SEQUANA
WATER ENVIRONMENT ENERGY

MALLEE CMA STRATEGIC LEVEES PROJECT

CATEGORISATION REPORT

REVISION A



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1 INTRODUCTION / CONTEXT

In response to the 2022 Spring floods, the Victorian Government, through the Department of Energy, Environment and Climate Action (DEECA), initiated funding for a Strategic Levee Categorisation Assessment across northern Victoria. This effort involves collaboration among four northern Victorian Catchment Management Authorities (CMAs)—Goulburn Broken, North Central, North East, and Mallee CMAs—and key partners including Local Government Authorities, Victoria State Emergency Service (VICSES), DEECA, relevant Water Corporations such as Lower Murray Water, Goulburn Murray Water and Grampians Wimmera Mallee Water and also Public Land Managers such as Parks Victoria. The purpose of this assessment is to enhance flood intelligence and incorporate it into Municipal Flood Emergency Plans (MFEPs) for the region.

The project focuses on developing detailed flood intelligence surrounding key levees and floodplain features, with the longer term objective of identifying and implementing practical emergency actions. This intelligence aims to strengthen flood protection for communities and infrastructure at high risk, ultimately improving flood preparedness and resilience across northern Victoria.

The initial phase of the levee categorisation project focused on identifying and assessing strategic levees and significant floodplain features within the jurisdictions of Mildura and Swan Hill Rural City Councils and Buloke Shire Council. The objective of this task was to locate and categorise strategic levees and features that influenced flood behaviour, such as elevated roads, railways, channels, natural levees, and lunettes. This phase began with a desktop approach conducted in close collaboration with Catchment Management Authorities (CMAs), Victoria State Emergency Service (VICSES), and Local Government Authorities (LGAs).

The methodology for levee categorisation involved a series of steps that were completed to comprehensively identify and categorise levee structures and floodplain features in the target areas. The following steps were implemented:

- Data collection and review was conducted, gathering essential topographic and flood-related information, including GIS layers, historical flood data, prior studies, inventories, and current flood mitigation and emergency management plans. This review incorporated crucial data from stakeholders such as Mallee CMA and the LGAs, providing a foundation for mapping key levee structures and flood-influencing features.
- Data gap analysis was then completed to identify any missing information, particularly in urban areas and surrounding regions. Where gaps were identified, this information was requested via a Request for Information Register.
- Community engagement formed a key component of the project methodology. Engagement activities, including stakeholder workshops and community drop-in sessions, were used to validate mapped data, refine levee classifications, and incorporate local knowledge into the assessment process. This ensured that the categorisation outcomes reflect both technical analysis and on-ground experience.
- Finally, the levees and floodplain features were assessed using advanced GIS tools to analyse the available Light Detection and Ranging (LiDAR), Digital Elevation Models (DEM) and flood study data. This detailed assessment provided insights into the effectiveness and resilience of the identified levees in mitigating floods.

While the desktop-based strategic levee categorisation process offers a cost-effective and efficient method for initial assessments, it inherently comes with several limitations. These limitations stem primarily from the nature and quality of the available data and the constraints of remote analysis, which can impact the overall reliability and accuracy of the categorisation outcomes.

An ArcGIS layer that meets Spatial Data Specification (SDS) requirements, enabling future categorisation and review, has been prepared to accompany this report. This information will be used to support further review and discussion among project stakeholders as the next steps in the levee categorisation process unfold.

This report has been updated to reflect reporting requirements provided by DEECA, ensuring consistency in reporting across all Catchment Management Authorities and alignment with current emergency management and floodplain planning frameworks.

2 BACKGROUND INFORMATION

Levee categorisation relied on a comprehensive collection of data sources and local insights. Critical to this effort was the relevant data and local knowledge provided by CMAs, LGAs, and VICSES. Their understanding of the landscape and experience with past flood events ensured that the identification of levees and floodplain features was grounded in both technical data and practical, on-the-ground knowledge.

Flood studies and the Victorian Spatial Data Specification for flood data provided a standardised framework for mapping and assessing levee structures, ensuring that the data conformed to recognised specifications for flood planning and response across the state. Key GIS datasets acquired to support the assessment of individual levees are outlined in Table 1 below.

The Municipal Floodplain Emergency Plans (MFEPs) offered specific insights into the flood response strategies already in place, allowing alignment of the levee assessment with existing emergency plans, while helping identify areas where these plans could be strengthened with additional levee intelligence.

Known incident responses from recent flood events, including those in 2010, 2011, 2012, 2016 and 2022, were also reviewed which provided historical context for flood behaviour and levee performance. These records offered valuable insights into the specific challenges and effectiveness of previous mitigation efforts, highlighting which levee structures or floodplain features had effectively impeded floodwaters in strategic locations and which areas required further attention or improvement.

Aerial flood photography, including imagery from Sentinel Satellite, VICSES event photos, and CMA flood records, allowed the identification of floodplain features and observation of the influence of levees on floodwaters during actual flood events. This imagery was crucial for verifying and refining the location and role of floodplain features identified during data analysis, helping to clarify areas where floodwaters were directed or restrained by natural and artificial levees.

Finally, available LiDAR and other topographical data served as the foundation for the detailed Digital Elevation Models (DEMs) used to map and assess levee features. This high-resolution elevation data enabled visualisation of terrain features with greater accuracy, allowing for measurement and analysis of levee dimensions, such as crown height and width, and to assess each feature's effectiveness and resilience in flood mitigation. Together, these resources ensured a robust and well-informed approach to categorising levees and floodplain features across the study area.

A full description of the GIS methodology is provided in Appendix 1.

SIGNIFICANT FLOODPLAIN FEATURES

A topographic feature was deemed a significant floodplain feature when it satisfied the following criteria:

- The feature is an artificial structure (typically a road, railway or channel).
- The feature appears to impact the extent of flooding in the 2022 event. A combination of the observed 2022 Flood Extent layer and the 2022 Sentinel-2 satellite imagery was used to determine this.
- Where available, the digital elevation model indicates that there is a clear topographic barrier.

TABLE 1. GIS SOURCE DATA

DATASET NAME	DESCRIPTION	SOURCE
Levee datasets		
Levee Categorisation Layer	The consolidated levee alignment dataset that will be used to categorise, add and assess all levees within the project areas.	Tetra Tech Coffey (consolidated from various other data sources)
Rural Levee Layer (2017)	Levee alignments assessed in 2017.	MCMA
Robinvale Levee Layer	Surveyed alignment for the Robinvale town levee, assessed in 2022 by the Swan Hill Rural City Council	MCMA
CMA Levee Layer	North Central CMA levee alignment dataset	NCCMA
VFD Original Levee Layer	Victorian Flood Database original levee alignments.	MCMA
PM Survey Levee Layer	Levees near Mildura, extracted from survey CAD datasets.	MCMA
Southern Mallee Surveys Layer	Levee alignments assessed during the Southern Mallee levee surveys in 2023	MCMA
Reference datasets		
Project AOI	Key project boundaries (Mildura Rural City, Swan Hill Rural City and Buloke Shire)	MCMA
DEM (1m and 5m)	Digital elevation model (1 meter resolution)	DFSI NSW
Planning Overlay	Planning overlay classification, including land subject to inundation and floodways).	Vicmap
Planning Zone	Planning zone boundaries (urban floodway zones).	Vicmap
Railway	Road alignments and names.	Vicmap
Cadastre	Cadastral boundaries.	Vicmap
Emap Water Images (2022)	Photos and locations from Emap surveys in 2022.	MCMA
Southern Mallee Survey Images	Photos and locations from Southern Mallee levee surveys in 2023	MCMA
Observed 2022 Flood Extent	Estimated inundation extent from the 2022 flood event.	Emergency Management Victoria
Sentinel-2 Imagery (05.12.2022)	Sentinel-2 satellite imagery captured during the 2022 flood event.	European Space Agency
Sentinel-2 Imagery (15.11.2016)	Sentinel-2 satellite imagery captured during the 2016 flood event.	European Space Agency
Levee datasets		

3 PRELIMINARY CATEGORISATION PROCESS

The preliminary categorisation of levees will guide strategic decision-making in the next phases by establishing clear criteria to support the prioritisation of levee maintenance and emergency actions based on potential risk and resource availability. This categorisation process is grounded in the following key considerations of which will inform the development of a robust levee management and response framework.

1. **VICSES Operational Criteria**: The categorisation of levees will incorporate VICSES criteria, specifically their authority to direct emergency actions under the VICSES Act 2005 or the Emergency Management Act 2013. In events where the Regional Agency Commander (RAC) has declared a major flood imminent, prioritisation will focus on levees that serve to protect lives, critical infrastructure, public assets, and property. Category 2 levees, which play a significant role in safeguarding vital infrastructure and supporting life safety, will receive primary consideration given that Category 1 levees are in place with clear management responsibilities defined.

2. **Legal Context for Emergency Actions**: Since emergency levee operations involve complex legal considerations, legal counsel will play a pivotal role in confirming the permissibility of actions under emergency conditions, such as levee reinforcement or modification. This legal guidance will ensure that all actions planned for Category 2 levees, adhere to regulatory standards while maximizing effective flood response.

3. **Flood Scale and Magnitude Impact**: The geographic extent and magnitude of potential flood events are crucial in determining the practicality of emergency levee actions. For example, a localised flood event might allow for concentrated resources on a small number of high-priority levees, while a regional or statewide flood could strain resources and necessitate a more selective response. For less frequent, large-magnitude flood events (e.g., with a 1 in 100 Annual Exceedance Probability), the scope of necessary emergency works might exceed available resources, requiring a focused strategy on the most critical levees to manage plant, time, and budget limitations effectively.

