

# URBAN STORMWATER MANAGEMENT PLAN

2026 – 2036

# EXECUTIVE SUMMARY

Gannawarra Shire Council has prepared this Urban Stormwater Management Plan (the Plan) to provide a coordinated, risk-based approach to managing urban stormwater across the municipality. The Plan has been developed to meet Council's obligations under the Environment Protection Act 2017 (Vic) and the Order for Obligations of Managers of Land or Infrastructure (Urban Stormwater Management and On-site Wastewater Management), published in the Victorian Government Gazette on 7 May 2024.

The Plan applies to the townships of Kerang, Cohuna, Koondrook, Leitchville, Murrabit, Quambatook and Lalbert. It is intended to guide how Council plans, prioritises, delivers and reviews stormwater management activities over the next 10 years, while remaining flexible to respond to funding availability, climate change, growth pressures and emerging risks.

Urban stormwater poses risks to human health, property, infrastructure and the environment. In Gannawarra, these risks are influenced by flat topography, reliance on pumped drainage systems, ageing infrastructure, open drains and unsealed areas, legacy planning and drainage arrangements, and proximity to environmentally and culturally significant waterways such as the Murray River, Gunbower Creek and the Kerang Lakes. Climate change is expected to exacerbate these challenges through more intense rainfall events and longer dry periods, increasing both flooding and water quality risks.

The Plan identifies municipal-wide and township-specific stormwater risks and establishes a clear set of actions to minimise those risks so far as reasonably practicable. Actions focus on:

- reducing stormwater flooding through improved system capacity, asset management, maintenance and planning controls
- improving stormwater quality by minimising pollutant generation and transport
- managing stormwater volumes and velocities through Water Sensitive Urban Design (WSUD)
- strengthening Council's asset data, governance, operational procedures and decision-making frameworks
- supporting safe and appropriate future development.

The Plan is structured around individual township profiles, recognising that stormwater challenges, opportunities and priorities vary across the municipality. Each township section outlines local conditions, key risks, constraints and a targeted set of actions to address those risks. This approach supports more transparent prioritisation and clearer alignment between local issues and Council investment decisions.

The Plan has been developed through consultation with relevant stakeholders, including Catchment Management Authorities, water corporations and Council officers across multiple service areas. It is intended to operate alongside existing strategies, studies and asset management plans, including drainage studies, flood investigations, planning scheme controls and the Stormwater Asset Management Plan.

Implementation of the Plan will be led by Council and delivered through a combination of operational activities, capital works, planning controls, advocacy, partnerships and grant funding. Progress against actions will be reviewed annually, with a formal review and update of the Plan to occur at least every five years, in accordance with legislative requirements.

Overall, this Plan provides Council with a practical and adaptable framework to manage urban stormwater risks, protect community health, environmental and cultural values, and support the long-term liveability and resilience of Gannawarra's townships.

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# GLOSSARY

**AEP (Annual Exceedance Probability):** A way of describing the likelihood of a rainfall or flooding event occurring in any given year. For example, a 1% AEP event has a 1% chance of occurring in any year.

**Asset data:** Information about stormwater infrastructure such as its location, size, condition, age and material, usually stored in Council systems.

**Backflow:** Water flowing in the reverse direction, for example when a river level is high and water pushes back into stormwater pipes or drains.

**Backflow prevention device:** A flap gate, valve or similar device installed at an outlet to stop river water flowing back into the stormwater network.

**Catchment:** An area of land where rainfall drains into a common outlet such as a river, creek, wetland, or stormwater system.

**CMA (Catchment Management Authority):** A regional body responsible for catchment and waterway health, floodplain management and environmental programs. For this Plan, this includes the North Central CMA.

**Council:** Refers to Gannawarra Shire Council as the responsible manager of municipal stormwater assets and the body required to prepare this Plan under the Environment Protection Act 2017 (Vic).

**Detention basin:** A basin that temporarily stores stormwater during rainfall and releases it slowly to reduce peak flows and flooding downstream.

**Drainage network:** The network of roads, kerbs, channels, pits, pipes, pumps, drains, retention basins and wetlands used to transport stormwater.

**Environment Protection Act 2017 (VIC):** The primary legislation establishing obligations to minimise risks of harm to human health and the environment, including requirements for stormwater management planning.

**Floodplain:** Low-lying land adjacent to a watercourse or wetland that is subject to flooding during extreme rainfall events.

**Gross Pollutant Trap (GPT):** A stormwater treatment device designed to capture litter, debris, and coarse sediment before entering waterways.

**Levee:** An embankment constructed to reduce the risk of flooding by preventing water from entering an area from a river, creek or floodplain.

**Municipality:** The geographic area governed by Gannawarra Shire Council, including the townships of Kerang, Cohuna, Koondrook, Leitchville, Murrabit, Quambatook, and Lalbert.

**Pollutant Load:** The total quantity of a pollutant, such as sediment, nutrients, or litter, transported in stormwater runoff over a period of time.

**Ramsar:** Refers to an International Convention on Wetlands that was signed in 1971, in Ramsar, Iran.

**Runoff:** Water from rainfall or other sources that flows over the land surface and into stormwater systems or waterways, rather than infiltrating into the ground.

**Shared Socioeconomic Pathways (SSPs):** Climate change scenarios used to assess future greenhouse gas emissions and climate impacts under different global development pathways.

**Stormwater:** Rainfall that runs off surfaces such as roofs, roads, and pavements, collected and conveyed through drainage systems to receiving environments such as rivers, creeks, and wetlands.

**Tailwater:** High downstream water levels in a river, drain or channel that reduce the ability of stormwater to discharge, sometimes causing backflow and reduced drainage performance.

## **Water Sensitive Urban Design (WSUD)**

An approach to urban planning and design that integrates the urban water cycle into the built environment. WSUD aims to reduce stormwater impacts, enhance water quality, and improve urban amenity and biodiversity through measures such as rain gardens, wetlands, and permeable pavements.

## **Waterway**

A river, creek, channel, or wetland that conveys or holds water, either permanently or intermittently

# INTRODUCTION

## WHAT IS STORMWATER?

Stormwater is rainfall that runs off roofs, roads, driveways, footpaths, lawns, and other surfaces rather than soaking into the ground. As it flows, it travels through gutters, pits, and pipes before entering creeks, rivers, wetlands, and eventually, bays or the ocean.

Stormwater differs from:

- Sewage – wastewater from homes and businesses that is conveyed to a treatment plant via the sewer network
- Groundwater – water that infiltrates soil and accumulates within rock and sediment layers to form aquifers, which can discharge to rivers, wetlands, and bores

As stormwater moves over urban surfaces, it can collect pollutants such as litter, sediment, nutrients, oils, heavy metals, detergents, and microplastics. Without management, these pollutants degrade local waterways, wetlands, and ecosystems.

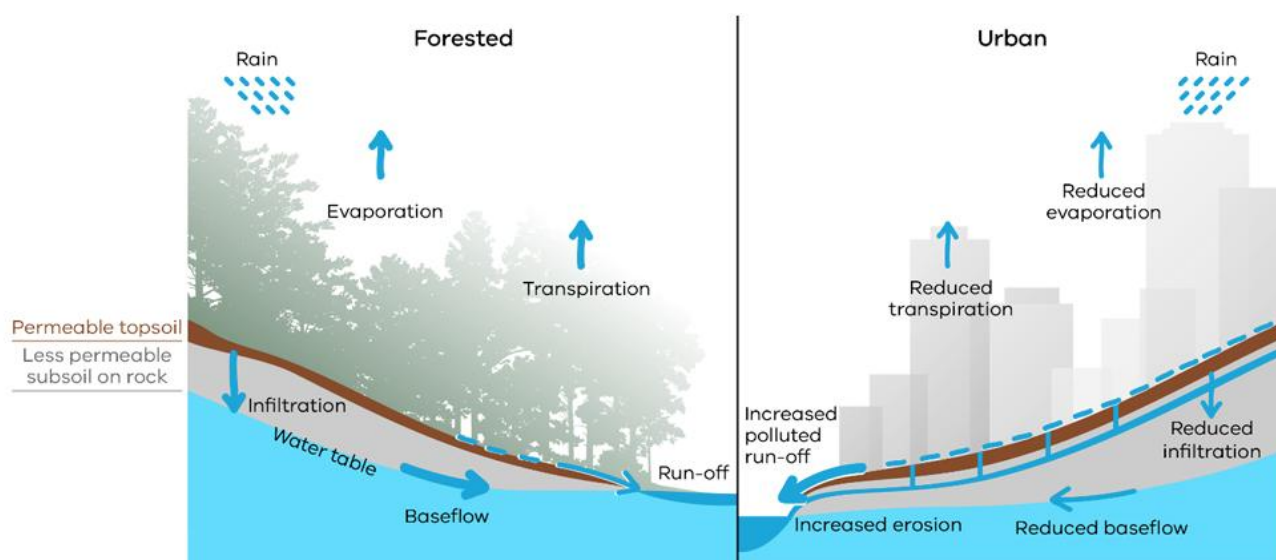
## WHY DOES IT NEED MANAGEMENT?

In natural landscapes, most rainfall infiltrates into the soil, is taken up by vegetation or evaporates back into the atmosphere, with only a small proportion becoming surface runoff.

Urban development alters this natural water cycle by replacing permeable surfaces with hard, impervious surfaces such as roads, roofs and pavements. This reduces infiltration, increases runoff volumes and velocities, and removes natural processes that filter and slow water movement. The use of piped drainage systems further accelerates runoff and concentrates flows.

As a result, stormwater volumes and flow velocities increase, elevating flood risk, erosion, and pollutant transport. Managing stormwater is therefore essential to:

- Reduce flooding and erosion impacts;
- Remove pollutants before they reach natural waterways; and
- Protect the health and cultural values of downstream ecosystems, including the Kerang Lakes and Gunbower Forest Ramsar sites.



Impacts of urban development on the water cycle (EPA Victoria 2021)

## PURPOSE AND OBJECTIVES

The purpose of the Urban Stormwater Management Plan (the Plan) is to provide a clear, strategic framework for managing urban stormwater in a way that protects communities, supports sustainable growth and safeguards the environment across Gannawarra Shire. The Plan focuses on identifying, prioritising and addressing stormwater risks through practical, achievable actions that improve system performance and long-term resilience.

At the core of the Plan are nine stormwater management objectives aligned with Council's overarching goals of liveability, growth and sustainability. These objectives represent the primary intent of the Plan and are used as the basis for assessing risks, prioritising actions and guiding implementation and review.

### LIVEABILITY

- **L1** - Reduce the frequency, duration and severity of stormwater flooding and nuisance ponding in urban areas, with priority given to established residential areas and known flooding hotspots.
- **L2** - Improve the reliability and performance of stormwater infrastructure to protect public safety, property and access during rainfall events.
- **L3** - Minimise community exposure to contaminated stormwater runoff to protect human health and maintain the amenity of streets, open space and public assets.

### GROWTH

- **G1** - Ensure new development and subdivision can be serviced by stormwater systems that do not increase flood risk to existing properties or infrastructure.
- **G2** - Integrate stormwater management and WSUD requirements into land use planning and development assessment to support orderly and sustainable urban growth.
- **G3** - Prevent the transfer of stormwater volumes, velocities and pollutant loads from new development to downstream environments and existing urban areas.

