North East Catchment Management Authority

Strategic Levee Categorisation Project

Final Report v6



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Project	Strategic Levee Categorisation Project
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Cover photograph: Wilson Road Levee at Wangaratta.

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Executive Summary

Overview

During the spring of 2022, significant widespread flooding occurred, notably across northern Victoria. The response efforts to the 2022 floods involved the management of levees during the course of the floods in an effort to minimise the impact of the floods on property damage, injury risk and loss of life risk.

In the aftermath of the floods, the Victorian Government initiated an inquiry to review the effectiveness of flood response efforts including the management of levees.

The Strategic Levee Categorisation Project has subsequently been initiated to improve flood intelligence in regards to levees in northern Victoria which will benefit future flood response efforts.

Outcomes and Deliverables

The project has encompassed the following:

- Assigned categories to the levees assessed according to the definitions adopted for the project.
- Drafting of flood intelligence content for future addition to the respective municipal flood emergency plans (FEPs).
- Update of the Victorian Flood Database (VFD) levee layer to the Spatial Data Specification (SDS) levee layer with the expanded attribute data.
- Engagement with each local government authority to discuss categorisations and levee management issues.
- Update of the North East CMA flood intelligence spreadsheet where it relates to specific levees in specific local government areas.
- Update of the SES flood intelligence template to reflect the findings of specific levees from this investigation. The VICSES can make the decision to incorporate any changes into future updates of the respective local municipal FEP's.
- For all Category 1 and 2 levees where LiDAR is available and of a sufficient quality, a long section of the levee has been developed showing the 1% AEP flood level and levee crest level.

Key Findings

The project has found that levees are commonly not currently subject to systematic maintenance, with few 'operation and maintenance' manuals either existing and / or in use. This is despite in some instance levee construction funding agreements specifying that the owner is responsible for future maintenance as a condition of the funding agreement.

Several larger levees are maintained in a similar manner to parks and gardens whereby grassed batters and pathways are managed but the structural integrity and regular condition assessments do not occur as a matter of course.

The paradox remains whereby strategic levees requiring maintenance and upkeep are not formally maintained because ownership of these levees is not formally recognised.

The management of levees should reflect their strategic function. Levees protecting communal assets and urban areas offering public benefits should be formally managed.

1 Introduction

Following the spring 2022 floods and a subsequent government inquiry into flood response matters, the Victorian Government through the Department of Energy, Environment and Climate Action (DEECA) provided funding to the Catchment Management Authorities (CMA's) in northern Victoria for a Strategic Levee Categorisation Project.

The Strategic Levee Categorisation project aims to provide improved flood intelligence for managing strategic levees located in Victoria north of the Great Dividing Range. The four CMA's involved in the project are the North East CMA, Goulburn Broken CMA, North Central CMA and the Mallee CMA.

This report documents the project undertaken for the North East CMA.

The project has aimed to:

- Identify and categorise levees based on the category definitions adopted for the project.
- Identify those strategic levees which require significant works ahead of an impending flood and the nature of those works.
- Identify temporary strategic levees which are needed for flood mitigation purposes, and the nature of the works required to construct them.
- Preparation of content for inclusion in the respective Municipal Flood Emergency Plans (MFEPs) which provides respondents with an understanding of what is required in managing the strategic levees within each LGA during a flood event.

2 Background

2.1 Project Overview

The Strategic Levee Categorisation project has been carried out for levees located north of the Great Dividing Range in northern Victoria. This area is covered by four CMA regions, namely North East, Goulburn Broken, North Central and Mallee.

The over arching objective of the project is to update the respective municipal Flood Emergency Plans (MFEPs) in regards to the management of strategic levees, in order to improve flood readiness, intelligence and response actions.

The content added to the MFEPs will detail:

- Those strategic levees which are formally managed and the level of protection they provide
- Those unmanaged strategic levees which may require emergency works to be delivered in order to provide flood mitigation benefits which meet the investment criteria nominated within the 2016 Victorian Flood Management Strategy

2.2 Levee Category Definitions

This project is intended to be largely limited to strategic levees. The definition of strategic levees adopted for this project is those levees that protect urban areas, large rural floodplain areas, or critical infrastructure.

The following levee category definitions has been adopted for this project:

Category 1 Levees – those strategic levees that are formerly managed whereby the operation and maintenance of the levees is carried out by or on behalf of the levee owner.

Category 2 Levees – those levees that are not managed but either provide flood protection to urban areas, or provide protection to rural areas where it meets the investment criteria outlined in the Victorian Flood Management Strategy (DELWP, 2016) and where it meets the VICSES threshold to act under the VICSES Act 2005 Sectio 32AC.There are three sub categories for Category 2 levees:

- **Category 2 – Type A** – Levees that do not require significant work ahead of a major flood and may require active period monitoring during a flood event.
- **Category 2 – Type B** – Levees which require significant work ahead of major floods, or levees which have known weaknesses from past floods. Active monitoring is required during a flood event.
- **Category 2 – Type C** – Location identified for a temporary levee ahead of a major flood. The temporary levee is removed post flood.

Category 3 Levees – strategic levees which provide unverified levels of flood protection to rural floodplain areas.

Private Levees – levees which have been built by individuals solely for the protection of their own property and assets.

Significant Floodplain Features - man made features on the floodplain, which are not levees, but will have a significant impact on flow patterns during major floods that would result in significant changes in flood behaviour (e.g. elevated roads, elevated railways, irrigation channel banks).

2.3 Data Supplied

The following data was supplied by the North East CMA for use during this project:

- Previous reports relevant to the project (flood studies, floodplain risk management studies, flood mapping studies, mitigation scheme design reports etc.)
- Digital elevation model datasets at various locations
- Flood depth, velocity, depth velocity product, height raster files derived from two dimensional hydraulic modelling
- Flood aerial imagery

2.4 Urban and Rural Levees

A key focus of this report is levees which protect urban centres (townships) and therefore significant public infrastructure.

Urban levees have been identified at:

- Rural City of Wangaratta
    - Wilson Rd
    - Parfitt Rd
    - Sunset Drive
    - Merriwa Park (also known as Christopher Robin, due to protection afforded to the pre - school of this name)
    - Old School Rd
    - Rattray Av
    - Markwood Levee
    - Other significant levees/features
        - Fishers Levee (rural)
        - Hume Freeway Diversion Channel
- Alpine Shire
    - Harrietville - Bon Accord Levee (also known as Bon Accord Track Harrietville or Harrietville Levee)
    - 148-152 Great Alpine Rd Harrietville
    - 142 Great Alpine Rd to Monarch Lane Harrietville
    - 114 and 122 Great Alpine Rd Harrietville
    - Downstream of Monarch Lane Harrietville
    - Porepunkah Caravan Parks
    - Ardern's Caravan Park Myrtleford
    - Rail trail adjacent to Great Alpine Rd
    - Whalley's Lane Myrtleford
    - Kiewa Valley Highway Mt Beauty (property immediately upstream)
    - Mount Beauty Caravan Park
    - Other significant levees/features
        - Myrtleford – Happy Valley Ck to Ovens River diversion channel
- Indigo Shire
    - Bartley St to Main St Chiltern
    - Martins Lane to Oxford St
    - Oxford St to Conness St
    - Conness St to Dickson Ct
- City of Wodonga

    - Small levee on Lincoln Causeway
    - Sanctuary Boulevard
    - Park Lane
    - Wodonga Raw Water Offtake (North East Water asset)
- Towong Shire
    - Eskdale Caravan Park
- East Gippsland Shire
    - Omeo Livingstone Park

Strategic rural flood protection levees (Category 3) can also be important in providing economic benefits such as reduced flood impacts on crops, pasture, rural land use buildings, infrastructure, livestock etc.

Notable strategic rural levees are located at:

- Kiewa River middle to lower floodplain
- Ovens River Markwood levee
- Lower Ovens River Boorhaman
- Fishers Levee Wangaratta
- Murray River floodplain

Most rural levee systems in Victoria are not currently managed. The 2016 VFMS states that large scale rural levee systems are no longer viewed as best practice and further states that it is unlikely that many, if any, of these rural levee systems will be formally maintained into the future.

3 Assessment of Urban Levees

3.1 Rural City of Wangaratta

3.1.1 Wangaratta

Wangaratta is centred on the confluence of the Ovens and King Rivers. Significant urban levees located at Wangaratta protecting against river flooding include the Wilson Road ring levee, Parfitt Road ring levee and the Merriwa Park Levee.

One Mile Creek and Three Mile Creek also run through the city. Of these there is a significant levee located on Sunset Drive adjacent to Three Mile Creek.

3.1.2 Markwood Levee

The Markwood Levee was reconstructed by a NECMA predecessor, the Ovens River Management Board, implementing part of the Markwood Deep Creek Water Management Scheme (ID&A 1995). The scheme has multiple components including the management of Deep Creek and the Ovens River system. The levee is designed to provide up to 5% AEP protection to residents in the Markwood district. The district has many smaller holdings, similar to a peri-urban area. The levee provides flood protection to up to 10 houses in its immediate vicinity.

The levee is well constructed and maintained, and is designed to consistently spill in a stable manner when overtopped.

3.1.3 Wangaratta 2022 MFEP

The Rural City of Wangaratta 2022 Municipal Flood Emergency Plan contains significant relevant intelligence in relation to levees. It is important however to note that significant upgrades to Parfitt Road and Wilson Rd levees are not reflected in that document.

The main flood height gauge at Wangaratta is located on the Ovens River at the Stockbridge. The 1% AEP flood levels at this gauge is 12.974 m (143.40 m AHD).

The 2022 Wangaratta MFEP is detailed in relation to specific floods. It could be refined to provide Council and Vic SES with more succinct information as how to interpret information and manage levees during floods. The MFEP also needs to be updated to reflect 2025 upgrades at the Parfitt Road levee.

The following information in the 2022 MFEP is provided for specific levees:

Wilson Road Levee

- Upgrade of the Northern Wilson Road Levee to 600mm freeboard from the 1% AEP was completed in June 2021. This extended from Wilson Road right through to Chandler Street. This section was completed as a priority in relation to its high risk due to weakness and instability.
- Superseded:
    - Sufficient 1% AEP freeboard of 300mm is available along the northern portion of the levee from Chandler Street (western end) to Wilson Road (eastern end).
    - Along the south-eastern section of the levee (Chainage 900 to 1700 m) there is generally adequate freeboard of 300-400 mm aside from a 100 metre section (Chainage 1050 to 1150m) where the freeboard drops to 240 – 270 mm.
    - Along the south-western section (Chainage 1700 to 2050 m) the freeboard is generally adequate however there is a 100 metre section (Chainage 1750 to 1850 m) where the freeboard drops to 250-280 mm.

- Overall, the assessment has identified that the Wilson Road Levee system currently does not provide adequate 1% AEP protection with two main sections of the levee having less than the preferred 300mm freeboard. During the 2010 flood, the levee south of Wilson Road reached stage 3 of 4 failure criteria, primarily due to long water exposure, and tree damage. The community was advised to evacuate based on this assessment.
- At 0.5% AEP (13.03m) the Wilson Road Levee is overtopped impacting several houses on Wilson Road and the side roads. The Wilson Road Levee is over topped at the northern end, impacting a number of properties and dwellings within the levee. These are located in the vicinity of the 100 metre section (Chainage 1050 to 1150m) where ground level elevations are lowest.

Parfitt Road Levee

- Upgrades to the Parfitt Road Levee were completed during 2025. The key aim was to increase the freeboard to 600mm.
- Superseded
  - The western half (Parfitt 1) was unpaved along the crest. An occasional established tree was observed at the toe of the batters.
  - Longitudinal cracking was observed at CH1125 W, which should be repaired imminently to limit the potential for piping from infiltrating water.
  - There is reduced freeboard in the south-western corner of the levee system along Pinkerton Crescent (Chainage 3350 to 0 m) with the lowest freeboard of 50-60 mm occurring at Chainage 0, near the entrance road to Painters Island Caravan Park.
  - Prior to the eastern upgrades the following was noted:
    - The Parfitt Road Levee was in generally fair condition, with some rutting and minor erosion, particularly at road and stock crossings, and some cracks in the crest.
    - The levee batters were generally uniform at approximately 3H:1V, 1 to 3m in height, and well grassed, although the batters are locally steeper at approximately 2.5H:1V in the south-eastern corner.
    - The eastern half of the levee (Parfitt 2) has a sealed track on the crest, used by pedestrians and cyclists.
    - At 12.92m. 1% Residential and commercial property within the levee on Wylie St and Parfitt Road, north of Morgan Road become impacted by flood waters. Overall, the assessment has identified that the Parfitt Road levee system currently does not provide adequate 1% AEP protection with Bowser Road overtopping and extensive sections of the levee having less than the preferred 300 mm freeboard, particularly along the eastern and south-western sections of the levee system.
    - At 0.5% AEP flood level. The majority of residential and commercial properties within the Parfitt Road levee are impacted by flood waters. In 2016 this levee began leaking between the bridge and hire company, near the pump station. Significant emergency sandbagging required by multiple agencies to stabilise the bank.
    - Sufficient 1% AEP freeboard is available along the western portion of the levee from Pinkerton Crescent to Bowser Road (Chainage 50 m to 1250 m) with there generally being a minimum of 500-600 mm freeboard through this section.
    - A shallow overtop (less than 30 mm) occurs at the northern boundary of the levee system across Bowser Road (Chainage 1300 m). Sandbagging is required in this location, and this has occurred in recent major flood events.

- Along the eastern section of the levee (Chainage 1300 to 3100 m) approximately 50% of the reach does not have the minimum 300 mm freeboard. There is a particularly low section from Chainage 1650 to 2150 m where the freeboard is as low as 140 mm.

Sunset Drive Levee

- The levee does afford a level of protection in a 1% AEP scenario as determined by the 2017 flood study
- Gate Valve on stormwater pipe outlet of levee. Gate valve can be actuated by Rural City of Wangaratta to stop flow and allow pump to discharge the area so rising levels in creek don't backflow and inundate adjacent homes.
- The Sunset Drive Levee is in generally good condition. The earthen levee embankment is low in height with gentle batters, well vegetated with grass and no evidence of erosion was observed.
- Part of the levee was a concrete and brick retaining wall upstream of the footbridge, and behind private property. The upstream extents of the wall are brick fence on private property boundaries.

Fishers Levee

- Fishers Levee is a private unmaintained levee on the Ovens River at the end of Fisher Lane, East Wangaratta.
- At 12m, it is likely to overtop
- At 12.92m, 1%AEP areas that are not protected by levees between Reedy Creek and the Ovens River, downstream of Fishers Lane, are inundated by generally more than 1 m of water.

Merriwa Park Levee (Christopher Robin)

The Merriwa Park levee is generally in poor condition. The upstream batter is steep with batters of typically 2H:1V with localised areas of up to 1.5H:1V and had significant amounts of established trees growing into the bank.

Evidence of slumping and creep was observed, and the path along the crest had cracks along the length which has been repaired. The cracking is inferred to be a result of stress relief. The trees in the embankment were warped. The slumping, cracking and warped trees are likely a result of localised small slope instabilities., rather than a global failure.

The downstream embankment was grassed with gentle batters. In general, the Merriwa Park levee is 300mm to 450mm below the 1% AEP event flood level, hence, to achieve 600mm freeboard it requires a 900mm to 1050mm height increase.