With the above key considerations in mind, a comprehensive categorisation approach was developed to incorporate Safety, Environmental and Economic impacts and considered the consequences of the flood inundation area. The levee categorisation approach considers:

- Responder safety
- Community safety
- The protection of key infrastructure
- Potential private residential loss
- Economic consequences
- Environmental impact (including biodiversity and wetland protection)
- Preservation of cultural heritage

The approach involved classifying levees based on their existing categories in current documents. If a levee was assessed as strategic but wasn't documented (and therefore not classified as Category 1 or 2), it was flagged for further review and possible re-evaluation. Table 2 below outlines the levee categories and their respective definitions. These categories and definitions were used to define the categorisation of each levee.

TABLE 2. LEVEE CATEGORIES

TYPE OF LEVEE	DESCRIPTION
Category 1	Defined as those levees that are formally managed whereby the operation and maintenance are in place that protect urban centres or defined areas.
Category 2	Defined as those levees that are not managed but provide flood protection to urban type centres, or rural areas where it meets the investment criteria outlined in the Victorian Floodplain Management Strategy (DELWP, 2016), and where it meets the VICSES threshold to act under the VICSES Act 2005 Section 32AC. Noting this will be further defined in the active VICSES project 'Flood Emergency Works – Principles and Policy Refresh'.
Category 2- Type A	Levees do not require significant work ahead of a major flood and may require active periodic monitoring.
Category 2- Type B	Levees require significant work ahead of major floods, or levees which have known issues (weaknesses) from past floods. Active monitoring is required during the flood event.
Category 2- Type C	Locality identified for a temporary levee ahead of a major flood and is removed post-flood
Category 3	Defined as strategic levees that provides unverified levels of flood protection to rural floodplain areas.
Private Levees	Levees which have been built by individuals solely for the protection of their own property and assets. These levees to do not protect public infrastructure or assets. Examples include ring levees around homes and property. Note, Private levees (where known) should be documented (not categorised) but identified as Private Levees.
Significant Floodplain Features	Features in the floodplain, which are not levees, but will have a significant impact on flow patterns during major floods that would result in significant changes in flood behaviour (i.e., elevated roads, irrigation channels, railway embankments, and the like). Such features were to fail or overtop may cause downstream impacts or cause the flood to move in unexpected directions

Table 3 & 4 outline the consequence metrics used to determine the total levee score which in turn can be used to Categorise the levee.

With seven metrics being considered the total possible score is 35 however not all metrics will be applicable to all levees i.e. If a levee is specifically designed to protect a piece of key public infrastructure it will not need to be assessed against private residential loss.

Thus, the total levee score is calculated as a percentage of the total possible score after removal of any metrics that are not applicable for any given levee.

In order to categorise a levee based on it's overall consequence score the following ranges have been adopted in consultation with the CMA using worked examples.

TABLE 3. LEVEE CATEGORY VS CONSEQUENCE SCORE

LEVEE CATEGORY	SCORE
Category 1	> 60%
Category 2	> 35% and ≤ 60%
Category 3	≤ 35%

TABLE 4. LEVEE CATEGORISATION CONSEQUENCE MATRIX

IMPACT	CONSEQUENCE CATEGORY	EXAMPLES OF SUPPORTING EVIDENCE		GUIDING METRIC DESCRIPTORS				
				VERY LOW	LOW	AVERAGE	HIGH	VERY HIGH
				1	2	3	4	5
Safety	Responder Safety	ARR Book 6 - Flood Hydraulics, Section 7.2.7 - General Flood Hazard Curves (Figure 6.9.7) - depth for a flow velocity of 1.0 m/s		Levee height ≤ 0.25m	0.25m < Levee Height ≤ 0.5m	0.5m < Levee Height ≤ 1.0m	1.0m < Levee Height ≤ 4.0m	Levee Height > 4.0m
	Community Safety	Major evacuation route		More than three major evacuation routes are available to enable community evacuation to closest unaffected town	Three evacuation routes are available to enable community evacuation to closest unaffected town	Two major evacuation routes are available to enable community evacuation to closest unaffected town	One major evacuation route is available to enable community evacuation to closest unaffected town	All major evacuation routes are blocked preventing community evacuation to closest unaffected town
Economic	Key Infrastructure	The maximum of either duration or number of customers affected		Inconsequential short term failure of infrastructure and service delivery	Isolated loss of infrastructure for short periods resulting in localised inconvenience	Mid-term failure of infrastructure affecting some parts of community	Mid to long term failure of significant infrastructure affecting large parts of community	Long term failure of significant infrastructure such as one of the identified sub-category
		Services (Power, Communications, Water/Waste Water)	Duration of infrastructure failure	≤ 2 hrs	2 - 12 hrs	12 – 24 hrs	24 – 48 hrs	> 48 hrs
			Number of customers affected	≤ 100 people	100 – 200 people	200 – 1,000 people	1,000 – 5,000 people	> 5,000 people

IMPACT	CONSEQUENCE CATEGORY	EXAMPLES OF SUPPORTING EVIDENCE	GUIDING METRIC DESCRIPTORS				
			VERY LOW	LOW	AVERAGE	HIGH	VERY HIGH
			1	2	3	4	5
	Private residential loss	Commercial buildings or dwellings protected by the levee	5 or less homes rendered temporarily uninhabitable	5 or less flooded over floor	6-20 flooded over floor	21-50 flooded over floor	>50 flooded over floor
	Economic Impact	Disruption to businesses impacting on Business operations and overall economy.	Disruption at the individual business level	Disruption at a business level impacting on the local economy	Disruption to selected business sectors impacting on the regional economy.	Significant disruption across business sectors impacting on State economy.	Widespread business failure impacting on National economy.
Environmental	Environmental Impact (Biodiversity, Wetland Protection)	Levees preventing floodwater entering and washing away wetland biodiversity.	Isolated cases of environmental impact, but no recovery action required	Isolated cases of environmental impact requiring a once off recovery effort	Isolated but significant impairment of ecological function	Severe impairment of ecosystem function affecting many species or landscapes	Widespread irrecoverable loss of ecosystem function across species and landscapes
	Cultural Heritage	Management of levee during a flood operation poses risk to cultural heritage	Limited damage to sites of local significance	Extensive damage to sites of local significance	Limited damage to sites of regional significance	Extensive damage to sites of Regional significance	Extensive damage to sites of State Significance

This systematic categorisation helps to identify and prioritise future resource and management requirements, enhancing the readiness of flood-prone areas to withstand varied flood conditions across northern Victoria.

4 LIMITATIONS

While the desktop-based strategic levee categorisation process offers a cost-effective and efficient method for initial assessments, it inherently comes with several limitations. These limitations stem primarily from the nature and quality of the available data and the constraints of remote analysis, which can impact the overall reliability and accuracy of the categorisation outcomes. Some of these challenges were partially overcome through stakeholder engagement, as local knowledge and identification of new information sources were incorporated into the review process.

Key limitations for this report include:

Accuracy of Existing Data

The accuracy of any desktop assessment is dependent on the quality of existing datasets, which may vary in precision and completeness. Outdated or erroneous data can lead to misclassification or incorrect mapping of levees, particularly in regions where updates to datasets have not been systematically performed.

Where multiple data sources were available, the review team were able to use cross referencing to validate levee locations. However, in some cases the available data is not sufficient for the purpose of identifying all errors in the source data.

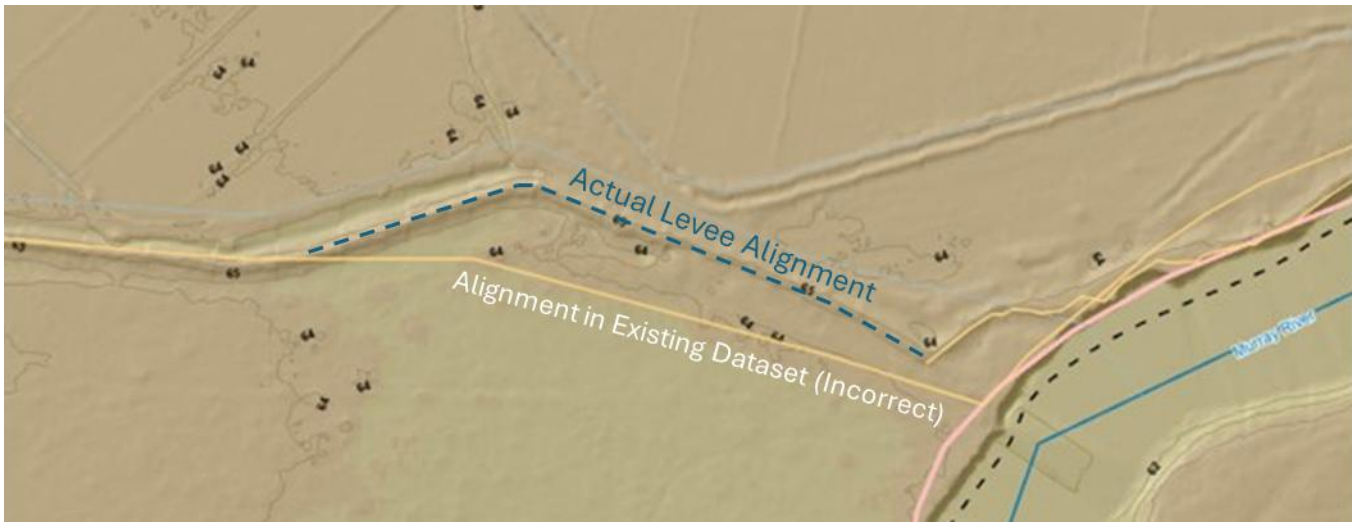


FIGURE 1. EXAMPLE OF MISALIGNMENT IN AN EXISTING DATASET

Extent of Key GIS Layers

The level of confidence in the assessment of levee categories relies on the availability of key GIS layers at the location of the levee. For example, the location and extent of levees within the area mapped with a Digital Elevation Model (DEM) at 1 metre increments are able to be clearly identified, however 27% of the identified levees are not within the area where this data set is available. Other key GIS layers that are not available for the whole region include: flood modelling, observed flood extent and aerial photography.