### SUSTAINABILITY

- **S1** - Reduce pollutant generation, mobilisation and discharge from urban stormwater systems to protect waterways, wetlands and sensitive downstream environments with environmental, community and cultural value.
- **S2** - Improve the long-term resilience and adaptability of stormwater infrastructure to climate change, including increased rainfall intensity and more frequent extreme events.
- **S3** - Deliver stormwater infrastructure and management practices that are cost-effective over their lifecycle and aligned with Council's asset management principles.

These objectives guide the identification of risks, development of actions and prioritisation of investment throughout the Plan. They also provide a consistent framework for monitoring performance and reviewing progress over time.

In delivering these objectives, the Plan satisfies Council's obligations under the *Environment Protection Act 2017* (Vic) and the associated *Order for Obligations of Managers of Land or Infrastructure – Urban Stormwater Management* (Government Gazette No. S 226, 7 May 2024), ensuring that risks to human health and the environment from urban stormwater are identified, assessed and managed so far as reasonably practicable.

## HOW THE PLAN WILL BE USED

This Plan is intended to be used as a practical, risk-based decision-support tool that guides how Council identifies stormwater risks, plans and prioritises actions, delivers improvements, and monitors and reviews outcomes across the municipality.

Specifically, the Plan will be used to:

### Identify risks

The Plan documents municipal-wide and township-specific stormwater risks to human health, property and the environment. These risks provide the evidence base for decision-making and enable early identification of emerging issues.

### Plan and prioritise actions

The identified risks and objectives are used to develop and prioritise operational, capital, investigation and policy actions. This supports transparent and consistent prioritisation of works and investment, ensuring limited resources are directed to areas of greatest risk and community benefit.

### Deliver improvements

Delivery of stormwater improvements, including maintenance activities, capital works, WSUD initiatives and planning controls, will be undertaken in accordance with the priorities and actions set out in this Plan and through Council's existing capital works, operational and planning processes.

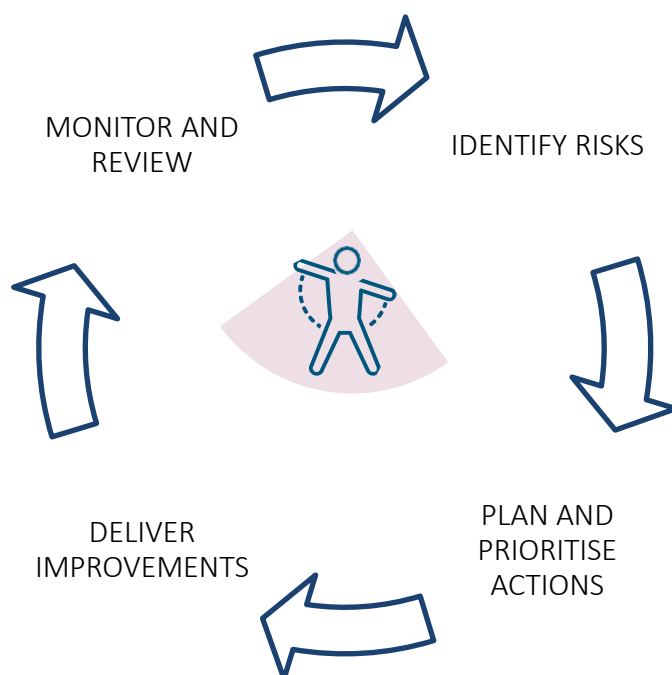
### Support coordinated decision-making

The Plan provides a shared reference point for Council teams involved in infrastructure, planning, environment, asset management and finance, helping to align stormwater-related decisions and avoid fragmented or reactive responses.

### Monitor and review

The Plan establishes a framework for monitoring implementation and reviewing outcomes over time. This supports internal reporting, informs future updates to the Plan, and enables Council to demonstrate how stormwater risks are being managed and reduced.

The Plan is not intended to replace detailed drainage studies, flood modelling or design work. Rather, it provides the strategic context for when and where those more detailed assessments are required, and how their outcomes should be prioritised and applied.



# BACKGROUND AND CONTEXT

## GEOGRAPHIC AND ENVIRONMENTAL SETTING

Gannawarra Shire is located in north-west Victoria within the Loddon Mallee region, covering approximately 3,700 square kilometres. The municipality is predominantly rural, characterised by irrigated and dryland agriculture, riverine landscapes, and nationally significant wetlands. Its low-lying topography strongly influences local drainage behaviour and flood risk.

Key transport corridors such as the Murray Valley Highway and Loddon Valley Highway connect townships and support economic activity. While urban growth remains modest, the Gannawarra's Urban Growth Strategy (2024) identifies opportunities for infill development, town centre revitalisation, and planned expansion.

This environmental and settlement context underpins the need for a coordinated, climate-resilient approach to managing stormwater across the Shire.

## CLIMATE AND FLOOD HISTORY

Gannawarra experiences a semi-arid climate, marked by hot, dry summers and cool winters. Long-term climate trends indicate increased temperature extremes and declining average rainfall, consistent with broader regional climate projections for northern Victoria.

The municipality has experienced several major flood events, notably in 2011, 2022, and 2023–24, which have caused significant inundation and infrastructure impacts across multiple townships. These events highlight the increasing need for adaptive and resilient stormwater infrastructure capable of managing both short-duration, high-intensity rainfall and prolonged wet periods.



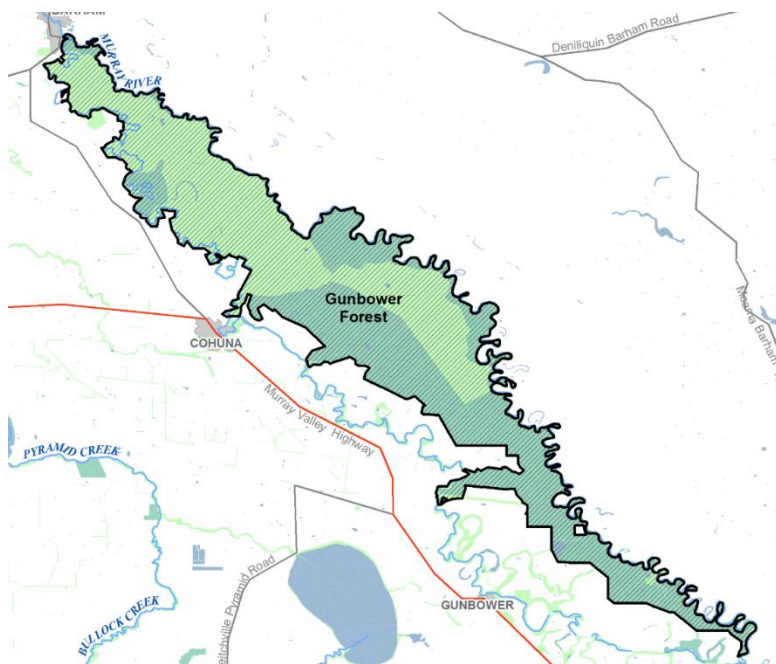
Urban Flooding - Kerang

## RAMSAR SITES AND WATERWAYS

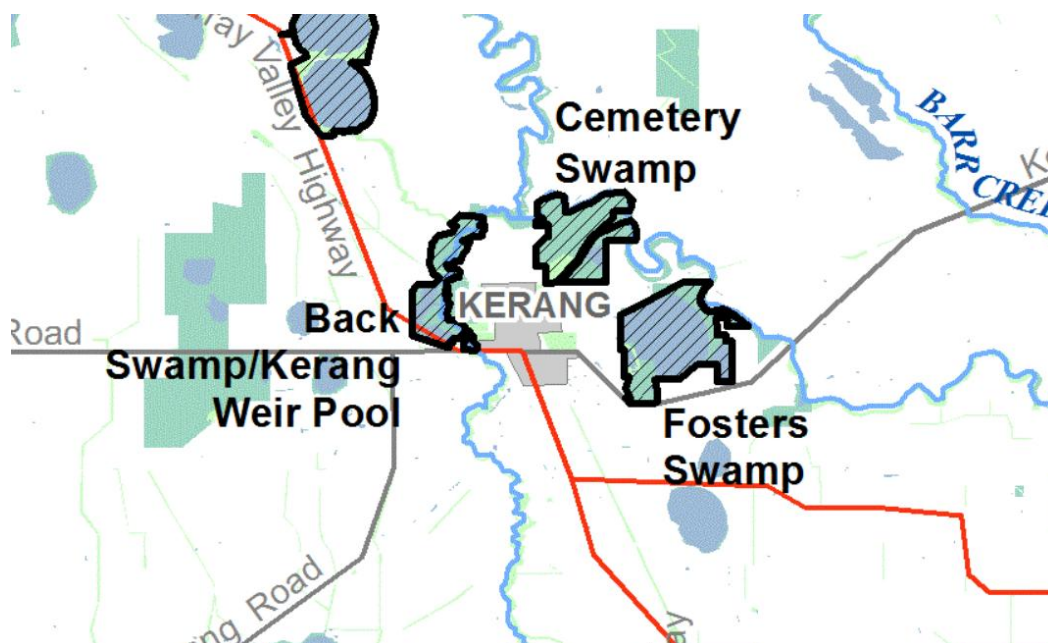
The Shire includes sections of the Murray, Loddon, and Avoca Rivers, along with two internationally recognised wetlands:

- Kerang Lakes Ramsar Site – a complex network of lakes and wetlands that support significant ecological values.
- Gunbower Forest Ramsar Site – a large red gum forest along Gunbower Creek that provides important floodplain storage, groundwater recharge, and biodiversity habitat.

These systems play a vital role in regulating regional hydrology, supporting biodiversity, and influencing local drainage and stormwater behaviour.



Gunbower Forest extents



Kerang Lakes extents

## TOWNSHIPS

The Plan applies to the seven townships of Kerang, Cohuna, Koondrook, Leitchville, Murrabit, Quambatook, and Lalbert, each with distinct stormwater challenges and environmental settings.

### Kerang

As the Shire’s primary service centre, Kerang is located within a low-lying floodplain connected to the Loddon River and Kerang Lakes Ramsar Site. Stormwater management relies heavily on pumped infrastructure, with flat topography and limited water quality treatment contributing to localised flooding and downstream environmental sensitivity.

### Cohuna

Cohuna is situated adjacent Gunbower Creek, a highly sensitive Ramsar-listed environment. Drainage is constrained by flat terrain, GMW channels and limited acceptable discharge locations, with recent WSUD-focused developments demonstrating opportunities to improve water quality outcomes.

### Koondrook

Koondrook is a small township on the Murray River with an ageing and undersized drainage network influenced by river levels and limited hydraulic capacity. Stormwater flooding is generally localised, with future improvements focused on network capacity, discharge management and water quality protection.

### Leitchville

Leitchville is a compact rural township with a sealed road network and pit and pipe drainage system discharging to an open drain. Stormwater issues are generally minor and localised, with flat grades at the outlet requiring ongoing maintenance to manage ponding and vegetation growth.

### Murrabit

Murrabit is a small township serviced by a modern pit and pipe network draining to a detention basin with a pumped outlet to a GMW channel. Stormwater risks are localised and manageable, with priorities centred on sediment control, basin maintenance and addressing isolated drainage issues.

