



Wodonga Urban Landcare Network

Wodonga Regional Waterway Action Plan

Wodonga Urban Landcare Network

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EXECUTIVE SUMMARY

Background

In 2000, the Wodonga City Council and the North East Catchment Management Authority (CMA) jointly developed the Wodonga Waterway Action Plan (Thompson Berrill Landscape Design). This Plan is now out of date with many of its objectives met and new issues arising from a change in social, environmental and economic factors occurring across the project area in recent years. As such, the development of a new Waterway Action Plan was sought.

The primary objective of the Waterway Action Plan is to provide guidance to the relevant project stakeholders, including the North East CMA, the Wodonga City Council and the local Landcare groups on the sustainable restoration and management of waterway systems within the Wodonga City Council.

The Waterway Action Plan has been developed with reference to the following key principles, developed by the project partners:

- Providing a relevant resource of best management practice in relation to waterways.
- Ensuring that the values and functions of waterways and floodplains are maintained.
- Recognising aesthetic values and promoting recreation and social opportunities.
- Respecting community values, aspirations and priorities as they relate to the waterways of Wodonga.

The project area for this Waterway Action Plan encompasses all waterways in the Wodonga City Council. Each of these creeks have a unique range of values and threats. The higher priority waterways across the project area are Castle Creek, Felltimber Creek, House Creek, Huon Creek, Jack in the Box Creek, Kookinburra Creek, Middle Creek, Wodonga Creek, Finns Creek, the Kiewa River and Yackandandah Creek.

Method

The Waterway Action Plan provides a strategic plan for the waterways across the Wodonga City Council region and builds upon recent community consultation work undertaken by the Wodonga Urban Landcare Network in partnership with North East CMA. The development of the plan involved the following key stages:

- Project Scoping and Initiation. This included an inception meeting with WULN and Project Control Group, a visit to some key areas with the Project Control Group, and a review of background information, documentation and data.
- Identification of issues, opportunities and current Best Practice actions through undertaking targeted field assessments and workshops with the project reference group.
- Preparation of the Draft Waterway Action Plan by drawing on existing background information, investigations, relevant strategies and policies and knowledge of the current condition of the project area gained through the targeted field assessments.

Relevant Catchment Influences and Processes

Through the review of background information and site inspections the following key catchment processes and influence were identified across the project area:

- Increased discharge from land clearing and urbanisation.
- Bed deepening often related to increased discharge and larger peak flows.



- Bank erosion associated with various waterway processes.
- Sediment transport and deposition. Significant sediment deposits were evident in the lower Huon Creek and Jack in the Box Creek.
- Poor soil and water management associated with land development and construction sites can be a major sediment contributor to waterways.
- The removal of riparian vegetation and large woody habitat. Removing vegetation from the banks and large wood not only acts to increase the rate of flow but also reduces the banks resistance to erosion.
- Grazing pressures were identified across a substantial proportion of the waterways within the project area.
- Waterway crossings within the project area are influencing the hydrologic, hydraulic and physical conditions surrounding the crossing site.
- Willows and other weeds species were prolific across waterways in the urban areas.
- Large stands of Phragmites were present across the project area.

Upon completion of the field inspection and review of the relevant literature, a vision was developed for the waterways of the Wodonga area by the project team. This vision being:

“To develop ecologically healthy and self-sustaining waterway environments throughout the Wodonga region, promoting community values and social utilisation of the riparian zone where applicable”.

The vision is a broad objective to be achieved through the successful management of the Wodonga waterway corridors through this Regional Waterway Action Plan. To achieve this vision, the Wodonga Urban Landcare Network and stakeholders have identified the following management objectives:

- Ensure that the values and functions of waterways and floodplains are maintained or improved.
- Recognise aesthetics values and to promote recreation and social opportunities.
- Respect community values, aspirations and priorities as they relate to the waterways of Wodonga.

The successful implementation of the Plan shall lead to the riparian zones in the priority waterways being less weedy, better connected (both in terms of people and habitat), and more stable.

Management Recommendations

To achieve the vision set for the waterways of Wodonga the following actions have been identified:

- Stock access management.
- Exotic flora management.
- Native flora management.
- Bed instability and bank erosion management.
- Stakeholder engagement.
- Manage sediment inputs.

To assist with prioritising projects, guiding principles have been developed. These principles should be considered in the development of any future works proposal to demonstrate and/or justify the strength of any individual works proposal or funding bid. The principles that should be considered in the prioritisation process are:

- Project planning and development – Priority given to projects with:



- Clear and measurable project objectives,
- Actions that are complementary to the Plan and other Plans/Strategies,
- Projects that are in line with Best Practice Management.
- Protection of existing waterway values. Priority to be given to protecting ecological and structurally intact reaches.
- Erosion management – priority given to addressing bed erosion and erosion that is negatively impacting on public and environmental assets.
- Weed management – targeting the highest priority weed species first including black willow.
- Riparian vegetation management – prioritise the protection of existing values and where the revegetation provides multi-benefits outcomes.
- Sediment Management – priority given to those actions that involve the management of sediment supply at the source.



CONTENTS

1	INTRODUCTION	12
1.1	Project Area	12
1.1.1	Geographic Extent	12
1.2	Project Aims	13
1.3	Project Governance	13
1.3.1	Project Control Group	13
1.3.2	Project Reference Group	13
1.4	Method	14
1.5	Consultation	16
1.6	Acknowledgement of Country	16
2	MANAGEMENT CONTEXT	17
2.1	Overview	17
2.2	Urban Development and Growth	17
2.3	Land Tenure and Management Purpose	18
2.3.1	Riparian Management Zones	18
2.3.2	Riparian Management Zone Expectations	24
2.4	Stakeholder Authorities and Partner Organisations	25
2.4.1	Wodonga Urban Landcare Network	26
2.4.2	Wodonga City Council	27
2.4.3	North East Catchment Management Authority	28
2.4.4	Parklands Albury Wodonga	28
2.4.5	Department of Environment, Land, Water and Planning	28
2.4.6	Country Fire Authority	28
2.5	Strategies and Plans	28
2.5.1	The North East Regional Catchment Strategy	29
2.5.2	North East Waterway Strategy	30
2.5.3	The Wodonga Retained Environment Network (WREN) – A Threatened Species and Habitat Conservation Strategy	30
2.5.4	The Leneva Valley and Baranduda Native Vegetation Precinct Plan (NVPP)	31
2.6	Approval Requirements	32
2.6.1	Land Manager Approval	34
2.6.2	Council Approval	34
2.6.3	Works on Waterways Permits	34
2.6.4	Cultural Heritage	35
3	RELEVANT CATCHMENT INFLUENCES AND PROCESSES	36
3.1	Overview	36
3.2	Increased Discharge	36
3.3	Bed Deepening	36
3.4	Bank Erosion	37



3.5	Sediment Transport and Deposition	37
3.6	Soil and Water Management	38
3.7	Riparian Vegetation and Large Woody Habitat Removal	39
3.8	Stock Pressures	39
3.9	Waterway Crossings	39
3.10	Willows	41
3.11	Phragmites	41
4	CATCHMENT CONDITION	44
4.1	Overview	44
4.2	Kookinburra Creek	46
4.2.1	Upper Reach	46
4.2.2	Mid Reach	48
4.3	Felltimber Creek	50
4.3.1	Upper Reach	51
4.3.2	Mid Reach	53
4.3.3	Golf Course Reach	57
4.3.4	Lower Reach	59
4.4	Huon Creek	64
4.4.1	Upper Reach	65
4.4.2	Mid Reach	67
4.4.3	Lower Reach	70
4.5	Castle Creek	74
4.5.1	Upper Reach	74
4.5.2	Mid Reach	77
4.5.3	Lower Reach	78
4.6	House Creek	80
4.6.1	Upper Reach	81
4.6.2	Mid Reach	83
4.6.3	Lower Reach	86
4.7	Jack-in-the-Box Creek	89
4.7.1	White Box Rise Reach	90
4.7.2	The Piped Reach	95
4.7.3	Lower Reach	96
4.8	Middle Creek	99
4.8.1	Upper Reach	99
4.8.2	Mid Reach	101
4.8.3	Lower Reach	104
4.9	Yackandandah Creek	106
4.9.1	Staghorn Flat Reach	107
4.9.2	The Kiewa Reach	110
4.10	Kiewa River	113
4.11	Wodonga Creek	115



5	MANAGEMENT RATIONALE	116
5.1	Vision and Objectives	116
5.2	Restoration and Rehabilitation	116
6	MANAGEMENT RECOMMENDATIONS	117
6.1	Management Recommendations and Prioritisation	117
6.1.1	Overview	117
6.1.2	Prioritisation	117
6.2	Future and Existing Developments	129
6.3	Key Management Tools	130
6.3.1	Vegetation Establishment	130
6.3.2	Fencing (Stock Exclusion)	132
6.3.3	Woody Weed Management	133
6.3.4	Structural Works	133
7	MONITORING AND EVALUATION	137
8	REFERENCES	139