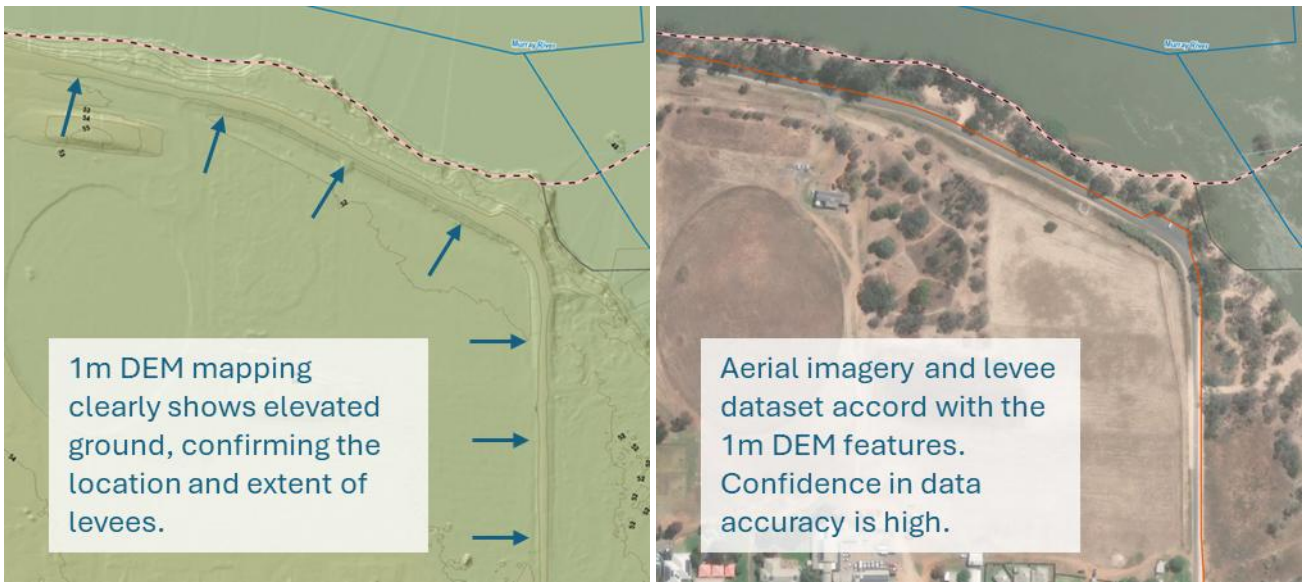


FIGURE 2. EXAMPLE OF CLEARLY DEFINED LEVEE USING 1M DEM (ROBINVALE LEVEE)

Quality and Timing of Aerial Imagery

The effectiveness of desktop-based assessments relies heavily on the quality of aerial imagery. Low-resolution or outdated imagery can hinder the ability to identify levee features, assess conditions, or detect recent changes. Furthermore, the quality of imagery may vary across different regions, impacting the consistency of the assessment.

Availability of Levee Height Information

A significant limitation is the availability and accuracy of levee height data. Levee height plays an important role in consequence assessments related to responder safety. However, precise height measurements are missing from the source datasets for most of the levees evaluated. In some cases, approximate levee heights can be inferred from contour lines in the 1m DEM layer. Overall, though, the lack of reliable height information means that most levees are assigned an average height status by default.

Availability of Levee Ownership Status

Ownership information for levees is not readily available for many of the levees included in this assessment. The absence of definitive ownership data complicates the identification of responsible parties for maintenance and can hinder strategic planning and decision-making. In particular, levees that are privately owned and maintained are not assigned as category 1,2 or 3, and instead would be flagged as 'private.'

For the purpose of completing this assessment without a comprehensive list of levee ownership, all levees identified were assigned a category unless there was clear evidence that the levee is exclusively used as a private asset.

Availability of Building Floor Elevation Data

Under the private residential loss criterion, the impact rating is based on the number of buildings where floodwater is likely to rise above the floor level. Detailed floor elevation data for dwellings is often scarce or inconsistent. Without a comprehensive data source for floor elevations, this assessment conservatively assumes that buildings within an area protected by a levee will be impacted.

Note: This assumption likely overstates the number of dwellings affected, particularly given that building approval requirements in recent decades have mandated that new homes be constructed with floors above historic flood levels.

Flood Path Modelling/Observations

Desktop assessments often rely on simplified flood models or historical observations, which may not fully capture the complexity of real-world flood behaviour. Limited access to detailed hydraulic modelling or field observations can result in less accurate assessments of flood pathways, overtopping risks, and potential levee failures.

Levee Maintenance Status

Category 2 subcategories A and B are assigned based on the levees' condition and maintenance requirements. However, existing documents and datasets provide limited information on the maintenance status of each levee. Additionally, emergency repairs during the 2022 flood event, as well as subsequent flood damage, have likely altered the condition of some levees in this category.

To assist in validating the assumptions made we undertook a series of engagements with Local Government, VicSES, CMA's and the local community. Stakeholder engagement improved the accuracy of Type A and B assignments by incorporating local knowledge and better identifying future maintenance needs. The outcomes from these stakeholder engagement activities can be found in sections 8 and 9.

5 CATEGORISATION RESULTS / FINDINGS

Using the process outlined in Section 3, an initial desktop review resulted in a preliminary category assignment for each levee. Levees previously identified in a MFEP as a high priority levee retained their Category 1 status. Private levees and Significant Floodplain Features did not need to be tested against the criteria. As such, the review process was mostly focused on determining whether the remaining levees met the criteria for Categories 2 and 3.

In the initial levee assessment, levees were examined in the GIS mapping system to identify whether dwellings, commercial buildings, or key community infrastructure were present in the potential impact zone in the event of a levee failure. For most levees, these elements were either absent or insufficient to meet the threshold for a rating above 'very low' in the relevant criteria. In such cases, where no pathway existed for assigning a category higher than 3, the levees did not undergo a full assessment against all criteria.

Levees with the potential for a classification of Categories 1 or 2 were then flagged for a more detailed assessment in consultation with CMA representatives prior to engagement with other stakeholders.

An overview of the category assignment process is shown in Figure 3.

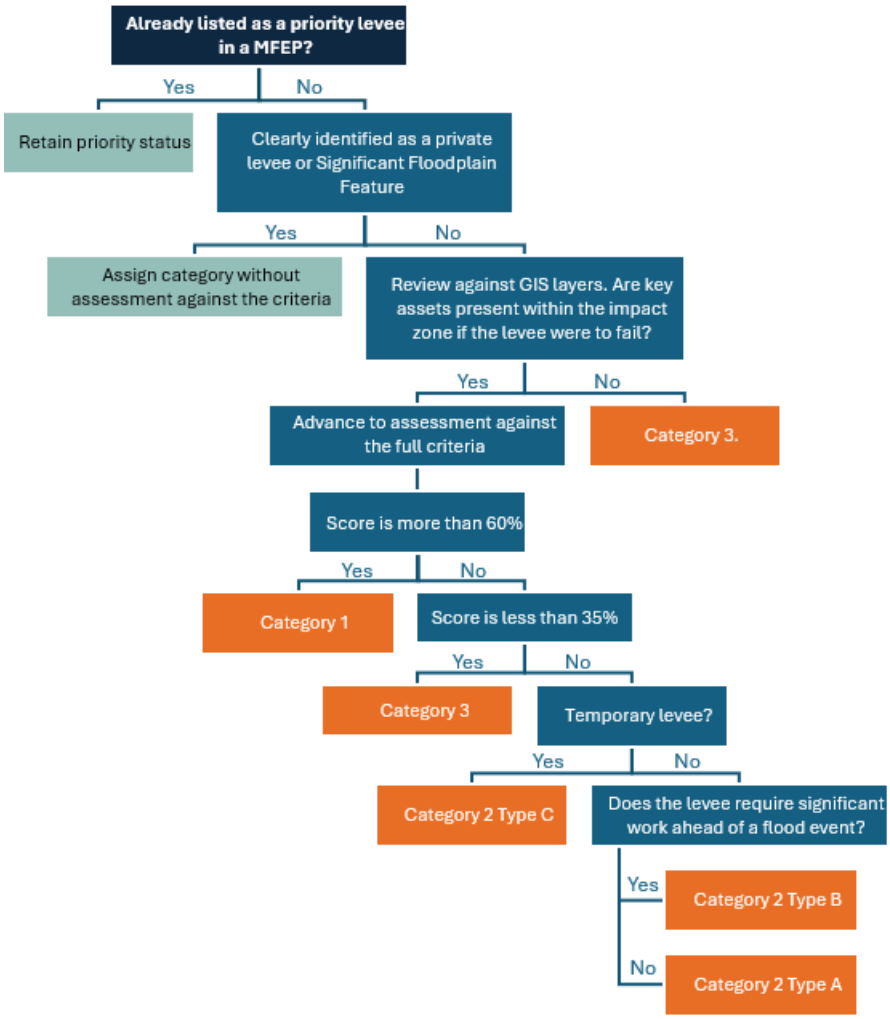


FIGURE 3. LEVEE CATEGORISATION WORKFLOW

Further refinement of the levee assignments took place in response to feedback through the engagement phase. In total, **358 km** out of **395 km** of identified levees were classified as **Category 3**, **Private**, or **Significant Floodplain**

Features. The remaining **37 km** (9% of the mapped levees) received a classification of **Category 1 or 2**. Figures 4 and 5 show a breakdown of levee category assignments.

