social Capacity for NRM	Enhance commitment to Junior Landcare
	Supporting Institutional Capacity for NRM	Partnership with Woomelang & District Development Association, to work towards site goals for the Railway Dams project
	Habitat Restoration	maintain and enhance local biodiversity assets, for community enjoyment and ecological function.
	Community Driven Planning for NRM	Prepare and implement Group Action Plan

6. Prioritising Potential Management Actions

Potential management action categories are prioritised in terms of:

- the value of a regional asset within the catchment asset area;
- the priority to address a threatening process to those values;
- the capacity of the management action to address the threatening process; and
- the level of investment (in both of time and money) required to exercise that capacity.

Individual management actions are grouped and scored by consensus against agreed criteria and then each potential management action group within the Catchment Asset is assigned to a category that defines the prospective priority to the implementation.

Four category levels were identified:

None – indicates that either the management action group not contained in management plans relevant to the Catchment Asset area or the targeted threatening processes that it addresses is unknown or not present within the Catchment Asset area.

Low – typically indicates either that the targeted threatening processes are of low priority within this Catchment Asset area or the management action category is known to be generally not effective at mitigating the threatening process. It may also indicate that there is insufficient knowledge or data available to define or quantify the effectiveness of the management action to mitigate the threatening process and therefore prioritise it with confidence. Further research may be required to rectify this situation.

Medium – typically indicates that the targeted threatening processes are of medium priority within this Catchment Asset area and the management action category is known to be generally effective at mitigating the threatening process and is within the region's capacity to implement over the life of the RCS. It may also indicate that there is some uncertainty with the effectiveness of the potential management action upon a high priority threatening process in terms of either the scale of the threat, the known capacity of the action or the investment required to exercise that capacity.

High – indicates that the targeted threatening processes are of high priority within this Catchment Asset area and the management action category is known to be effective at mitigating the threatening

process and is within the region's capacity to implement over the life of the RCS and that action is required urgently in order to prevent further impact as a result of the threatening process.

7. Management Action Priorities

Threatening Processes Priority of Action

Table 22 below represents the findings of a group based analysis in June 2013 of the threat level posed by threatening processes upon Regional Assets within this Catchment Asset based on the criteria contained in Appendix 2. *Categorising Threatening Processes*. The bottom row of the table contains a median 'score' for the threat level posed by each of the threatening processes across the Catchment Asset. These 'scores' are the same as those shown in Table 2.

Table 22: Threatening Process Priority of Action Summary

	Land & water salinisation	Invasive Plants	Invasive Animals	Altered Hydrological Regimes	Soil Erosion	Inappropriate Water Use Practices	Recreational Pressures	Land Use Change	Direct off-site interactions	Misaligned community perceptions	Inappropriate fire regimes	Constrained regenerative capacity
Rivers	medium	high	high	high	medium	medium	medium	high	low	medium	none	high
Wetlands	medium	high	high	high	high	medium	medium	high	low	medium	none	high
Threatened Species	high	high	medium	high	high	medium	medium	high	low	medium	medium	high
Terrestrial Habitat	medium	high	medium	high	high	medium	medium	high	low	medium	medium	high
Soils	high	high	high	high	high	medium	none	high	low	medium	none	none
Agricultural Land	high	high	high	high	high	medium	none	high	low	medium	none	none
Groundwater	none	none	none	none	none	none	none	none	none	none	none	none
Cultural Heritage	none	high	high	high	high	medium	high	high	low	medium	none	none
Community Capacity	none	none	none	none	none	none	none	none	none	medium	none	none
ALL REGIONAL ASSETS	High	High	High	High	High	Medium	Medium	High	Low	Medium	Medium	High

Management Action Priority Matrix

The table below represents the findings of an integration and analysis of the following components:

- the threatening processes priority of action table shown above;
- the management actions from existing management plans shown in Table 21;

- knowledge and evidence supporting past successes (or otherwise) of various management actions in the Mallee or in this Catchment Asset area; and
- the likelihood of implemented management actions addressing or mitigating threatening processes over the life of the RCS.

The criteria used to apply a value to each management action against each Regional Asset is contained in Appendix 6. *Prioritising Potential Management Actions*. The far right column of the table contains a median 'score' for each the management action priority across the Catchment Asset. These 'scores' are the same as those shown in Table 3.

Table 23: Management Action Priority Summary

	Rivers	Wetlands	Threatened Species	Terrestrial Habitat	Soils	Agricultural Land	Groundwater	Cultural Heritage	Community Capacity	Across All Assets
Pest Plant Control	High	High	High	High	High	High	None	High	None	**High**
Pest Animal Control	High	High	High	High	High	High	None	High	None	**High**
Habitat Protection	Medium	High	High	High	Low	Low	None	High	None	**High**
Habitat Restoration	Low	Medium	Medium	Medium	Low	Low	None	Medium	None	**Medium**
Revegetation	Low	Medium	Medium	Medium	Medium	Medium	None	Low	None	**Medium**
Environmental Watering	High	High	High	High	High	Medium	None	Medium	None	**High**
Soil Erosion Control	Medium	High	Medium	Medium	High	High	None	High	None	**High**
Threatened Species Interventions	High	High	High	High	None	None	None	None	None	**High**
Enhancing Land Management Regimes	Medium	High	High	High	High	High	None	High	None	**High**
Supporting Human Capacity for NRM	Medium	Medium	Medium	Medium	Medium	Medium	None	Medium	Medium	**Medium**
Supporting Institutional Capacity for NRM	Medium	Medium	Medium	Medium	Medium	Medium	None	Medium	Low	**Medium**
Supporting Social Capacity for NRM	Medium	Medium	Medium	Medium	Medium	Medium	None	Medium	Medium	**Medium**
Institutional Planning for NRM	Medium	High	High	High	High	High	None	Medium	Medium	**High**
Community Driven Planning for NRM	Medium	Medium	Medium	Medium	High	Medium	None	Medium	Low	**Medium**
Landholder Driven Planning for NRM	Medium	Medium	Medium	High	High	High	None	High	Low	**High**

Research to improve knowledge	Medium	High	High	High	High	High	None	High	Medium	**High**
Asset condition monitoring and assessment	High	High	High	High	High	High	None	High	Low	**High**

Therefore, the highest priority management actions within this Catchment Asset over the life of the Regional Catchment Strategy should be:

- Pest Plant Control;
- Pest Animal Control;
- Habitat Protection
- Environmental Watering;
- Soil Erosion Control;
- Threatened Species Interventions;
- Enhancing Land Management Regimes
- Institutional Planning for NRM;
- Landholder Driven Planning for NRM;
- Research to improve knowledge; and
- Asset condition monitoring and assessment.

Implementation of these actions should provide the greatest impact on the mitigation of the most concerning threatening processes within this Catchment Asset and make a significant contribution to the achievement of the expected outcomes of the Mallee Regional Catchment Strategy.

12 – Avoca Basin Terminal Lakes System and Creeklines

Regional Catchment Strategy Implementation Plan

Mallee Regional Catchment Strategy 2013-19