### Quambatook

Located on the Avoca River and protected by a levee, Quambatook drains via a pit and pipe system to a pumped river outfall. With no growth anticipated, stormwater management is focused on liveability, outlet performance and protecting downstream recreational environments.

### Lalbert

Lalbert is the smallest township in the municipality, with a simple stormwater system draining to a retention and reuse pond. With no off-site discharge and no growth pressures, stormwater risks are low and management is focused on pump operation and safe reuse of stored stormwater.



Gannawarra Shire townships (Council Plan 2025)

# POLICY AND STRATEGIC ALIGNMENT

## LEGISLATIVE FRAMEWORK

Council’s responsibilities for stormwater management are guided by several key legislative frameworks. These include powers and obligations relating to land use planning, flood management, infrastructure delivery, and environmental protection.

The Plan specifically fulfils Council’s obligations under the Environment Protection Act 2017 (Vic) and the associated Order for Obligations – Urban Stormwater Management Plans (Government Gazette No. S226, 7 May 2024).

The Order requires Councils to:

- Identify and minimise risks of harm to human health and the environment from urban stormwater;
- Minimise the generation and transport of pollutants; and
- Minimise the generation, velocity, and volume of stormwater flows.

## TRADITIONAL OWNERS

Council recognises that stormwater planning, maintenance, renewal and capital works may intersect with Aboriginal cultural heritage, culturally significant waterways, and Traditional Owner interests.

Traditional Owners maintain longstanding cultural connections to the lands, waterways, wetlands and floodplains within the municipality. Stormwater infrastructure investigations, upgrades and new works have the potential to interact with areas of cultural significance and may be subject to statutory obligations under relevant legislation.

Council will incorporate appropriate cultural heritage due diligence, early engagement with relevant Traditional Owner representatives, and project-specific statutory processes into stormwater investigations, planning, design and delivery where required.

## COUNCIL PLAN (2025)

The Urban Stormwater Management Plan has been developed with objectives that are aligned with the three strategic goals of the Council Plan 2025 - 2029: Liveability, Growth, and Sustainability. This ensures the intent and direction of the Plan supports Council’s broader strategic priorities.

Once actions have been developed in detail and the associated implementation parameters defined, each action will be aligned with a relevant Plan objective, providing a clear line of sight back to the Council Plan and supporting strategic decision-making.

| Goal           | Relevance to the Urban Stormwater Management Plan                                                                                                   |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Liveability    | Enhances community safety and wellbeing through effective drainage, flood protection, and integration of WSUD in public open spaces.                |
| Growth         | Guides sustainable urban development and subdivision design to ensure stormwater infrastructure supports future expansion and economic development. |
| Sustainability | Improves water quality, reduces flood risk, and delivers climate-resilient stormwater systems consistent with Council’s environmental priorities.   |

## URBAN GROWTH STRATEGY (2024)

The Plan complements the Urban Growth Strategy by ensuring stormwater planning and infrastructure delivery is integrated with future township growth and land use change. It supports a coordinated approach to drainage and WSUD outcomes in new development areas by strengthening the link between strategic

planning, subdivision design requirements, and downstream network capacity constraints.

The proposed actions focus on improving development controls, design guidance and compliance processes to ensure growth is supported by fit-for-purpose and climate-resilient stormwater infrastructure. This approach helps minimise future flood risk, reduces adverse downstream impacts, and ensures stormwater systems are planned and delivered in a manner consistent with Council’s long-term growth objectives.

## **CLIMATE CHANGE ADAPTATION AND MITIGATION STRATEGY (2022)**

The Plan supports the objectives of the Climate Change Strategy by addressing stormwater-related climate risks.

It does this by proposing actions that:

- Reduce stormwater flood risk through prioritised drainage upgrades and mitigation works;
- Set guidelines for designing infrastructure informed by future climate projections; and
- Promote WSUD which aid in sustaining green infrastructure and community amenity during hot and dry periods.

## **PARTNERSHIPS AND GOVERNANCE**

Delivering sustainable stormwater outcomes requires strong collaboration between Council and regional partners responsible for land, water, and environmental management.

### **Water Authorities**

- Coliban Water, Lower Murray Water, and Grampians Wimmera Mallee Water deliver urban water and wastewater services within their service areas. Collaboration with these authorities ensures alignment between stormwater and water infrastructure planning.
- Goulburn-Murray Water (GMW) manages the region’s irrigation and raw water supply network. Coordination with GMW supports integrated drainage management, flood mitigation, and stormwater harvesting opportunities.

### **Catchment Management**

- The North Central Catchment Management Authority (NCCMA) oversees waterway health, floodplain management, and catchment-scale environmental programs. Partnerships with the NCCMA ensures that stormwater initiatives contribute to broader catchment and water quality and cultural value objectives.

### **Land and Environmental Management**

- Parks Victoria manages most Crown land reserves adjoining the townships, including significant wetlands and forested floodplains. Collaboration helps ensure stormwater discharges protect these sensitive environments.
- The Department of Energy, Environment and Climate Action (DEECA) provides policy direction, regulatory oversight, and guidance to ensure the USMP aligns with state water, climate, and environmental frameworks, including the Environment Protection Act 2017 and Water for Victoria. They are also responsible for the management of Gunbower Forest.

# MUNICIPAL WIDE RISKS

Municipal-wide risks are those that affect multiple townships across Gannawarra Shire and arise from shared physical, environmental, operational and governance conditions. These risks influence the performance of stormwater systems across the municipality and inform the prioritisation of actions within this Plan.

## MAINTENANCE LIMITATIONS

Council faces a municipality-wide risk associated with maintaining an ageing and geographically dispersed stormwater network across its townships. Limited operational budgets and competing service demands can restrict the frequency of inspection, cleansing and proactive maintenance activities.

Inadequate maintenance can result in blocked pits and pipes, reduced hydraulic capacity, sediment accumulation and accelerated asset deterioration. These issues increase the likelihood of localised flooding, prolonged ponding and water quality impacts, particularly in the flat catchments of Gannawarra Shire.

Without a structured and risk-based maintenance approach, stormwater infrastructure performance and reliability will continue to decline, increasing risks to public safety, property and the environment.

## ASSET DATA

Incomplete or outdated stormwater asset data presents a municipal risk to effective planning, response and long-term management. Gaps in GIS records, condition assessments and asset attributes limit Council's ability to accurately understand network capacity, identify critical assets and prioritise renewal or upgrade works.

Poor data quality also constrains Council's ability to respond efficiently to flooding or pollution incidents and undermines evidence-based decision-making. This risk is compounded in areas with legacy infrastructure and undocumented private drainage connections.

Improving asset data quality is essential to reducing uncertainty and supporting investment decisions.

## INDUSTRIAL LAND USE

Industrial land uses across the municipality present an elevated stormwater pollution risk due to the nature of activities undertaken and the scale of vehicle movements. Unsealed or degraded yards, outdoor material storage and frequent truck traffic contribute to the generation and mobilisation of sediment, hydrocarbons and other contaminants.

Sediment and pollutants are often tracked from private industrial sites onto public roads and subsequently washed into Council's drainage network. In some cases, high levels of suspended solids can block drainage infrastructure, reducing system capacity and increasing maintenance requirements.

Without targeted management, education and monitoring, industrial land uses will continue to contribute disproportionately to stormwater pollution and infrastructure performance issues.

## RESIDENTIAL LAND USE

Residential areas contribute to municipal stormwater risks through common domestic activities such as car washing, gardening, waste disposal and poor maintenance of private drainage infrastructure. Pollutants including detergents, nutrients, sediment and litter are readily transported into the stormwater system during rainfall events.

In addition, illegal or inappropriate private stormwater connections, including connections to sewer infrastructure, can create risks to both stormwater and wastewater systems. Cumulatively, residential runoff degrades water quality, increases Council maintenance burdens and reduces the effectiveness of downstream treatment or natural systems.

Addressing residential contributions to stormwater pollution requires ongoing education, clear guidance and integration with broader water management initiatives.

## PUMPS

Due to flat topography and downstream constraints, most urban areas across the municipality rely on pump stations to manage stormwater discharge. This reliance introduces a municipal risk associated with mechanical failure, power outages and operational complexity.

Pump failures or interruptions can result in rapid and widespread flooding, particularly during high rainfall events. The consequences of failure are amplified by limited storage, minimal system redundancy and the interconnected nature of drainage catchments.

Mechanical systems also impose ongoing operational and maintenance costs and require specialised knowledge to manage effectively, increasing long-term risk if not adequately resourced.



*Pump outlets at Wyndham Street, Kerang*

## CLIMATE CHANGE

Climate change represents a significant and escalating municipal risk to stormwater management across Gannawarra Shire. Future climate projections are commonly described using Shared Socioeconomic Pathways (SSPs), which represent different global emissions trajectories. Lower-emissions pathways (such as SSP1-2.6) assume strong global mitigation, while higher-emissions pathways (such as SSP5-8.5) assume continued growth in greenhouse gas emissions.

Across Victoria, projections consistently indicate that short-duration, high-intensity rainfall events will increase under all SSPs, with the magnitude of change increasing toward the end of the century. By 2100, design rainfall intensities are expected to increase by approximately:

- 12–22% under lower-emissions scenarios, and
- 41–86% under higher-emissions scenarios, particularly for short, intense storm events that drive urban flooding.

These changes are expected to be accompanied by longer dry periods between rainfall events, increasing pollutant build-up on urban surfaces and resulting in higher pollutant loads when storms occur.

Existing drainage systems, many of which were not designed for these conditions, are likely to be exceeded more frequently. In Gannawarra's flat catchments, even modest increases in rainfall intensity can substantially increase flood extent, flood duration and reliance on pumped drainage systems.

Without adaptive planning and climate-informed decision-making that considers a range of SSP futures, stormwater risks to communities, infrastructure and the environment are expected to continue to increase over time.

## DATA, EDUCATION AND COMMUNITY AWARENESS GAPS

Limited community understanding of stormwater impacts, private drainage responsibilities and pollutant pathways presents a municipality-wide risk to stormwater outcomes. Poor awareness can contribute to illegal connections, inappropriate discharges, inadequate private infrastructure maintenance and behaviours that increase pollutant generation.

These issues place additional pressure on Council's drainage system and complicate compliance and enforcement activities. Addressing education and awareness gaps is critical to achieving sustained improvements in stormwater performance and water quality.

## TOPOGRAPHY

The predominantly flat topography across Gannawarra's townships, particularly in Kerang, Cohuna, Koondrook and Murrabit, creates an elevated municipal risk of inefficient stormwater drainage and prolonged surface ponding. Limited natural relief restricts hydraulic gradients within both natural and constructed drainage systems, resulting in reduced flow velocities and delayed runoff conveyance following rainfall events.

The very flat road grades across Gannawarra's urban centres mean that even minor surface level changes caused by pavement deterioration or settlement of kerb and channel can lead to persistent ponding. This accelerates pavement damage, creates localised nuisance flooding, and reduces effective drainage capacity. Limited hydraulic gradients also restrict runoff conveyance, encouraging sediment and pollutant accumulation within pits, pipes and open drains, which further degrades system performance and contributes to downstream water quality impacts.