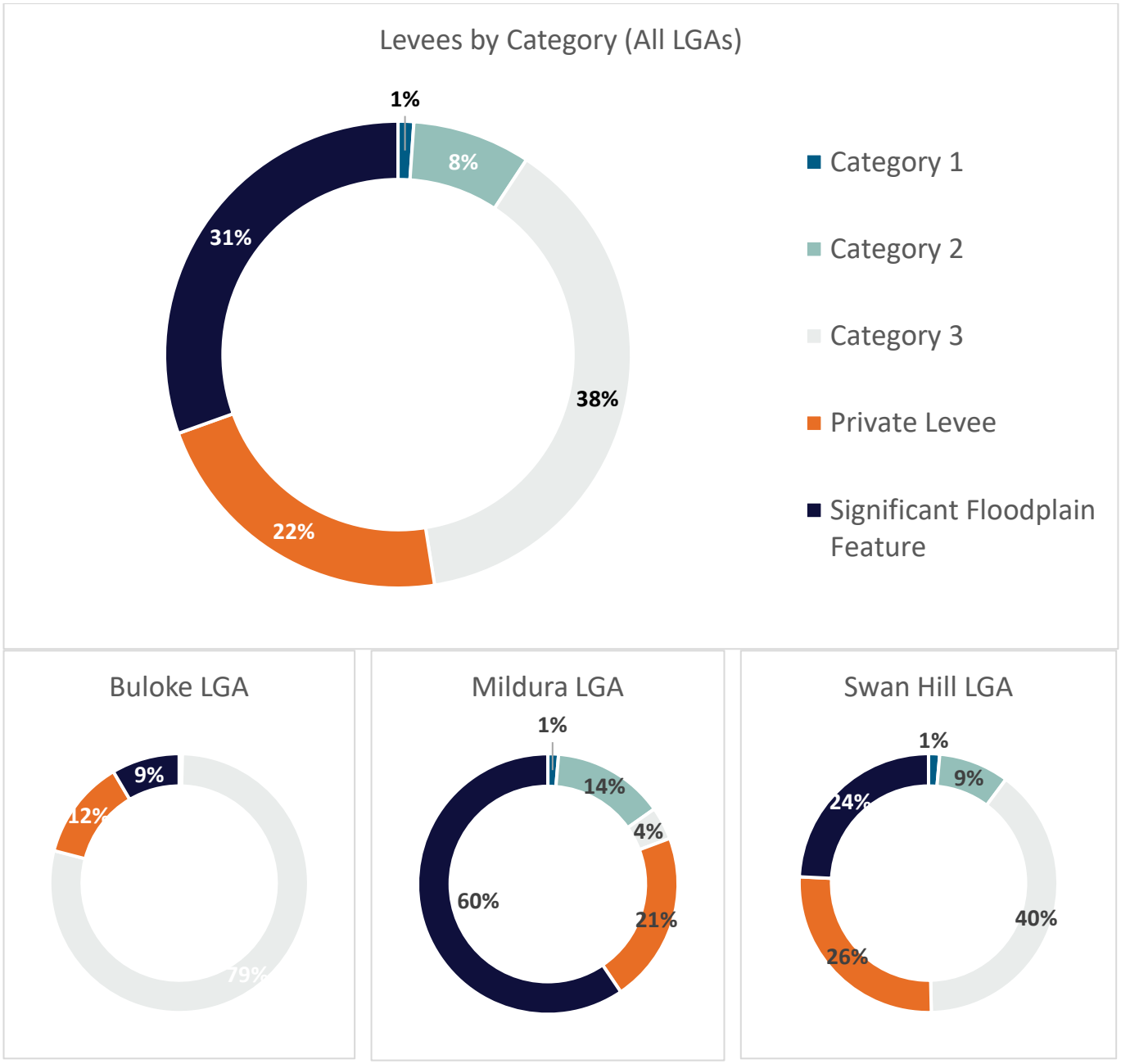


FIGURE 4. LEVEES CATEGORIES (% OF TOTAL LENGTH)

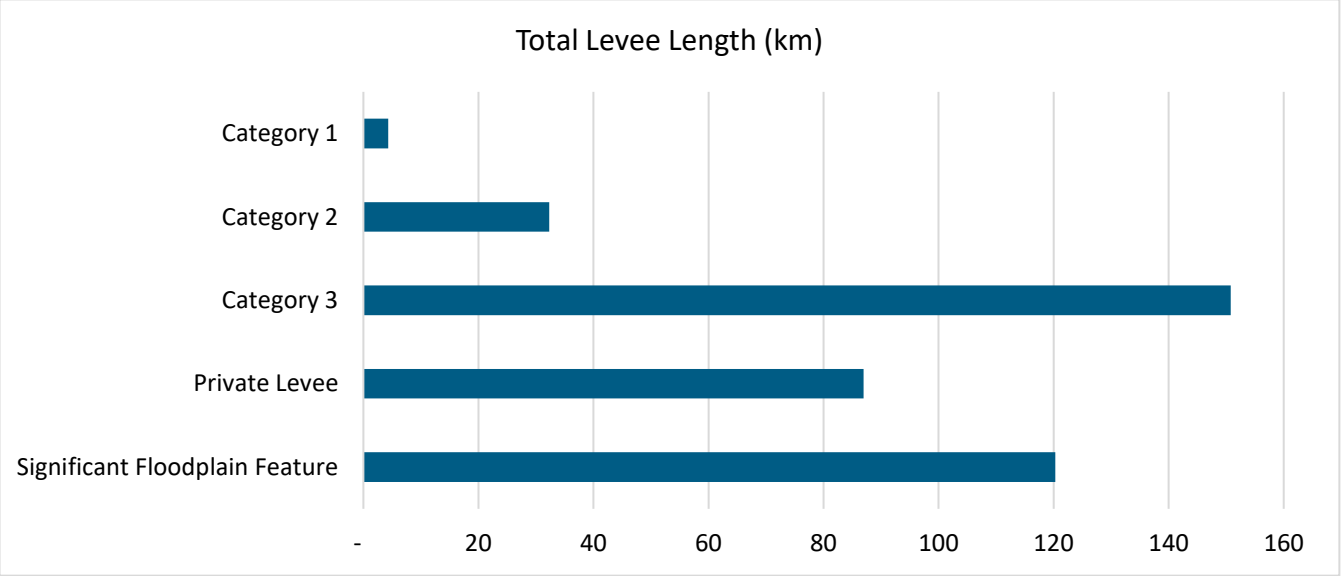


FIGURE 5. TOTAL LEVEE LENGTH (KM)

6 ANALYSIS, MAPPING AND DATA INSIGHTS

The spatial analysis and mapping undertaken as part of this project provides important insights into the distribution, function, and relative importance of levees across the Mallee CMA region. As stated above in Section 5, the assessment identified a total of approximately 395 km of levees and floodplain features. Of this, the majority (approximately 91%) were classified as Category 3, Private Levees, or Significant Floodplain Features. The remaining 9% were identified as Category 1 or Category 2 levees, representing those assets with the greatest strategic importance in terms of community safety, infrastructure protection, and emergency response.

Spatial analysis indicates that:

- Category 1 levees are limited in number and are generally associated with critical infrastructure or urban protection systems.
- Category 2 levees are more widely distributed and often provide protection to smaller communities or key rural assets but lack formal management arrangements.
- Category 3 and Private levees dominate the rural floodplain and are often fragmented, informal, or constructed for localised benefit.
- Significant Floodplain Features, such as roads, railways, and channels, play an important role in influencing flood behaviour and can have unintended consequences during flood events.

Mapping outputs also highlighted several key trends:

- Unmanaged or informal levees are concentrated in rural areas, particularly where historical flood response actions have occurred.
- There are gaps in available high-resolution data (e.g. LiDAR coverage), which reduces confidence in some levee assessments.
- Local knowledge has a high importance in validating levee alignments and function, particularly where physical evidence is limited.

These insights reinforce the need for a coordinated and consistent approach to levee management, improved data collection, and ongoing collaboration between agencies and communities to support flood preparedness and response.

7 GIS MAPS/ LAYERS

Maps were utilised in reviews with VICSES, the LGAs and subsequently through the community engagement process. The maps helped to ensure additional information was gathered and important details could be captured. These maps provided support to the online GIS portal which allowed for comments directly within, providing users with the opportunity to write their comments onto hard copy maps ensuring our levee information is as accurate as possible.

The maps utilised at the LGA and VICSES review workshops were taken at a higher level to reflect the template and typical output that can be produced from the GIS platform. Some example maps from these workshops have been included below. The maps produced for the community engagement sessions focused on target areas and zoomed into smaller sections for a more detailed review. These maps also merged private and Category 3 levees to ensure the focus of these sessions was directed to the significant and critical levees. The maps produced and utilised in the community engagement have been included in Appendix 3.

Figure 6 illustrates how levee categorisations were refined through the engagement process. Initial categorisation identified several levees in the Mildura area as Category 1 (as shown on the map); however, consultation with Mildura Rural City Council confirmed that these levees are not subject to active management. As a result, their categorisation was revised to reflect their current management status.