Tennis courts, playground and sound shell pavilion clubhouse usually floods to well above clubhouse floor level. 1993 nearly reached roof level. Note that:

- At 12.5m the rest of Merriwa Park is not protected by the levee.
- At 12.7m Merriwa Park levee is under threat. Consideration to sandbag or implementation of other protection measures.
- At 12.82m, the levee is 700mm under water

Painters Island Levee

Painters Island Caravan Park is impacted from the Ovens River from 11.9m. The Caravan Park is situated between the Ovens River and the Parfitt Road Levee System. Note that:

- At 11.6m, water against Painters Island river levee / concrete path over most of its length but freeboard remains.
- At 12.3m, overtopping of levee/bike path along Ovens River frontage of Painters Island at the defined low point in the levee (dip can also operate to drain water from the park depending on level of filling from Apex Park). Low ground in Painters Island will be flooded to level controlled by Pinkerton Crescent and dip in river levee.
- At 12.3m ,shallow overtopping of Pinkerton Crescent (<200mm) near 35 Pinkerton (at rear of Painters Island). Timing and level depends on duration at this level. Low ground in Painters Island will be flooded to level controlled by Pinkerton Crescent and dip in river levee.

3.1.4 Site Inspections

The levees were given a cursory inspection during late 2024 and early 2025. Comments arising from this inspection are summarised in Table 1 below. It is noted that the Parfitt Road levee was being upgraded at the time of inspection.

Based on the analysis of available information the following categorisations (Table 1) have been provided for specific levees.

Table 1 Rural City of Wangaratta Levee Categorisations

Levee	Description	Level of Protection	Categorisation	Comment
Parfitt Road	This levee is a well maintained levee managed by the Rural City of Wangaratta (Figure 3). It has well maintained batters and one location with a concrete crest. The levee has been sealed for pedestrian and bicycle access. At the time of inspection, Council was upgrading the elevation and batters in several locations. This has since been completed.	1% AEP plus 600mm following the completion of all upgrades in 2025	Cat 1	Cat 1 on confirmation of annual management approach
Wilson Road	This is a well maintained levee, which has since 2021 been upgraded to address deficiencies in height and batter grade. It is also understood the internal batter in the vicinity of Thomas St and Heach St (Figure 4) has been upgraded to address localised seepage issues.	1% AEP plus 600mm for southern section 1% AEP plus 600mm northern section	Cat 1	Cat 1 on confirmation of annual management approach
Merriwa Park (Christopher Robin)	This levee provides protection for assets in Merriwa Park including Christopher Robin pre-school and the Wangaratta Lawn Tennis Club facilities (Figure 5). The batters appear relatively steep and has a large amount of woody vegetation is growing on the outer batter. The elevation of the crest varies significantly, with the levee higher in the south than at its northern extents.	300mm to 450mm below the 1% AEP at northern end	Cat 1	Council has secured significant funding to upgrade this levee to state standards and is currently developing designs for the upgrade.
Painters Island	This levee is partially maintained and is in variable condition (Figure 6). At the Stockbridge end of the levee an elevated Council footpath essentially defines the levee. Downstream of the Sydney Weir Footbridge, the levee is in poor condition and consists of pushed up earthen material of variable condition. The batters at this location are steep and some erosion is present on the inside batter. The crest elevation is variable.	1% AEP 12.975m Painters Island Caravan Park impacted from 11.9m 11.6 Water against Painters Island river	Cat 3	Informal downstream of the Sydney Beach footbridge, but in reasonable condition near the Caravan Park. Caravan Park component

Levee	Description	Level of Protection	Categorisation	Comment
		levee / concrete path 12.3 Overtopping levee/bike path along Ovens River Low ground in Painters Island will be flooded to level controlled by Pinkerton Crescent and dip in river levee.		protects area to be evacuated during flood. Rural component potentially protects some houses, however currently not a continuous levee and protection limited.
Sunset Drive	This levee commences at the end of an elevated brick boundary fence on the adjoining private property. It then consists of a partly earthen levee and reinforced concrete wall up to the corner of Sunset Drive. The levee runs north as a well maintained earthen levee north along Sunset Drive (Figure 7). Although a number of houses are within the levee only 2-3 house are likely to be protected above floor level.	12.92m. Less than 1% AEP protection. Levee exposed to 1% AEP flows at downstream extents.	Cat 1	Cat 1 on confirmation of annual management approach
Old School Road	This recently constructed levee runs parallel to the right bank of a small waterway which crosses Old School Road (Figure 8). The earthen levee appears well constructed, and assists in protecting the development at the eastern end of Old School Rd.	No data available, independent of Ovens River	Cat 1	Good condition, not clear if specific management is required.
Gun Club College Crescent	This levee provides some protection to the gun club, but would be better defined as a berm around the gun club, acting as a barrier for stray ammunition.	No data available	Cat 3	Cat 3, but not a rural levee. Public gun club at risk, but no real risk to human life.
Rattray Av	Essentially a footpath on the floodway parkland along Rattray Av (Figure 9). Protects the road and some front yards from flooding. Unlikely to protect houses	0.5% AEP. The One Mile Creek Breaks Out of The Creek Reserve Along Rattray Avenue	Cat 2 A	Low level levee, which provides some protection to road more than anything.
Fishers Levee	A private rural levee on the Ovens River right bank, between Detour Rd and Yellow Creek It is unclear what public assets or features are protected by the levee, potentially protects NEW WWTP ponds	12m Consider Fishers Levee (1917 levee along Yellow Creek) likely to overtop. 12.92 1% Areas that are not protected by levees between Reedy Creek and the Ovens River, downstream of Fishers Lane are inundated by generally more than 1 m of water.	Cat 3	Some protection of Great Alpine Road flooding and some possible impact on NEW Wastewater Treatment Pond Embankments. Local houses on Great Alpine Rd expected to flood with or without this levee due to flows along Yellow Ck.
Hume Freeway Diversion			Significant Floodplain Feature	Diverts flow from One Mile Creek to King

Levee	Description	Level of Protection	Categorisation	Comment
Channel and Weir				River parallel to Hume Fwy
Markwood Levee	The Markwood Levee (Figures 2 & 10) was reconstructed by a NECMA predecessor, the Ovens River Management Board, implementing part of the Markwood Deep Creek Water Management Scheme (ID&A 1995). The scheme has multiple components including the management of Deep Ck and the Ovens River system. The levee is designed to provide 5% AEP protection to residents in the Markwood district. The district has many smaller holdings, similar to a peri-urban area. The levee provides flood protection to up to 10 houses in its immediate vicinity. The levee is well constructed and maintained and is designed to consistently spill in a stable manner when overtopped.	5%AEP protection based on original design	Cat 1	An approved and managed levee under the Water Act 1989

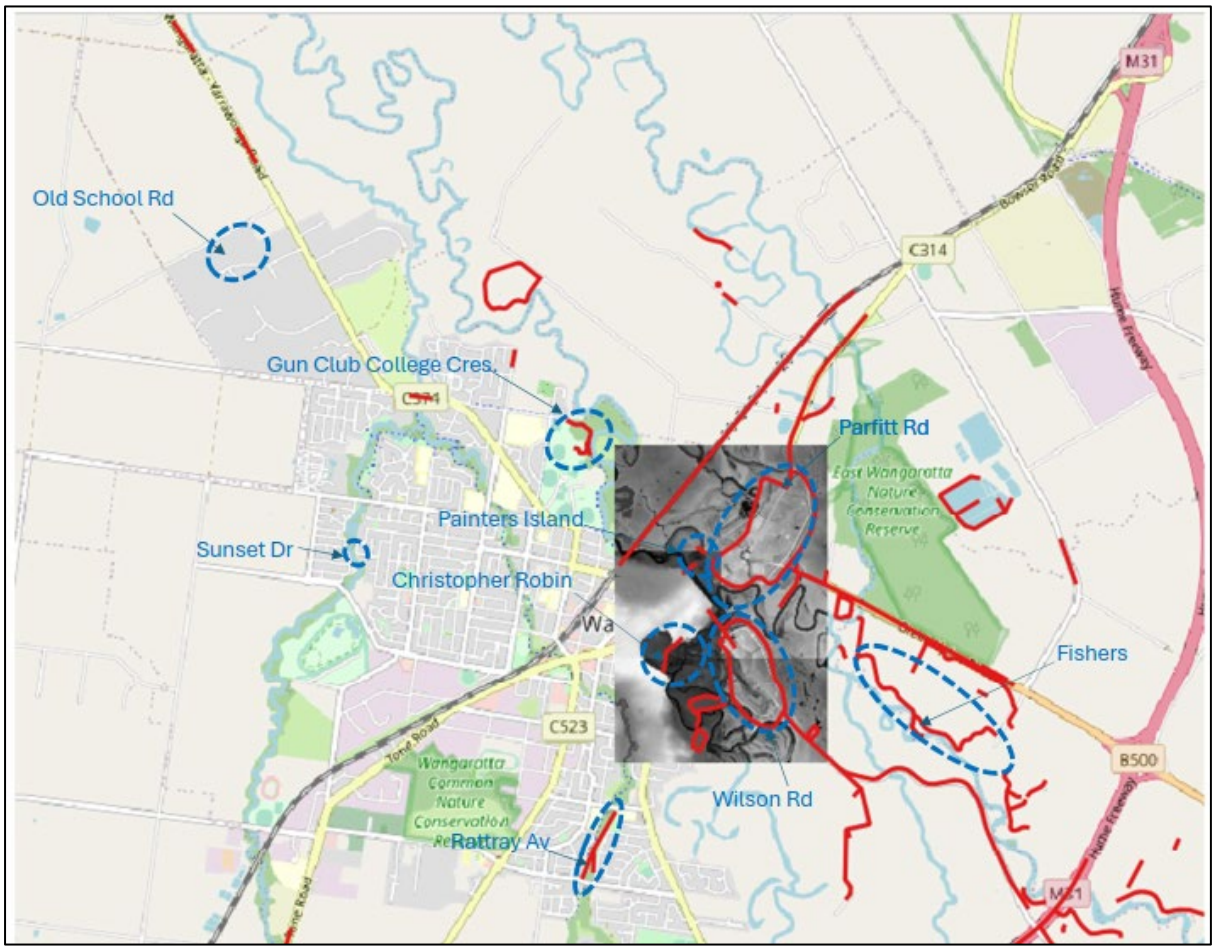


Figure 1 Wangaratta Levees Locality Plan

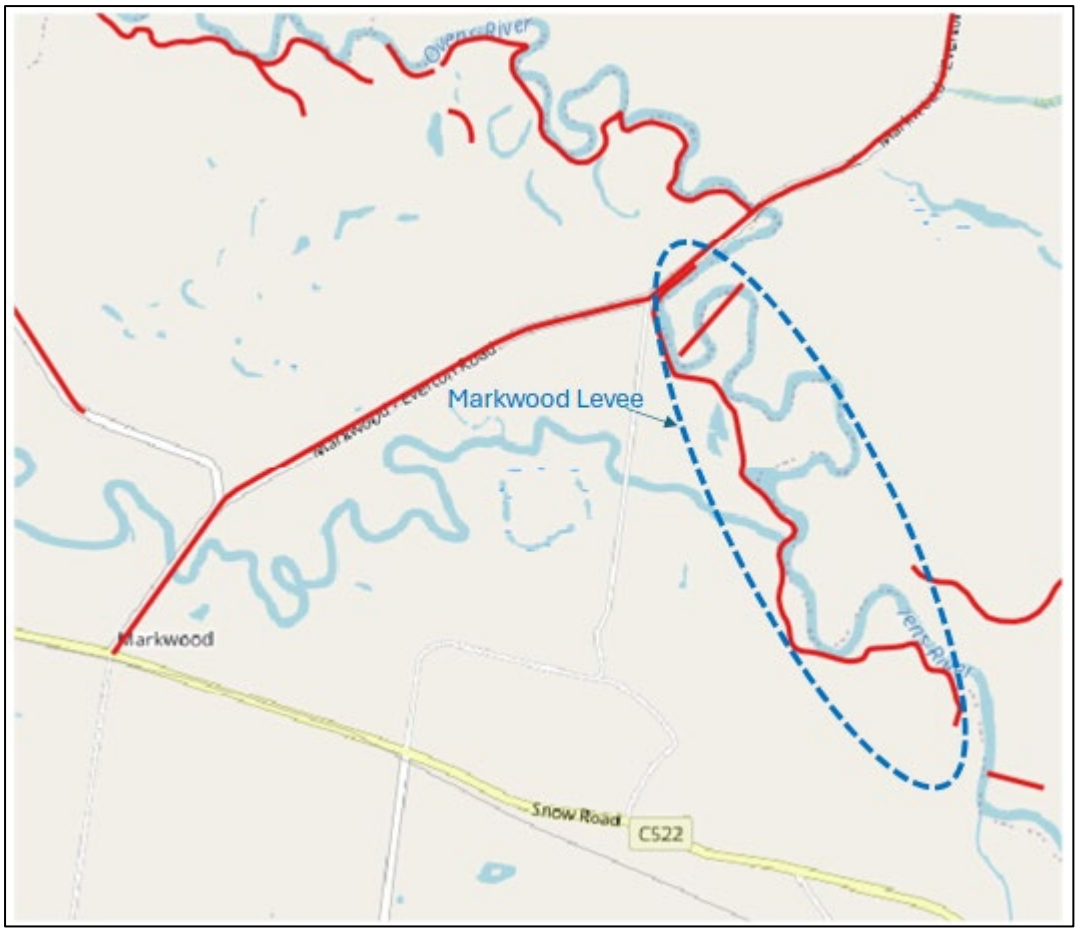


Figure 2 **Markwood Levee Locality Plan**



Concrete levee behind Wangaratta Caravan Park



Reconstructed levee on eastern extents under construction - 2025

Figure 3 **Parfitt Road Levee Photographs**



Pump at Thomas St



Crossing at Dunphy St

Figure 4 Wilson Road Levee Photographs



Kindergarten immediately adjacent to levee



Levee profile at Merriwa Park

Figure 5 Merriwa Park Levee Photographs



Levee adjacent to caravan park



Old levee downstream of Sydney Beach Footbridge.

Figure 6 Painters Island Levee Photographs



Downstream extents of levee, where flood waters can enter from



Earthen levee, with concrete wall levee upstream of footpath crossing

Figure 7 Sunset Drive Levee Photographs



Levee on right side of floodway channel

Figure 8 Old School Rd Levee Photograph



Low levee provides immunity to footpath, parkland and road.

Figure 9 Rattray Avenue Levee Photograph



Markwood levee adjacent to Markwood Everton Rd



Levee behind house

Figure 10 Markwood Levee Photographs

Management Issues

- All major levees maintained by the Rural City of Wangaratta appear to be well managed and maintained. However, formal Operation and Maintenance Plans have not been made available for this project.
- Consideration should be given to the ongoing management of the Markwood Levee moving forward, to ensure known responsibilities for future maintenance and management.