APPENDICES

Appendix A – Waterway Condition Maps and Summary Sheets

LIST OF FIGURES

Figure 1-1	The project area and major waterways.	12
Figure 1-2	Project method outline.	15
Figure 2-1	Current and future growth areas surrounding Wodonga (reproduced from the Wodonga Growth Strategy, 2016).	18
Figure 2-2	Example Formal Parkland, Gerard Moylan Park, Wodonga.	19
Figure 2-3	Informal Parkland.	20
Figure 2-4	Riparian Reserve at the top of Jack in the Box Creek, upstream of Thomas Mitchell Drive.	21
Figure 2-5	Example Rural Riparian Reserve on Kookinburra Creek incorporating revegetation work.	22
Figure 2-6	Example Rural Riparian Reserve, where stock pressures are evident within and surrounding the waterway.	22
Figure 2-7	A Habitat Reserve.	23
Figure 2-8	Constructed Floodway on Jack in the Box Creek.	24
Figure 2-9	Project stakeholders and partners.	26
Figure 2-10	Key strategies and plans relevant to the Waterway Action Plan.	29
Figure 2-11	Likely approvals requirements associated with waterway rehabilitation works.	33
Figure 3-1	Conceptual diagram of head-cut erosion (or knickpoint recession) migration process.	37
Figure 3-2	Sand deposited in channel, Huon Creek downstream of Yarralumla Drive.	38
Figure 3-3	Phragmites within the Felltimber Creek channel downstream of Parkes Road.	42
Figure 3-4	Phragmites patch adjacent Huon Creek at David Winterbottom Park.	43



Figure 4-1	Site assessment locations. Reported sites are represented by the red dots, visited sites are represented by the green dots.	45
Figure 4-2	Kookinburra Creek reaches.	46
Figure 4-3	Vegetation along the upper Kookinburra Creek.	47
Figure 4-4	Entrenched section of Kookinburra Creek which has been fenced and revegetated.	49
Figure 4-5	Bank instabilities on Kookinburra Creek.	49
Figure 4-6	Felltimber Creek reaches.	51
Figure 4-7	Looking down the Felltimber Creek valley. Note the largely cleared catchment, with the exception of the Swainsona Reserve.	52
Figure 4-8	Looking upstream at Upper Reach of Felltimber Creek. The bedrock and floating rock makes the reach highly stable.	52
Figure 4-9	Downstream view of the entrenched section of Felltimber Creek. Inset floodplain pockets have formed in this section and discontinuous bank erosion is evident.	54
Figure 4-10	Downstream view of the culvert crossing beneath McGaffins Road. The base of the structure is being to undermine.	54
Figure 4-11	Upstream view of a change in bed grade within Felltimber Creek downstream of Felltimber Creek Road, currently held by willow roots.	55
Figure 4-12	Downstream view of Felltimber Creek downstream of Felltimber Creek Road showing the urban encroachment and garden plantings.	56
Figure 4-13	Felltimber Creek Mid Reach weeds become more abundant and diverse in a downstream direction.	56
Figure 4-14	Head-cut present in the Golf Course Reach.	58
Figure 4-15	Typical section of the Felltimber Creek reserve, situated between residential development and golf course.	59
Figure 4-16	Looking downstream at the levy along the right bank at Wodonga TAFE.	60
Figure 4-17	Felltimber Creek has deepened, evidenced by the exposed River Red Gum roots in this image.	61
Figure 4-18	Bank erosion within the Lower Reach of Felltimber Creek.	61
Figure 4-19	Looking upstream at rock beaching work within the lower section of Felltimber Creek, adjacent Wodonga TAFE.	62
Figure 4-20	Felltimber Creek adjacent to Morefield Park Drive showing the woody riparian vegetation comprises a mixture of native and exotic species.	63
Figure 4-21	Felltimber Creek adjacent Wodonga TAFE showing exotic groundcover.	63
Figure 4-22	Huon Creek reaches.	65
Figure 4-23	Exposed bedrock located downstream of Gilberts Road.	66
Figure 4-24	A small head-cut located upstream of the Gilbert Road crossing.	66
Figure 4-25	Undermining of the Gilberts Road crossing.	67
Figure 4-26	Over enlarged channel located within the Mid Reach of Huon Creek.	68
Figure 4-27	Rock beaching located on an outside bend.	69
Figure 4-28	Deposited sand creating a uniform bed profile in the Lower Reach of Huon Creek.	70
Figure 4-29	Sand being transported through Huon Creek and being deposited in House Creek.	71
Figure 4-30	Looking upstream at erosion around a stormwater outlet on Huon Creek at Veronica Egan Park.	71
Figure 4-31	Location and photograph of Common Reed wetland.	72
Figure 4-32	Close up view of Parrot's Feather at the downstream end of Huon Creek.	73
Figure 4-33	Castle Creek reaches.	74
Figure 4-34	Confined Valley of the Upper Reach of Castle Creek.	75



Figure 4-35	Bedrock steps that are present the Upper Reach of Castle Creek will limit channel adjustment.	75
Figure 4-36	The bank damage and erosion caused by cattle and gully erosion in the Upper Reach of Castle Creek.	76
Figure 4-37	Looking upstream at an over enlarged section of Castle Creek with an inset floodplain pocket.	77
Figure 4-38	Reach location and photo showing lack of natives and presence of willows.	78
Figure 4-39	Head cut that has been armoured with concrete.	79
Figure 4-40	Creek line upstream in summer (left) and downstream in winter (right) of Yarralumla Drive.	80
Figure 4-41	House Creek reaches.	81
Figure 4-42	Erosion is evident in an area where the grass is mown to the top of the bank.	82
Figure 4-43	Left bank managed parkland, weed infested right bank.	83
Figure 4-44	Looking downstream at a large sand deposit in House Creek.	84
Figure 4-45	Head-cut in House Creek, approximately 50 metres upstream of Melbourne Road, that is currently stabilised by willow roots.	85
Figure 4-46	Semi-formal parkland floodplains, Black Willow infested channel downstream from Brockley Street.	85
Figure 4-47	Parrots Feather infestations upstream of Lawrence Street, closeup of stem and leaves.	86
Figure 4-48	Rock lined channel of House Creek located under the Hume Freeway.	87
Figure 4-49	House Creek weeds surrounding Red Gums within Phil Locke Adams Park.	88
Figure 4-50	Heavily infested channel downstream of Forrest Mars Avenue, Felix Grundy Park with Tree of Heaven infesting hillslope adjacent to abattoir.	88
Figure 4-51	Jack in the Box Creek reaches.	90
Figure 4-52	Grassed swale that is one of the main tributaries of Jack-in-the-Box Creek.	91
Figure 4-53	Rill erosion has occurred at the White Box Rise development.	92
Figure 4-54	Sand bags being used to direct sediment into a side entry pit at the existing development of White Box Rise.	92
Figure 4-55	Significant volume of sediment in the upstream pond at Wodonga Racecourse and Recreation Reserve.	93
Figure 4-56	Looking upstream at erosion in one of the tributaries of Jack-in-the-Box Creek, upstream (south) of Victoria Cross Parade.	93
Figure 4-57	Jack-in-the-Box Creek grass swale in Arthur Dunstan Park.	95
Figure 4-58	Junction pit at Osburn Street. Note the milky water to the left of the junction pit.	96
Figure 4-59	Woody weed infested riparian zone adjacent to Kendall Street.	97
Figure 4-60	A Red Gum patch near the old railway line adjacent Jack in the Box Creek.	98
Figure 4-61	Middle Creek reaches.	99
Figure 4-62	Incised channel of Middle Creek showing unrestricted stock access to the channel.	100
Figure 4-63	Silver Creek, a tributary of Middle Creek, has deepened, likely in response to deepening within Middle Creek.	101
Figure 4-64	Bank erosion occurring on the outside bend and deposition occurring on the inside of the bend.	102
Figure 4-65	A rock chute situated in Middle Creek downstream of Frederic Street Road. The rock chute is providing an important function in maintaining channel stability.	103
Figure 4-66	Willows and Common Reed dominate the floodplain upstream of the Kiewa Valley Highway.	105
Figure 4-67	Willows occupy the channel downstream of Whytes Road.	105
Figure 4-68	Yackandandah Creek reaches.	107



Figure 4-69	Black Willow planted at the toe of the bank behind pile fields. Pile field works have frequently been implemented in conjunction with exotic vegetation plantings.	108
Figure 4-70	Looking downstream at the right bank. This section of stream has been subject to exotic vegetation plantings to manage erosion. Crack Willow has been planted on the inset floodplain (in the foreground), Black Willow on the bank toe and poplars on the top of the bank.	109
Figure 4-71	Looking downstream at Black Willow growing in the channel bed. In-stream willows are frequent within this reach.	109
Figure 4-72	Looking downstream within the Kiewa River, immediately downstream of the Yackandandah Creek – Kiewa River confluence.	111
Figure 4-73	Stock have unrestricted access throughout the Kiewa Reach of Yackandandah Creek. Access tracks on the bank face are common through this reach.	111
Figure 4-74	Typical section the Kiewa Reach, showing straight channel, scattered native and exotic vegetation.	112
Figure 4-75	Kiewa River reaches.	113
Figure 4-76	Outside bend located downstream of the Murray Valley Highway. Note the absence of riparian vegetation. Bank erosion has occurred across this outside bend.	114
Figure 6-1	Concept vegetation arrangement involving a vertical bank profile.	131
Figure 6-2	Concept revegetation arrangement for a sloped bank profile.	132
Figure 6-3	Conceptual rock beaching concept design arrangement.	134
Figure 6-4	An example of a timber revetment site, aimed at managing bank erosion. The application of this technique is strongly dependent upon the availability and arrangement of suitable timber.	135
Figure 6-5	An example rock chute, aimed at providing a stable bed gradient from one bed elevation to a lower bed elevation.	136

LIST OF TABLES

Table 1-1	Project Control Group Members.	13
Table 1-2	Project Reference Group Members.	14
Table 2-1	Current Growth Areas (Wodonga City Council, 2018).	17
Table 2-2	Typical characteristics of management zones. Black ticks denote usual practices, grey ticks denote possible practices.	25
Table 6-1	Summary of Management Strategies and Actions.	120
Table 7-1	Key indicators to look for during ongoing monitoring.	138



1 INTRODUCTION

Water Technology was commissioned by the Wodonga Urban Landcare Network (WULN) to develop a Waterway Action Plan (WAP) for the waterways within the Wodonga City Council region.