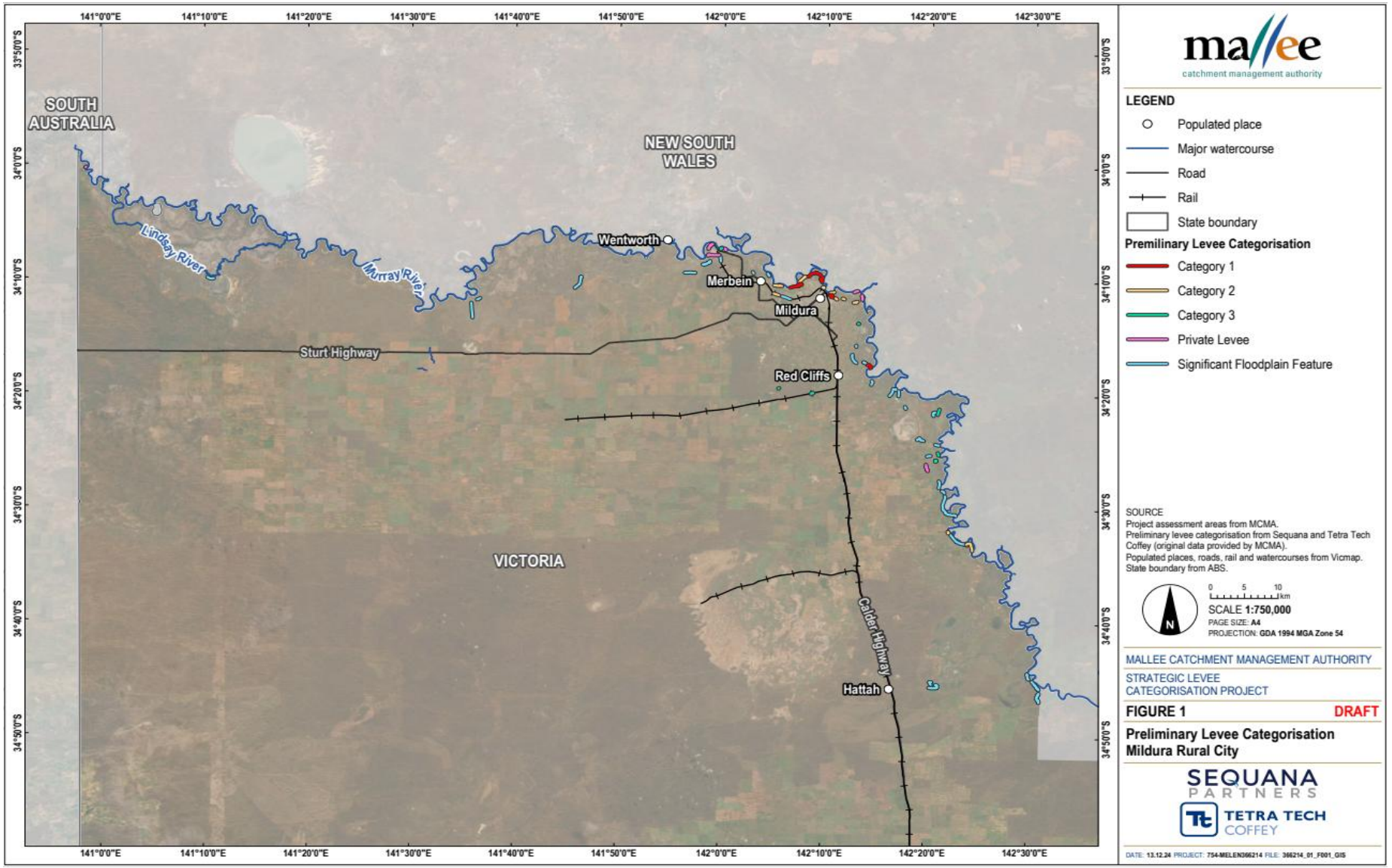


FIGURE 6. MILDURA LGA WORKSHOP EXAMPLE MAP

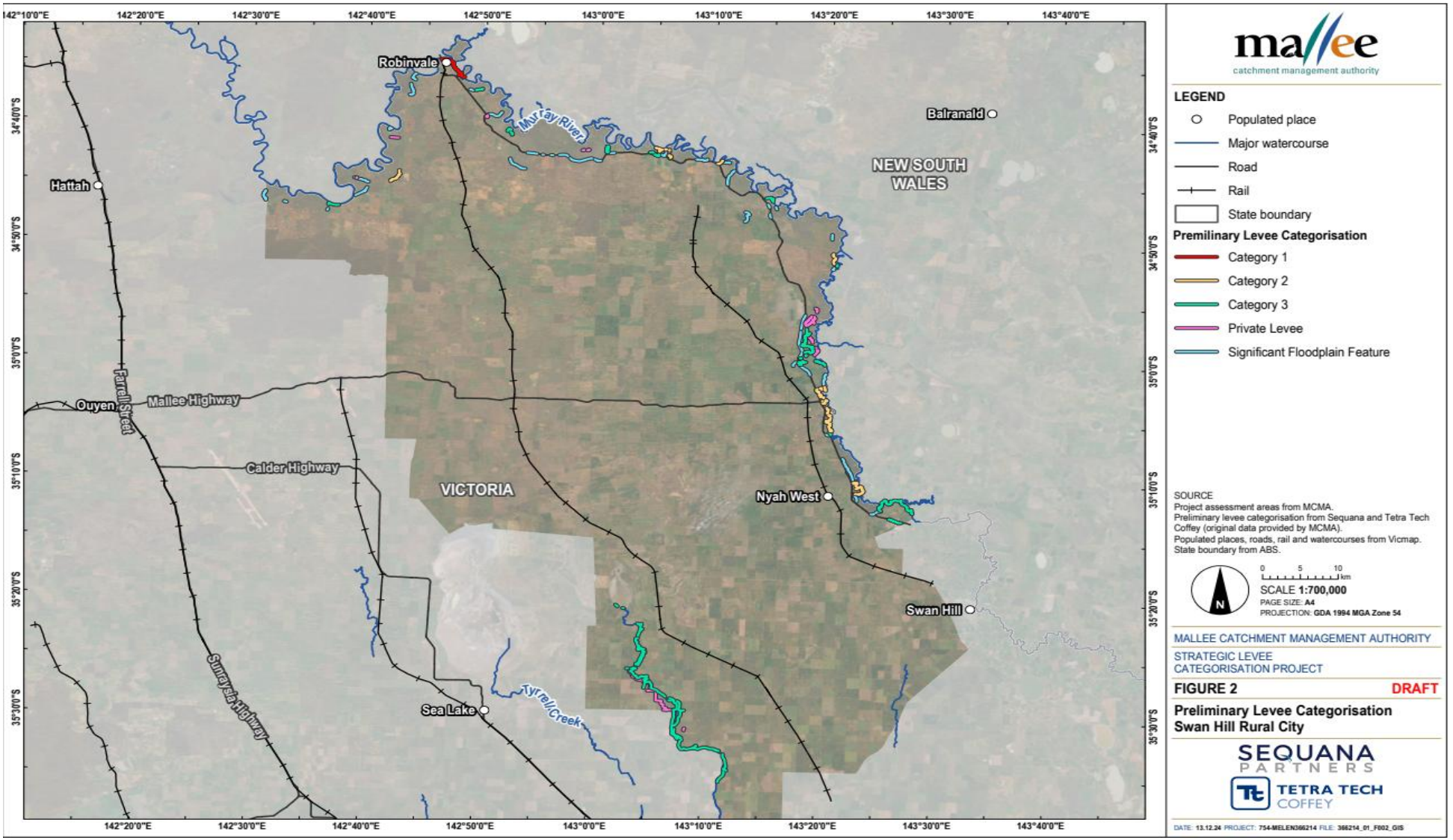


FIGURE 7. SWAN HILL LGA WORKSHOP EXAMPLE MAP

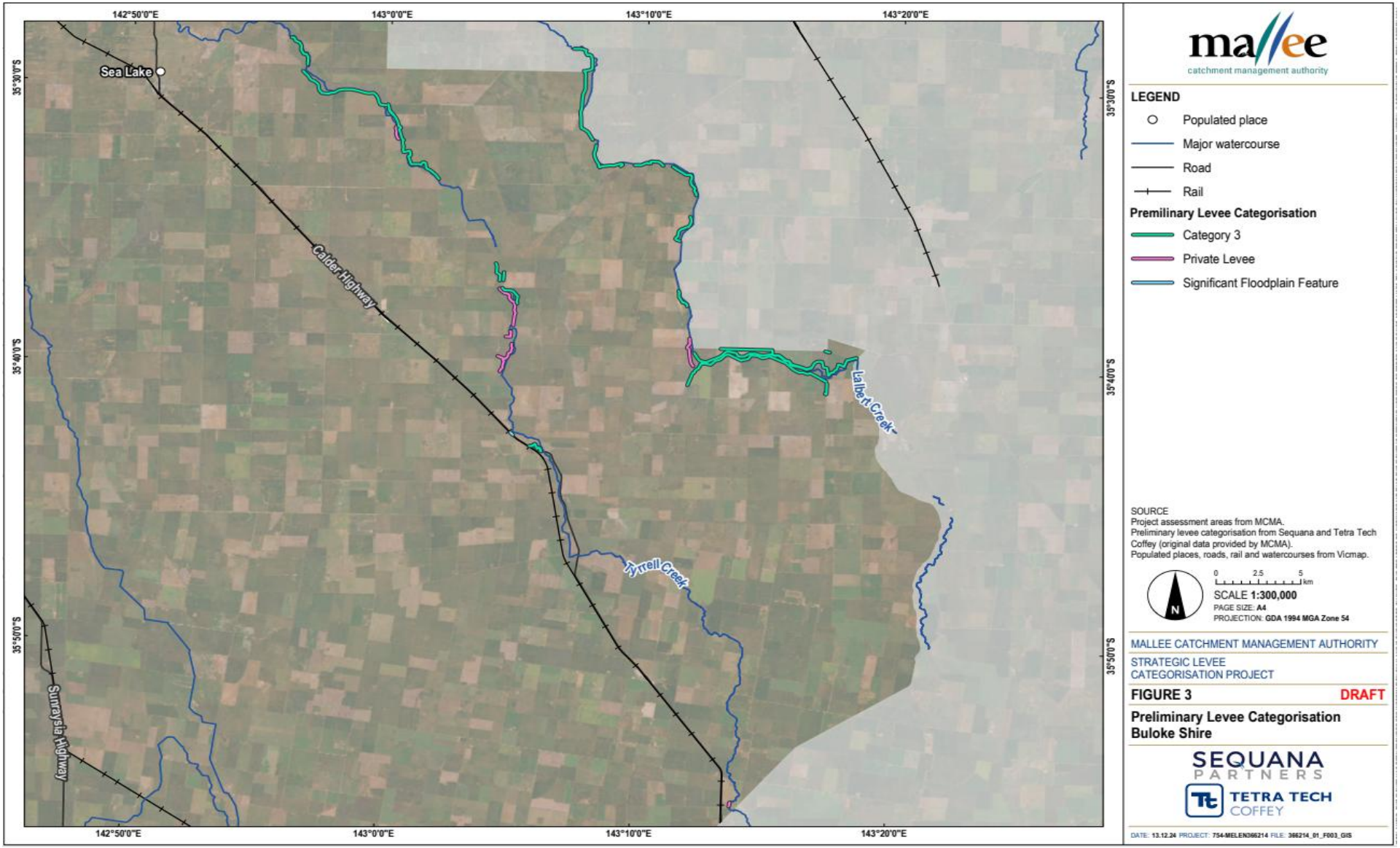


FIGURE 8. BULOKE SHIRE LGA WORKSHOP EXAMPLE MAP

8 LEVEE CATEGORISATION REVIEW WORKSHOPS- LOCAL GOVERNMENT AGENCIES

The purpose of the LGA workshops was to review the preliminary Levee Categorisation with the CMAs, VICSES and the LGAs. The workshops provided the opportunity to update the WebGIS data and refine the categorisation of individual levees based on local knowledge and ground-truthing.

The workshops were held with the following key stakeholders:

- **Mildura Levee review workshop:**
  18/02/2025, MCMA, Mildura LGA, VicSES, Lower Murray Water & Sequana
- **AusNet Red Cliffs Power Station workshop:**
  20/02/2025, MCMA, AusNet & Sequana
- **Buloke Levee review workshop:**
  25/02/2025, MCMA, NCCMA, DEECA, Buloke LGA, VicSES & Sequana
- **Swan Hill Levee review workshop:**
  26/02/2025, MCMA, NCCMA, DEECA, Swan Hill LGA, VicSES, Lower Murray Water & Sequana

Appendix 2 details the updates made to alignments, ownership status, category assignments and previously unmapped levees following the LGA sessions.

9 COMMUNITY ENGAGEMENT

As part of the Mallee Levee Review, community engagement played a key role in verifying mapped information, building local awareness, and identifying any additional flood mitigation infrastructure or concerns. A series of public drop-in sessions were held across the region to provide opportunities for local residents to view draft levee maps, ask questions, and provide feedback.

9.1 COMMUNITY DROP-IN SESSIONS

Drop-in session locations were selected by Mallee CMA in consultation with local government representatives. Sites were prioritised based on their proximity to levee systems where local interest was expected to be highest. Rather than simply targeting larger population centres, the team focused on areas where informal or lesser-known levees were present and community insight would be most valuable.

Drop-in session locations were selected by Mallee CMA in consultation with local government representatives. Sites were prioritised based on their proximity to levee systems where local interest and past community advocacy for improved management had been noted—particularly in areas without formal levee management arrangements already in place. Rather than simply targeting larger population centres, the team focused on locations where discussions were more likely to lead to meaningful input relevant to the review.

While holding events in larger towns with formal levee management may have drawn more casual foot traffic, it was considered unlikely to result in meaningful input specific to the review. More likely, staff would have spent much of their time fielding general service enquiries outside the scope of the project.

The following community drop-in sessions were conducted:

- **Nichols Point** – 5 May 2025, Nichols Point General Store
- **Mildura** – 5 May 2025, Old Aerodrome Oval Sports Complex
- **Robinvale** – 23 May 2025, Marciano's Cafe Plus
- **Boundary Bend** - 23 May 2025, Riverbend Cafe
- **Culgoa** – 19 June 2025, Mallee Bunker Cafe
- **Nullawil** – 19 June 2025, Nullawil Recreation Reserve
- **Berriwillock** – 20 June 2025, Berriwillock Community Centre
- **Sea Lake** – 20 June 2025, Sea Lake Community Complex

Representatives from Mallee CMA, local councils, water authorities and levee review consultants were present at sessions to support discussions and respond to questions. These sessions were promoted through local council channels and Mallee CMA communications.

9.2 OVERVIEW OF COMMUNITY FEEDBACK

Overall, community members showed interest in reviewing the maps and understanding which levees had been identified near their properties. The sessions identified:

- General agreement with the location of the levees presented.
- General agreement with the preliminary classifications.

Most feedback focused on clarifying levee alignments or understanding how the mapped data might influence future flood preparedness and emergency planning.

Notable Exceptions

Exceptions to the general trend included:

- A signed petition from residents near the Karadoc Avenue levee, expressing a desire for the levee to be formally managed and advocating for a higher classification.

Out of Scope Enquiries

With council and CMA staff present, some attendees used the opportunity to raise issues that extended beyond the scope of the levee review. These included:

- Questions regarding planning and development requirements in flood-prone areas.
- Enquiries about the legality of levees constructed near certain properties, and requests for direction on how to raise these matters with the appropriate authority.