*Stormwater ponding during light rain at Fehring Court, Cohuna*

## UNSEALED ROADS AND UNVEGETATED AREAS

Unsealed roads, road verges, open drains and other unvegetated surfaces across urban areas are a significant source of sediment entering Council’s stormwater network. During rainfall events, fine sediments are readily mobilised from these surfaces and transported into pits, pipes, open drains and detention basins.

Sediment accumulation reduces the effective hydraulic capacity of underground drainage infrastructure, leading to increased ponding, localised flooding and more frequent blockages.

Sediment-laden runoff also increases maintenance demands and operational costs, requiring more frequent pit cleaning, jetting and desilting of basins. Where sediment is discharged to downstream waterways, it can contribute to water quality degradation and increased nutrient transport.

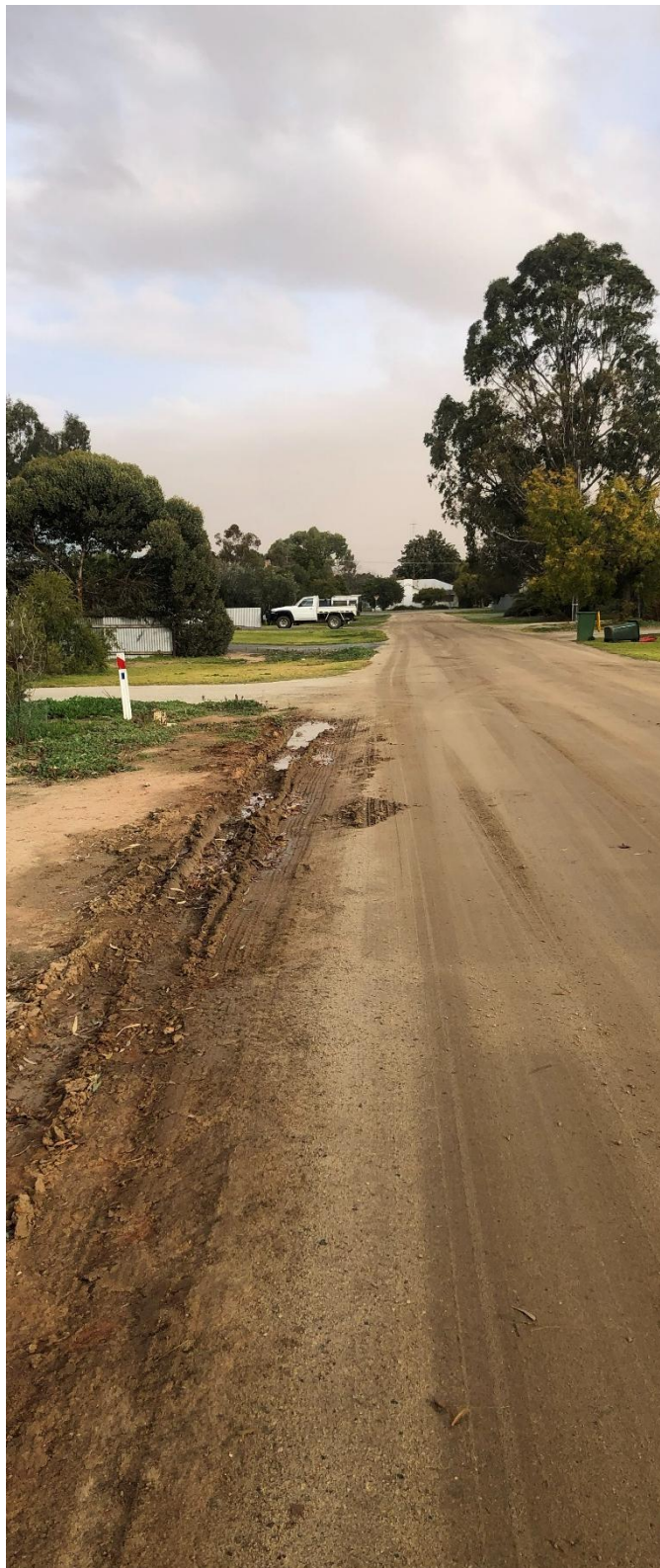
The extent of unsealed roads and unvegetated areas within several townships means sediment generation is a persistent, system-wide risk rather than an isolated issue.

## ILLEGAL WASTEWATER AND TRADE WASTE CONNECTIONS

Legacy illegal or inappropriate connections between wastewater systems and the stormwater network present an ongoing risk to human health and the environment. These connections typically arise from historical plumbing practices, unsewered or partially sewerred areas, informal trade waste discharges, or property modifications undertaken without appropriate approvals.

Illegal connections can introduce sewage, greywater or trade waste into the stormwater system, leading to direct discharge of contaminants to receiving waterways during both dry weather and rainfall events. This poses risks to public health, particularly where stormwater drains discharge near recreational areas, open space or sensitive waterways.

In addition to water quality impacts, wastewater discharges can cause blockage of pits and pipes through the accumulation of fats, oils, solids and organic matter, increasing maintenance requirements and the likelihood of system failure. These issues are often difficult to detect, with problems only becoming apparent following complaints, odour issues or downstream impacts.



*Unsealed road, Koondrook*

## MUNICIPAL RISKS SUMMARY

| ID  | Risk                                           | Description                                                                                                                                                                                                                                             | Type                         |
|-----|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| M01 | Maintenance limitations                        | Limited budgets restrict inspection and maintenance frequency, leading to blocked pits, reduced network capacity, and increased flooding and pollutant accumulation.                                                                                    | Human Health & Environmental |
| M02 | Asset data                                     | Incomplete or inaccurate GIS data for pits, pipes, and pumps limits Council's ability to plan renewals and respond effectively to flooding or pollution events.                                                                                         | Human Health                 |
| M03 | Industrial land use                            | Industrial sites contribute sediment, hydrocarbons, and nutrients through unsealed yards, heavy vehicle traffic and illegal discharge of trade waste, increasing pollution and maintenance needs.                                                       | Environmental                |
| M04 | Residential land use                           | Common domestic activities such as car washing and gardening introduce pollutants into drains, reducing system performance and degrading water quality.                                                                                                 | Environmental                |
| M05 | Pumps                                          | Many townships rely on pumped systems due to flat terrain, increasing flood risk and maintenance demand due to potential power outages or failures.                                                                                                     | Human Health & Environmental |
| M06 | Climate change                                 | More intense rainfall and prolonged dry periods will exacerbate flooding, asset deterioration, and pollutant loads, threatening community health and ecosystem resilience.                                                                              | Human Health & Environmental |
| M07 | Data, education, and community awareness gaps  | Public understanding of stormwater impacts and asset responsibilities can contribute to poor private drain maintenance and pollutant discharge.                                                                                                         | Environmental                |
| M08 | Unsealed roads and unvegetated areas           | Significant quantities of open swale drains, unsealed road verges and unvegetated areas contribute to sediment mobilisation and deposition within underground stormwater networks, reducing hydraulic capacity and increasing maintenance requirements. | Human Health & Environmental |
| M09 | Illegal wastewater and trade waste connections | Historic illegal or inappropriate connections between wastewater systems and the stormwater network, particularly in unsewered residential areas, continue to pose risks to stormwater quality and downstream receiving environments.                   | Human Health & Environmental |

# TOWNSHIP RISKS

## KERANG

Kerang is the administrative and primary service centre of Gannawarra Shire, accommodating the largest proportion of the municipal population and a broad mix of residential, commercial and industrial land uses. The township is located within a low-lying landscape connected to the Loddon River, Pyramid Creek and the Kerang Lakes Ramsar Site, which provides significant environmental value but also presents substantial stormwater management challenges.

### Growth

Kerang is projected to remain the primary focus for urban growth, with population forecast to increase from approximately 3,757 people in 2021 to between 3,850 and 4,009 by 2046. Growth is expected to occur through a combination of residential infill, redevelopment and expansion of industrial land, particularly in areas already constrained by drainage capacity.

### Stormwater, flooding and water quality issues

Kerang experiences frequent nuisance flooding and periodic property flooding due to extremely flat topography, clay soils and limited natural drainage gradients. Stormwater runoff is slow to drain and relies heavily on mechanical pumping to discharge to the Loddon River. Known flooding hotspots include Ninth Street, Redgum Drive, Marne Street, parts of the Tate Drive industrial area, and sections of the central township around Murray Street and Wyndham Street. Water quality treatment within the township is limited, with most stormwater discharged with minimal treatment to downstream waterways connected to Ramsar-listed wetlands.

### Existing infrastructure and constraints

The township is serviced by an extensive underground piped network that is largely undersized by contemporary standards, with much of the system providing less than a 50% AEP level of service. Multiple pump stations are required to manage stormwater due to the presence of levees and rail embankments that restrict overland flow paths. The main outfall at Wyndham Street comprises three electric pumps with a backup diesel unit, creating a high reliance on power availability and operational oversight. As growth continues, the combination of flat topography, constrained outlets and ageing infrastructure will increase flood risk, maintenance demand and the consequences of pump or power failure unless mitigated through staged upgrades and complementary non-structural measures.

### Drainage Characteristics

- Predominant drainage type: pumped underground pipe network
- Key constraints: very flat topography, levees, rail embankments and limited outfalls
- Primary flooding mechanisms: network surcharge, lack of overland relief and pump dependence.
- Water quality considerations: limited treatment prior to discharge to the Loddon River and Kerang Lakes Ramsar Site
- Operational challenges: high reliance on electrical power, ageing assets and complex pump system operation

# Risks

| ID   | Risk                                   | Description                                                                                                                                                                                                        | Type         |
|------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| KE01 | Complex pumped stormwater network      | Multiple interlinked pump systems make operation dependent on staff expertise, with knowledge loss posing system performance and safety risks.                                                                     | Human Health |
| KE02 | Dependence on electricity supply       | Pump stations rely on power and are vulnerable to outages, as seen in the 2023 floods, creating widespread flooding risk.                                                                                          | Human Health |
| KE03 | Undersized and ageing infrastructure   | Legacy drainage assets are undersized, limiting capacity and requiring major upgrades for measurable improvement.                                                                                                  | Human Health |
| KE04 | Flat topography                        | Minimal gradient restricts gravity drainage, resulting in regular ponding and nuisance flooding.                                                                                                                   | Human Health |
| KE05 | Redgum Drive basin                     | The basin and associated pump are inadequate for current catchment demands, constraining upstream development and increasing flood risk.                                                                           | Human Health |
| KE06 | Property flooding                      | Known hotspots such as Ninth Street experience repeat inundation due to system under-capacity.                                                                                                                     | Human Health |
| KE07 | Legacy paved road widths               | Wide sealed roads unnecessarily increase run-off volumes leading to additional pollution generation.                                                                                                               | Environment  |
| KE08 | Railway and levee barriers             | Drainage outlets are restricted by the rail line and levee, causing trapped overland flows and prolonged inundation.                                                                                               | Human Health |
| KE09 | Erosion at pump outlets                | Inadequate outlet protection causes scour and sedimentation in downstream channels.                                                                                                                                | Environment  |
| KE10 | Driveway culverts in LDRZ areas        | Uneven or undersized driveway culverts impede flow, leading to ponding and local flooding.                                                                                                                         | Human Health |
| KE11 | Future growth and drainage constraints | Planned growth areas sit upstream of networks already at capacity or beside levees that trap flows, constraining development.                                                                                      | Environment  |
| KE12 | Water quality degradation              | Minimal WSUD or treatment systems exist within Kerang. Stormwater runoff carries sediment and pollutants directly to the Loddon River/Ramsar wetland sites, posing a risk to water quality and aquatic ecosystems. | Environment  |

## COHUNA

Cohuna is the second-largest township in Gannawarra Shire and functions as a key service hub for the eastern part of the municipality. The township is located on Gunbower Creek, a tributary of the Murray River within the Gunbower Forest Ramsar Site, placing it within a highly sensitive environmental and water supply context.