3.2 Alpine Shire

3.2.1 Harrietville

Harrietville is located at the confluence of the East Branch and West Branch of the Ovens River. The Great Alpine Road runs through the town. Much of the town is located above the Ovens River floodplain. However on the East Branch, the Harrietville - Bon Accord Levee provides 1% AEP flood protection. This levee was formed from dredge tailings following World War 2. It is at high risk of scour failure from high velocities expected in the adjacent river. Breaching of the levee could result in significant risks to the community and infrastructure. A business case has been completed for the upgrade of the levee.

On the West Branch, downstream of the confluence with the East Branch, there are several informal levees of pushed up alluvial material. Most levees are discontinuous and do not afford flood protection (Figure 11).

3.2.2 Porepunkah

Downstream of the Great Alpine Rd bridge at Porepunkah, there are several caravans on the floodplain of the Ovens River (Figure 12). One park in particular, Mt Buffalo Caravan Park has a significant levee protecting multiple permanent cabins from Ovens River flooding. The levee does not protect the park from Buckland River flooding.

3.2.3 Myrtleford

Myrtleford fronts the Happy Valley Creek which shares the Ovens River floodplain and is a tributary of the Ovens River (Figure 13). There are several levees on the Happy Valley Creek, which provide varying levels of protection:

- Rail Trail – affords protection to multiple houses but not formally managed as a levee.
- Ardern's Caravan Park – levee in poor condition which affords localised protection to the park.
- Whalley's Lane – an informal levee behind private property, which provides localised protection.

3.2.4 Mount Beauty

There is a small informal bank on the Kiewa River at Mount Beauty Caravan Park which affords protection to several permanent cabins and camp sites (Figure 14).

Upstream of the Kiewa Valley Highway on the West Kiewa River, one house has an informal levee system to protect the property (Figure 14). The levee is discontinuous and may be sand bagged during flood events.

3.2.5 Alpine Shire Flood and Storm Emergency Plan

The 2021 Alpine Shire Flood and Storm Emergency Plan contains limited relevant intelligence in relation to levees and is relevant mainly to the Bon Accord Levee. It notes:

Harrietville Levees

- Left bank of Ovens River East branch between Bon Accord Track and Feathertop Lane (Harrietville - Bon Accord Levee).
- Right bank of Ovens River (downstream of confluence) East Branch levee is above 1% AEP level.
- Floodwaters break out from East Branch (around and downstream of School Bridge) to land behind the east bank levee at approximate 20% AEP

- Levees constructed during gold mining operations in the 1950s. The levees are not constructed to modern standards and may be prone to erosion or breach.

Porepunkah Bridge Caravan Park

- 20% AEP Porepunkah Bridge Caravan Park. Shallow breakout flows through central part of site.

Mt Buffalo Caravan Park

- 20% AEP floodwater begins to overtop Harrisons Lane and enters the Mt Buffalo Caravan Park (east of Buckland River).

Myrtleford

- Happy Valley Creek. The breakout flows to Happy Valley Creek have historically been associated with a gauge level of 4.5 m for the Ovens River @ Eurobin (Minor FCL). However in recent events (August 2016 onwards) breakouts have occurred just downstream of Selzer's Lane at a lower threshold (4.3 m). As Ovens River flows increase above this threshold, Happy Valley Creek carries an increasing proportion of flows and bank full flows occur along Happy Valley Creek in Myrtleford around 5-5.5 m. Significant out-of-bank flows along Happy Valley Creek commence at Eurobin gauge 5.7 m.
- Diversion Channel. In Myrtleford, the diversion channel from Happy Valley Creek to the Ovens River was constructed in 2009 and commenced operation in 2010, prior to the flood events of September 2010. This channel, instigated as part of the Myrtleford Floodplain Management Study (2000) and constructed as a Water Management Scheme under the Water Act 1989, is designed to divert floodwater and reduce impact during an Ovens River flood. Up to Moderate flooding, floodwater is diverted from Happy Valley Creek (at the Whalley's Lane culverts) back into the Ovens River near the end of Gerraty's Lane. Above Moderate the channel is overtopped and also increases the speed of floodwater travel along the diversion channel. The channel helped reduce the impact of the 2010 flood on the town but does not completely mitigate the flood risk from around 5.0m on the Eurobin Gauge.
- Ardern's Caravan Park - 19 people evacuated from the Myrtleford and Ardern's Caravan Park in December 2010. No details on immunity.

Mount Beauty

Mount Beauty is located between the Kiewa River West Branch and the Kiewa River East Branch, a short distance upstream of the confluence of the two branches. The centre of the township is located on rising ground above the Mt Beauty Regulating Pondage. The regulating pondage is an off-stream storage which acts to regulate outflows from the Kiewa West Power Station tailrace prior to release to the Kiewa River West Branch.

Flooding impacts in Mt Beauty / Tawonga result principally from the Kiewa River West Branch and breakout flows from Simmonds Creek which impact the area north of Simmonds Creek Road through to the Kiewa Valley Highway (overtopping the highway) with flows returning to the Kiewa River West Branch around and to the south of the Mt Beauty Holiday Centre. The lower parts of the Holiday Centre were subject to flooding in 1998. Damage to roads and bridges along the Kiewa River East Branch (i.e. Damms Road) is known to have occurred in 1998.

3.2.6 Site Inspections

Based on the analysis of available information the following categorisations (Table 2) have been provided for specific levees.

Table 2 Alpine Shire Levee Categorisations

Levee	Description	Level of Protection	Categorisation	Comment
Harrietville				
Harrietville - Bon Accord Levee	The levee is very steep on the river side and has regrowth of native and exotic trees along that batter (Figure 15). It is likely seepage would occur through the alluvial gravel material. The levee is steep in grade from top to bottom. Failure would likely create rapid avulsion and major damage across floodplain to west branch.	1% AEP with more than 1m. freeboard. Affords significant protection, but in poor condition.	Cat 2B	Significant levee protecting houses, shops and school camp. Built from river cobble and clay. Has steep batters, prone to erosion on river side, trees growing through levee. Failure increases the risk of an avulsion of the Ovens River. Following thorough engineering and hydrological investigation consideration have informed a DTF business case to upgrade the levee and bring it under formal management to enable Cat 1 status.
Pioneer Park	This levee was originally the right bank of the Ovens River through Pioneer Park, it appears to have been removed since the original GIS layers were identified.	n/a	N/A	Identified in SDS, but no longer exists
148-152 Great Alpine Rd	Private levee around sheds and private business (Figure 16)	10% AEP Water Tech 2016	Cat 3	Discontinuous levee from unconsolidated material. Protects property more from high velocity flows
142 Great Alpine Rd to Monarch Lane	Discontinuous tailings pushed up, affords no protection (Figure 17)	Discontinuous affords no protection	Cat 3	Discontinuous levee from unconsolidated material.
114 and 122 Great Alpine Rd	Private levee / solid fence around these properties (Figure 18). Gates can be managed with sandbags.	Not identified as levee in flood study, LiDAR cannot pick up fence.	Private	Informal solid brick wall with flood sand bagging and some earthen levee around 2 private properties
Downstream of Monarch Lane	Diverter bank, open at downstream extent, which diverts high velocity flows from properties (Figure 19).	Discontinuous affords no protection	Cat 3	Discontinuous levee from unconsolidated material. Protects property more from high velocity flows
Porepunkah				
Mt Buffalo Caravan Park	Localised levee to the east of the main park protects it from Ovens Riverine flooding (Figure 21). Multiple permanent vans are located in this park which may otherwise be inundated. Evacuation of Caravan Park preferred method of management during a flood.	Reviewing Upper Ovens Flood Study 2016, the Flood contour through the park is of the order 268m for 20%, 10% and 5% AEP. The typical crest appears to be 267.8m, therefore limited protection up to 20% AEP flood.	Cat 2B	Private Caravan Park levees, providing protection of private assets, but multiple permanent lodgings. Park would be evacuated.
Myrtleford				
Ardern's Caravan Park	Protects the caravan park from Happy Valley Creek floods (Figure 22). This park appears to have few permanent vans, therefore the preferred management approach during a flood is to evacuate the park.	Reviewing Upper Ovens Flood Study 2016, the Flood contour through the park is of the order 210.8m The typical crest	Cat 3	Private Caravan Park levee, providing protection of private assets

Levee	Description	Level of Protection	Categorisation	Comment
		appears to be 210.8m, therefore may provide limited protection up to 1% AEP flood.		
Rail Trail adjacent to Great Alpine Rd	The old rail line effectively acts as a levee to houses adjacent to Great Alpine Rd (Figure 23). The natural lay of the land has a high point between 96 and 98 Great Alpine Rd where a track runs through to south of the levee. Therefore the levee protects land to east and west of this location.	Appears to overtop at less than a 1% AEP flood of the order 213.7m, varying along the levee.	Cat 2A	Rail Trail embankment with non-return valve effectively acts as a levee. Needs to be checked prior to floods. Protects multiple private houses from inundation.
Whalleys Lane	An informal levee runs between the Happy Valley Creek and houses at 19 and 31 Whalley's Lane (Figure 24). The levee has a narrow crest and steep batters and is not likely to have been constructed from clay material, but probably local alluvial material.	Appears to overtop at approximately a 1% AEP flood of the order 210.6m, with a typical crest level 210.73m.	Cat 3 (Private Levee)	Local deflecting levee protecting houses from high velocity flows. Likely a private levee.
Myrtleford Diversion Channel	This channel was constructed in the early 2000's. It captures water from the Happy Valley Creek and gravitates it across the floodplain to the Ovens River when flood levels in each waterway allow this.		Significant Floodplain Feature	Diverts flow from Happy Valley Ck to Ovens River
Mount Beauty				
Mt Beauty Caravan Park	This levee was constructed following the completion of erosion control works by NECMA in the late 1990's. It was constructed by the manager of the park at the time, without formal approval. The levee provides localised protection to cabins and caravan sites adjacent to the river (Figure 25).	Levee elevation 338.1m typical. No flood elevations available	Cat 3	Private Caravan Park levee, providing protection of private assets
Upstream Kiewa Valley Highway	This levee appears to be on private land. It is approximately 0.6m high and has a gap in a central location, which could be sandbagged during a flood to afford protection to the house on this allotment (Figure 26).	Levee elevation 343.25m typical. No flood elevations available	Cat 3	Private levee, providing protection of private assets



Figure 11 Harrietville Levees Locality Plan

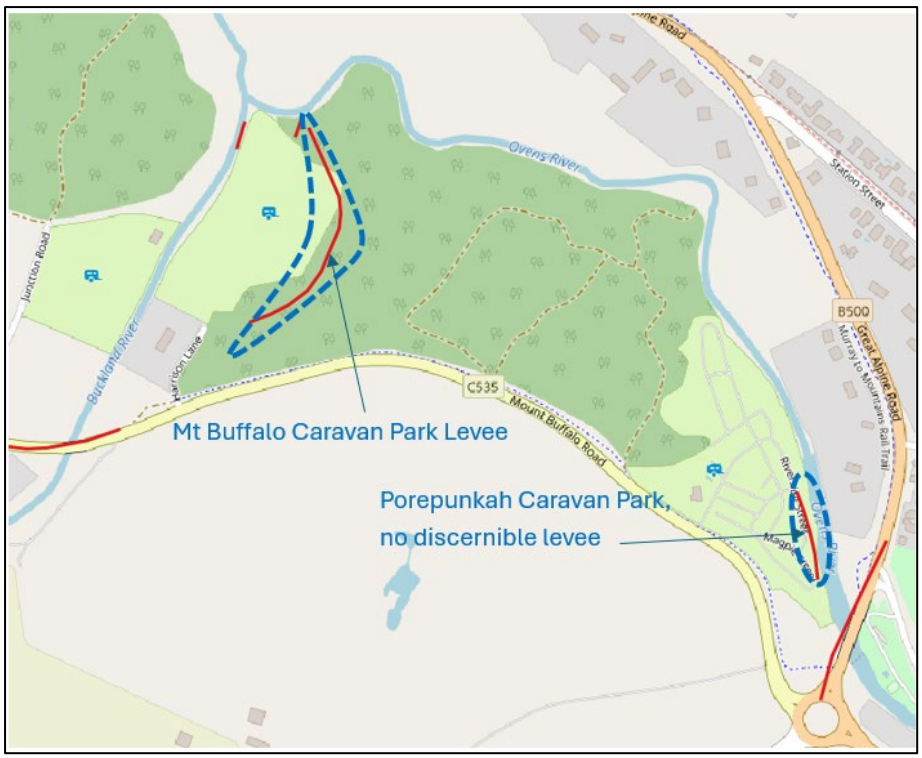


Figure 12 Porepunkah Levees Locality Plan



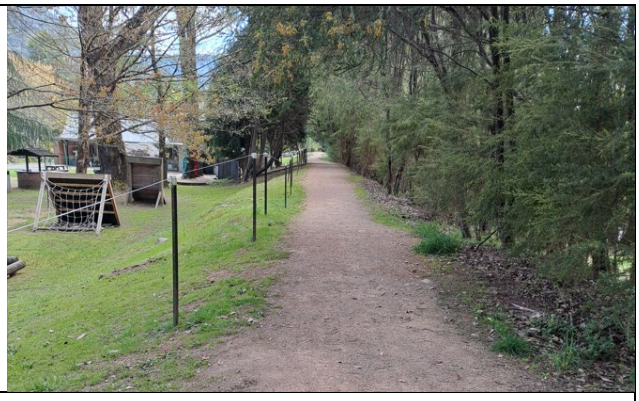
Figure 13 Myrtleford Levees Locality Plan



Figure 14 **Mt Beauty Levees Locality Plan**



Fallen tree on river side batter



Levee and walking track looking downstream

Figure 15 **Harrietville - Bon Accord Levee Photographs**



Levee on boundary fence



Levee adjacent to river

Figure 16 **148-152 Great Alpine Rd Levee Photographs**



Discontinuous river gravel mounds

Figure 17 142 Great Alpine Rd Levee Photograph



Two private properties protected by rock and brick fence levees

Figure 18 114 and 122 Great Alpine Rd Levee Photograph



Levee constructed of river gravel, resembles more a retaining wall

Figure 19 Downstream of Monarch Lane Levee Photograph



No discernible levee present

Figure 20 Porepunkah Caravan Park Levee Photograph



Southern extent of levee



Informal northern extents

Figure 21 Mt Buffalo Caravan Park Levee Photographs



Pump on top of levee, trees also on crest



Levee from inside caravan park

Figure 22 Ardern's Caravan Park Levee Photographs



Rail trail effectively acting as a levee

Figure 23 Rail Trail Levee Photograph



Levee on creek frontage affording protection to houses

Figure 24 Whalley's Lane Levee Photograph



Short section of levee filling depression, protecting campground and cabins

Figure 25 Mt Beauty Caravan Park Levee Photograph



Private levee upstream of Kiewa Valley Highway

Figure 26 Kiewa Valley Hwy Levee Photograph

Management Issues

There are no known formally managed levees in Alpine Shire, however the Harrietville - Bon Accord Levee needs to operate as a Category 1 levee to protect Harrietville residents and assets. The overall condition of the levee is variable, it is essentially constructed from larger diameter alluvial material. The banks are heavily vegetated on the river side, while a school camp is located on the dry-side of the levee. Failure of this levee would pose significant consequences to the public and to public assets. A business case for the upgrade of the levee has been prepared.