While these matters were outside the scope of the current assessment, they were listened to and acknowledged. Where possible, attendees were provided with guidance on which agency or authority would be best placed to address their enquiries and how to progress the matter further.

9.3 CHANGES RESULTING FROM THE COMMUNITY SESSIONS

LEVEE ID	LEVEE NAME	ENGAGEMENT ACTION/ COMMENT
M-L0010	Karadoc Avenue, Nichols Point, Mildura LGA	Community petition and letter submitted requesting formal management of the levee. The submission included justification for an elevated status, and following review, the initial Category 2 classification was reinstated. Discussions during the drop-in session confirmed that sections of bank material had recently been

		removed to repair another nearby levee, and the levee was therefore assigned a **Category 2B**.
M-L0038	Newells Rd, Tyrell Creek, Buloke Shire LGA	Landowner advised no levee along this section and noted two different levee sections in this area

Beyond the specific levee-level changes identified, the community engagement process played a broader role in shaping the overall project outcomes. Feedback from community members helped to validate the general accuracy of the mapped levee network and preliminary classifications, while also reinforcing the importance of certain assets that may not have been fully captured through desktop analysis alone. The engagement process highlighted areas where community reliance on levees is higher than initially assumed, as well as locations where expectations regarding levee management differ from current governance arrangements. These insights informed refinements to the categorisation approach, improved confidence in the final dataset, and reinforced the need for clear communication regarding levee function, limitations, and responsibilities in future flood events.

9.4 ENGAGEMENT SUMMARY

The community engagement sessions provided an important checkpoint in the levee review process. They confirmed a general alignment between the mapped data and local knowledge, while also helping to surface a few specific issues requiring further attention. The feedback received will be used to help finalise levee classifications and inform future communication with residents.

10 REGIONAL EMERGENCY DOCTRINE (MFEP'S)

A key objective of the Strategic Levee Categorisation project is to support the integration of improved flood intelligence into regional emergency management frameworks, particularly Municipal Flood Emergency Plans (MFEPs).

Across the project area, MFEPs are at varying stages of update and refinement. The outcomes of this project are intended to inform these updates by providing:

- Improved spatial data on levee locations and understanding of levee importance priority
- Enhanced understanding of levee function and performance during flood events
- Identification of priority levees that require monitoring or intervention during flood events

A summary of MFEP status across the region is provided below:

LGA	MFEP STATUS	NOTES
Mildura Rural City Council	Levee Appendices Updated	Nil
Swan Hill Rural City Council	Levee Appendices Updated	The Mallee CMA region does not fully encompass this LGA. Additional MFEP updates required through the neighbouring CMAs corresponding project
Buloke Shire Council	Levee Appendices Updated	The Mallee CMA region does not fully encompass this LGA. Additional MFEP updates required through the neighbouring CMAs corresponding project

The integration of levee categorisation outputs into MFEPs supported the following outcomes:

- Clearer articulation of flood intelligence
- Ability to improve decision-making during emergency events
- Better alignment between agencies regarding levee roles and responsibilities

Updates to MFEP templates are currently being progressed by VICSES and local government will further support the consistent inclusion of levee data and categorisation outcomes.

11 CONCLUSION AND RECOMMENDATIONS

The Strategic Levee Review undertaken by the Mallee CMA followed a consistent and evidence-based approach to identify, categorise, and validate levees across the region. The review process drew on existing datasets, flood modelling, and 2022 satellite imagery, with levees assessed against defined criteria relating to safety, economic, environmental, infrastructure, and cultural factors.

Stakeholder and community engagement were central to the review. Agency workshops helped refine classifications and align findings with current emergency management practices. Community drop-in sessions allowed residents to view draft maps, clarify alignments, and raise local issues. While most community feedback affirmed the proposed categories, a small number of cases generated further discussion or requests for reclassification.