The project is supported by Wodonga City Council, North East CMA and Wodonga Urban Landcare Network (WULN) and builds on recent community consultation work that has been undertaken by WULN in partnership with the North East CMA.

1.1 Project Area

1.1.1 Geographic Extent

The project area for this Waterway Action Plan encompasses all waterways in the Wodonga City Council. Each of these creeks have a unique range of values and threats.

The higher priority waterways across the project area are Castle Creek, Felltimber Creek, House Creek, Huon Creek, Jack in the Box Creek, Kookinburra Creek, Middle Creek, Wodonga Creek, Finns Creek, the Kiewa River and Yackandandah Creek.



Figure 1-1 The project area and major waterways.



1.2 Project Aims

In 2000, the Wodonga City Council and the North East Catchment Management Authority (CMA) jointly developed the Wodonga Waterway Action Plan (Thompson Berrill Landscape Design). This Plan is now out of date with many of its objectives met and new issues arising from a change in social, environmental and economic factors occurring across the project area in recent years. As such, the development of a new Waterway Action Plan was sought.

The primary objective of the Waterway Action Plan is:

To provide guidance to the relevant project stakeholders, including the North East CMA, the Wodonga City Council, the local Landcare groups and other relevant parties, on the sustainable restoration and management of waterway systems within the Wodonga City Council.

The Waterway Action Plan has been developed with reference to the following key principles, developed by the project partners:

- Providing a relevant resource of best management practice in relation to waterways.
- Ensuring that the values and functions of waterways and floodplains are maintained.
- Recognising aesthetics values and promoting recreation and social opportunities.
- Respect community values, aspirations and priorities as they relate to the waterways of Wodonga.

1.3 Project Governance

1.3.1 Project Control Group

A Project Control Group (PCG) was established for the Waterway Action Plan development. The PCG comprised the project manager organisation (the Wodonga Urban Landcare Network) and primary project partners (Table 1-1). The primary roles of the Project Control Group were to:

- Guide the preparation of the Waterway Action Plan development.
- Disseminate information to their relevant stakeholder group/agency.

Table 1-1 Project Control Group Members.

Stakeholder/group/agency	Project Control Group Member
Wodonga Urban Landcare Network (Project manager)	Julie Hind Anne Stelling Michelle Wilkinson
Wodonga City Council (Project partner)	Andrew Griffiths
North East CMA (Project partner)	Lachlan Campbell

1.3.2 Project Reference Group

The Project Reference Group (PRG) comprised key individuals and/or organisations that were deemed to have an interest in what is being proposed in the Wodonga Regional Waterway Action Plan by the Wodonga Urban Landcare Network. The PRG members were invited to participate in the Waterway Action Plan consultation process. Those who accepted an invitation to attend the PRG are summarised in Table 1-2. The Wodonga



Local Aboriginal Network were unable to accept a position on the PRG due to time constraints. Additionally, some organisations were unable to attend specific meetings due to availability.

Table 1-2 Project Reference Group Members.

Stakeholder/group/agency	Name
Wodonga Urban Landcare Network	Anne Stelling (WRWAP Project Manager) Michelle Wilkinson (WRWAP Project Officer)
Wodonga City Council	Andrew Griffiths
North East CMA	Lachlan Campbell
DELWP Crown Land Management	Pennie Keenes Glen Johnson
Parklands Albury Wodonga	Ant Packer
Wodonga TAFE	Kevin Albert
Mitta Mitta Canoe Club	Dave Cromarty
Individual landholders	Des McCourt Andrew Crocos
Wodonga Golf Club	John Anderson
Landcare Groups	Karen Stacey David Saxton Brian Trebilcock
Developers	Joshua Hall (Spiire) Felicia Davis (Land Urban) David Larkin (Land Urban)

1.4 Method

The Waterway Action Plan provides a strategic plan for the waterways across the Wodonga City Council region and builds upon recent community consultation work undertaken by the Wodonga Urban Landcare Network in partnership with North East CMA. This project represents the first time a Waterway Action Plan has been championed by a Landcare Network within the region.

Where possible, this Waterway Action Plan has been developed with reference to the policy and procedures outlined in the North East CMA Waterway Action Plans – Strategic and Implementation Policy (North East CMA 2008). This project represents the development of the strategic plan phase of the Waterway Action Plan process and involved the following key stages (Figure 1-2):

1. **Project Scoping and Initiation.** This stage involved:
 - a. An inception meeting with the Wodonga Urban Landcare Network and Project Control Group to communicate relevant information and knowledge.
 - b. A visit to some of the key areas with relevant stakeholders to gain an insight into the condition and issues present across the project area.
 - c. A review of relevant data and documentation with a focus on information pertaining to the history, management, condition, values and threats across the project area. The review assisted the selection of field assessment locations to ensure that the field work was undertaken on an informed basis.



2. **Issues, Opportunities, Current Best Practice Actions.** This stage involved:
 - a. Undertaking targeted field assessments based on the background research and through consultation.
 - b. Identification of the values, issues and opportunities present across the project area with reference to current best practice actions.
 - c. Undertaking a workshop with the Project Control Group and the Project Reference Group to transfer and seek knowledge in regards the waterway condition and Waterway Action Plan development process.
3. **Preparation of the Draft Waterway Action Plan.** The development of the Waterway Action Plan drew upon existing background information, investigations, relevant strategies and policies and a knowledge of the current condition of the project area gained through the targeted field assessments. Appropriate management strategies and actions were subsequently developed to address the key threats to values in the reach to produce the Waterway Action Plan for the project area.

The broader stakeholder engagement and implementation components will be undertaken outside of the current project scope.



Figure 1-2 Project method outline.



1.5 Consultation

The project partners have a strong focus on developing effective partnerships with relevant stakeholders and the community. A Community Engagement Plan was prepared as part of the development of this Waterway Action Plan with reference to The North East CMA Waterway Action Plans – Strategic and Implementation Policy (2010).

The Community Engagement Plan was used as a tool to develop a framework that guides the consultation process throughout the life of the Waterway Action Plan project. The actions contained within the Community Engagement Plan were developed by the WULN project staff, Michelle Wilkinson and Anne Stelling and the Water Technology project staff (Jamie Kaye, Tom Atkin and Julian Martin) for the life of the Waterway Action Plan development stage. The Community Engagement Plan was developed with reference to:

- The identified levels of community participation for each stage of the project based on the Public Consultation Spectrum (International Association for Public Participation 2004).
- The North East CMA Waterway Action Plans – Strategic and Implementation Policy (2010).
- The WULN's capacity to contribute to the Waterway Action Plan process.
- The stakeholder's and community's capacity to contribute to the Waterway Action Plan process.

1.6 Acknowledgement of Country

The project stakeholders acknowledge the traditional owners of the land on which the project area sits and pay their respects to their Elders past, present and future, for they hold the memories, the tradition and the culture of all Aboriginal and Torres Strait Islander people.



2 MANAGEMENT CONTEXT

2.1 Overview

This section summarises:

- Key influencing land uses.
- The relevant roles and responsibilities of stakeholder Authorities and partner organisations.
- Strategies and plans relevant to the stakeholder Authorities and the project area.

2.2 Urban Development and Growth

The Wodonga City Council is a fast-growing regional city. The Wodonga Growth Strategy (Wodonga City Council, 2016) states that the City has a current population of 39,644 and with consideration of the designated growth areas has a capacity to support an ultimate population of 100,000 people. Comparatively, the Australian Bureau of Statistics estimated a 2001 resident population of 31,232 (a difference of 8,119 people compared to 2016). To accommodate the growth, urban development has occurred and will continue to occur across the regional City into the future. Past urbanisation practices have contributed to several pressures and changes to the waterways across the Wodonga region. This is further discussed in subsequent sections of the Plan.

A summary of the current growth areas according to the Wodonga City Council website is summarised in Table 2-1. A map of the growth areas, reproduced from the Wodonga Growth Strategy (Wodonga City Council, 2016) is provided in Figure 2-1.

Table 2-1 Current Growth Areas (Wodonga City Council, 2018).