### Growth

Cohuna is projected to experience the strongest population growth in the municipality, increasing from approximately 2,139 people in 2021 to between 2,410 and 2,746 by 2046. Growth is occurring through residential expansion in established and emerging estates, increasing the importance of coordinated stormwater and WSUD planning to manage cumulative impacts.

### Stormwater, flooding and water quality issues

Stormwater drainage in Cohuna is constrained by flat terrain and limited outfall options. The primary trunk drainage system runs along Channel Street and discharges to Barr Creek, a heavily modified waterway with known salinity issues. While localised flooding is generally less severe than in Kerang, kerb ponding and slow drainage are common following rainfall events.

Gunbower Creek is recognised by Coliban Water, NCCMA and DEECA as an extremely high-value waterway, supporting environmental, recreational and potable water supply functions. Stakeholders have expressed a clear position that no additional untreated stormwater should be discharged to the creek.

### Existing infrastructure and constraints

Newer residential areas have incorporated alternative drainage treatments, including flush kerb profiles draining to shallow swales supported by pit and pipe systems. While these approaches demonstrate improved WSUD outcomes, their delivery in a fragmented, stage-by-stage manner has resulted in multiple small basins and a growing maintenance burden for Council.

GMW channels crossing the northern part of Cohuna further constrain drainage by requiring stormwater to pass beneath them via siphons, which are difficult to inspect and maintain. As growth continues, these structural and environmental constraints will limit discharge opportunities and increase reliance on distributed storage, treatment and source control measures.

### Drainage Characteristics

- Predominant drainage type: gravity pipe network into GMW drainage channels
- Key constraints: flat terrain, GMW channels, siphons and limited environmentally acceptable outfalls
- Primary flooding mechanisms: slow conveyance, kerb ponding and tailwater effects
- Water quality considerations: Gunbower Creek and Barr Creek sensitivity, potable water offtake location
- Operational challenges: maintenance of multiple basins and siphon crossings

## Risks

| ID  | Risk                                       | Description                                                                                                                                                                                     | Type                       |
|-----|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| C01 | Discharge to high-value waterway           | Gunbower Creek holds significant ecological and recreational value, and stakeholders have expressed concern about additional stormwater discharges that may impact its environmental condition. | Environment                |
| C02 | Flat terrain and limited outfall capacity  | Flat grades and minimal drainage slope cause slow runoff and persistent kerb ponding across residential areas.                                                                                  | Human Health               |
| C03 | Tailwater constraints from GMW drains      | High tailwater in GMW channels impedes discharge, causing backwater effects and localised flooding.                                                                                             | Human Health               |
| C04 | Siphons beneath GMW channels               | Siphon crossings are difficult to maintain and prone to blockage, increasing flood risk.                                                                                                        | Human Health               |
| C05 | Water quality degradation                  | Few WSUD measures exist, most stormwater enters waterways untreated.                                                                                                                            | Environment                |
| C06 | Future growth and drainage constraints     | Additional development will increase runoff to already constrained outfalls and raise Council's WSUD maintenance burden.                                                                        | Human Health & Environment |
| C07 | Maintenance of third-party drainage assets | Stormwater discharges to GMW managed drains create dependency on external maintenance, increasing flood and compliance risks if assets are not managed consistently.                            | Human Health & Environment |

## KOONDROOK

Koondrook is a small township located on the Murray River opposite Barham (NSW), with a strong connection to river-based recreation and nature-based tourism associated with Gunbower Island and surrounding waterways. The township services a predominantly residential and rural catchment.

### Growth

Koondrook is projected to experience moderate growth, with population increasing from approximately 927 people in 2021 to between 1,027 and 1,040 by 2046. Growth is expected to occur through limited infill and expansion in identified development areas, subject to servicing and drainage constraints.

### Stormwater, flooding and water quality issues

Koondrook's stormwater system is constrained by very flat topography and limited hydraulic capacity. The township drains primarily via a single trunk pipe network discharging at Vine Street to the Murray River, supplemented by minor outlets to Gunbower Creek and local roadside swales. Hydraulic modelling undertaken in 2019 indicates the system provides only a 63% AEP level of service, resulting in frequent localised flooding during moderate rainfall events.

Flooding hotspots are widespread across the township, with shallow inundation commonly occurring along streets and within properties where culverts are undersized or poorly maintained.

### Existing infrastructure and constraints

The drainage network is undersized and ageing, with pipe capacity rather than outfall capacity identified as the primary system constraint. While the Vine Street pump upgrade has been implemented, modelling confirms that further pump upgrades alone will not materially reduce flooding without broader network augmentation.

Koondrook is protected from Murray River flooding by levees, although their ownership, condition and performance are uncertain. Existing planning controls, including the Land Subject to Inundation Overlay, are based largely on riverine flooding and may not accurately reflect stormwater flood risk. Continued growth without coordinated trunk drainage upgrades will increase both flooding frequency and maintenance demand.

### Drainage Characteristics

- Predominant drainage type: gravity pipe network with reliance on pumps when Murray River levels are high
- Key constraints: flat topography, undersized pipes, levees and limited overland flow path
- Primary flooding mechanisms: pipe surcharge, culvert blockages and lack of system capacity
- Water quality considerations: direct discharge to the Murray River and Gunbower Creek
- Operational challenges: ageing assets, reliance on private culvert maintenance and limited storage

## Risks

| ID  | Risk                                         | Description                                                                                                                             | Type                       |
|-----|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| K01 | Underperforming WSUD asset                   | The failed WSUD project at Koondrook Environmental Reserve adds maintenance burden and discourages further initiatives.                 | Environment                |
| K02 | Undersized drainage network                  | Existing pipes convey only ~63 % AEP flows, causing frequent flooding during moderate storms.                                           | Human Health & Environment |
| K03 | Levee and floodplain constraints             | The levee prevents natural discharge to the Murray River, requiring pumps and backflow devices that elevate maintenance and flood risk. | Human Health & Environment |
| K04 | Poor maintenance and private drainage issues | Blocked or unaligned driveway culverts reduce system efficiency and increase local flooding.                                            | Human Health & Environment |
| K05 | Outdated planning controls                   | Flood overlays reflect riverine rather than local stormwater risk.                                                                      | Human Health               |
| K06 | Future growth and drainage constraints       | Northern and southern growth areas lack trunk drainage, increasing flooding and pollutant loads downstream.                             | Human Health & Environment |
| K07 | Water quality degradation                    | Untreated runoff enters the Murray River and Gunbower Creek, impacting aquatic ecosystems.                                              | Environmental              |

## LEITCHVILLE

Leitchville is a small rural township located approximately 15 kilometres south-east of Cohuna in northern Gannawarra Shire. With a population of around 550, it functions as a local service centre for the surrounding agricultural district. The township is compact and predominantly residential, supported by limited commercial and light-industrial activity and key community facilities including a recreation reserve and travellers rest area.

### Growth

Leitchville is not expected to experience population or urban growth. Stormwater management actions should therefore be focused on maintaining existing infrastructure, supporting liveability and managing localised drainage performance rather than accommodating expansion.

### Stormwater, flooding and water quality issues

Stormwater drainage in Leitchville is generally well defined, with sealed roads and kerb and channel directing runoff to an underground pit and pipe network. Localised ponding can occur near the township outlet due to very flat grades and vegetation growth within the receiving open drain, although broader flooding and water quality risks are limited.

### Existing infrastructure and constraints

The drainage network falls toward the north-west and discharges to a constructed open drain along the southern side of Leitchville–Kerang Road. While the system is largely adequate for current conditions, the low gradient of the outfall drain reduces conveyance efficiency and increases reliance on routine maintenance to manage vegetation and standing water. There is no direct discharge to sensitive waterways, with Kow Swamp located outside the township drainage catchment.

### Drainage Characteristics

- Predominant drainage type: pit and pipe network servicing sealed roads with kerb and channel
- Key constraints: very flat outfall drain and vegetation growth
- Primary flooding mechanisms: localised ponding near the outlet
- Water quality considerations: no direct discharge to sensitive waterways
- Operational considerations: outlet maintenance

### Risks

| ID  | Risk                                 | Description                                                                                              | Type                       |
|-----|--------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------|
| L01 | Flat outfall and drain maintenance   | The main outfall along Leitchville–Kerang Road has minimal grade, causing sediment build-up and ponding. | Human Health               |
| L02 | Lack of WSUD measures                | No formal treatment assets exist, incidental filtration occurs via open drains only.                     | Environmental              |
| L03 | Aging underground network            | Old pit and pipe infrastructure is prone to blockages and reduced capacity.                              | Human Health               |
| L04 | Former industrial site redevelopment | Any redevelopment of the old factory site could increase impervious area and pollutant runoff.           | Human Health & Environment |

## MURRABIT

Murrabit is a small urban township located in the north-east of the Gannawarra municipality, approximately 1.5 kilometres west of the Murray River. The township supports a stable residential community and local recreational facilities, with surrounding land uses predominantly agricultural in nature.

### Growth

**Murrabit is not identified for growth within the Gannawarra Urban Growth Strategy and is not expected to experience any meaningful urban expansion.**

### Stormwater, flooding and water quality issues

Stormwater runoff in Murrabit is influenced by unsealed local roads, flat terrain and limited drainage redundancy. While the primary road network is sealed, gravel roads generate sediment-laden runoff that discharges to the stormwater system and contributes to maintenance and water quality issues. Localised flooding occurs at several locations, including Forbes Street, where infilling of a roadside swale has redirected flows into private property, and Browning Avenue, where stormwater from the road verge drains into an adjacent low-lying allotment.

### Existing infrastructure and constraints

The township is serviced by a relatively new pit and pipe drainage network that conveys stormwater to a single end-of-line detention basin before being pumped to a GMW-managed drainage channel adjacent to Murrabit West Road. While the basin shows signs of embankment scour and limited vegetation, these issues are generally localised and manageable, with current risks largely contained and not considered to pose a significant risk to human health or the environment.