At a regional level, the review found that levees warranting formal management arrangements are largely recognised and integrated into existing Municipal Flood Emergency Plans (MFEPs). However, Category 2 and 3 levees, particularly those with a small beneficiary base, remain contentious. In the absence of clear oversight, these structures can create uncertainty during flood events about whether they will perform or be maintained.

Strategically, it is generally agreed that communal assets should be managed by relevant authorities, while levees offering private benefit fall to individual responsibility. Yet in practice, roles are not always clearly understood, and expectations can differ, highlighting the need for clearer communication, guidance, and coordination.

11.1 CATEGORY 1 LEVEE MANAGEMENT AND ACCOUNTABILITY

Category 1 levees represent those assets that are formally managed and are critical to the protection of communities, infrastructure, and essential services.

As part of this project, Category 1 levees have been identified and reviewed in consultation with the relevant stakeholders. These levees are generally associated with defined management arrangements, including maintenance and, where applicable, emergency response responsibilities.

A summary of Category 1 levees and their indicative management responsibilities is provided below:

LEVEE NAME	LOCATION	RESPONSIBLE AUTHORITY
Lower Murray Water Treatment Plant	Mildura LGA	Lower Murray Water (LMW)
LMW Irrigation and Urban Pump Station Levee	Mildura LGA	Lower Murray Water (LMW)
Robinvale Levee	Swan Hill LGA	Swan Hill Rural City Council
Robinvale Pumping Station	Swan Hill LGA	Lower Murray Water (LMW)

Note: The identification of Category 1 levees is based on available data, stakeholder input, and workshop outcomes. In several instances, levees that function as critical assets are not currently subject to formal management arrangements. These levees have been identified as potential Category 1 levees, subject to further investigation and confirmation of ownership, governance, and maintenance responsibilities.

Establishing clear accountability for Category 1 levees is critical to ensuring effective maintenance, preparedness, and response during flood events.

11.2 LEVEE OPPORTUNITIES AND ALIGNMENT WITH RFMS PRIORITIES

The project has identified a number of opportunities to improve flood risk management outcomes through targeted investment, improved governance, and enhanced community engagement.

These opportunities align with the objectives and principles of the Regional Floodplain Management Strategy (RFMS), particularly in relation to:

- Reducing flood risk to communities and infrastructure
- Supporting informed land use planning
- Improving emergency management capability
- Strengthening community resilience

Key opportunities identified include:

- Further investigation of Category 2 levees to determine suitability for formal management arrangements
- Targeted upgrades or formalisation of levees protecting critical infrastructure or population centres
- Improved data collection and asset management systems to support decision-making
- Enhanced engagement with communities to support shared understanding of levee function and limitations

Future community consultation will be an important component of progressing these opportunities, particularly in areas where levee classification or management status may change. Engagement will ensure that local knowledge continues to inform decision-making and that community expectations are appropriately managed.

These opportunities will inform future prioritisation under RFMS-aligned programs and funding streams.

11.3 POLICY CHALLENGES IDENTIFIED

The Strategic Levee Categorisation project has identified a number of policy and governance challenges that influence the management and effectiveness of levees across the region.

These key challenges include:

- Unclear Ownership and Responsibility-
  In many cases, levee ownership and management responsibility has not been clearly defined. This is particularly evident for rural levees and those constructed informally over time. The absence of clear accountability creates uncertainty during both maintenance and emergency response.
- Rural Levee Management-
  Levees in rural areas often provide benefits to multiple landholders or communities but do not fall under formal management arrangements. This creates challenges in determining who is responsible for maintenance, upgrades, and emergency actions.
- Funding Constraints-
  There is limited funding available for the ongoing maintenance and upgrade of levees, particularly those that do not meet current investment criteria. This can result in assets deteriorating over time, reducing their effectiveness during flood events.
- Inconsistent Data and Asset Records-
  The lack of a consistent, statewide levee database limits the ability to effectively manage levee assets and plan for future investment. Data gaps and inconsistencies also impact the reliability of assessments and decision-making.
- Community Expectations-
  Community expectations regarding levee performance and management do not always align with current governance arrangements. This can create challenges during flood events where assumptions are made about the level of protection provided.

These challenges highlight the need for continued collaboration between CMAs, DEECA, local government, and emergency services to improve policy clarity and support more effective levee management across the region.

11.4 NEXT STEPS/ ACTIONS

Updates to the MFEP documents are currently underway through VicSES and local government collaboration. The outcomes of this review should be incorporated into future MFEP updates, ensuring consistency in how levees are mapped and described. Continued collaboration between CMAs, councils, emergency services, and local communities will be key to ensuring effective, locally supported levee management into the future.

In response to the review's findings and the issues identified through stakeholder engagement, the following recommendations are proposed to guide future planning and investment:

Recommended Actions

The Mallee CMA Strategic Levee Review has identified a suite of actions to strengthen flood preparedness, governance, and asset management across the region. These recommendations integrate stakeholder feedback, community engagement outcomes, and further refinements developed through subsequent technical review.

1. **Adopt Final Levee Classifications**

The project has developed a consistent framework for levee categorisation across the region. It is recommended that these classifications be considered for adoption across relevant systems, including FloodZoom and Municipal Flood Emergency Plans (MFEPs), to support consistent interpretation of levee function and importance. Ongoing review and refinement of classifications should be anticipated as new data becomes available or conditions change.

2. **Investigate Category 2 Levees for Formal Management Arrangements**

The assessment has identified a number of Category 2 levees that provide protection to communities, infrastructure, or key assets but are not currently subject to formal management arrangements. Further investigation may be undertaken to better understand the feasibility, costs, and benefits associated with potential management options for these levees, particularly where they align with the investment principles of the Victorian Floodplain Management Strategy. Detailed precinct-level Flood Mitigation Plan (FMP) assessments are recommended for identified high-value levee systems. In multiple cases the Categorisation score outlines a Category 1 assessment score which subsequently suggest a greater potential consequence of failure, higher exposure of assets and/or stronger community reliance. These levees should therefore be treated as a higher priority for future investigation. Continue working with relevant LGAs and stakeholders to elevate the following levees (currently not under formal management) to become Category 1 levees and thus formally recognised and maintained:

- Mildura Brickworks
- Merbein Pumping Station
- Ranfurly Way
- Sewerage Lagoon & Lower Murray Water Treatment Plant
- Red Cliffs Power Station

3. **Targeted Field Surveys of Priority Levee Assets**

While this assessment has relied primarily on desktop analysis, there are opportunities to improve confidence in levee data through targeted field validation. This may be particularly valuable for levees where data gaps exist, where condition is uncertain, or where recent flood events may have altered asset performance.

4. **Develop a Regional Levee Asset Database**

The project has highlighted the value of maintaining consistent and up-to-date levee information. Opportunities exist to further develop and maintain a regional levee dataset that supports improved data sharing, ongoing updates, and alignment with state data standards. This may include capturing additional attributes such as ownership, condition, and maintenance status over time.

5. **Map Floor Levels in High-Risk Levee Areas**

A prioritised, layered approach is recommended for mapping building floor levels. Stage 1: continue desktop mapping of dwellings within Category 2 levee zones. Stage 2: undertake targeted on-ground floor-level surveys in high-risk localities. Priority should be given to areas behind unmanaged Category 2 levees. Integration into FloodZoom and MFEPs will enhance emergency response planning.

6. **Clarify Roles and Responsibilities for Low-Priority Levees**

A statewide communication product is recommended, developed collaboratively by CMAs and DEECA, to clarify levee ownership, maintenance responsibilities, and emergency management roles. This material should distinguish publicly managed levees from private or unregulated structures.

7. **Explore Permanent Levee Options for Frequently Reinstated Sites**

In some locations, temporary levees are repeatedly constructed during flood events. These locations may warrant further consideration to better understand whether alternative approaches could improve efficiency and reduce the need for repeated emergency works.

8. **Establish a Regular Review Cycle for Levee Classifications**

Given the dynamic nature of flood risk, land use, and infrastructure, it is recommended that levee classifications be subject to periodic review. This may occur on a defined cycle or following significant flood events to ensure that classifications remain current and reflective of on-ground conditions.

9. **Levee Data Enhancement**

A data field could be added in the regional levee asset database to identify whether a levee currently exists or historically existed. This supports improved record-keeping and aligns with community discussions referencing legacy levee structures.

10. **Road Resilience Coordination with DTP**

Collaborate with the Department of Transport and Planning (DTP) to identify flood-affected road sections and assess opportunities for road raising or drainage improvements to support faster recovery and reduced isolation during flood events.

11. **Levee Performance Information Sharing**

The project has reinforced the importance of collaboration between CMAs, local government, emergency services, and other stakeholders. Continued coordination may support improved consistency in data management, emergency response, and long-term planning related to levee systems.

Additionally, specific Levee recommendations have been included below which have been informed by the numerous review workshops conducted.

Levee Recommended Actions

- **M-L0011 Mildura Brickworks –** The importance was agreeable as this levee protects the ability to pump out stormwater however the levee is not shown in the optimal extent or location and is currently not in place. To be considered as a Category 1 levee.
- **M-L0012 Merbein Pumping Station**- The importance was agreeable as this levee protects an important asset however the levee is not formally managed. To be considered as a Category 1 levee.
- **M-L0064 Kentish Lane**- Advised to talk to the Road management authority regarding this levee to consider if the road could be raised and managed in lieu of a Levee.
- **M-L0065 Tooleybuc Rd-** Advised to talk to the Road management authority regarding this levee to consider if the road could be raised and managed in lieu of a Levee.
- **M-L0143 East Burra Creek-** Advised to talk to the Road management authority regarding this levee to consider if the road could be raised and managed in lieu of a Levee.