Development	Capacity
New West Village	250 to 300 lots.
Meridian Estate	1000 lots.
Riverside Estate	2200 lots.
Valley Views	50 lots.
Nordcom development	200 lots.
Glenwood Estate	900 lots.
Whenby Grange	700 to 800 lots.
Kitchington and Beaumont estates	165 and 400 lots.
Leneva growth corridor	Capacity for 14,000 new homes.

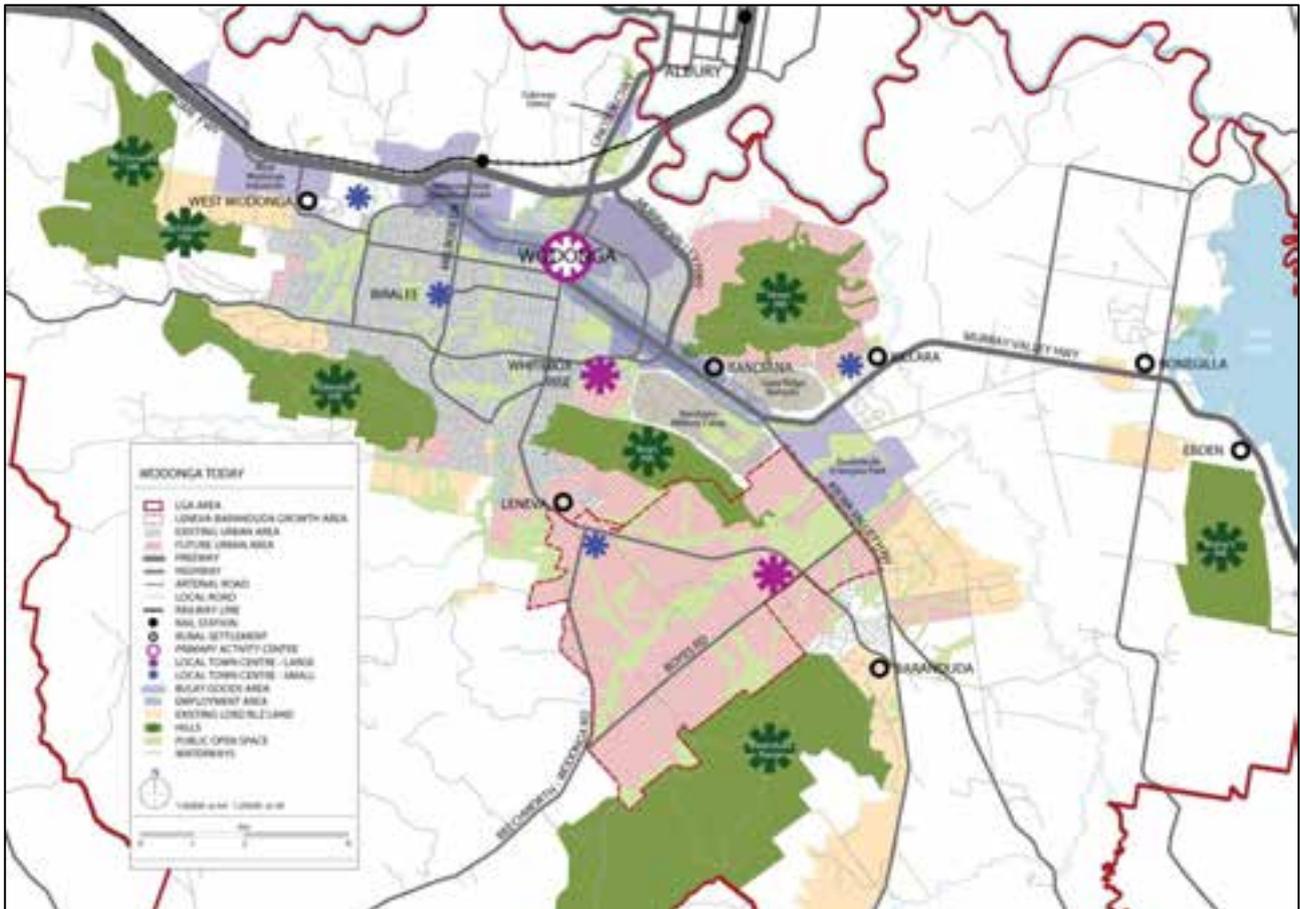


Figure 2-1 Current and future growth areas surrounding Wodonga (reproduced from the Wodonga Growth Strategy, 2016).

2.3 Land Tenure and Management Purpose

The management of riparian land is influenced, or even controlled, by the land's tenure and purpose. Crown land usually offers the community, and Landcare Groups, the opportunity to liaise with the land managers (e.g. Wodonga Council, Parklands Albury Wodonga, DELWP, Committee of Management) to undertake waterway improvement works within that land. Freehold land requires the consent the landholder before works can be undertaken and relies on the landholder to manage and maintain that land appropriately into the future. Relationships between the assisting groups and the land manager/landholder is vital to ensure waterway improvements are successful.

It is important from the outset to have a clear vision for the potential use and appearance of the riparian land being improved. The riparian land vision needs to be understood by all stakeholders so that the methods of management are understood and accepted.

2.3.1 Riparian Management Zones

Various land uses are present adjacent the waterways across the project area. These land-uses (or Riparian Management Zones as they have been called in this Plan) often dictate how a riparian area might look and be managed. Several management zone types relevant to the project area were identified during this project, namely:



- **Formal Parkland.**
- **Informal Parkland.**
- **Riparian Reserve.**
- **Rural Riparian Reserve.**
- **Habitat Reserve.**
- **Constructed Floodway.**

Each of the zones are defined in the following sections to help guide the management of the different riparian areas. The Riparian Management Zones could not be mapped as part of the current project scope.

2.3.1.1 Formal Parkland

Formal Parkland refers to high use, high maintenance riparian areas, characterised by mown grasses and often comprise only overstorey feature trees that include both native and exotic species. These parks are usually in high activity built-up areas, close to amenities including public toilets, sporting facilities or off-stream parks. Formal paths are usually present, and the vegetated riparian verge is often very narrow. An example is shown in Figure 2-2.



Figure 2-2 Example Formal Parkland, Gerard Moylan Park, Wodonga.

Note that, although these formal parklands may be mown close to the tip of bank, and exotic feature trees may be planted, this is not a recommended management practice near urban waterways. The planting of exotics, particularly invasive seeding or suckering species should not occur near waterways. In some parks, WULN and Council have an understanding that no new exotic trees will be planted.



2.3.1.2 Informal Parkland

These parks are areas mown or slashed periodically and usually contain grasses, shrubs and overstorey. Most of these areas are kept open throughout the year and the entire park can be accessed on foot. These areas often have pathways through them either formed or unsealed. The adjacent waterway often has fringing macrophytes and revegetated verges. An example is shown in Figure 2-3.



Figure 2-3 Informal Parkland.



2.3.1.3 Riparian Reserve

Riparian Reserves are areas that may be narrow reserves abutting residential freehold or more open areas that have a higher habitat value than parklands. The narrow reserves adjacent to residential properties are by nature often difficult to access, rarely have defined pathways and as a result are less frequently used or accessed. Woody weed densities are also often higher in these areas. The wider Riparian Reserve areas often have defined pathways and are less frequently slashed compared to Informal Parklands. Resultantly, Riparian Reserves often contain regenerating native trees and shrubs. An example Riparian Reserve on Jack in the Box Creek is shown in Figure 2-4.



Figure 2-4 Riparian Reserve at the top of Jack in the Box Creek, upstream of Thomas Mitchell Drive.



2.3.1.4 Rural Riparian Reserve

Rural Riparian Reserves are often Crown Water Frontages that typically abut rural freehold land. These areas are often subject to grazing pressure, so there is not necessarily a distinct boundary or land-use change. Rural Riparian Reserves are common across many of the waterways within the project area upstream of Wodonga. An example Rural Riparian Reserve on Kookinburra Creek is provided in Figure 2-5 and Figure 2-6.



Figure 2-5 Example Rural Riparian Reserve on Kookinburra Creek incorporating revegetation work.



Figure 2-6 Example Rural Riparian Reserve, where stock pressures are evident within and surrounding the waterway.



2.3.1.5 Habitat Reserve

A Habitat Reserve refers to areas that contain a high diversity of indigenous flora or significant remnants and therefore are likely to contain high habitat values for fauna. Habitat Reserves may include some woody weed invasion and the ground layer may be dominated by exotic species. Weed control and the preservation and enhancement of flora values is of high priority in these zones. Slashing and removal of terrestrial fallen timber is discouraged, thus allowing natural regeneration and the preservation of habitat. An example Habitat Reserve is shown in Figure 2-7.



Figure 2-7 A Habitat Reserve.



2.3.1.6 Constructed Floodway

The Constructed Floodway Management Zone encompasses the land where the creek channel has been piped (e.g. Jack-in-the-Box Creek). Floodways can occur within any urban waterway management zone and are not necessarily distinguished as entirely separate zones. However, the floodway management regime may be very different from the zone that surrounds it. For example, the floodway might be maintained free of woody vegetation while the surrounding land (e.g. an Informal Parkland) contains feature trees as shown in Figure 2-8.