### Drainage Characteristics

- Predominant drainage type: modern gravity pit and pipe network discharging to an end-of-line detention basin with a pumped outlet
- Key constraints: flat topography with sediment sources primarily associated with unsealed local roads
- Primary flooding mechanisms: localised issues related to roadside drainage modifications and low points rather than system-wide capacity
- Water quality considerations: sediment management within the network prior to discharge to GMW drainage infrastructure
- Operational challenges: routine maintenance opportunities including embankment stabilisation, vegetation establishment and sediment control

### Risks

| ID   | Risk                             | Description                                                                                                              | Type         |
|------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------|
| MU01 | Detention basin embankment scour | The detention basin shows embankment erosion and limited vegetation, increasing sediment runoff and inlet blockage risk. | Environment  |
| MU02 | Unsealed roads                   | Unsealed surfaces generate sediment-laden runoff that can block pits and pipes.                                          | Environment  |
| MU03 | Localised stormwater flooding    | Poor surface grading causes localised flooding near Forbes Street and Browning Avenue.                                   | Human Health |
| MU04 | Dependence on stormwater pump    | A single pump station manages township discharge, failure could cause widespread flooding despite basin storage.         | Human Health |

## QUAMBATOOK

Quambatook is a small township located in the south-west of Gannawarra Shire on the Avoca River. The town supports a stable residential community and a range of local recreational facilities, including the Quambatook Weir Reserve and Community Swimming Pool, which are important assets for residents and visitors.

### Growth

Quambatook is not identified as a growth area within the Gannawarra Urban Growth Strategy and is not expected to experience population growth.

### Stormwater, flooding and water quality issues

Localised flooding occurs along Tennyson Street, primarily due to outlet constraints and backflow prevention during elevated river levels. Road drainage is generally well managed through kerb and channel or vegetated swales, with sediment generation limited to isolated locations such as Cobden Street where adjacent gravel areas exist.

Stormwater currently receives limited water quality treatment prior to discharge to the Avoca River and downstream recreational areas. Given the township's modest scale and lack of growth pressures, these risks are generally contained and can be managed through targeted improvements, maintenance and investigation of reuse or treatment opportunities.

### Existing infrastructure and constraints

Stormwater is managed via a pit and pipe network discharging to an end-of-line pump station adjacent to the Community Swimming Pool before release to the Avoca River. The township is protected from riverine flooding by a recently constructed levee.

A former stormwater harvesting scheme pumped runoff to a storage pond behind the sporting field east of the Avoca River. While decommissioned, it demonstrates the feasibility of stormwater reuse and presents an opportunity for future Integrated Water Management initiatives.

### Drainage Characteristics

- Predominant drainage type: gravity pit and pipe network discharging via a pumped outlet
- Key constraints: flat topography, reliance on an end-of-line pump station and river tailwater levels
- Primary flooding mechanisms: localised outlet constraints and backflow during high river levels
- Water quality considerations: direct discharge to the Avoca River and downstream recreational areas
- Operational considerations: pump operation, outlet management and sediment control in isolated locations

### Risks

| ID  | Risk                                    | Description                                                                                                                                                                                 | Type         |
|-----|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Q01 | Discharge to high-value waterway        | Stormwater drains directly to the Avoca River conveying pollutants that pose a risk to ecology, public amenity and recreation as flows ultimately discharge to the Quambatook Weir Reserve. | Environment  |
| Q02 | Flood levee backflow device operation   | Manual and flap gates protecting outfalls may fail or be mis-operated, causing flooding or backflow.                                                                                        | Human Health |
| Q03 | Existing flooding along Tennyson Street | Flat topography and levee constraints cause localised flooding during heavy rainfall.                                                                                                       | Human Health |
| Q04 | Dependence on stormwater pump           | A single pump station discharging to the Avoca River creates reliance on mechanical operation for flood protection.                                                                         | Human Health |

## LALBERT

Lalbert is the smallest township within the Gannawarra municipality, with a population of approximately 138 people. It is located in the north-west of the Shire and supports a small, low-density residential community with limited commercial activity.

### Growth

Lalbert is not expected to experience population or urban growth. Stormwater management considerations are therefore focused on maintaining the performance of existing infrastructure rather than accommodating future development

### Stormwater, flooding and water quality issues

Stormwater is managed through a localised pit and pipe drainage network with minimal flood risk. As stormwater is retained within the township and reused for irrigation, there is limited potential for downstream environmental impacts.

### Existing infrastructure and constraints

The drainage network conveys runoff to an end-of-line pump station that discharges to a stormwater retention pond located south of the Lalbert Recreation Reserve, where water is reused for irrigation. As there is no direct discharge to receiving waterways, environmental risks are low. Ongoing stormwater management is primarily dependent on effective pump operation and appropriate management of potential public health risks associated with the retention pond.

### Drainage Characteristics

- Predominant drainage type: pit and pipe network with pumped discharge to a retention and reuse system
- Key constraints: reliance on a single pump and storage pond
- Primary flooding mechanisms: minimal under current conditions
- Water quality considerations: localised reuse with no off-site discharge
- Operational considerations: pump maintenance, monitoring and pond management

### Risks

| ID   | Risk                          | Description                                                                                                                 | Type                       |
|------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------|----------------------------|
| LA01 | Reuse of untreated stormwater | Stormwater reused for irrigating sports fields is untreated, posing potential health risks to field users.                  | Human Health               |
| LA02 | Grain storage site runoff     | Poor onsite drainage at the grain facility may discharge sediment or hydrocarbons into surrounding land or drains.          | Environment                |
| LA03 | Negative growth impacts       | Population decline reduces investment in drainage upkeep, leading to asset deterioration and higher flood risk.             | Human Health & Environment |
| LA04 | Reliance on pumped network    | The town's pumped drainage system may fail unnoticed due to its isolation and small population, causing prolonged flooding. | Human Health               |

# IMPLEMENTATION FRAMEWORK

## OVERVIEW

The Implementation Framework sets out how the Urban Stormwater Management Plan will be translated into prioritised, deliverable actions to manage the risks posed by urban stormwater to human health, property, infrastructure and the environment.

The framework provides a clear and transparent process that links identified risks to defined actions, assigns responsibility for delivery, and establishes priorities, timeframes, costs and funding pathways. While the framework supports Council's obligations under the Environment Protection Act 2017 (Vic) Order for Obligations of Managers of Land or Infrastructure, it is primarily intended to guide practical, risk-based decision-making and investment across Council operations, capital programs and planning processes.

Actions identified through the Plan are consolidated in an Actions Table included in **Appendix A**. The table provides a consistent structure for implementing and reviewing actions over the life of the Plan.

## FROM RISKS TO ACTIONS

The Implementation Framework follows a structured process:

1. Urban stormwater risks have been identified at both a municipal-wide and township-specific level.
2. One or more actions have been developed to address each identified risk.
  - a. Some actions address multiple risks and may apply across the municipality.
  - b. Other actions are specific to individual townships or localised issues.
3. Each action is described clearly and assigned an action type to provide context on the nature of the response, using the action type categories defined in this Plan.
4. Actions are explicitly linked back to the risks they address, ensuring a clear line of sight between risk identification and implementation.

This approach recognises that many stormwater risks are interconnected and that a single action may contribute to the management of multiple risks.

Implementation of actions may require engagement with external stakeholders and approval authorities. Where works involve Crown land, waterways, wetlands or third-party assets, Council will engage with the relevant stakeholders and obtain any required approvals prior to delivery.

Council will also consider cultural heritage requirements and Traditional Owner engagement, where relevant, during the planning and delivery of stormwater projects.

## ACTION TYPES

To provide clarity on the nature of each response and how actions are intended to be delivered, all actions within the Implementation Framework have been assigned to one of the following action types. These action types reflect the primary delivery pathway and function of each action.

### Operations & maintenance

Actions focused on the day-to-day operation, inspection and maintenance of Council's stormwater assets to maintain service levels, manage flood risk and respond to incidents. This includes routine and risk-based maintenance, pump operation, emergency response procedures and operational planning.

### Asset data & systems improvement

Actions that improve the accuracy, completeness and accessibility of stormwater asset data and supporting systems. This includes asset data capture, GIS improvements, condition assessments, documentation and

knowledge management to support informed decision-making and reduce reliance on individual staff knowledge.

### **Investigations & studies**

Actions that develop the technical evidence base required to understand risks, identify constraints and inform future planning, design and investment decisions. This includes drainage and flood studies, modelling, concept and detailed designs, condition assessments and investigations related to growth or climate change.

### **Capital works & infrastructure upgrades**

Physical works to renew, upgrade or expand stormwater infrastructure to improve system capacity, performance, safety and resilience. This includes drainage upgrades, pump station works, detention basins, renewals and flood mitigation infrastructure.

### **Water quality & WSUD implementation**

Actions aimed at reducing pollutant loads and improving the quality of stormwater discharges to receiving environments. This includes WSUD measures, stormwater treatment systems, erosion and sediment control and stormwater harvesting or reuse initiatives.

### **Planning & development controls**

Actions delivered through planning schemes, policies and development assessment processes to manage stormwater impacts from new development and redevelopment. This includes drainage and WSUD requirements, overlay controls, development staging and protection of downstream infrastructure capacity.

### **Risk management & resilience**

Actions that strengthen Council's ability to anticipate, manage and respond to stormwater-related risks, including flooding, asset failure and climate change impacts. This includes emergency planning, system redundancy, resilience measures and integration with broader risk and emergency management frameworks.

### **Community education & behaviour change**

Actions that support improved community understanding of stormwater impacts and responsibilities, and encourage behaviours that reduce flooding, pollution and asset damage. This includes education campaigns, guidance on private drainage maintenance and source-control initiatives.

### **Partnerships & advocacy**

Actions delivered in collaboration with external stakeholders or that require coordination, funding or policy support beyond Council. This includes working with Catchment Management Authorities, water corporations, State agencies, neighbouring councils and the community, as well as advocacy for funding or regulatory change.

## **ROLES AND RESPONSIBILITIES**

For each action, a responsible Council unit has been assigned, aligned with Council's organisational structure. This ensures accountability for delivery and supports coordinated implementation across Council.

The Council units involved in implementation include:

### **Assets & Property**

Responsible for management of Council-owned stormwater assets, including asset data, condition, lifecycle planning and integration with asset management plans.

### **Operational Services**

Responsible for day-to-day operation and maintenance of the stormwater network, including inspections, reactive works and emergency response.

### **Planning & Regulatory**

Responsible for planning scheme controls, development assessment, WSUD requirements and regulatory processes that manage stormwater impacts from new development.

## Projects & Design

Responsible for investigations, concept and detailed design, and delivery of stormwater capital works and upgrade projects.

## Community Health

Supports consideration of public health risks associated with flooding, water quality and environmental conditions.

## PRIORITY SETTING

Each action has been assigned a priority rating of low, medium, high or very high. Priorities have been determined based on:

- the level of risk to human health as the primary consideration
- the level of risk to the environment as a secondary consideration
- the consequence of inaction
- the extent to which the action addresses multiple risks.

This risk-based prioritisation supports transparent decision-making and assists Council to focus resources on actions that deliver the greatest risk reduction.

## TIMEFRAMES

Each action has been assigned an indicative implementation timeframe:

- **Short term:** 1–3 years
- **Medium term:** 3–6 years
- **Long term:** 6–10 years
- **Ongoing:** actions intended to be embedded into Council policies, procedures or business-as-usual operations.

Timeframes have been selected having regard to the complexity, cost and delivery requirements of each action. Longer timeframes have been applied to more complex or higher-cost actions to allow for appropriate planning, design, approvals and funding to occur in advance of delivery.

## INDICATIVE COSTS AND FUNDING SOURCES

Indicative, high-level cost bands have been assigned to each action to support integration with Council's budgeting and financial planning processes. These cost bands are not detailed estimates but provide an order-of-magnitude indication to inform prioritisation and resourcing decisions.