3.3 Indigo Shire

3.3.1 Chiltern

The primary flood risks to Chiltern are from the Black Dog Creek, which flows from south to north through the western end of Chiltern township, as well as its key tributaries which flows from east to west through the township. The catchment area of Black Dog Creek upstream of Chiltern is approximately 179 km^2. Black Dog Creek flows into the Murray River 14 kilometres downstream of Corowa. A number of small tributaries rise from the hills to the east and north of Chiltern and flow through the centre of the township.

Flooding patterns through the Chiltern Township are complex and are the result of flooding in three separate tributaries of Black Dog Creek. Over the previous decades, works has been undertaken to divert water away from an old course of the creek that would naturally have crossed Conness St. These works provide a measure of protection. However beyond this level of protection flooding of various properties will occur in a flood event.

The community of Chiltern has experienced flooding several times in recent years including February 2012, November 2010 and September 2005. In the September 2005 event Conness Street was inundated up to depths of one metre and numerous properties were flooded. Following the 2005 event the Chiltern Flood Study was commissioned. The flood study considers a number of structural mitigation options including an upstream retarding basin. Local drainage and culvert upgrades were designed in 2012 and have been constructed (Figure 28).

3.3.2 Indigo Shire MFEP

The Indigo Shire Flood and Storm Emergency Plan contains significant relevant intelligence in relation to levees in Chiltern.

The 2021 Chiltern Flood Mitigation Evaluation – Study Report sets out a summary of constructed flood mitigation works as follows:

- Construction of an online retention basin adjacent to Suffolk Street upstream of North Road to retard flows from the northern tributary and reduce breakout flows in the vicinity of Kilgour Street.
- Channel upgrade works and bund walls at Crawford Street upstream of Main Street to reduce flood extent and incidence of breakout flows.
- Channel upgrade works between Park Street / Martins Lane and Chiltern-Rutherglen Road to reduce flood extents.
- Channel upgrade works and bunding at Chiltern-Rutherglen Road to Dickson Court to reduce flood extents.
- Channel upgrade works at Epsom Road.
- Culvert upgrades at Kilgour Street and Park Street.
- Channel upgrade works at Epsom Road.
- Culvert upgrades at Kilgour Street and Park Street.

With little to no warning time for Chiltern and being susceptible to flash flood risk, rainfall rates can be applied and monitored for actions.

Rainfall Rate Data

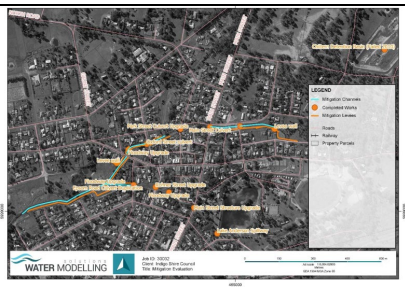
60-65 mm within 2 hrs 95-100 mm within 12 hrs	1% AEP event (100 year ARI event) Significant breakout from northern streamline to Conness St occurs. Significant overland flow path through Chiltern. Isolated depths of greater than 1m through town centre. Approximately 71 properties at risk. A minor breakout from channel adjacent to Peake Court. Properties in Peake Court also subject to flooding from overland flow down Nickless St. Flooding depths between 0.25 m and 0.5 m in Peake Ct.
	November 2005 and February 2012 Flood Events
50-55 mm within 2 hrs 85-90 mm within 12 hrs	2% AEP event (50 year ARI event) Significant overland flow paths occur through Chiltern. Depths between 0.5 m and 1 m through town centre. Approximately 56 properties at risk. Significant breakout from channel adjacent to Peake Court. Flooding depths up to 0.25 m in Peake Court. Properties in Peake Court also subject to flooding from overland flow down Nickless St.
45 mm within 2 hrs 70-75 mm within 12 hrs	5% AEP event (20 year ARI event) Breakout from northern streamline adjacent to Conness St through remnant flow path. Significant overland flow path through Chiltern. Approximately 37 properties at risk. Breakout from channel adjacent to Peake Court occurs. Flooding of Peake Court properties of depths up to 0.25 m.
35-40 mm within 2 hrs 60-65 mm within 12 hrs	10% AEP event (10 year ARI event) Breakout from northern streamline adjacent to Conness St. Shallow depths, flowing slowly overland. Approximately 25 properties at risk.
30-35 mm within 2 hrs 55-60 mm within 12 hrs	20% AEP event (5 year ARI event) Very shallow, slow overland flow.

Figure 27 MFEP flooding information for Chiltern

3.3.3 Site Inspections

Based on the analysis of available information the following categorisations (Table 3) have been provided for specific levees.

Table 3 Indigo Shire Levee Categorisations

Levee	Description	Level of Protection	Categorisation	Comment
Chiltern				
Bartley St to Main St (Figure 29)	 The retaining walls were completed in 2012 and are based on the 2007 Flood Study. The concrete retaining walls have been built to achieve 600mm freeboard to the 100-year ARI event. Over 750m of earth levees and retaining walls were constructed along the floodway north of Peak and Dickson Courts, downstream of Conness Street and Epsom Road. Both the channel and the levee were completed in 2012 after being based on the 2007 flood study. The levee and channel configuration has been designed to provide immunity to adjacent properties for a 1% AEP event.	Designed as 1% AEP immunity. Levee profiles compared to 1% AEP indicate variable protection. This may be in part due to limited LiDAR detail.	Cat 2A	Largely earthen levee with a small concrete section on the left side of the waterway. Well constructed, will become Council query whether levees are Cat 1, or if they should be Cat 2A or 2B, given they have no formal ops manual, and they act more as a local drainage scheme during a flood event.
Martins Lane to Oxford St (Figure 30)		Designed as 1% AEP immunity. Levee profiles compared to 1% AEP indicate variable protection. This may be in part due to limited LiDAR detail.	Cat 2B	Permeable concrete sections and drainage requires preparation for flooding. Council query whether levees are Cat 1, or if they should be Cat 2A or 2B, given they have no formal ops manual, and they act more as a local drainage scheme during a flood event.
Oxford St to Conness St (Figure 31)		Designed as 1% AEP immunity. Levee profiles compared to 1% AEP indicate variable protection. This may be in part due to	Cat 2B	Permeable concrete barrier, provides no protection. Council query whether levees are Cat 1, or if they should be Cat 2A or 2B,

Levee	Description	Level of Protection	Categorisation	Comment
		limited LiDAR detail.		given they have no formal ops manual, and they act more as a local drainage scheme during a flood event.
Conness St to Dickson Ct (Figure 32)		Designed as 1% AEP immunity. Levee profiles compared to 1% AEP indicate variable protection. This may be in part due to limited LiDAR detail.	Cat 2A	Largely earthen levee with a small concrete section around tree. Well constructed. Council query whether levees are Cat 1, or if they should be Cat 2A or 2B, given they have no formal ops manual, and they act more as a local drainage scheme during a flood event.



Figure 28 Chiltern Levees Locality Plan



Earthen levee left bank

Figure 29 Bartley St to Main St Levee Photograph



Earthen Levee leading into concrete section

Figure 30 Martins Lane to Oxford St Levee Photograph



Vertical concrete levee



Porous concrete levee

Figure 31 Oxford St to Conness St Levee Photographs



Floodway downstream of Conness St



Concrete levee around large native tree

Figure 32 Conness St to Dickson Ct Levee Photographs

Management Issues

The Chiltern Levees are managed by Council as part of the Chiltern Flood Mitigation Scheme. Council engaged Dryside Engineering (2020) to assess the condition and capacity of the assets and recommend any upgrades. The investigation provided some general advice on the overall maintenance of the assets including weed maintenance, filling behind concrete levees and general maintenance of flap gates on a regular basis. The levees appear to be subject to formal management arrangements however, Council prefers that they remain classified below Category 1.

3.4 City of Wodonga

3.4.1 Urban Wodonga

Wodonga is located to the south of the Murray River floodplain approximately 20km downstream of Hume Dam. The Wodonga LGA includes the Murray River floodplain from Lake Hume to Barnawartha North. The majority of the urban area is located outside of the Murray River floodplain. However, Gateway Island (limited commercial and industrial development) is located within the floodplain and bounded by Wodonga Creek to the south and the Murray River to the north.

Several tributary creeks, which impact on flooding through the town are:

- Felltimber Creek - Within the urban area, Felltimber Creek flows primarily through a golf course and reserves and parks.
- House Creek and tributary stream, Huon Creek – House Creek flows primarily through parks and reserves within the urban area, but impacts on dwellings at Cypress Court and Park Lane (between Brockley Street and Melbourne Road). House Creek passes beneath the Hume Freeway at Sumsion Gardens entering Wodonga Creek downstream of the Lincoln Causeway.
- Jack in the Box Creek – drains a small catchment (industrial and military land) south of Bandiana. Creekside reserves are narrow and some flood impacts on private property occur around and downstream of Thomas Mitchell Drive. Downstream of Lawrence Street, industrial land closely abuts the creek and flooding can impact industrial land.

3.4.2 Wodonga Municipal MFEP

The Wodonga 2019 Municipal Flood Emergency Plan contains some relevant intelligence in relation to levees as follows:

- Sanctuary Boulevard Levee adjacent House Creek downstream of Yarralumla Drive. This is an earth levee providing flood protection to one per cent AEP level plus freeboard to low-lying land and associated houses (approximately 26 properties). The levee is owned and maintained by the council.
- Cypress Court and Park Lane contain a small number of houses (approximately 10 in total) exposed to flooding. Two houses flood to above floor level in the 1% AEP event on Cypress Court. Levees are proposed for future implementation in these areas.
    - Note:
        - Park Lane was constructed in 2019 and needs to be incorporated in a future update of the MFEP.
        - Cyprus Court is still not constructed.
- There is no mention of Gateway Island levees within the MFEP.

3.4.3 Site Inspections

Based on the analysis of available information the following categorisations (Table 4 & Figure 33) have been provided for specific levees.

Table 4 City of Wodonga Levee Categorisations

Levee	Description	Level of Protection	Categorisation	Comment
Gateway Island A	This site consists of the elevated pathway located between the river and the brewery (Figure 34). The path provides protection of parkland adjacent to the brewery, but does not appear to impact floor levels in this location.	1% AEP = 153.3m (Molino Stewart 2010) Crest level variable	Cat 2C	This levee is considered a Cat2C levee instead of Cat 3. Council own property inundated because of overtopping this levee. To upgrade the levee would require major cost; it is Council's preference to undertake localised protection or removal of cellars in the Le Maisson building, negating any need to further sandbag, or managing this levee to any great degree during floods. No people live in buildings affected.
Gateway Island B	This site is located immediately upstream of play facility on the causeway (Figure 35). There are no significant buildings protected, however some protected is afforded to the currently disused facility.	1% AEP = 153.3m (Molino Stewart 2010) Crest level variable	Cat 3	The levee is located on currently unoccupied land and does not appear to be formally managed.
Sanctuary Boulevard	This site is located on the right bank of House Creek downstream of Yarralumla Drive (Figure 36). The levee was upgraded in the early 2000's to provide 1% AEP protection for houses on Sanctuary Boulevard.	1% AEP design = 0.77m minimum freeboard over its length	Cat 1	The levee is well constructed and maintained, with grassed batters, and concrete path crest in several locations.
Park Lane	This levee was constructed in 2019, and provides protection to hoses on Park Lane fronting House Creek (Figure 37).	1% AEP design. Analysing the long section compared to the 1% AEP, show freeboard of the order 300mm, but not 600mm.	Cat 1	The levee is well constructed with a grassed crest and batters and was constructed by City of Wodonga.

Levee	Description	Level of Protection	Categorisation	Comment
Wodonga Raw Water Offtake	In 2025, North East Water is constructed a concrete retaining wall around the Wodonga Raw Water Offtake Pumps (Figure 38), to provide flood immunity to critical infrastructure including pumps and electrical infrastructure.	1% AEP design – recent LiDAR comparison not available.	Cat 1 / Private (owned by North East Water	The structure is a vertical concrete wall with provision from drop bars at the entrance gate. It is maintained by North East Water

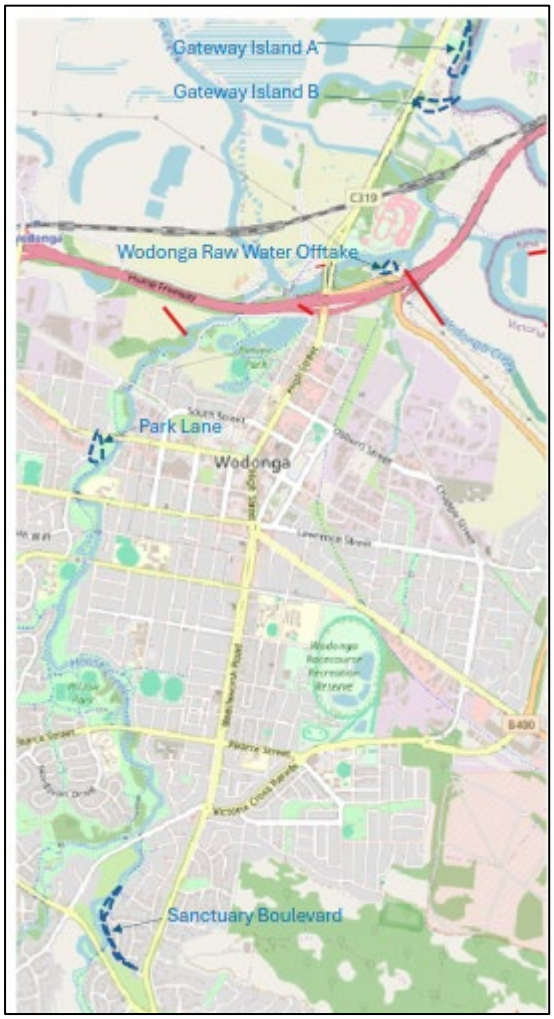


Figure 33 Wodonga Levees Locality Plan



Concrete path effectively acting as a low levee

Figure 34 Gateway Island A Levee Photograph



Levee south of private play park

Figure 35 Gateway Island B Levee Photograph



Footpath acting as concrete crest, leading to grassed crest



Well maintained levee

Figure 36 Sanctuary Boulevard Levee Photographs



Earthen levee

Figure 37 Park Lane Levee Photograph



Newly constructed levee around raw water offtake facility

Figure 38 Wodonga Raw Water Offtake Photograph

Management Issues

- The Wodonga MFEP requires updating to reflect the levees identified in this study including those on Gateway Island, Park Lane and the newly constructed North East Water levee at the raw water offtake.
- Consideration should be given to the construction of the Cyprus Court levee as described in the MFEP.

3.5 Towong

3.5.1 Eskdale

Eskdale is located on the Little Snowy Creek floodplain which runs in a northerly direction through the township.

A levee was reconstructed by DEECA in association with North East CMA at Eskdale in 2017. This followed flood damage to the previous informal levee at the site (Figure 39).

The levee was reconstructed to afford flood protection to the caravan park at Eskdale. The levee also appears to reduce the risk of a secondary flood path developing down a depression east of the caravan park.

The levee strictly speaking does not appear to conform with Victorian Guidelines for the construction of levees. The levee includes alluvial gravel material, vegetation upon its batters and a power pole is located upon its crest.

3.5.2 Towong MFEP

The Towong Shire 2023 Flood and Storm Emergency Plan focuses upon the flooding impact from the Mitta Mitta River. There is no mention of the Eskdale Caravan Park levee in the MFEP.