Figure 2-8 Constructed Floodway on Jack in the Box Creek.

2.3.2 Riparian Management Zone Expectations

A clear understanding of the Riparian Management Zone type surrounding a waterway is considered valuable in the determination of successful and practical management strategies and actions. For instance, if a reach or park surrounding a waterway is to be a Formal Parkland, it should be accepted that the management of this area may include the presence of exotic trees, the absence of native understorey and the absence of fallen timber. However, Council acknowledge the threat of exotic plants in riparian areas and the potential for spread through waterways from seed or vegetatively. Council is committed to ensuring exotic plant species with high potential to drop seed and spread are excluded from any new plantings undertaken within the riparian area, and over time to removing existing exotics from the riparian and adjacent areas. Council's current practice for works in the riparian zone (verge 5-10m from top of bank) in areas where the vegetation has been highly modified from native, (including formal parklands) is to mulch the ground and undertake revegetation works including understorey planting. Plants species used are indigenous native species; however, some non-indigenous natives may be used to increase habitat outcomes for local fauna. Conversely, a Habitat Reserve may be managed to exclude exotic vegetation, whilst encouraging the presence of native understorey and fallen timber.



A summary of the features and typical management characteristics for each of the defined Management Zones is provided in Table 2-2. Notably, these zones can be variable and small patches of different zones can be present within others (i.e. one park may contain a mosaic of Riparian Management Zones). These features and management characteristics indicated in Table 2-2 are typical for that type of Zone, not mandatory or necessarily recommended management approaches. For example, a Formal Parkland might be managed for habitat values along the immediate creekline, with a revegetated bank and retained habitat logs.

Table 2-2 Typical characteristics of management zones. Black ticks denote usual practices, grey ticks denote possible practices.

Features and Management Characteristics	Formal Parkland	Informal Parkland	Riparian Reserve	Rural Riparian Reserve	Habitat Reserve	Constructed Floodway
Pathways present	✓	✓	✓			✓
Regularly mown	✓					✓
Occasionally mown or slashed		✓	✓			
Not slashed			✓	✓	✓	
Grazing can be present				✓		
Maintained for recreation	✓	✓	✓		✓	✓
Maintained for habitat			✓	✓	✓	
Trees only	✓	✓		✓		
Exotic trees featured	✓			✓		
Native trees and understorey	✓	✓	✓	✓	✓	
Woody logs and branches (habitat) retained			✓	✓	✓	

2.4 Stakeholder Authorities and Partner Organisations

This Waterway Action Plan is led by the Wodonga Urban Landcare Network with support from the Wodonga City Council and the North East Catchment Management Authority. The key stakeholder Authorities and partner organisations are summarised in Figure 2-9 and the following sections.

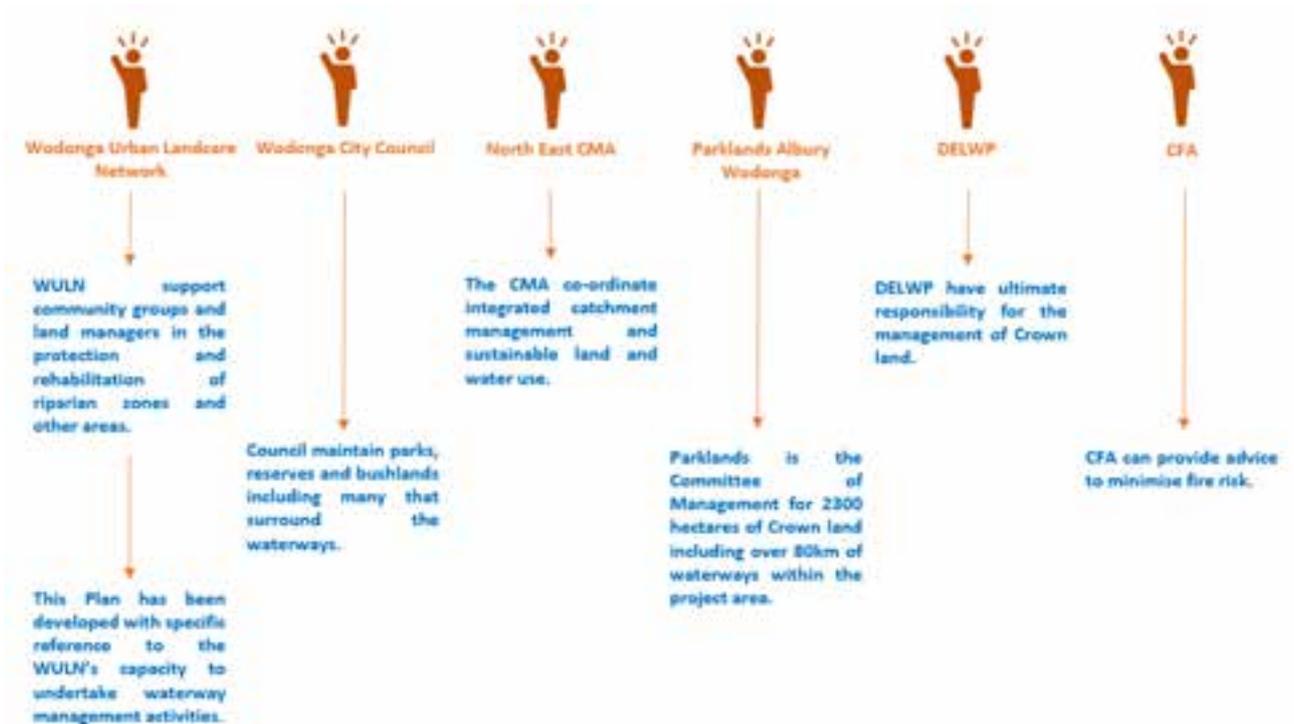


Figure 2-9 Project stakeholders and partners.

2.4.1 Wodonga Urban Landcare Network

Wodonga Urban Landcare Network (WULN) provides support to stewardship groups and facilitates opportunities for linkages, information sharing, co-operative and wholistic planning and community involvement in land management across the municipality of Wodonga. **WULN support new and existing community groups and land managers to be actively involved in the protection, preservation, improvement and management of parks, gardens, bushland, farmland and the open spaces of Wodonga.**

The WULN is managed by a committee of volunteers from local community organisations. A part time Facilitator is funded by the Victorian Government to provide support and co-ordinate training and other opportunities for member groups.

WULN works with dependent and independent member groups as well as school groups, TAFE, Universities, Wodonga City Council, community volunteers, individual land holders and other land managers. The current member groups of WULN are:

- Baranduda Landcare Group.
- Bonegilla Rail Trail Advisory Group.
- Clyde Cameron Reserve Group.
- Friends of Felltimber Creek.
- Friends of Lou Lieberman Park.
- Friends of Lower Huon and David Winterbottom Reserve.
- Friends of the Ridge Reserves.
- Friends John Potter Park.



- Friends of Willow Park.
- Friends of Whenby Grange.
- Friends of the WRENS – Baranduda.
- Huon Creek Landcare.
- Leneva Castle Creek Landcare Group.
- Our Native Garden Community Nursery.
- Parklands Albury Wodonga.
- The Bhutanese Community Farm.

This Waterway Action Plan has been developed with specific reference to the WULN's objectives and capacity to undertake waterway management activities.

2.4.2 Wodonga City Council

Wodonga City Council maintain parks, reserves and bushlands throughout the municipal boundary including many that border Wodonga's waterways. As a major urban centre within the regional catchment, Council recognise the need to ensure sustainable natural resource management of parks, reserves and bushlands, considering impacts of land use and development on waterways.

Wodonga City Council is responsible for the implementation of a number of land management actions, planning controls, and infrastructure/facility installation and maintenance that ensure Wodonga's parks, reserves and bushlands are managed to:

- Protect significant patches of native vegetation and habitat corridors.
- Ensure no major loss of biodiversity.
- Provide recreational enjoyment by the community along our waterways.

Some of the land management actions that council implement include:

- Soil and stormwater management controls for development sites.
- Protection of the hillside environments which provide a significant catchment into urban waterways.
- Weed management (as governed by the CALP Act 1994).
- Administration of the Wodonga Planning Scheme, which includes native vegetation protection measures and overlay controls (including flood overlay and environmental significance overlay).
- Installation and maintenance of park furniture and pedestrian and cycle pathways.

Wodonga City Council also see a role in partnering and supporting the many community led initiatives and organisations that seek to apply for grants and conduct works on council managed land, including along Wodonga's waterways. In conjunction with the Wodonga Urban Landcare Network, council supports and helps foster growth in the many '*Friends of*' groups that are active in the parks and reserves surrounding Wodonga's waterways. Council provides resources and assistance to groups undertaking weed control and revegetation activities to significantly improve biodiversity and water quality as well as the visual amenity.

As the urban environment expands, council will have an active role in planning for city growth, climate change and customer expectations and the increased pressure this will place on Council's parks, reserves and bushlands and the associated waterways.



2.4.3 North East Catchment Management Authority

The North East Catchment Management Authority (North East CMA) is responsible for co-ordinating integrated catchment management and sustainable land and water use across North East Victoria, which is inclusive of the project area. The work of the North East CMA is guided by the Regional Catchment Strategy and North East Waterways Strategy.