Each action has also been linked to one or more potential funding sources:

- **Operational budgets:** Funding for routine operations, maintenance, inspections, programs and ongoing activities delivered through Council's annual operating budgets.
- **Capital works program:** Funding for renewal, upgrade or construction of stormwater infrastructure delivered through Council's capital works planning and budget processes.
- **External grants and funding programs:** Funding from State or Commonwealth programs, or other external sources, typically for design and construction of capital works.

## LINK TO PLAN OBJECTIVES

All actions within the Implementation Framework are explicitly aligned with one or more of the Plan's objectives. This ensures that implementation contributes directly to improving liveability, supporting safe and sustainable growth, and protecting the environment, while maintaining a clear line of accountability between actions and the outcomes the Plan seeks to achieve.

# MONITORING AND REVIEW

Monitoring and review will ensure the Urban Stormwater Management Plan remains effective, current and aligned with Council's obligations under the Environment Protection Act 2017 (Vic). Council will monitor progress on implementation of actions on an annual basis, using existing operational reporting, capital works tracking and asset management systems.

Annual monitoring will focus on:

- progress against the actions and timeframes set out in the Implementation Framework
- changes in identified stormwater risks, including flooding incidents and water quality issues
- performance and condition of key stormwater assets, particularly pumps, basins and outlets
- the number of projects screened for cultural heritage and Traditional Owner engagement requirements, and where engagement was undertaken during investigation or concept design stages
- lessons learned from investigations, capital works, storm events and implementation of cultural heritage due diligence and engagement processes.

Outcomes of the annual review will be used to refine priorities, adjust delivery timeframes and inform future budget and grant funding decisions. In accordance with the EPA Order for Obligations – Urban Stormwater Management, Council will undertake a formal review and update of the Plan at least every five years and publish a report on implementation outcomes. This approach supports continuous improvement and ensures stormwater risks to human health and the environment are managed so far as reasonably practicable.

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# APPENDIX A – ACTION TABLE

ACTION TABLE

| Municipal Wide |                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                         |                                         |                          |           |                          |                 |                                      |                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------|--------------------------|-----------|--------------------------|-----------------|--------------------------------------|-------------------------|
| ID             | Action Description                                                                                                                                                                                                                                                                                                                                                                                                    | Risk Addressed                                          | Action Type                             | Responsible Council Unit | Priority  | Implementation Timeframe | Indicative Cost | Funding Source                       | Plan Objective Achieved |
| M-A01          | Develop a proactive stormwater maintenance schedule for each township, prioritising assets based on their risk/criticality ranking. (Correlates with Task 5 of the Stormwater Asset Management Plan Improvement Plan).                                                                                                                                                                                                | M01, L03, MU02, LA03, K04, L01, L03                     | Operations & maintenance                | Operational Services     | Low       | Short term (1-3 years)   | <\$5k           | Operational budgets                  | S3                      |
| M-A02          | Prepare procedure for capturing asset data from other planned Council activities, such as condition assessments, capital works and stormwater and flooding studies.                                                                                                                                                                                                                                                   | M02                                                     | Asset data & systems improvement        | Assets & Property        | Low       | Short term (1-3 years)   | <\$5k           | Operational budgets                  | L2                      |
| M-A03          | Update the Asset Protection Policy to also cover operational activities related to domestic, industrial and commercial land use.                                                                                                                                                                                                                                                                                      | M03, M09, LA02                                          | Planning & development controls         | Projects & Design        | Low       | Short term (1-3 years)   | <\$5k           | Operational budgets                  | L2                      |
| M-A04          | Review the Asset Protection Permit System policy and previous non-conformance occurrences to confirm whether the \$200 bond adequately covers the cost of repairing stormwater assets damaged during demolition or building works.                                                                                                                                                                                    | M03,M04                                                 | Asset data & systems improvement        | Projects & Design        | Low       | Short term (1-3 years)   | <\$5k           | Operational budgets                  | L2                      |
| M-A05          | Partner with the EPA to develop a formal procedure and warning system for managing non-compliance with stormwater management on industrial sites, including processes for monitoring, education, warnings, enforcement and infringements.                                                                                                                                                                             | M03, LA02                                               | Planning & development controls         | Operational Services     | Medium    | Short term (1-3 years)   | <\$5k           | Operational budgets                  | S1                      |
| M-A06          | Deliver community education campaigns on:<br>- Stormwater pollution prevention from domestic activities such as car washing, and garden chemical use.<br>- Private drainage responsibilities and their benefits                                                                                                                                                                                                       | M04, M07, K04                                           | Community education & behaviour change  | Projects & Design        | Medium    | Medium term (3-6 years)  | \$10k-\$25k     | Operational budgets                  | S1                      |
| M-A07          | Progress a staged program to improve resilience of critical stormwater pump systems across the municipality, including remote monitoring, enhanced maintenance and contingency measures for power outages and pump failures.                                                                                                                                                                                          | M05, MU04, K03, Q04, LA04                               | Operations & maintenance                | Operational Services     | High      | Short term (1-3 years)   | \$10k-\$25k     | Operational budgets                  | L2                      |
| M-A08          | Require new subdivisions to consider integrated drainage planning, accounting for downstream capacity limits and future upstream development. Leverage other planning works such as township structure plans and rezonings including design and development overlays.                                                                                                                                                 | KE11, C06, K06                                          | Planning & development controls         | Planning & Regulatory    | Low       | Ongoing                  | <\$5k           | Operational budgets                  | G1, G3                  |
| M-A09          | Develop stormwater specific design note or guideline outlining how new designs must consider climate change horizons in accordance with the latest ARR guidelines.                                                                                                                                                                                                                                                    | M06                                                     | Planning & development controls         | Projects & Design        | High      | Short term (1-3 years)   | \$10k-\$25k     | Capital works program                | S2                      |
| M-A10          | Ensure new permits for LDRZ subdivisions require driveway and culvert works to be completed and satisfactory AS-CON data provided prior to issuing the Statement of Compliance.                                                                                                                                                                                                                                       | KE10                                                    | Planning & development controls         | Planning & Regulatory    | Low       | Ongoing                  | <\$5k           | Operational budgets                  | L2                      |
| M-A11          | Ensure road renewal projects consider integrated WSUD measures to reduce impervious areas and promote stormwater treatment.                                                                                                                                                                                                                                                                                           | M08, KE07, KE12, C05, K07                               | Water quality & WSUD implementation     | Projects & Design        | Low       | Ongoing                  | <\$5k           | Capital works program                | L3                      |
| M-A12          | Explore partnership opportunities with Coliban Water, Lower Murray Water and Grampian Wimmera Mallee Water for checking for illegal connections of sewer to stormwater systems and vice versa.                                                                                                                                                                                                                        | M09                                                     | Partnerships & advocacy                 | Projects & Design        | Low       | Short term (1-3 years)   | <\$5k           | Operational budgets                  | S1                      |
| M-A13          | Prepare WSUD Engineering Guidelines specific for Gannawarra Shire Council outlining minimum requirements for new developments.                                                                                                                                                                                                                                                                                        | M03, M04, M06, M08, L04, KE11, KE12, C05, C06, K06, K07 | Planning & development controls         | Projects & Design        | Very High | Short term (1-3 years)   | \$10k-\$25k     | Operational budgets                  | G2, G3                  |
| M-A14          | Provide informative signage at popular recreation areas explaining the water cycle, benefits of WSUD, impacts of pollutants etc.                                                                                                                                                                                                                                                                                      | M04, M07                                                | Community education & behaviour change  | Community Health         | Low       | Medium term (3-6 years)  | \$5k-\$10k      | Capital works program                | L3                      |
| M-A15          | Identify key pollutants generated by Council assets and operations and implement targeted work methods and environmental risk controls to minimise their mobilisation into the stormwater system, including timing and frequency of activities such as street sweeping to align with periods of high pollutant generation.                                                                                            | M01, M03, M04, KE12, C05, K07                           | Operations & maintenance                | Operational Services     | Medium    | Short term (1-3 years)   | \$5k-\$10k      | Operational budgets                  | S1                      |
| M-A16          | Actively promote and support individual dwelling WSUD initiatives, such as rainwater tanks, raingardens and swales, through targeted guidance, incentives and integration with planning and building processes.                                                                                                                                                                                                       | M04, M06, M07, KE12, C05, K07                           | Community education & behaviour change  | Planning & Regulatory    | Medium    | Ongoing                  | <\$5k           | Operational budgets                  | S1                      |
| M-A17          | Develop and implement a stormwater cultural heritage and Traditional Owner engagement protocol. The protocol will include early identification of projects with potential cultural heritage implications, engagement pathways with relevant Traditional Owner groups and organisations, referral pathways for specialist advice where required, and consideration of statutory approvals and assessment requirements. | N/A (Consultation Outcome)                              | Partnerships & advocacy                 | Projects & Design        | Medium    | Short term (1-3 years)   | <\$5k           | Operational budgets                  | S1                      |
| Kerang         |                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                         |                                         |                          |           |                          |                 |                                      |                         |
| ID             | Action Description                                                                                                                                                                                                                                                                                                                                                                                                    | Risk Addressed                                          | Action Type                             | Responsible Council Unit | Priority  | Implementation Timeframe | Indicative Cost | Funding Source                       | Plan Objective Achieved |
| K-A01          | Prepare and maintain a consolidated Operations and Maintenance Manual for the Kerang stormwater network to support consistent operations, staff handover and emergency response, including procedures for power outages, pump failures and system exceedance events.                                                                                                                                                  | KE01, KE02, M05                                         | Operations & maintenance                | Operational Services     | Medium    | Short term (1-3 years)   | \$5k-\$10k      | Operational budgets                  | L2, S2                  |
| K-A02          | Support delivery of Action K-A01 by undertaking a targeted knowledge capture and transfer exercise for the Kerang stormwater network, led by senior staff, to inform and validate the Operations and Maintenance Manual and reduce reliance on individual expertise.                                                                                                                                                  | KE01                                                    | Operations & maintenance                | Operational Services     | Medium    | Short term (1-3 years)   | <\$5k           | Operational budgets                  | L2                      |
| K-A03          | Progress a staged program of capital drainage upgrades in priority locations identified by the Kerang Drainage Study, subject to funding availability and detailed design confirmation, to incrementally improve system performance and reduce flood risk.                                                                                                                                                            | KE03, KE06, KE11                                        | Capital works & infrastructure upgrades | Projects & Design        | High      | Medium term (3-6 years)  | \$2M-\$3M       | Capital works program                | L1, S3                  |
| K-A04          | Investigate opportunities to improve stormwater outfall operation and conveyance associated with the railway and levee barriers as part of any related works, including levee assessments, drainage upgrades, or development-led stormwater management strategies.                                                                                                                                                    | KE08                                                    | Capital works & infrastructure upgrades | Projects & Design        | Low       | Ongoing                  | NIL             | Operational budgets                  | L2, G1                  |
| K-A05          | Partner with landcare and community groups to prevent further erosion at stormwater outfall locations within the Loddon River reserve.                                                                                                                                                                                                                                                                                | KE09                                                    | Partnerships & advocacy                 | Projects & Design        | Low       | Medium term (3-6 years)  | \$25k-\$50k     | External grants and funding programs | S1                      |