3.5.3 Site Inspections

Based on the analysis of available information the following categorisations (Table 5) have been provided for the Eskdale Levee.

Table 5 Towong Shire Levee Categorisations

Levee	Description	Level of Protection	Categorisation	Comment
Eskdale Caravan Park	This levee was reconstructed with approval by DEECA and NECMA in 2019 following flooding and exposure to the park by floodwater. The levee now maintains flow in the Little Snowy Creek and maintains the current course of the creek through town. The levee is topsoiled with gravelly bed material, and is vegetated with native trees and fruit trees (Figure 40). There is also a power pole located at the crest of the levee. These features mean it does not strictly meet DEECA levee guidelines for a formally constructed levee, and may be prone to damage from roots in the future. An older component of the levee continues downstream through the park. This section has a track cut through it, and a permanent van located on its crest at the downstream extent.	The levee is overtopped at a flow rate of close to 240 m^3/s, a flow rate in excess of a 0.5% AEP flood event, however the northern end of the caravan park becomes inundated at lower flow rate (less that 180m^3/s). It is also important to note that the access to the Eskdale Caravan Park becomes inundated when flows are less than 120m^3/s (approximately 2% AEP event). This is significantly lower flow rate than when the levee is over topped. At a flow rate of 120m^3/s the access road is inundated by flows in excess of 500mm deep.	Cat 2B	Review of the condition and risks associated with the levee should be reviewed prior to impending floods. Furthermore a review of the condition and possible maintenance requirements should also be undertaken on a regular basis and following flood events which impact the levee.



Figure 39 Eskdale Levee Locality Plan



Downstream extents of original levee



Reconstructed levee with trees and power pole

Figure 40 Eskdale Caravan Park Levee Photographs

Management Issues

For the Eskdale Caravan Park levee, the condition and possible maintenance requirements should be undertaken on a regular basis and following flood events which impact the levee.

3.6 East Gippsland

3.6.1 Livingstone Park Levee Omeo

An informal levee is located on the southern bank of the Livingstone Park Swimming pool, providing capacity to the pool and directing high flows down the Livingstone Creek (Figure 41). This asset should not be considered a levee, but part of the overall dam structure which is the swimming pool.

3.6.2 Site Inspections

This levee was inspected by Confluence in April 2025.

Based on the analysis of available information the following categorisations (Table 6) have been provided for specific levees.

Table 6 East Gippsland Shire Levee Categorisations

Levee	Description	Level of Protection	Categorisation	Comment
Livingstone Park	This levee diverts and maintains flow into the swimming pool on Livingstone Creek. It acts as a creek bank for the overflow flowpath around the pool (Figure 42). No members of the community are protected by this asset.	No DEM or flood data available for this study.	Cat 2A	Not known to be managed as a levee, but part of the layout of Livingstone Park as managed by East Gippsland Shire.



Figure 41 Livingstone Park Omeo Levee Locality Plan



Raised bank between pool and creek floodway

Figure 42 Livingstone Park Levee Photograph

4 Discussion

4.1 Rural Levees

The work to date has focused on those levees protecting urban areas, not rural levees. This was largely influenced by the policy around rural levee management in Victoria as put forward by the 2016 VFMS. The VFMS advises that:

- Large scale flood mitigation infrastructure, including levees, is not considered best practice for rural land use areas.
- It is unlikely that many, if any, of the rural levee schemes will be formally maintained into the future, unless it can be demonstrated that the levees in question meet the specified investment criteria as per Section 17.2 of the Strategy.
- New ring levees to protect individual buildings within rural areas will be allowed pending their assessment and approval as part of the relevant planning approvals process. The landholder proponent will be responsible for construction and maintenance of these works.

Previously constructed rural levee schemes within the NECMA region are not currently formally managed by state or local government authorities. The exception to this is Markwood Levee, which is technically managed by NECMA as approved and managed levee under the Water Act 1989.

4.2 Urban Levees

Category 1 urban levees located within the NECMA region which are managed by the LGA are listed below:

- Rural City of Wangaratta
    - Parfitt Rd
    - Wilson Rd
    - Merriwa Park
    - Old School Rd
    - Sunset Drive
    - Markwood
- Indigo Shire
    - Nil
- Wodonga City
    - Sanctuary Boulevard
    - Park Lane
    - North East Water – Raw Water Offtake
- Towong Shire
    - nil
- East Gippsland Shire
    - nil

Category 2 urban levees located within the NECMA region are located at:

- Rural City of Wangaratta
    - Rattray Avenue
- Alpine Shire
    - Mt Buffalo Caravan Park
    - Rail Trail adjacent to Great Alpine Road
    - Harrietville - Bon Accord Levee

- Indigo Shire
    - All Chiltern levees
- Wodonga City
    - Gateway Island A
- Towong Shire
    - Eskdale Caravan Park
- East Gippsland Shire
    - Livingstone Park Omeo

4.3 Categorisation Definition Issues

Formal levee categorisation definitions have been proposed for this project (refer to Section 2.2).

Comments on these definitions are given below:

- **Category 1 - formally managed urban levees**
    - Rural City of Wangaratta and City of Wodonga all own and to a degree manage Category 1 levees within the NECMA region.
    - There are no viewed Operation and Maintenance manuals for any levees.
    - The level of protection of the Category 1 levees varies from levee to levee. There is no one consistent approach such as 1% AEP plus 600mm.
    - There is limited content in the existing MFEPs with regards to the management of the levees during flood events, however the Wangaratta MFEP provides significant information at detail, which may need to be refined for ease of use.
- **Category 2 - not formally managed urban levees**
    - Examples of Category 2 urban protection levees are located across the catchment.
    - Harrietville - Bon Accord Levee is a very significant levee for Harrietville and the Great Alpine Rd. The current condition and management does not afford it Category 1 categorisation, however given its importance there should be an aspiration to upgrade it to a standard affording a Category 1 levee.
    - The level of protection based on the crest height only is generally lower than the 1% AEP event and in some cases difficult to define due to available asset or flood information.
    - The Category 2 subcategory definitions, Type A and Type B, distinguish between those levees requiring 'work ahead of a major flood' and those which don't. Most Category 2 levees will be overtopped below the 1% AEP flood level. Pending available resources and sufficient time permitting, work may be undertaken to delay or prevent overtopping of Category 2 levees by raising though sandbagging or some other means.
    - The category definition assigned (Type A or Type B) is problematic given that the practicality and need for enhancement works will vary from flood to flood (e.g. raising by say 200 mm is likely to be practical within a relatively short window of time whilst raising by say 1 metre may not be practical given time and resources limitations).
    - Category 2 Type C are defined as a temporary levee erected ahead of a major flood, which is removed post flood. There are temporary infill levee segments within Category 1 levees at Parfitt Rd. Gateway Island A has been categorised by the City of Wodonga as Cat 2C.
    - There may be some ongoing debate for some Caravan Parks such as Eskdale and Mt Buffalo whether they should be Category 2 or 3 levees. There are multiple permanent cabins and vans at these localities. These private assets cannot be readily removed in a flood, therefore evacuation or sand bagging are the only viable options in a flood event.
- **Category 3 - strategic rural levees**

- Examples of Category 3 levees are:
  - Private rural levees.
  - Rural levees constructed but not managed that have localised impacts, such as those on the lower Kiewa River.
  - The private levees and levees with minimal asset protection including minor urban levees such as Wangaratta Gun Club.
- The level of protection of the Category 3 levees varies but is generally less than 1% AEP without freeboard.

4.4 Flood Emergency Works Policy Review (September 2024).

VICSES published a report in September 2024 documenting a review of flood emergency works policy. The review focuses on policies and activities specifically relating to construction, removal or alteration of levees during VICSES exercises. The review report states that:

- MFEPs contain varied or nil content on levee management arrangements and related agency responsibilities.
- VICSES would benefit from issuing a guidance document relating to the use of powers for emergency works.
- The next step would be for the VICSES to revise its current processes and procedures to clarify and align with the above flood emergency guidance document

The expectation was that:

- The VICSES will focus on (give priority to) delivering flood emergency works to Category 2 and 3 levees during flood events which meet the investment criteria nominated by the 2016 VFMS, and where time and resources allow.
- The owners of the Category 1 levees will be responsible for delivering any necessary flood emergency works to the levees which they own, during flood response periods.

4.5 Management of High Risk Assets

There remains a paradox that the highest risks posed are those resulting from the lack of formal management of the levee and therefore mitigation of risk.

The prime example of this is the Harrietville - Bon Accord Levee. The levee provides protection of assets and life in the township of Harrietville. Failure of the levee may result in a rapid avulsion of the Ovens River East Branch resulting in risk to life and public and private assets. For an extensive background on this levee refer to:-

- Report:- Harrietville Bon Accord Track Levee Upgrade- Geomorphic Assessment and Risk Profiling – Confluence Group and Fluvial Systems - November 2025
- Business Case DTF Short Form:- Protecting Harrietville from Major Flood Risk – Modernising the Hareitville Levee - Optias – December 2025

In Urban Levees Review (SKM 2014) it was found in general:

- The maintenance and inspection regimes for levees are often unknown and vary significantly across the state. Ongoing maintenance activities typically include an annual inspection and mowing and, if required, control or removal of saplings growing on levee banks, repair of animal burrows, repair of any damage, and reinstatement of areas of erosion, scour, and cracking.

It recommended:

- That levee maintenance regimes be implemented or improved for every urban levee where they are non-existent or insufficient. The Victorian response to the Environment and Natural Resources Committee Inquiry into Flood Mitigation Infrastructure in Victoria states that "*outside Melbourne, the ownership of, and responsibility for, the management and ongoing maintenance of all urban levees, including modern urban levees created under formal schemes, is assigned to local councils".*

In relation to the Harrietville - Bon Accord Levee, specifically it found based on the site observations, the following issues require short-term rectification:

- Possible re-build of parts of the levee, which has been identified as being in a particularly poor condition due to damage. Particular attention needs to be provided to the Ovens River (wet side), where extensive erosion has taken place. A geotechnical investigation should be undertaken to inform this decision.
- Repair of other areas of erosion and deformation of the levee.
- Clearing of overgrown vegetation and removal of any trees (and their root systems) which are growing in the levee banks.
- Seeding of the portions of the levee which are currently bare of grass to provide some protection against erosion and scour. Hydro-mulching and watering (or similar, suitable to the soil conditions) may be considered to provide favourable conditions to encourage growth.
- To prevent on-going damage from vehicle traffic, consideration should be given to fencing the levees to prevent free access, and alternative routes should be considered.

In addition to short-term rectification of the above issues, the recommended maintenance regime for all section of the levee includes:

- Annual inspections by a suitably qualified engineer or technician.
- Regular mowing / trimming of grass, weeds and minor vegetation growing on the embankments (crest and bank slopes), and re-seeding of any areas which have lost grass coverage.
- Removal of new saplings before their root system develops and compromises the levee.
- Repair of any animal holes or burrows in the levee bank or foundation should they be identified after mowing.
- Repair of any sections of the levee damaged by vehicles, animals or other traffic.
- Reinstatement of any areas of erosion should they be identified.
- Geotechnical testing should be undertaken to confirm material suitability for any levee reconstruction works.

Since 2014, it appears many of these actions have been acted upon at some locations. Whilst at other locations no action has occurred. This may be because management responsibility of levees in many locations has not been resolved.

As an outcome of the Levee Categorisation project it is now recommended:

- Bon Accord Harrietville Levee be recognised as a Category 1 levee.
- Given this categorisation clarify and resolve ownership and future management responsibilities consistent with relevant flood policies and public land management processes.
- North East CMA has now largely completed a sub-project which has:
    - Prepared a high level waterway engineering / geomorphic risk assessment of the of the levee
    - Assessed the likely failure mode and opportunities for maintenance or reconstruction

- Completed a DTF compliant business case recommending a preferred solution to replace the levee.
- Completed supplementary investigations including a preliminary design, engineers estimate, cultural heritage due diligence, geotechnical analysis and soil classification, soil contamination testing, and vegetation assessments.
- Future investment, ownership or upgrade decisions are subject to funding approval processes, which may require further assessment and prioritisation actions to occur.

5 VFD to SDS Levee Layer Update

5.1 Overview

Levee data available to the North East CMA prior to the Strategic Levee Categorisation project has been in the form of the Victoria Flood Database (VFD). The attribute data associated with the VFD database has been expanded for the new Spatial Data System (SDS) database. The SDS database has the following attribute data for the levee layer:

- Levee Name
- Levee ID
- Study Scenario ID
- Construction Year
- Construction Material
- Levee Height
- Freeboard
- Level of Protection
- Land Status
- Land Manager
- Levee Management Status
- Levee Owner
- Mapping Method
- Reliability
- Surveyor
- Source
- Study ID Note Code
- Report Code
- Capture Date
- Modified Date
- Version
- Shape Length
- Length

While most of the above attributes are self-explanatory, the following section describes updates and remaining gaps following this project.

5.2 Key Outcomes of VFD Update

5.2.1 Line Updates

Some of the VFD data had been captured inaccurately. For major urban levees the levee lines have been recaptured to accurately reflect the actual alignment of the levee. This was particularly the case for significant Category 1 levees such as the Parfitt Road Levee at Wangaratta.

5.2.2 Entry of valid levees only

The VFD layer was found to include several duplication levees. Where this has occurred, the duplications have been deleted.

In rural locations in particular, many elevated local roads had been included as levees. These have been redefined as Significant Floodplain Features, as they are not managed as levees, and typically include culverts and drains to manage flood flows.

A number of very minor features such as short driveways, and localised irrigation channels had been listed as levees. These features have either been defined as significant floodplain features, or deleted, where they are localised and unlikely to have any real impact on regional flooding.

5.2.3 Levee Owner

While the ownership of specific levees has not generally been resolved at a State level, in this instance the land manager such as Council, VicRoads, DEECA or private owners have been assigned as levee owners as a starting point. Attributing ownership does not necessarily translate to an active management responsibility/duty. The presence of historical unmanaged levees on public land does not, on its own, imply asset management responsibility, a duty to maintain them, or liability for failure.

5.2.4 Levee Categorisation

The levee Category 1, 2 or 3 determination has been assigned to the Levee Management Status attribute field for each levee.

5.2.5 Levee Height

The height of levees can be entered as a measured AHD level, or a height of the levee from the natural ground surface. This has been determined typically from 1m LiDAR ground surface data for Category 1 and 2 levees.

It should also be noted that for the large number of rural levees, LiDAR data is restricted to 10m gridded data, which is not sufficiently fine to provide accurate data for levees.

5.3 Full dataset example for Wangaratta

Figure 43 below shows the SDS levee layer data and the original VFD data. Note the differences in alignment in many cases.