2.4.4 Parklands Albury Wodonga

Parklands Albury Wodonga are a not for profit organisation that undertake conservation, recreation, cultural heritage and tourism projects across Albury and Wodonga. Parklands Albury Wodonga is the Committee of Management for 2300 hectares of Victorian Crown land which includes over 80km of waterways in Wodonga local government area. **Parklands Albury Wodonga work with a range of partners and volunteers to actively manage and rehabilitate a number of the bushland parks, waterways and degraded landscapes across the project area including the lower Kiewa River.**

2.4.5 Department of Environment, Land, Water and Planning

Department of Environment, Land, Water and Planning (DELWP) have ultimate responsibility for the management of Crown Land. The management arrangement can vary depending the parcel of land. Management arrangement may include:

- DELWP having direct management over the land.
- DELWP appointing a Committee of Management to manage the land.
- DELWP leasing the land to individuals or organisations.

2.4.6 Country Fire Authority

The Country Fire Authority (CFA) works with Council and other land managers to develop fire management plans across the project area. In term of managing Wodonga's waterways, the **CFA can provide management advice to minimise the risk of revegetation activities contributing to an increased fire risk.**

2.5 Strategies and Plans

Key strategies and plans relevant to the waterways across the project area are summarised in Figure 2-10 and the following sections.



Figure 2-10 Key strategies and plans relevant to the Waterway Action Plan.

2.5.1 The North East Regional Catchment Strategy

The North East Regional Catchment Strategy (RCS) is an integrated planning framework for land, water and biodiversity management across North East Victoria. The RCS defines a range of 6 year and 20-year objectives and actions to be implemented by various levels of Government, community groups, land managers, research bodies and industry bodies. The North East RCS vision will be realised by achieving the following 20-year high level objectives:

1. Whilst conserving the environment, we will maintain and enhance the health and condition of:
 - i. land resources and their long-term productivity.
 - ii. water resources and their long-term productivity.
 - iii. biodiversity resources.
2. People will identify with and value the:
 - i. Urban landscape for its diverse economy, access to aggregated services and enhanced liveability through connection with the natural environment.
 - ii. Lifestyle landscape for its environmental aesthetics, tourism, strongly connected communities and access to the regional economy.
 - iii. Agriculture landscape for its productivity, quality land and water resources, and strongly connected communities that identify with their valleys, plains and plateaus.
 - iv. Forest landscape for its national parks, recreation, water and forest resources.
 - v. Alpine landscape for its iconic status, high biodiversity, tourism and clean water resources.
3. The community will actively participate in the integrated management and protection of natural resources.
4. Agencies and the community will work together to monitor and evaluate the condition of natural resources and the effectiveness of protection measures to improve natural resource management.



2.5.2 North East Waterway Strategy

The North East Waterway Strategy sets a vision for management of waterways across the North East catchment until 2022. The North East Waterway Strategy is integrated with the North East Regional Catchment Strategy and works on an asset-based approach. The asset-based approach identifies areas with significant values and the threats to those values. This allows for priority setting to better target the investment.

The North East Waterway Strategy has adopted the following vision for the North East Waterways:

“Our waterways are valued, healthy and well-managed; supporting environmental, social, cultural and economic values.”

To achieve this vision, five long term goals for the management of the waterways in the North East have been identified. These are:

1. Maintain or improve populations of threatened species and communities that are dependent upon waterways in the North East region.
2. Maintain or improve the connectivity within and between the different types of waterways.
3. Maintain or improve water quality in priority water supply catchments.
4. Maintain waterways that are formally recognised and in a near-natural or ecologically healthy state.
5. Raise awareness of and protect the social and cultural heritage values of waterways.

2.5.3 The Wodonga Retained Environment Network (WREN) – A Threatened Species and Habitat Conservation Strategy

The Wodonga Retained Environment Network (WREN) Strategy was developed by the Albury-Wodonga Corporation in 2006 to ensure that future urban development within the **Leneva Valley Growth Area** is undertaken in a manner that protects the environment and habitat areas within the Growth Area. This Strategy is the key document for protecting and maintaining the biodiversity within the study area.

The WREN Strategy relates to proposed urban growth areas extending from the edges of the urban Wodonga area in the north, the Baranduda township in the south, part of the Huon Creek and Castle Creek Valleys in addition to the majority of the Leneva Valley.

The primary objectives of the WREN strategy are stated as follows:

- Identify the key environmental assets relating to biodiversity conservation, including threatened species and threatened ecological communities, in the Wodonga area.
- Develop a strategy for the protection of environmental assets on Corporation and private land within the increasingly urbanized study area which protects, and where possible enhances, populations of native plants and animals, with emphasis on threatened species and their habitats.
- Provide a strategy for urban development by the WCC and landowners.
- Ensure that this strategy is consistent with the objectives of Victoria’s Biodiversity Strategy and specifically with the principles and priorities outlined in the local Biodiversity Action Plan for the area known as the Lower Kiewa Landscape Zone (Ahern 2004).
- Ensure that that the strategy satisfies the requirements of the Victorian legislation relating to native vegetation management and the “Net Gain Principle” outlined in the policy document “Victoria’s Native Vegetation Management – A Framework for Action” (VNVMF), DNRE (2002).
- Ensure this strategy is consistent with the objectives of the North East Regional Catchment Strategy (North East CMA 2004).



- Develop an action plan for the implementation and the on-going evaluation and management of the strategy.
- Complement and build on the Albury Ranges and Thurgoona Threatened Species Conservation Strategies.
- Ensure that the methodology applied in this strategy is applicable elsewhere.
- Demonstrate that native vegetation removal associated with the proposed urban development of areas outside of the WREN is adequately offset by the protection and subsequent management of the WREN itself.

The WREN strategy identifies waterways as a key habitat feature within the study area as they provide habitat connectivity for threatened species between the woodland habitats of the hills, the scattered remnant habitats of the plains and the riparian corridor on the Kiewa River Floodplain.

The WREN Strategy separates the proposed urban growth areas into 12 regions (Precincts A through to L). Within each Precinct, the WREN document lists ecological values, management objectives and development constraints.

2.5.4 The Leneva Valley and Baranduda Native Vegetation Precinct Plan (NVPP)

The Leneva Valley and Baranduda Native Vegetation Precinct Plan (NVPP) was developed subsequent to the development of the WREN Strategy. The WREN Strategy formed the basis of NVPP which became an Incorporated Document at Clause 52.16 and Clause 81 of Wodonga's Planning Scheme in October 2013. The purpose of the NVPP is to:

- Implement the recommendations of the WREN.
- Identify the native vegetation that can be removed, destroyed or lopped without a planning permit and identify the native vegetation to be protected.
- Identify the areas where native vegetation may be removed with a permit.
- Ensure that any removal, destruction or lopping of any native vegetation is consistent with the conservation of the ecological values of the WREN Strategy and is in accordance with the three-step approach to net gain as set out in Victoria's Native Vegetation Management – a Framework for Action (DNRE 2002).
- Ensure that areas set aside to protect native vegetation are managed to conserve their ecological values in accordance with DNRE (2002).
- Set out the works or other necessary actions required to offset the removal destruction or lopping of native vegetation where that native vegetation is allowed to be removed, destroyed or lopped under this NVPP subject to a permit and without a permit.
- Streamline the planning approvals process through a landscape and precinct wide approach to native vegetation protection and management.

The Leneva Valley and Baranduda NVPP defines three categories of native vegetation within the proposed urban growth areas (defined the WREN Strategy), which are:

- **Category 1** - native vegetation that may be removed without a permit subject to the conditions and requirements of the NVPP.
- **Category 2** - native vegetation that should be retained but may be removed subject to a planning permit and will require offsets.



- **Category 3** - native vegetation that is to be retained and permanently protected as the offsets for the native vegetation removed in Category 1.

2.6 Approval Requirements

Various approvals may be required prior to undertaking waterway rehabilitation works. It is recommended that the necessary approvals be determined at an early stage of project planning. The likely approvals requirements are summarised in Figure 2-11 and detailed in Section 2.6.1 through to Section 2.6.4.



Who owns or is responsible for the land?

E.g. Council, Crown, Parklands
Albury Wodonga, Developers,
Private Residents



Written consent should always be obtained by the landowner/manager before any works are undertaken.



Any proposals on Crown land should be referred to DELWP for advice prior to undertaking works; applying for funding grants or obtaining permits where landowner support and consent is required.

Is a Planning Permit Required?

Wodonga City Council is responsible for issuing Planning Permits.



Works such as the placement of fill and construction of tracks, trails, culverts or built structures may require a Planning Permit. Weed removal and tree planting generally do not require Planning Permits



Contact Wodonga City Council's Planning Office at an early stage of planning a works activity to determine if a Planning Permit is required.

Is a Works on Waterways Permit Required?

The North East CMA are responsible for issuing Works on Waterways Permits.



A Works on Waterways Permit is required for any works or activities in, under, on, or over the bed and banks of a designated waterway.



A Works on Waterways Application Form needs to be submitted to the North East CMA for assessment. Application forms can be obtained from the CMA website.

Is Cultural Heritage Approval Required?