ACTION TABLE

|           |                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                                         |                          |          |                          |                 |                                      |                         |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------|--------------------------|----------|--------------------------|-----------------|--------------------------------------|-------------------------|
| K-A06     | Prepare high level water quality model using MUSIC for Kerang to enable cost-benefit analysis of possible WSUD initiatives.                                                                                                                                                                                                                                                                                     | KE12           | Investigations and studies              | Projects & Design        | Medium   | Medium term (3-6 years)  | \$25k-\$50k     | Capital works program                | L3                      |
| K-A07     | Prepare plan for delivery of cost-positive options identified by K-A06 and include relevant actions in the next revision of the Urban Stormwater Management Plan.                                                                                                                                                                                                                                               | KE12           | Investigations & studies                | Projects & Design        | Medium   | Medium term (3-6 years)  | \$5k-\$10k      | Operational budgets                  | L3                      |
| K-A08     | Upgrade the Riverside Park irrigation basin to increase storage volumes and improve water supply reliability during periods of low rainfall.                                                                                                                                                                                                                                                                    | KE12           | Capital works & infrastructure upgrades | Projects & Design        | Medium   | Short term (1-3 years)   | \$100k-\$250k   | External grants and funding programs | S2, S3                  |
| Cohuna    |                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                                         |                          |          |                          |                 |                                      |                         |
| ID        | Action Description                                                                                                                                                                                                                                                                                                                                                                                              | Risk Addressed | Action Type                             | Responsible Council Unit | Priority | Implementation Timeframe | Indicative Cost | Funding Source                       | Plan Objective Achieved |
| C-A01     | Prevent direct stormwater discharges to Gunbower Creek unless treatment is provided in accordance with Urban Stormwater Management Guidelines (EPA Victoria June 2021).                                                                                                                                                                                                                                         | C01, C05       | Planning & development controls         | Planning & Regulatory    | High     | Ongoing                  | NIL             | Operational budgets                  | S1                      |
| C-A02     | Prepare the Cohuna Drainage Study to validate network capacity and localised flooding issues and recommended mitigation measures. Include high-level water quality modelling for the township as part of the project to inform future WSUD initiatives including cost-benefit analysis.                                                                                                                         | C02, C05, C06  | Investigations and studies              | Projects & Design        | Medium   | Medium term (3-6 years)  | \$100k-\$250k   | Capital works program                | S3                      |
| C-A03     | Liaise with GMW to improve performance and avoid high tailwater levels along the Tolls Lane and Roviras Road drainage outfall channels, including identification of critical monitor and maintenance locations. Develop Memoranda of Understanding with GMW to establish maintenance responsibilities and expectations.                                                                                         | C03, C07       | Partnerships & advocacy                 | Operational Services     | Medium   | Short term (1-3 years)   | NIL             | Operational budgets                  | L2                      |
| C-A04     | Minimise developments that propose to increase discharge to siphon locations. Investigate options to redirect flows to alternative outlets and/or provide relief points in the event of siphon blockage.                                                                                                                                                                                                        | C04            | Planning & development controls         | Planning & Regulatory    | Low      | Ongoing                  | NIL             | Operational budgets                  | G3                      |
| C-A05     | Prepare a delivery plan for delivery of WSUD initiatives identified by the Cohuna Drainage Study.                                                                                                                                                                                                                                                                                                               | C05            | Water quality & WSUD implementation     | Projects & Design        | Medium   | Medium term (3-6 years)  | \$5k-\$10k      | Operational budgets                  | S1                      |
| Koondrook |                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                                         |                          |          |                          |                 |                                      |                         |
| ID        | Action Description                                                                                                                                                                                                                                                                                                                                                                                              | Risk Addressed | Action Type                             | Responsible Council Unit | Priority | Implementation Timeframe | Indicative Cost | Funding Source                       | Plan Objective Achieved |
| KO-A01    | Undertake additional community consultation to inform rehabilitation of the Koondrook Environmental Reserve, ensuring that grant limitations are explained.                                                                                                                                                                                                                                                     | K01, K07, M07  | Community education & behaviour change  | Projects & Design        | Medium   | Short term (1-3 years)   | <\$5k           | Operational budgets                  | S1                      |
| KO-A02    | Subject to community support, prepare an IWM functional design for the redevelopment of the Koondrook Environmental Reserve to support eligibility for grant funding. The design should also aim to improve local stormwater capacity by incorporating an OSD component, where feasible.                                                                                                                        | K01, K02, K07  | Capital works & infrastructure upgrades | Projects & Design        | Medium   | Short term (1-3 years)   | \$25k-\$50k     | Capital works program                | L3, S1, S2              |
| KO-A03    | Subject to grant funding, deliver a rehabilitation project for the Koondrook Environmental Reserve.                                                                                                                                                                                                                                                                                                             | K01, K02, K07  | Capital works & infrastructure upgrades | Projects & Design        | Medium   | Medium term (3-6 years)  | \$500k-\$1M     | External grants and funding programs | L3, S1, S2              |
| KO-A04    | Subject to grant funding, implement priority drainage upgrades identified in the Koondrook Stormwater and Drainage Strategy, with consideration of complementary road sealing and footpath improvements where they support drainage outcomes.                                                                                                                                                                   | K02, K06       | Capital works & infrastructure upgrades | Projects & Design        | Medium   | Medium term (3-6 years)  | \$5M+           | External grants and funding programs | L1                      |
| KO-A05    | Develop and implement an operating procedure for the main Koondrook pump station, including defined trigger levels for closing the manual penstock and starting pumps during high flows (replacing reliance on weekly visual inspection against bridge pier caps), and confirm availability and deployment requirements for portable pumps at the south-east Gunbower Creek outlets when flap gates are closed. | K03            | Operations & maintenance                | Operational Services     | High     | Short term (1-3 years)   | \$25k-\$50k     | Operational budgets                  | L2                      |
| KO-A06    | In partnership with NCCMA, progressively remove the LSIO as the township levee is upgraded in accordance with the Koondrook Levee Study. Consider conversion of LSIO to SBO for land where stormwater flooding is known to occur or shown to occur in the Koondrook Stormwater and Drainage Strategy.                                                                                                           | K05            | Planning & development controls         | Planning & Regulatory    | Low      | Medium term (3-6 years)  | \$10k-\$25k     | Operational budgets                  | G1                      |
| KO-A07    | Prepare high level water quality model for the town to enable cost-benefit analysis of possible WSUD initiatives, expanding on works undertaken as part of the Koondrook Stormwater and Drainage Strategy.                                                                                                                                                                                                      | K07            | Investigations & studies                | Projects & Design        | Medium   | Medium term (3-6 years)  | \$25k-\$50k     | Capital works program                | S1                      |
| KO-A08    | Prepare plan for delivery of cost-positive options identified by KO-A07 and include relevant actions in the next revision of the Urban Stormwater Management Plan.                                                                                                                                                                                                                                              | K07            | Investigations & studies                | Projects & Design        | Medium   | Medium term (3-6 years)  | \$5k-\$10k      | Operational budgets                  | S1                      |
| Murrabit  |                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                                         |                          |          |                          |                 |                                      |                         |
| ID        | Action Description                                                                                                                                                                                                                                                                                                                                                                                              | Risk Addressed | Action Type                             | Responsible Council Unit | Priority | Implementation Timeframe | Indicative Cost | Funding Source                       | Plan Objective Achieved |
| MU-A01    | Regrade and stabilise detention basin embankments and establish deep-rooted vegetation to reduce erosion and sediment runoff.                                                                                                                                                                                                                                                                                   | MU01           | Capital works & infrastructure upgrades | Projects & Design        | Low      | Medium term (3-6 years)  | \$50k-\$100k    | Capital works program                | S1                      |
| MU-A02    | Investigate opportunities to upgrade the existing Murrabit detention basin to support stormwater harvesting for irrigation of the adjacent sporting field.                                                                                                                                                                                                                                                      | M06            | Investigations & studies                | Projects & Design        | Low      | Medium term (3-6 years)  | \$5k-\$10k      | External grants and funding programs | S2                      |
| MU-A03    | Prepare a concept design for open drain and culvert upgrades along Kerang–Murrabit Road near Forbes Street and, where feasible, deliver construction works to improve drainage performance and reduce private property flooding.                                                                                                                                                                                | MU03           | Investigations & studies                | Projects & Design        | High     | Short term (1-3 years)   | \$50k-\$100k    | Capital works program                | L1                      |
| MU-A04    | Investigate the feasibility of regrading the nature strip adjacent to 1 Browning Avenue and, where feasible, implement minor works to improve overland flow paths and direct local runoff to the existing stormwater pit.                                                                                                                                                                                       | MU03           | Investigations & studies                | Projects & Design        | High     | Short term (1-3 years)   | \$10k-\$25k     | Capital works program                | L1                      |
| MU-A05    | Prepare a basic MUSIC model to assess the water quality performance of the existing stormwater system and identify potential opportunities for improved pollutant removal where best-practice targets are not achieved, subject to future prioritisation and available funding.                                                                                                                                 | MU05           | Investigations & studies                | Projects & Design        | Low      | Short term (1-3 years)   | \$5k-\$10k      | Capital works program                | S1                      |

ACTION TABLE

| Quambatook |                                                                                                                                                                                                                |                |                          |                          |          |                          |                 |                       |                         |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------|--------------------------|----------|--------------------------|-----------------|-----------------------|-------------------------|
| ID         | Action Description                                                                                                                                                                                             | Risk Addressed | Action Type              | Responsible Council Unit | Priority | Implementation Timeframe | Indicative Cost | Funding Source        | Plan Objective Achieved |
| Q-A01      | Investigate options to retrofit the stormwater outlet to the Avoca River with a gross pollutant trap, trash screen or similar device to reduce litter, sediment and debris entering the receiving waterway.    | Q01            | Investigations & studies | Projects & Design        | Medium   | Short term (1-3 years)   | \$5k-\$10k      | Capital works program | S1                      |
| Q-A02      | Prepare a Quambatook levee and drainage operations manual that documents standard, pre-flood and post-flood operating procedures, including requirements for manually operated backflow prevention devices.    | Q02            | Operations & maintenance | Projects & Design        | High     | Short term (1-3 years)   | \$5k-\$10k      | Operational budgets   | L2                      |
| Q-A03      | Prepare a concept design to improve drainage along Tennyson Street and, where feasible and funding permits, implement drainage upgrades to improve discharge to the Avoca River and reduce localised flooding. | Q03            | Investigations & studies | Projects & Design        | Low      | Medium term (3-6 years)  | \$10k-\$25k     | Capital works program | L1                      |
| Laibert    |                                                                                                                                                                                                                |                |                          |                          |          |                          |                 |                       |                         |
| ID         | Action Description                                                                                                                                                                                             | Risk Addressed | Action Type              | Responsible Council Unit | Priority | Implementation Timeframe | Indicative Cost | Funding Source        | Plan Objective Achieved |
| LA-A01     | Assess the existing stormwater harvesting process against the Australian Guidelines for Water Recycling: Stormwater Harvesting and Reuse to ensure risks to human health are identified and addressed.         | LA01           | Investigations & studies | Community Health         | Medium   | Medium term (3-6 years)  | \$5k-\$10k      | Capital works program | L3                      |