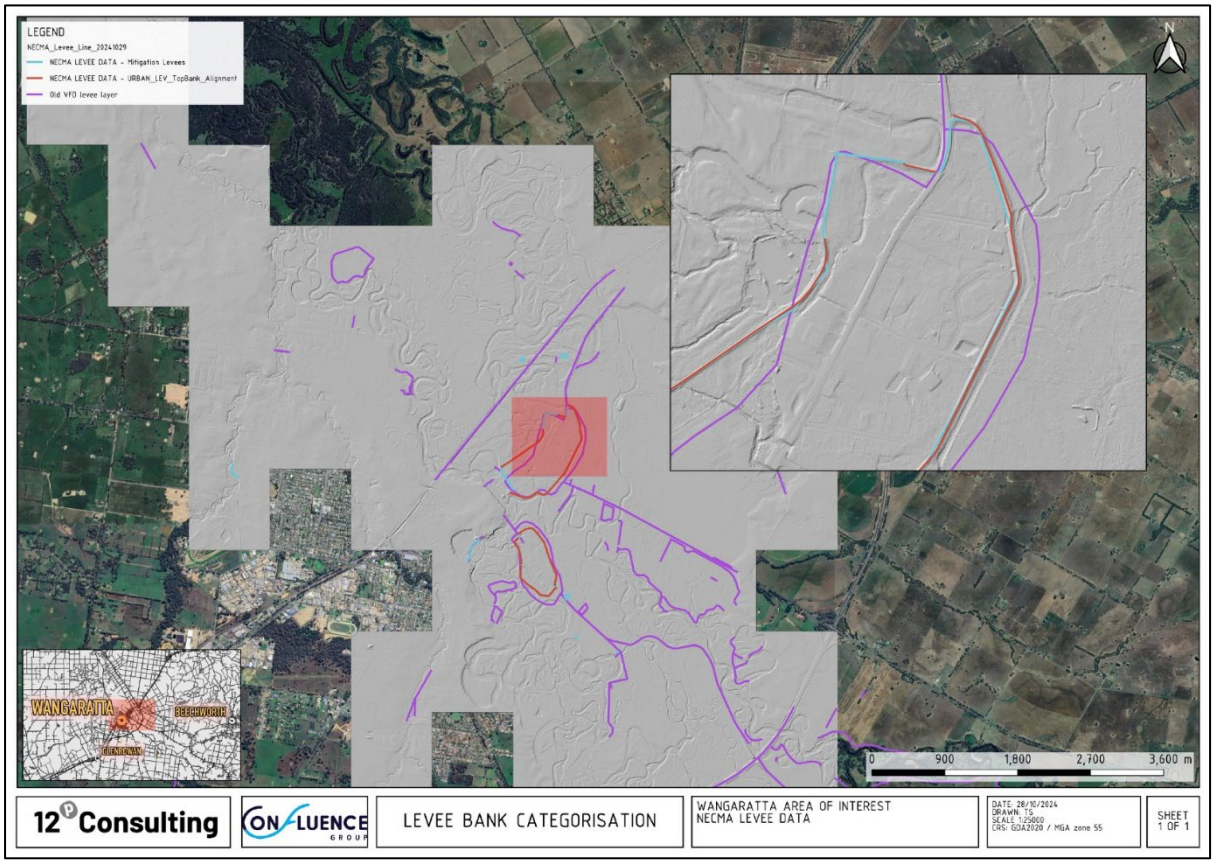


Figure 43 Wangaratta SDS Levee Layer Data

6 Flood Emergency Plan Updates

6.1 Overview

Consideration should be given to updating Flood Emergency Plans (FEPs) to include the intelligence derived from the Strategic Levee Categorisation project.

The following sections summarise the levee intelligence data for each LGA.

6.2 Rural City of Wangaratta

Levee data (key flood intelligence information) within the Rural City of Wangaratta LGA is summarised in the following tables:

- Table 7 – Category 1 Levees
- Table 8 – Category 2 Levees
- Table 9 – Category 3, Private Levees and Significant Floodplain Features

Table 7 Rural City of Wangaratta – Category 1 Levees – Key Flood Intelligence Information

ID & Name	**Parfitt Road Levee**
Location	Located east and west of Parfitt Road north of Ovens River. East side 1,750m long, west side concrete levee 350m long, west side earth levee 1,020m long.
Owner	Rural City of Wangaratta
Year completed	Updated to 1% AEP freeboard plus 600mm minimum, as well as a structural upgrade in some locations in 2025.
Protected assets	Houses, caravan park and businesses either side of Parfitt Rd and surrounding streets.
Design height, crest level and freeboard	1% AEP plus 600mm, varies depending on location along levee.
Description	Clay, western extents grassed crest, eastern levee sealed path, concrete wall at caravan park
Preparatory works	Sandbag, Parfitt Rd north and Pinkerton Cres in accordance with specific flood intelligence.
Consequences of failure	Significant number of houses and businesses located within levee.
Comms requirements	Closure of Parfitt Rd and Pinkerton Cres reported.
Known low point(s)	Parfitt Rd north and Pinkerton Cres
Physical condition and known deficiencies	Excellent condition, upgraded in accordance with industry standards, maintained by Council.
Overtopping height and location(s)	Parfitt Rd Levee upgraded in 2025 whereby the levee crest is now 600 mm above the 1% AEP flood.
Likely failure mode(s) and location(s)	Overtopping expected at low points on roads only.
Sequence of inundation	Significant number of houses and businesses located within levee.
Past performance	Prior to upgrade there were several low points, which have since been upgraded.
Other relevant information	

ID & Name	**Wilson Road Levee**
Location	Located east of the King River heading towards Oxley Flats Road, through the area known as Wilson Rd. 2200m long.
Owner	Rural City of Wangaratta
Year completed	Updated to 1% AEP freeboard plus 600mm, as well as a structural upgrade in south west end of Thomas St in 2022.
Protected assets	Houses either side of Wilson Rd and surrounding streets.
Design height, crest level and freeboard	1% AEP plus 600mm minimum, varies depending on location along levee.
Description	Clay, grassed batters, gravel path crest protection.
Preparatory works	Sandbag, Wilson Rd King River end in accordance with specific flood intelligence.
Consequences of failure	Significant number of houses located within levee.

Comms requirements	Closure of Wilson Rd and therefore Oxley Flats Rd reported.
Known low point(s)	Wilson Rd, Oxley Flats Rd (less than 600mm cover, but above 1% AEP)
Physical condition and known deficiencies	Excellent condition, upgraded in accordance with industry standards, maintained by Council.
Overtopping height and location(s)	Wilson Rd levee upgraded in 2022 whereby the levee crest is now 600 mm above the 1% AEP flood.
Likely failure mode(s) and location(s)	Low points on Wilson Rd and Oxley Flats Road only. Previous seepage and foundation issue at Thomas St, reported to have been remediated by Council during 2022 upgrades.
Sequence of inundation	Significant number of houses and businesses located within levee.
Past performance	Prior to upgrade there were several low points, which have since been upgraded. Seepage and foundation issues at Thomas St remediated in 2022.
Other relevant information	

ID with Name & Type	**Merriwa Park – also known as Christopher Robin**
Location	Earthen levee with capped crown (footpath) on the left side of One Mile Ck on Rattray Av north of the Cribbes Rd intersection.300m long.
Year completed	1960's unverified.
Protected assets	Protects Christopher Robin Pre-School Centre, the council access / egress road, recreational parkland - playing surfaces, tennis clubrooms. Urban dwellings are materially above the levee crest level.
Design height, crest level and freeboard	The Merriwa Park levee is 300mm to 450mm below the 1% AEP Event flood level, hence, to achieve 600mm freeboard it requires 900mm to 1050mm height increase.
Description	Earthen structure with asphalt seal on crest.
Preparatory works	Sandbagging of Christopher Robin Pre-School Centre is undertaken. Permanent access road swing gate closed and locked with signage used by council in flood events. Note Pre-school access is via Ely Street, not the council park access road.
Consequences of failure	Flooding of pre-school, parkland and tennis club assets likely.
Comms requirements	Close park, and Pre-School Centre. Lock gates for all access to levee and park.
Known low point(s)	In general, The Merriwa Park levee is 300mm to 450mm below the 1% AEP Event flood level, hence, to achieve 600mm freeboard it requires 900mm to 1050mm height increase.
Physical condition and known deficiencies	The Merriwa park levee was generally in poor condition. The upstream bank was over-steepened at batters of typically 2H:1V with localised areas of up to 1.5H:1V and had significant amounts of established trees growing into the bank. As of 2025, the Rural City of Wangaratta has obtained significant funding and as of 2026 completed designs for an upgrade of the levee as part of its capital works plan.
Overtopping height and location(s)	Overtops from northern extents. Gauge 12.7 Merriwa Park levee under threat – consideration to sandbag or implementation of other protection measures The Christopher Robin Kindergarten will be threatened but has its own access / egress road used by staff and parents. Gauge 12.71 (Flooding gets worse from this point on) Floodwaters begin to impact low lying areas of Merriwa Park within the levee including Christopher Robin Pre-School Centre.
Likely failure mode(s) and location(s)	Overtopping likely mode
Sequence of inundation	Overtops from low spots at northern end.
Past performance	Good intelligence in MFEP to demonstrate past performance.
Other relevant information	

ID & Name	**Sunset Drive Levee**
Location	Located on Sunset Drive east of 3 Mile Creek. Includes concrete and brick walls behind three properties on Walter St
Owner	Rural City of Wangaratta
Year completed	Concrete section upstream of footbridge and upgrades of earthen levee completed in 2010's by Council.
Protected assets	The 0.5% AEP was modelled and suggests that dwellings at 13 & 15 Walter Street and 2 & 4 Sunset Drive may be impacted above floor level, sandbagging may be viable.

Design height, crest level and freeboard	Sunset Drive levee- The levee does afford a level of protection in a 1% AEP scenario as determined by the 2017 flood study. The Three Mile Creek breaks out near Walter Street and impacts on dwellings at 13 and 15 Walter Street and 2 Sunset Drive. Floor levels taken in 1993 (+/-50mm) that suggests the 1% AEP flood level should be below floor level. There is a gate valve installed on the stormwater outlet, which was installed to counter previous issues with a flap gate installed on the end of the pipe.
Description	Concrete wall and brick wall levee 95m long, earthen levee downstream 80m long. Earthen levee is grassed and mown by Council.
Preparatory works	Consider sandbagging 13 & 15 Walter Street and 2 & 4 Sunset Drive
Consequences of failure	Inundation of road and possibly 13 & 15 Walter Street and 2 & 4 Sunset Drive
Comms requirements	Closure Walter Rd and Sunset Dr at each end, door knock 13 & 15 Walter Street and 2 & 4 Sunset Drive.
Known low point(s)	From flood modelling it appears large floods can enter from upstream and downstream of the levee.
Physical condition and known deficiencies	Concrete wall and earthen levee in good, well maintained condition. Brick walls unverified.
Overtopping height and location(s)	Sunset Drive levee- The levee does afford a level of protection in a 1% AEP scenario as determined by the 2017 flood study. The Three Mile Creek breaks out near Walter Street and impacts on dwellings at 13 and 15 Walter Street and 2 Sunset Drive. Floor levels taken in 1993 (+/-50mm) that suggests the 1% AEP flood level should be below floor level. There is a gate valve installed on the stormwater outlet, which was installed to counter previous issues with a flap gate installed on the end of the pipe.
Likely failure mode(s) and location(s)	From flood modelling it appears large floods can enter from upstream and downstream of the levee.
Sequence of inundation	Inundation of 13 & 15 Walter Street and 2 & 4 Sunset Drive.
Past performance	Gate Valve on stormwater outlet of levee. Gate valve can be actuated by Council to stop flow & allow the pump to discharge the area so rising levels in creek don't backflow and inundate adjacent homes.
Other relevant information	

ID & Name	**Old School Road Levee**
Location	Located on the east bank of the unnamed waterway at the low point along Old School Rd, approximately 450m west of Yarrawonga Rd. Levee approximately 200m long.
Owner	Rural City of Wangaratta
Year completed	Concrete section upstream of footbridge and upgrades of earthen levee completed in 2023 by Council.
Protected assets	Modelling data unavailable for this project.
Design height, crest level and freeboard	Not verified
Description	Earthen embankment with flap gates to allow stormwater to exit back to the waterway.
Preparatory works	Not provided by Council
Consequences of failure	Not provided by Council
Comms requirements	May impact local residents along Old School Rd and east to Yarrawonga Rd in this estate (unverified)
Known low point(s)	unverified
Physical condition and known deficiencies	Appears to be in good condition, recently constructed.
Overtopping height and location(s)	unverified
Likely failure mode(s) and location(s)	unverified
Sequence of inundation	May impact local residents along Old School Rd and east to Yarrawonga Rd in this estate (unverified)
Past performance	New levee, untested.

Other relevant information	

ID & Name	**Markwood Levee**
Location	On the left floodplain and bank of the Ovens river upstream of the Markwood Everton Road. The levee runs for a distance of 1,300m
Owner	North East CMA predecessors reconstructed the levee in 1995. The Markwood Levee was reconstructed by a NECMA predecessor, the Ovens River Management Board, implementing part of the Markwood Deep Creek Water Management Scheme (ID&A 1995). The scheme has multiple components including the management of Deep Ck and the Ovens River system.
Year completed	1995
Protected assets	The levee provides flood protection to up to 10 houses in its immediate vicinity.
Design height, crest level and freeboard	The levee is designed to provide 5% AEP protection to residents in the Markwood district.
Description	Earthen levee running parallel to the left floodplain of the Ovens River. The district has many smaller holdings, similar to a peri-urban area.
Preparatory works	none
Consequences of failure	The levee provides flood protection to up to 10 houses in its immediate vicinity. Refer to management scheme document for specific detail.
Comms requirements	Residents downstream of the levee should be made aware of overtopping potential and prepare for evacuation as needed.
Known low point(s)	The levee is well constructed and maintained, and is designed to consistently spill in a stable manner when overtopped.
Physical condition and known deficiencies	The levee is well constructed and maintained, and is designed to consistently spill in a stable manner when overtopped.
Overtopping height and location(s)	Overtops consistently in accordance with the flood profile as modelled.
Likely failure mode(s) and location(s)	Unverified, however consistent spilling may find low points prone to scour.
Sequence of inundation	Overtops consistently in accordance with the flood profile as modelled.
Past performance	Unverified.
Other relevant information	

Table 8 **Rural City of Wangaratta – Category 2 Levees – Key Flood Intelligence Information**

ID with Name & Type	**Rattray Av (Cat2A)**
Location	Essentially raised footpath on the left side of One Mile Ck on Rattray Av north of the Cribbes Rd intersection.300m long.
Year completed	1960's unverified.
Protected assets	Protects the Council Rd, parkland, but provides minimal if any protection to private housing which is higher than the levee crest.
Design height, crest level and freeboard	0.5% AEP protection. Via LiDAR crest levels appear to vary at approximately RL147.25m AHD.
Description	Earthen footpath with asphalt seal on crest, built up to effectively form a levee.
Preparatory works	None.
Consequences of failure	Potential flooding of Rattray Av.
Comms requirements	Potential closure of Rattray Av, and isolation of residents.
Known low point(s)	LiDAR indicates the levee may be lower at downstream extents, but the consequences are minimal.
Physical condition and known deficiencies	Well grassed in good condition and well maintained as a path.
Overtopping height and location(s)	0.5% AEP protection. Via LiDAR crest levels appear to vary at approximately RL147.25m AHD.
Likely failure mode(s) and location(s)	Overtopping likely mode
Sequence of inundation	May back up from downstream around the levee. Water will likely back up into stormwater.
Past performance	None noted.
Other relevant information	