Aboriginal Victoria is responsible for Cultural Heritage approvals.



Many of Wodonga's waterways are identified as Areas of Cultural Sensitivity and require cultural heritage approvals to undertake works that involve mechanical ground disturbance including the construction of tracks. Standard revegetation and maintenance activities typically do not require Cultural Heritage approvals.



Contact Wodonga City Council's Planning Office at an early stage of planning a works activity to determine if the works area has been identified as an Area of Cultural Sensitivity and if the proposed works require approval.

Figure 2-11 Likely approvals requirements associated with waterway rehabilitation works.



2.6.1 Land Manager Approval

Before planning or conducting works, it is important to establish the land owner status. This is especially important around waterways and reserves, where there can be multiple land owners/managers/committees of management (i.e. Council, the Crown, Parklands Albury Wodonga, developers and private residents).

Written consent should always be obtained by the landowner/manager before any works are undertaken. This is generally a requirement for permit and grant applications.

Depending on the scope of works and status of the Crown land, approval from DELWP may be required to undertake works along Crown waterways. Consideration must be given to the impact the works may have on Cultural Heritage, Native Title, Threatened Flora and Fauna along with any other site-specific values. **Any proposals on Crown land should be referred to DELWP for advice prior to:**

- **Undertaking works.**
- **Applying for funding grants.**
- **Obtaining permits where landowner support and consent is required.**

In the case that works are to be undertaken on Council managed land, Council would need to make sure there is appropriate insurance, public liability and OHS requirements in place. Council would also specify that any damage to Council managed land or assets are re-instated or repaired (either by the group/individual or the financial cost to council to undertake the re-instatement works).

2.6.2 Council Approval

Wodonga City Council is responsible for issuing Planning Permits. The requirements for a Planning Permit will vary depending on the site (Planning Zone) and the works proposed. **Works such as the placement of fill and construction of tracks, trails, culverts or built structures may require Planning Permits. Management activities, such as weeding removal and tree planting generally do not require Planning Permits.** Council may also refer the works to adjoining landowners (government and private) and the relevant water and catchment authorities.

It is best to discuss planned works with Council's Planning Office early in the planning stage to determine whether the works requires a planning permit.

2.6.3 Works on Waterways Permits

Works on a waterway have the potential to lead to significant and widespread adverse impacts on the waterway and broader environment. As such, Catchment Management Authorities are responsible for regulating works on waterways. The regulation of works on waterways is managed through Works on Waterways Permits. These **permits are required for any works or activities in, under, on, or over the bed and banks of a designated waterway** in Victoria (North East CMA).

Some examples of works and activities that require a permit include but are not limited to:

- Stabilisation works, such as rock beaching.
- Debris and vegetation removal.
- Sand and gravel extraction.
- Modification of stormwater outlet.
- Waterway crosses, including bridges, fords, and culverts.



The only possible activity which does not require a Works on Waterways Permit is the planting of native vegetation along a waterway.

To obtain a Work on Waterway Permit, an application form is to be filled in and submitted to the North East CMA with an application fee. Depending on the complexity of the works detail provided in the application, the North East CMA may request additional information, in order to assess the application. Subject to the application and proposed works being deemed satisfactory, the North East CMA will issue a permit. Once a permit has been received, North East CMA must be notified at least 7 days prior to commencing the works and at the completion of the works. A Works on Waterway Permit will generally be valid for 12 months from the date of issuing.

2.6.4 Cultural Heritage

Many of Wodonga's waterways are identified as Areas of Aboriginal Cultural Sensitivity and require Cultural Heritage approvals from Aboriginal Victoria to undertake **any works that involve mechanical ground disturbance, including the construction of tracks. Generally, standard revegetation and maintenance activities will not require Cultural Heritage approvals.**

Wodonga City Council's planning department will be able to identify if an area has been identified as an Area of Aboriginal Cultural Sensitivity and if the proposed works require approval.



3 RELEVANT CATCHMENT INFLUENCES AND PROCESSES

3.1 Overview

This section summarises the relevant catchment influences and processes that are common across the project area. Many of these processes are considered threats to the physical and/or biological waterway condition.

3.2 Increased Discharge

Many of the waterways across the project area have been considerably altered by the impacts associated with **land clearing and urbanisation**. Land clearing and urbanisation have a number of impacts on waterway processes, in particular by altering the flow characteristics within a stream. These impacts include:

- **Increased flow rates and larger peak flows** (fast flashy flooding) through the clearance of native vegetation across the catchment area and the construction of largely impermeable infrastructure such as roads and houses.
- **Increased erosive power within the channel**. This often leads to substantial erosion within the bed and banks of a waterway as it adjusts to account for the increased flows. Once a geomorphic threshold is crossed (i.e. the erosion process is initiated), the erosion becomes progressively worse and the potential for recovery is very difficult to achieve in the short to medium term.

3.3 Bed Deepening

Bed deepening involves the lowering of the bed level within a waterway through erosion. This erosion process is frequently initiated by increased flow rates and larger peak flows (discussed in Section 3.2) associated with land clearing and urbanisation but can also occur due to other influences (e.g. the construction of waterway crossings, artificial channelisation etc.). Bed deepening has negative effects on:

- **Bank stability**. Bed deepening often leads to channel widening (erosion of both banks). Furthermore, increased channel capacity leads to increased erosive power within the channel, further exacerbating the erosion issue.
- **In-stream geomorphic diversity**. Bed deepening frequently removes in-stream features such as pools and riffles that provide valuable in-stream habitat.
- **Floodplain hydrology**. Bed deepening and associated channel widening lead to increased channel capacity, which has the potential to decrease floodplain connectivity (i.e. overbank flows). Floodplain connectivity is vitally important for stream and floodplain health.

Commonly, bed deepening occurs through a process called head-cut migration (or knickpoint regression). Head-cut migration presents as an abrupt change in channel slope, similar to small waterfalls or cascades within the channel (Schumm, 1977) (Figure 3-1). A small plunge pool may be present at the base of the head-cut due to the higher energy of falling water.

Head-cut erosion occurs in an upstream direction. In general, after a head-cut forms, it will continue to migrate upstream until it reaches either the head of the catchment or a solid barrier (e.g. a rock bar, road crossing). Discharge reduction in the creek may reduce the migration rate of a head-cut, however without physical intervention within the channel, the head-cut will generally continue to migrate and the creek will continue to deepen and subsequently cause channel widening (Booth, 1990). This has the potential to impact on existing and potential infrastructure that is aligned with the current bed elevation.

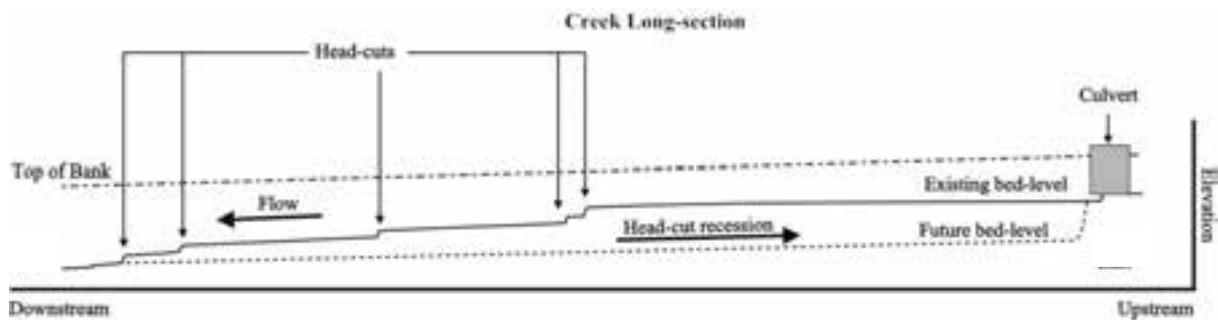


Figure 3-1 Conceptual diagram of head-cut erosion (or knickpoint recession) migration process.

3.4 Bank Erosion

Bank erosion can occur in response to a number of different processes and in a variety of forms. As previously discussed in Section 3.3, bank collapse commonly occurs in response to channel deepening, resulting in the widening of the channel (Leopold et al., 1964). Increased channel capacity results in larger flows being contained within the channel, which leads to increased erosive power. This is a significant problem when combined with disturbed or unvegetated bank sediments.

Erosion along outside bends often occurs in waterways resulting in steep banks along the outside of a bend. Erosion of this sort is often exacerbated by a lack of riparian vegetation to stabilise the bank. The toe of the bank is gradually (or episodically) eroded until the bank is vertical or undercut and the bank subsequently collapses under its own weight. **Erosion on the outside of meander bends is a natural process of channel planform change.** Erosion is expected at the outside of bends, as it is an area in increased flow velocity. Likewise, deposition is expected on the inside of the bend, as it is an area of reduced flow velocity.

Slumping or failure of the bank can also be initiated through geotechnical instabilities within the bank and not directly associated with channel flow. This can also occur through draw down, where the bank becomes unstable through the transfer of ground water through the saturated bank to the channel. Once a bank fails, erosion can occur rapidly due to the exposed unconsolidated sediment.