Table 9 **Rural City of Wangaratta – List of Category 3, Private Levees & Significant Floodplain Features**

List of Category 3 levees
Painters Island Levee – right bank of Ovens River adjacent to caravan park.
Gun Club College Crescent. – protects low lying land at the eastern end of College crescent. No housing protected.
Fishers Levee – private levee on the right bank of the Ovens River adjacent to the Great Alpine Road. Commences close to adjacent to Detour Rd.
List of Private levees
113 Wilson Road
"Glenloth" 171 Oxley Flats Road
22 Taylors Lane
132 Stamps Lane
65 Burrows Street
57 Bowser Road
"Allan Gibb House" 1100 Carboor Everton Road
Griffiths Lane
"Cheshire Levees" O'Keefe Road
List of Significant Floodplain Features acting as levees
Hume Freeway Diversion Channel and Weir - Diverts flow from One Mile Creek to King River parallel to Hume Fwy

6.3 Alpine Shire

Levee data (key flood intelligence information) within the Alpine Shire LGA is summarised in the following tables:

- Table 10 – Category 2 High Risk Levees
- Table 11 – Category 2 Levees
- Table 12 – Category 3, Private Levees and Significant Floodplain Features

Table 10 Alpine Shire – Category 2 Levees – Key Flood Intelligence Information

ID & Name	**Harrietville - Bon Accord Levee (Cat2B)**
Location	Runs parallel to the left bank of the Ovens River East Branch and extends from Bon Accord Track to Feathertop Lane. 400m in length.
Owner	Not confirmed. Largely located on Crown frontage but partly enters private property over its length on the dry side batter.
Year completed	Formed from dredge tailings to varying degrees from post World War 2, and into the 1950's.
Protected assets	Protects multiple assets on the floodplain between the East Branch and West Branch including Great Alpine Rd, multiple dwellings, out buildings and large shed, town water treatment plant, school camp, church, hotel, shops.
Design height, crest level and freeboard	1% AEP with more than 1m freeboard.
Description	Not an engineered structure but a by-product of mining activity. Formed from dredge tailings, with mature vegetation growing along the batters. The levee will be prone to high velocity scour.
Preparatory works	The river is ungauged and unpredictable. Consider evacuation of residents and road closures when rapid rises expected.
Consequences of failure	Major loss of property and assets, potential development of a new river course.
Comms requirements	Door knocking and evacuation likely, closure of Great Alpine Road through Harrietville.
Known low point(s)	Relatively high, however if scour occurs there are multiple low points on the dry side.
Physical condition and known deficiencies	Poor condition due to dredge tailing construction, and mature vegetation prone to overtopping. Thorough engineering investigation in 2025 has confirmed that the levee poses a material risk and recommends reconstruction to contemporary standards.
Overtopping height and location(s)	Unlikely to overtop.
Likely failure mode(s) and location(s)	Scour most likely form of failure due to high velocities (>2.9m/s), and the potential for river blockages. Low points are present on the dry side at the water treatment plant, camp hall and private properties to the north. Sandbagging to protect assets considered futile.
Sequence of inundation	Inundation could be very rapid depending on speed of scour and size of blockages. River rise and fall can be rapid.
Past performance	Significant scour occurred in 1993, but the entire levee did not breach.
Other relevant information	

Table 11 Alpine Shire – Category 2 Levees – Key Flood Intelligence Information

ID with Name & Type	**Myrtleford Rail Trail adjacent to Great Alpine Rd (Cat2A)**
Location	The old rail line east of Myrtleford past the Butter Factory. Runs for a distance of 1,500m, to the point where it runs close to the Great Alpine Road again.
Year completed	1900's as part of a rail embankment
Protected assets	Protects a transport company depot, machinery business and of the order 25 houses.
Design height, crest level and freeboard	Not designed for flood protection of properties. Appears to overtop at less than a 1% AEP flood of the order 214m AHD to 215m AHD, varying along the levee. Floodplain Management Strategy 2000, appears to assume the culverts are open and flooding is assumed.
Description	Rail Trail embankment with an unmanaged non-return valve effectively acts as a levee. Protects several multiple private houses from
Preparatory works	Need to ensure culverts/valves under the levee are closed.
Consequences of failure	Flooding of multiple houses, floor levels are not verified.
Comms requirements	Check for flooding of residences.
Known low point(s)	There is a naturally high point approximately halfway along the embankment, where the embankment returns to natural surface for a short distance.
Physical condition and known deficiencies	Condition of the embankment is unknown, while the rail trail is a sealed crest.
Overtopping height and location(s)	Appears to overtop at less than a 1% AEP flood of the order 213.7m, varying along the levee.
Likely failure mode(s) and location(s)	Overtopping likely mode, or flooding through culverts if left open.
Sequence of inundation	Overtopping likely mode, or flooding through culverts if left open.
Past performance	None noted.
Other relevant information	

ID with Name & Type	**Porepunkah – Mt Buffalo Caravan Park (Cat2B)**
Location	Constructed levee on the eastern fringes of the caravan park.
Year completed	Uncertain, however recent upgrades appear to have occurred.
Protected assets	Protects a caravan park which has multiple permanent sites. It is assumed evacuation of the park would occur.
Design height, crest level and freeboard	Reviewing Upper Ovens Flood Study 2016, the Flood contour through the park is of the order 268m for 20%, 10% and 5% AEP. The typical crest appears to be 267.8m, therefore limited protection up to 20% AEP flood.
Description	Earthen embankment levee which has been constructed to protect the park from Ovens River flooding and high velocities. The bank is reasonable condition, however construction standards such as compaction and material can not be verified.
Preparatory works	Evacuate the park if under threat.
Consequences of failure	Flooding of multiple permanent sites and park offices and buildings.
Comms requirements	Evacuate park.
Known low point(s)	Unverified.
Physical condition and known deficiencies	The bank is in reasonable condition, however construction standards such as compaction and material can not be verified.
Overtopping height and location(s)	Reviewing Upper Ovens Flood Study 2016, the Flood contour through the park is of the order 268m for 20%, 10% and 5% AEP. The typical crest appears to be 267.8m, therefore limited protection up to 20% AEP flood.
Likely failure mode(s) and location(s)	Overtopping likely mode, scour due to high velocities is also possible.
Sequence of inundation	Unverified, it is possible flooding could also occur along the river frontage, while a Buckland River flood has flooding consequences for the park.
Past performance	None noted.
Other relevant information	

Table 12 Alpine Shire – List of Category 3, Private Levees & Significant Floodplain Features

List of Category 3 levees
Harrietville Pioneer Park – This levee was originally the right bank of the Ovens River through Pioneer Park, it appears to have been removed since the original GIS layers were identified.
Harrietville 148-152 Great Alpine Rd. – Private levee around sheds and private business
Harrietville - 142 Great Alpine Rd to Monarch Lane – Discontinuous tailings pushed up, affords no protection
Harrietville - Downstream of Monarch Lane - Diverter bank, open at downstream extent, which diverts high velocity flows from properties
Myrtleford – Arderns Caravan Park - Protects the caravan park from Happy Valley Creek floods. This park appears to have few permanent vans, therefore the preferred management approach during a flood is to evacuate the park.
Myrtleford – Whalleys Lane - An informal levee runs between the Happy Valley Creek and houses at 19 and 31 Whalley's Lane. The levee has a narrow crest and steep batters and is not likely to have been constructed from clay material, but probably local alluvial material.
Mt Beauty Caravan Park - This levee was constructed following the completion of erosion control works by NECMA in the late 1990's. It was constructed by the manager of the park at the time, without formal approval. The levee provides localised protection to cabins and caravan sites adjacent to the river.
List of Private levees
Harrietville - 114 and 122 Great Alpine Rd - Private levee / solid fence around these properties. Gates can be managed with sandbags.
Mt Beauty - Upstream Kiewa Valley Highway - This levee appears to be on private land. It is approximately 0.6m high and has a gap in a central location, which could be sandbagged during a flood to afford protection to the house on this allotment.
List of Significant Floodplain Features acting as levees
Myrtleford Diversion Channel - This channel was constructed in the early 2000's. It captures water from the Happy Valley Creek and gravitates it across the floodplain to the Ovens River when flood levels in each waterway allow this.

6.4 Indigo Shire

Levee data (key flood intelligence information) within the Indigo Shire LGA is summarised in Table 13 (Category 2 levees).

Table 13 Indigo Shire – Category 2 Levees – Key Flood Intelligence Information

ID & Name	**Bartley St to Main St**
Location	Follows the waterway, commencing downstream of Bartley St, running through to Main St. Channel runs a distance of 340m
Owner	Indigo Shire
Year completed	Completed in 2012 and are based on the 2007 Flood Study.
Protected assets	Protects houses and roads from inundation during large storm events. Part of a floodway with efficient floodway features.
Design height, crest level and freeboard	Designed for 1% AEP; mapping of long section shows freeboard is variable. This may be due in part to LiDAR being unable to capture vertical concrete walls.
Description	Largely earthen levee with a small concrete section on the left side of the waterway. Well constructed, will become Council query whether levees are Cat 1, or if they should be Cat 2A or 2B, given they have no formal ops manual, and they act more as a local drainage scheme during a flood event.
Preparatory works	Ensure stormwater non return valves are functional on a regular basis.
Consequences of failure	Flooding of private property and businesses.
Comms requirements	Likely rapid rise and fall, so regular maintenance important.
Known low point(s)	Stormwater inlets with non return valves exist.
Physical condition and known deficiencies	In reasonable condition, and regularly mowed.
Overtopping height and location(s)	Overtops at upstream retaining wall and immediately upstream of Main St.
Likely failure mode(s) and location(s)	Failure due to leakage of non returns or seepage through concrete walls possible
Sequence of inundation	Acts as a relatively steep and efficient stormwater channel.
Past performance	Performs as designed.
Other relevant information	

ID & Name	**Martins Lane to Oxford St**
Location	Follows the waterway, commencing downstream of Martins Lane, running through to Oxford St. Channel runs a distance of 140m, earthen levee protects house on right side of waterway.
Owner	Indigo Shire
Year completed	Completed in 2012 and are based on the 2007 Flood Study.
Protected assets	Protects houses and roads from inundation during large storm events. Part of a floodway with efficient floodway features.
Design height, crest level and freeboard	Designed for 1% AEP; mapping of long section shows freeboard is variable. This may be due in part to LiDAR being unable to capture vertical concrete walls.
Description	Permeable concrete sections and drainage requires preparation for flooding. Council query whether levees are Cat 1, or if they should be Cat 2A or 2B, given they have no formal ops manual, and they act more as a local drainage scheme during a flood event.
Preparatory works	Ensure stormwater non return valves are functional on a regular basis. If concrete beam sections pose a risk due to sustained seepage to specific houses, consider sandbagging.
Consequences of failure	Flooding of private property and businesses.
Comms requirements	Likely rapid rise and fall, so regular maintenance important.
Known low point(s)	Stormwater inlets with non return valves exist.
Physical condition and known deficiencies	In reasonable condition, though concrete beams are permeable.
Overtopping height and location(s)	Close to 1% AEP with minimal if any freeboard.

Likely failure mode(s) and location(s)	Failure due to leakage of non returns or seepage through concrete walls possible
Sequence of inundation	Acts as a relatively steep and efficient stormwater channel.
Past performance	Performs as designed.
Other relevant information	

ID & Name	**Oxford St to Conness St**
Location	Follows the waterway, commencing downstream of Oxford St, running through to Conness St. Channel runs a distance of 110m.
Owner	Indigo Shire
Year completed	Completed in 2012 and are based on the 2007 Flood Study.
Protected assets	Protects houses and roads from inundation during large storm events. Part of a floodway with efficient floodway features.
Design height, crest level and freeboard	Designed for 1% AEP; mapping of long section shows overtopping This may be due in part to LiDAR being unable to capture vertical concrete walls.
Description	Permeable concrete barrier, provides no protection on the left bank upstream of Conness St. Council query whether levees are Cat 1, or if they should be Cat 2A or 2B, given they have no formal ops manual, and they act more as a local drainage scheme during a flood event.
Preparatory works	Ensure stormwater non return valves are functional on a regular basis. If concrete beam sections pose a risk due to sustained seepage to specific blocks, consider sandbagging.
Consequences of failure	Flooding of private property and businesses.
Comms requirements	Likely rapid rise and fall, so regular maintenance important.
Known low point(s)	Stormwater inlets with non return valves exist.
Physical condition and known deficiencies	In reasonable condition, though concrete beams are permeable.
Overtopping height and location(s)	Check vertical concrete walls in a flooding situation.
Likely failure mode(s) and location(s)	Failure due to leakage of non returns or seepage through concrete walls possible
Sequence of inundation	Acts as a relatively steep and efficient stormwater channel.
Past performance	Performs as designed.
Other relevant information	

ID & Name	**Conness St to Dickson Ct**
Location	Follows the waterway, commencing downstream of Conness St, running through to Conness St. Channel runs a distance of 500m.
Owner	Indigo Shire
Year completed	Completed in 2012 and are based on the 2007 Flood Study.
Protected assets	Protects houses and roads from inundation during large storm events. Part of a floodway with efficient floodway features.
Design height, crest level and freeboard	1% AEP with 450mm freeboard. Check eastern levee, does not appear to have been captured by LiDAR
Description	Largely earthen levee with a small concrete section around tree. Well constructed. Council query whether levees are Cat 1, or if they should be Cat 2A or 2B, given they have no formal ops manual, and they act more as a local drainage scheme during a flood event.
Preparatory works	Ensure stormwater non return valves are functional on a regular basis. If concrete beam sections pose a risk due to sustained seepage to specific blocks, consider sandbagging.
Consequences of failure	Flooding of private property and businesses.
Comms requirements	Likely rapid rise and fall, so regular maintenance important.
Known low point(s)	Stormwater inlets with non return valves exist.
Physical condition and known deficiencies	In reasonable condition, though concrete beams are permeable.
Overtopping height and location(s)	1% AEP +450mm minimum, except Eastern Levee.

Likely failure mode(s) and location(s)	Failure due to leakage of non returns or seepage through concrete walls possible
Sequence of inundation	Acts as a relatively steep and efficient stormwater channel.
Past performance	Performs as designed.
Other relevant information	

6.5 City of Wodonga

Levee data (key flood intelligence information) within the City of Wodonga LGA is summarised in the following tables:

- Table 14 – Category 1 Levees
- Table 15 – Category 2 Levees
- Table 16 – Category 3, Private Levees and Significant Floodplain Features

Table 14 City of Wodonga – Category 1 Levees – Key Flood Intelligence Information

ID & Name	**Sanctuary Boulevard Levee**
Location	Commences at the rear of 37 Sanctuary Boulevard fronting Yarralumla Dr. IT then becomes a more formalized levee on the right bank of House Creek immediately downstream of Yarralumla Dr. The levee is 630m in length.
Owner	City of Wodonga
Year completed	Early 2000's
Protected assets	Protects houses within the Sanctuary Boulevard precinct.
Design height, crest level and freeboard	1% AEP with 600mm minimum freeboard.
Description	The levee is well constructed and maintained, with grassed batters, and concrete path crest in several locations.
Preparatory works	No preparation works are known prior to flooding
Consequences of failure	Flooding of multiple private houses in the Sanctuary Boulevard precinct.
Comms requirements	Contact landowners if there is a perceived risk.
Known low point(s)	There are no known low points. Stormwater non returns are likely.
Physical condition and known deficiencies	In very good condition with grassed batters and grass or concrete path crest.
Overtopping height and location(s)	The 1% AEP does not overtop
Likely failure mode(s) and location(s)	Failure due to leakage of non returns or overtopping
Sequence of inundation	Likely regular and consistent overtopping
Past performance	Performs as designed.
Other relevant information	

ID & Name	**Park Lane Levee**
Location	Commences at the rear of 11 Park Lane and runs to the service road at Melbourne Rd. The levee is 160m in length.
Owner	City of Wodonga
Year completed	2019
Protected assets	Protects houses fronting Park Lane.
Design height, crest level and freeboard	1% AEP with 300mm freeboard typical.
Description	The levee is well constructed with a grassed crest and batters and was constructed by City of Wodonga.
Preparatory works	No preparation works are known prior to flooding
Consequences of failure	Flooding of multiple private houses on Park Lane.