3.5 Sediment Transport and Deposition

Sediment transport is a natural feature of a catchment. Typically, sediment is eroded from the headwaters (bedrock) and subsequently transported downstream during flow events. Often sediment is stored for long periods of time either in-channel or as floodplain sediment prior to subsequent erosion, transport and deposition further down the catchment. Deposition will occur where there is a reduction in channel and/or valley slope and therefore a reduction in flow energy. This is evident in the downstream sections of Jack in Box Creek and Huon Creek (Figure 3-2).

Management options for excess sediment (summarised by Sims and Rutherford, 2017) within the lower reaches of waterways within the project area include:

- Reducing the **sediment supply** at the source. In context of the project area, the sediment sources are typically the upstream of most reaches, which are typically cleared and subject to grazing pressure and where bed and bank erosion is occurring.
- Promoting **sediment storage** in the channel or floodplain.
- Accelerating **sediment transport** through the system.
- Directly **extracting sediment** from the channel.



As noted by Sims and Rutherford (2017) these options are not necessarily mutually exclusive. The most practical, cost effective and lowest impact solutions within the project area are likely to be:

- The management of **sediment supply** at the source, most readily achieved through vegetation establishment and stock exclusion in the upper catchments.
- Promoting **sediment storage** in the channel or floodplain, most readily achieved through vegetation establishment and stock exclusion in the upper and mid catchment reaches.

It should be acknowledged that these are long term management solutions. The response time between the works and the reduction in sediment supply within the downstream reaches could be measured in decades.



Figure 3-2 Sand deposited in channel, Huon Creek downstream of Yarralumla Drive.

3.6 Soil and Water Management

Soil erosion associated with land development and construction sites can be a major sediment contributor to waterways. This is particularly relevant in urban environments where soil erosion is efficiently transferred to receiving waterways via existing stormwater drains.

Suitable sediment and erosion control measures associated with land development and construction activities should be developed during the project planning phase. Relevant documentation prepared by the Environmental Protection Authority (EPA) Victoria, includes:

- The Environmental Guidelines for Major Construction Sites (accessed here: <http://www.epa.vic.gov.au/~media/Publications/480.pdf>).
- Construction Techniques for Sediment Pollution Control (accessed here: <http://www.epa.vic.gov.au/our-work/publications/publication/1991/may/275>).



3.7 Riparian Vegetation and Large Woody Habitat Removal

Large woody habitat (logs and large branches) and native riparian vegetation, as well as providing critical habitat, act to reduce stream discharge and peak flows by adding roughness to the channel, banks and floodplain, thus reducing the waters velocity.

Removing vegetation from the banks not only acts to increase the rate of flow but also reduces the banks resistance to erosion. Vegetation slows flows, adds cohesion to the bank sediments and adds a physical barrier to erosion when vegetation such as grasses, rushes, reeds and shrubs, flatten against the banks during floods.

Large woody habitat acts in much the same way to provide roughness to the bed and banks thus slowing water and reducing erosion. Large woody habitat promotes local variation in the channel hydraulics which generates local scouring and deposition, thus geomorphic diversity and habitat niches for aquatic fauna. Large woody habitat is a natural phenomenon and is a sign of river health and good aquatic habitat.

Many waterways in Victoria are deficient in the large woody habitat. This is often due to the historic removal of large woody habitat from waterways and the loss of suitable riparian vegetation that is the natural source of large woody habitat.

3.8 Stock Pressures

A substantial proportion of the waterways across the project area are in areas subject to grazing pressures. Potential negative implications associated with unrestricted grazing pressures on a waterway include:

- A reduction in riparian vegetation condition through vegetation loss and prevention of natural recruitment.
- A decrease in bed and bank stability through ground disturbance and vegetation loss.
- A decrease in water quality through increased sediment inputs, defecation and pathogens.

3.9 Waterway Crossings

In general, most waterway crossings (e.g. bridges, culverts, fords) will have some influence on the hydrologic, hydraulic and physical conditions surrounding the crossing site. Suitably designed and constructed waterway crossings consider the long-term stream dynamics and hydrologic and hydraulic conditions at the crossing site to minimise potential impacts. A failure to consider these factors during design potentially risks long term physical damage to the surrounding waterway and potential damage to, and/or failure of the crossing structure.

The potential impacts associated with waterway crossings are site specific but, in general, may include:

- The alteration of the stream's natural flow pattern, both in-channel and floodplain flows, including:
 - The reduction in hydraulic capacity through the structure.
 - The raising of water levels (an increased afflux or backwater effect) upstream of the crossing structure, potentially increasing the flooding upstream.
 - Increased hydraulic forces and hence erosion potential surrounding the crossing structure (both upstream and downstream) through the concentration of flows and poor design arrangements.
- The disturbance and/or removal of riparian and in-stream vegetation.
- Prevention of fish passage/aquatic fauna through the crossing structure.
- The reduction in sediment transport through the crossing structure.
- Increased sediment and nutrient loads due to altered roadside drainage arrangements.



Waterway crossings have the potential to contribute to the initiation of erosion processes. This process is common (DSE, 2007). In general, scour downstream of structures is due to one of two reasons:

- **Poor design of the structure:** In-stream structures that result in a drop on its downstream side will create scour. Proper design of in-stream structures includes an apron at the bottom of the structure, designed to prevent scour from the hydraulic jump.
- **A head-cut initiated downstream:** This will have migrated up the channel to meet the structure and created a drop on its downstream side.

Conversely, in certain circumstances waterway crossings can have a positive influence on waterway processes and stream health, where they can halt the upstream progression of head-cuts. Where multiple road crossings intersect the stream network, the sediment removed from the downstream side of the culvert is then deposited (trapped) on the upstream side of the subsequent culvert, and so on. Depending on the distance between culverts, the pipe-culverts can then start to act as a form of grade control, whereby the lowered bed level upstream and raised bed level downstream reduces the overall longitudinal channel slope of that section, in turn reducing stream power. If these structures are to be removed, extreme care should be taken to replace them with something that will halt the head-cut retreating upstream. Failure to mitigate the onset of retreat, due to removal of the barriers will result in large-scale and rapid bed incision upstream. This will result in rapid and substantial bank collapse and channel widening.



3.10 Willows

Willows were widely planted across the North East Victorian region between the 1930's to the 1980's with the primary intent of managing bank erosion. By the 1990's, the negative influences of willows on waterway health, including bed and bank erosion were well established and the use of willows to control erosion ceased (North East CMA, 2013). **Willows are now regarded as one of Australia's most invasive riparian and wetland weed species and in 1999 were listed as one of Australia's 20 Weeds of National Significance** (Holland and Davies, 2007).

Willows are a dominant woody weed species present across the project area. Adverse impacts associated with willows include:

- Colonisation of stream banks and subsequent dense shading prevents the establishment or survival of desirable riparian vegetation.
- Encroachment towards the centre of the waterway. This alters in-channel morphology, potentially causing erosion and reducing channel capacity.
- Aging willows tend to collapse into streams, causing erosion issues.
- Sudden and total leaf drop in autumn reduces dissolved oxygen concentrations and water temperatures.
- A reduction in habitat for terrestrial and aquatic fauna and macro invertebrate communities.

The North East CMA have a willow management policy, namely Managing Willows in the North East Catchment (NECMA 2013) which is available on the North East CMA website. The document provides the following goal in relation to willow management:

To work with the Community to practically and sustainably protect the health of waterways by reducing the spread and adverse impacts of willows.

Willow management activities should be planned and implemented in accordance with this Policy. Importantly, willow management activities must consider the role the willows are playing in terms of channel stability.

3.11 Phragmites

Phragmites australis (or Common Reed) is a native emergent water plant that is common across the project area and perceived to be an issue within the urban zone by several community members. The perceived issues associated with Phragmites typically include it being a colonising weed, contributor to flooding and a potential fire risk.

The following summary relating to Phragmites is adapted from Earth Tech (2004) and has been provided to highlight the true function and influence of Phragmites in waterways.

Phragmites can typically grow in water up to four metres deep and where the water table is up to four metres below the ground surface. Phragmites grows in freshwater, primarily on muddy substrates, but also on sandy substrates. Phragmites can also tolerate a wide range of water quality conditions. Phragmites typically propagate both from rhizome growth and rhizome dispersal (Frankenberg, 1994; ID&A, 1996) and fertile seeds in some habitats.

Phragmites provides a number of important functions within waterways including:

- It provides a form of erosion control.
- It is an efficient processor/filter of nutrients and sediment.
- It provides habitat for algae, micro-organisms, macroinvertebrates, fish and bird species.



Phragmites often colonise areas where sediment deposition has occurred and where there is shallow standing water (e.g. upstream of waterway crossings). Despite the perception Phragmites contributes to flooding, it is highly flexible and tends to lay down during high flow events. Commonly, it is another feature such as the waterway crossing that provides the greater influence on water levels during high flow events. Additionally, the fire risk associated with Phragmites is commonly overstated as the plant is commonly emerging from shallow standing water.

Example stands of Phragmites present within Felltimber Creek and Huon Creek are shown in Figure 3-3 and Figure 3-4 respectively.



Figure 3-3 Phragmites within the Felltimber Creek channel downstream of Parkes Road.



Figure 3-4 Phragmites patch adjacent Huon Creek at David Winterbottom Park.