Comms requirements	Contact landowners if there is a perceived risk.
Known low point(s)	There are no known low points.
Physical condition and known deficiencies	In very good condition with grassed batters and grass crest.
Overtopping height and location(s)	The 1% AEP does not overtop
Likely failure mode(s) and location(s)	Failure due to overtopping
Sequence of inundation	Likely regular and consistent overtopping
Past performance	Performs as designed, though limited flooding has been experienced to date
Other relevant information	

Table 15 City of Wodonga – Category 2 Levees – Key Flood Intelligence Information

Name	**Gateway Island A (Cat2C)**
Location	The levee commences behind the brewery on Gateway Island, and follows the edge of the floodway till it meets the Lincoln Causeway. The levee is 330m long.
Trigger for build	1% AEP = 153.3m (Molino Stewart 2010)
Protected assets	Le Maisson building
Description	This site consists of the elevated pathway located between the river and the brewery. The path provides protection of parkland adjacent to the brewery but does not appear to impact floor levels in this location.
Previous builds	Constructed several decades ago, but to be managed moving forward as Cat 2C
Learnings	Sandbag mainly to protect the cellar at the Le Maisson building.
Consequences of failure	This levee is considered a Cat2C levee instead of Cat 3. Council own property inundated because of overtopping this levee. To upgrade the levee would require major cost; it is Council's preference to undertake localised protection or removal of cellars in the Le Maisson building, negating any need to further sandbag, or managing this levee to any great degree during floods. No people live in buildings affected.
Comms requirements	Evacuate any buildings in advance.
Overtopping height and location(s)	Overtops in large floods managed by Council
Other relevant information	

Table 16 City of Wodonga List of Category 3 Levees

Gateway Island B – This site is located immediately upstream of play facility on the causeway. There are no significant buildings protected, however some protected is afforded to the currently disused facility.

6.6 Towong Shire

Levee data (key flood intelligence information) within the Towong Shire LGA is summarised in Table 17 (Category 2 levees).

Table 16 Towong Shire – Category 2 Levees – Key Flood Intelligence Information

ID with Name & Type	**Eskdale Caravan Park (Cat 2B)**
Location	Located on the right bank of Little Snowy Creek at the southern end of the Eskdale Caravan Park. The levee is 112m long.
Year completed	Upgraded following floods in 2019
Protected assets	Caravan Park
Design height, crest level and freeboard	The levee is overtopped at a flow rate of close to 240 m^3/s, a flow rate in excess of a 0.5% AEP flood event, however the northern end of the caravan park becomes inundated at lower flow rate (less that 180m^3/s). It is also important to note that the access to the Eskdale Caravan Park becomes inundated when flows are less than 120m^3/s (approximately 2% AEP event). This is significantly lower flow rate than when the levee is over topped. At a flow rate of 120m^3/s the access road is inundated by flows in excess of 500mm deep.
Description	This levee was reconstructed with approval by DEECA and NECMA in 2019 following flooding and exposure to the park by floodwater. The levee now maintains flow in the Little Snowy Creek and maintains the current course of the creek through town. An older component of the levee continues downstream through the park. This section has a track cut through it, and a permanent van located on its crest at the downstream extent.
Preparatory works	Evacuate caravan park as required. Review of the condition and risks associated with the levee should be reviewed prior to impending floods. Furthermore a review of the condition and possible maintenance requirements should also be undertaken on a regular basis and following flood events which impact the levee.
Consequences of failure	Flooding of caravan park.
Comms requirements	Evacuate caravan park as required.
Known low point(s)	The upstream reconstructed levee appears lower than the older downstream levee.
Physical condition and known deficiencies	The levee is topsoiled with gravelly bed material, and is vegetated with native trees and fruit trees. There is also a power pole located at the crest of the levee. These features mean it does not strictly meet DEECA levee guidelines for a formally constructed levee and may be prone to damage from roots in the future.
Overtopping height and location(s)	Overtops at upstream extents.
Likely failure mode(s) and location(s)	Overtopping likely mode, with scour of the dry side batter possible.
Sequence of inundation	Overtopping likely mode.
Past performance	None noted.
Other relevant information	

6.7 East Gippsland Shire

Levee data (key flood intelligence information) within the Towong Shire LGA is summarised in Table 18 (Category 2 levees).

Table 17 East Gippsland Shire – Category 2 Levees – Key Flood Intelligence Information

ID with Name & Type	**Livingstone Park (Cat 2A)**
Location	Located on the left bank of Livingstone Creek in the Livingstone Park in Omeo. The levee diverts flows from the pool and race via a rock chute into Livingstone Creek downstream. The levee is 170m long.
Year completed	Upgraded following floods in 2023
Protected assets	Livingstone Park
Design height, crest level and freeboard	unverified
Description	This levee diverts and maintains flow into the swimming pool on Livingstone Creek. It acts as a creek bank for the overflow flow path around the pool. No members of the community are protected by this asset.
Preparatory works	Close access to the park, although the levee will be isolated by the rock chute
Consequences of failure	Damage to the pool and Livingstone Park.
Comms requirements	As defined by Council.
Known low point(s)	unverified
Physical condition and known deficiencies	The levee was recently re-constructed and appears to be in satisfactory condition.
Overtopping height and location(s)	unverified
Likely failure mode(s) and location(s)	Scour
Sequence of inundation	Damage the creek and park environs.
Past performance	Rebuilt following damage in 2022.
Other relevant information	

7 Local Government Engagement

7.1 Rural City of Wangaratta

Rural City of Wangaratta's Manager of Infrastructure was consulted with following written advisement to Council of the draft categorisations.

Council agreed in general with the levee categories assigned with the exception of the Merriwa Park (Christopher Robin) Levee. Council advised that the Merriwa Park Levee has Federal Government funding for a future upgrade. No further details have been provided at the time of this report's completion. With respect to the Parfitt Road and Wilson Rd levees, recent upgrades have been completed in 2025-26. While no standalone operation and maintenance documents exists for the levees, they are evidently managed and maintained by council and are therefore be considered Category 1.

7.2 Alpine Shire

An in-person on-site meeting at Harrietville was attended by Alpine Shire Council, North East CMA, VICSES and Confluence Group on the 5 August 2025. The meeting covered the following:

- Discussion in relation to the levee categorisations assigned and how they relate to the definitions.
- Commitment for Council to be provided with the SDS levee layer and CMA spreadsheet at the completion of the project.
- Specifically, regarding Harrietville - Bon Accord Levee:
    - Levee was walked from top to bottom
    - Construction history discussed and noted levee is largely constructed from dredge tailing material and cobble stone
    - Broad risks of the levee breaching by seepage, slumping or trees overtopping discussed
    - Potential impact upon a short cut path to Great Alpine Road, school camp, hotel, shops and residences discussed.
    - A key difference with this levee is the upper catchment location, mean there is little warning of floods and there is no gauging. This poses a particular risk to the school camp.
    - A risk assessment, stability review, geotechnical drilling, preliminary design and conducting development of a business case following DTF's Investment Management Standard process as the end point of this projects scope. This work is complete.

7.3 Indigo Shire

An online meeting attended by Council, North East CMA, VICSES and Confluence Group took place on the 7 August 2025. The meeting covered:

- Presentation of the levee categorisation process, specific category definitions, levees categories assigned within the Indigo Shire (i.e. at Chiltern)
- Council questioned whether levees are Category 1, or if they should be Category 2A or 2B, given they have no formal operation and maintenance manual, and they act more as a local drainage scheme during a flood event. Council also advised that there are more significant flood risks throughout Chiltern during floods they would typically be more occupied with.
- Council to be provided with the SDS levee layer and the CMA spreadsheet at the completion of the project.

7.4 City of Wodonga

An in person meeting attended by Council, North East CMA, VICSES and Confluence Group was held on the 24 July 2025. The meeting covered:

- Presentation of the levee categorisation process, specific category definitions, levees categories assigned within the City of Wodonga
- Agreement from those present on all categorisations, with the exception of Gateway Island A. This levee is now considered a Category 2C levee instead of Category 3. This is because Council own property which becomes inundated when this levee is overtopped. To upgrade the levee would involve major cost, and it is Council's preference to undertake localised protection or removal of cellars in the Le Maisson building, negating any need to further sandbag, or manage this levee to any great degree during floods. No people live in buildings affected by this levee.
- Council to be provided with the SDS levee layer and the CMA spreadsheet at the completion of the project.
- Regarding the Cypress Street levee, Council will likely accept the offer from NECMA to update the flood model, assessing the possible impacts of climate change and how this might affect effected properties.

7.5 Towong Shire

The only levee highlighted in the Towong Shire is the Eskdale Caravan Park levee.

Council was sent a letter documenting the findings of the assessment of this levee, and were invited to contact the North East CMA should they wish to discuss the project further. Council was also contacted to confirm if they would like a meeting, but had not responded at the time of completion of this report.

7.6 East Gippsland Shire

The only levee highlighted in the East Gippsland Shire is the diversion bank at Livingstone Park in Omeo. The operation of this levee does not impact community safety, as people do not occupy this zone. Council was sent a letter documenting the findings of the assessment, and were invited to contact the North East CMA should they wish to discuss the project further. At the time of completion of this report, they had not contacted the North East CMA further.

8 Observations

The following observations highlight key themes and issues identified through the review of levee management, planning, and risk considerations across northern Victoria including the North East CMA area. They reflect current strengths, gaps, and emerging risks associated with levee ownership, capability, governance, and integration within broader floodplain management systems.

The following observations provide context for the community on the role levees play in managing flood risk, helping to explain how existing infrastructure influences safety, preparedness, and long-term use of the floodplain.

1. Importance of Categorisation

The systematic categorisation of levees in the North East CMA area, for the first time, is valued as it enables a clearer understanding of the relative importance and function of levees across the region. This provides a consistent basis to identify and prioritise levees. This then supports informed decision making regarding management effort, funding, and where maintenance resources should be most effectively focused. This approach has potential to be expanded over time to other catchment areas in Victoria.

2. Roles of Owners

Clear and well-communicated roles and responsibilities for levee ownership and management are critical, regardless of underlying land ownership status. The 2016 Victorian Floodplain Management Strategy highlights the importance of clear roles and responsibilities; where levee ownership and management remain uncertain, material gaps in maintenance and accountability remain. Consistent confirmation of ownership and management responsibilities enables responsible parties to plan and act with confidence, particularly when preparing for floods, rather than reacting during a flood situation. Where responsibilities remain unclear, particularly for unmanaged urban levees, there is an increased risk to communities.

3. Limitations of Owner Capabilities

Local Government Authorities (LGAs) play a vital role in the ownership and management of levee infrastructure; however, the complexity of levee planning, maintenance, and risk mitigation often requires specialist technical expertise and sustained investment. Many levee owners no longer retain the engineering, flood risk, or asset management capability needed to manage levees effectively over their lifecycle. This capacity constraint is compounded by the fact that many owners do not currently operate certified asset management systems with ISO 55000 or the Asset Management Accountability Framework (AMAF). These limitations can affect the consistency, safety, and long-term performance of levee assets, particularly in high risk settings.

4. Design and Maintenance

Access to recognised engineering standards for levee design and maintenance is critical for owners and consulting engineers. In the absence of agreed standards, approaches to levee design, assessment, and maintenance can vary significantly, increasing uncertainty and risk. Consistent standards support safer outcomes, reduce design and construction risk, and help ensure levees perform with their functional requirements for operational life of the asset.

5. Inspection and Assessment

Defined, scheduled inspection and engineering condition assessment of levees are essential to ensure assets protecting communities remain safe and functional. Levees, particularly those protecting higher-risk areas, require periodic inspection and formal assessment by appropriately qualified and registered engineers to identify defects, performance issues, and emerging risks. In practice, the frequency and consistency of these inspections can be constrained by available resourcing, leading to variable levels of assurance for Category 1 and, in some cases, Category 2 levees. The occurrence of a significant flood event further highlights the importance of inspections during and following flooding to confirm levee integrity and ongoing performance.

6. The Context of Levees in Broader Floodplain Management

Levees form an integral component of broader flood mitigation systems and require appropriate visibility and consideration within floodplain planning and management frameworks. Greater emphasis on levees in strategic intent supports a more holistic understanding of flood risk. Recognising levee categorisation, maintenance requirements, and associated risk profiles within these strategies helps ensure levees are consistently considered in land-use planning, infrastructure investment, and emergency management planning. Aligning specific levee features and roles with community risk profiles also improves transparency around relative risk and the role levees play in reducing flood impacts.

7. Community Awareness

Community awareness and understanding of levee risk remains a critical component of effective flood risk management. Communities living behind levees often perceive a reduced level of flood risk, which can influence behaviour and development expectations (the “levee paradox”). Awareness of residual risk, including the possibility of overtopping or failure, supports better preparedness and more realistic risk perceptions. Involving communities in discussions regarding material changes to levee assets, and ensuring relevant flood and levee information is available to prospective property purchasers, helps build trust and supports informed decision-making.

8. Floodplain Planning Considerations

The presence, absence, and functional role of levees within floodplains has material influence on flood behaviour and associated risk. Where levees are not adequately considered in land rezoning decisions, there is potential for unsafe development outcomes, increased exposure to flood hazards, and longer-term costs associated with retrofitting mitigation or emergency response. Recognising levee function as part of the floodplain system provides a more complete understanding of residual risk and supports safer, more sustainable land-use planning outcomes.

9. Consequence of Failure/Removal on Floodplain Inundation

Consideration of levee performance and failure scenarios within flood studies provides important insight into flood risk that may not be evident under design or “as-intended” operating conditions. Modelling potential levee failure scenarios supports more comprehensive risk assessment, particularly in locations where levee ownership, condition, or maintenance responsibilities are unclear. Incorporating consistent approaches to levee failure assessment within flood studies improves the value of these studies for land-use planning, emergency management, and community risk communication.

10. Impact on Modification on Flooding Behaviour

Significant modification of levees in urban settings can materially alter flood behaviour, residual risk, and community expectations of protection. Changes to levee configuration or standard of protection have the potential to introduce both positive and negative impacts that extend beyond the immediate asset footprint. Ensuring such modifications are informed by a robust flood risk management process supports balanced consideration of hydraulic, structural, social, and environmental factors, and reduces the likelihood of unintended consequences.

9 References

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