APPENDIX 1. GIS METHODOLOGY

The GIS methodology employed to create the GIS platform and levee layers is detailed in the attached document.

File Name: 754-MELEN366214-MCMA GIS Methodology for Strategic Levee Categorisation

APPENDIX 2. LGA WORKSHOP LEVEE EDITS

Mildura Local Government Area

Added Levees or Significant Floodplain Features

M-SFF104- Lake Cullulleraine regulator and channel



M-L0157 - Two additional private levees



M-L0158 – Additional private levee



M-L0159 – Additional private levee



M-L0160 – New Category 3 Levee



M-L0161 – Four new private levees, additional sections to M-L0095 and slight extension of M-L0011 to capture levee along front of properties



M-L0162 – New private levee



M-L0163 – New private levee



M-L0164 – New private levee



M-L0165 – New private levee



M-SFF104 – extension of floodplain feature here to capture raised road section



M-SFF123 - New floodplain feature added to capture channel here



M-L0166 – New Cat-3 levee added
Approximate alignment as no DEM coverage here and not clear in imagery.



M-L0012- Merbein Pump Station



Alter extent of Category 1 and add Category 3 Levee

M-SFF117- Ranfurly Way

Add Significant Floodplain features between Category 1 Levees to reflect the high ground

Before:



After:



M-L0047 – Updated alignment

Before:



After:

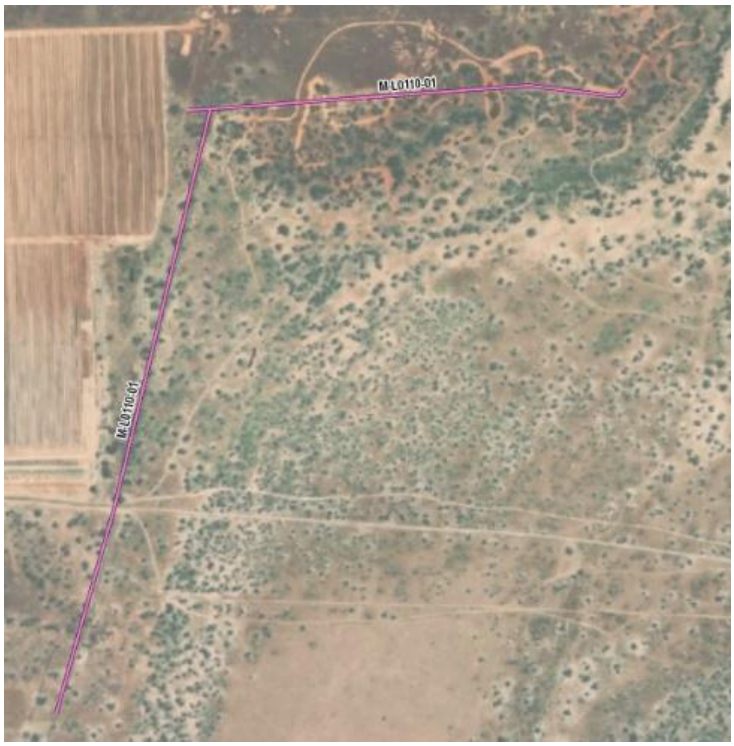


M-L0110 – Updated alignment

Before:



After:



M-L0022- Regina Avenue

Add Category 2- Type C (temporary levee) between Category 2 levees on Eleventh Street

After:



Edited Levee Alignment

M-L0019- Lake Hawthorn Railway Line Culvert &
M-SFF117- Lake Hawthorn Railway Line

Before:



After:



Reduce Cat 2 Levee to extent of culvert, extend Significant Floodplain Feature (railway)

M-L0013- LMW Treatment Plant & M-L0020- Mildura Homestead

Before:



After:



Reduce Levee extent, add additional temporary (type 2C) levees and Significant floodplain features.

Additional workshop actions that did not involve changing the alignment or adding additional Levees (and therefore were not captured in map screenshot) are listed the table below.

LEVEE ID	LEVEE NAME	WORKSHOP ACTION/ COMMENT
M-L0009	Sewerage Lagoon Levee & Mildura Homestead	Importance agreed, however the Levee is not formally managed currently. **Levee Changed to Cat 2**
M-L0010	Karadoc Avenue Nichols Point	Strong argument to suggest this levee should be Category 3, the resources required to manage this in a flood event do not equal the protection gained. **Levee changed to Cat 3** **NOTE:** Subsequent to the LGA workshop, a petition and letter demonstration community support for formal management of the levee was submitted. On review of the justifications provided, the Category 2 status was reinstated.
M-L0011	Mildura Brickworks (Etiwanda Wetlands)	The importance of the Levee was agreed however it was noted the extent and location is not optimal and the Levee is not currently in place. It was confirmed the Levee protects the ability to pump out stormwater. **Levee changed to Cat 2**
M-L0012	Merbein Pumping Station (Pump Hill)	LMW argued it's importance, could be considered Cat 1. Stated it protects clear water storage and irrigation pump station and is up to 3m high. It was also identified that this Levee has land tenure challenges. **Levee changed to Cat 1**
M-L0013	Lower Murray Water/Water Treatment Plant	Importance agreed, however the Levee is not formally managed currently. **No change**
M-L0014	Ranfurly Way (3MA Corner)	Importance agreed, however the Levee is not formally managed currently. **Levee Changed to Cat 2**
M-L0016	Kulkyne Way Nangiloc	Identified as a private levee. **Levee changed to Private**
M-L0021	Tennis Court Levee	**Levee removed**
M-L0024	City Bridge Levee	**Levee removed**
M-L0045	Bullock Swamp - Barko Rd	Identified as a private levee. **Levee changed to Private**
M-L0046	Kings Billabong Pump House	Identified as a private levee. **Levee changed to Private**
M-L0050	Old Wentworth Rd	Levee was unknown. **No change**
M-L0051	Unnamed wetland bank	Levee was unknown but identified as a private levee. **Levee changed to Private**
M-L0099	Cowra Ave	No existing levee. **Levee removed**
M-L0110	Towrie Creek	Noted this levee and surrounding SFF's are private levees. **Levee changed to Private**
M-L0111	Than Dhan Bend	Identified as a private levee. **Levee changed to Private**
M-L0138	Unnamed Private Levee	Identified as a private levee. **Levee changed to Private**

Buloke Shire Local Government Area

Added Levees or Significant Floodplain Features

M-SSF119- Birchip Railway & M-L0155- Birchip Temporary Road Cuts



M-SSF118- Bridge over Tyrell creek



Additional workshop actions that did not involve changing the alignment or adding additional Levees (and therefore were not captured in map screenshot) are listed the table below.

LEVEE ID	LEVEE NAME	WORKSHOP ACTION/ COMMENT
M-L0132	Mathiskes Tank Rd, Smiths Bridge Rd	Change to Significant Floodplain Feature
M-L0134	L S And C Allens Rd (South)	Change to Private Levee

Swan Hill Rural City Council

Added Levees or Significant Floodplain Features

M- L0157- Temporary Sandbagging to protect LMW Raw Water Pump Station



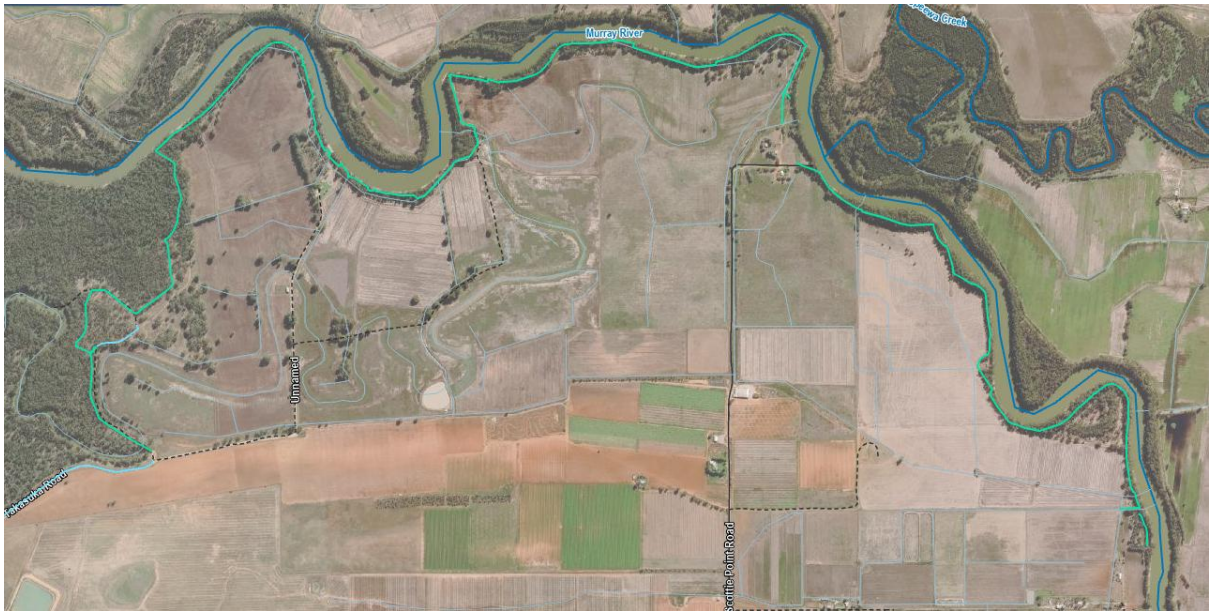
M- L0158- Culvert under Tol Tol Road



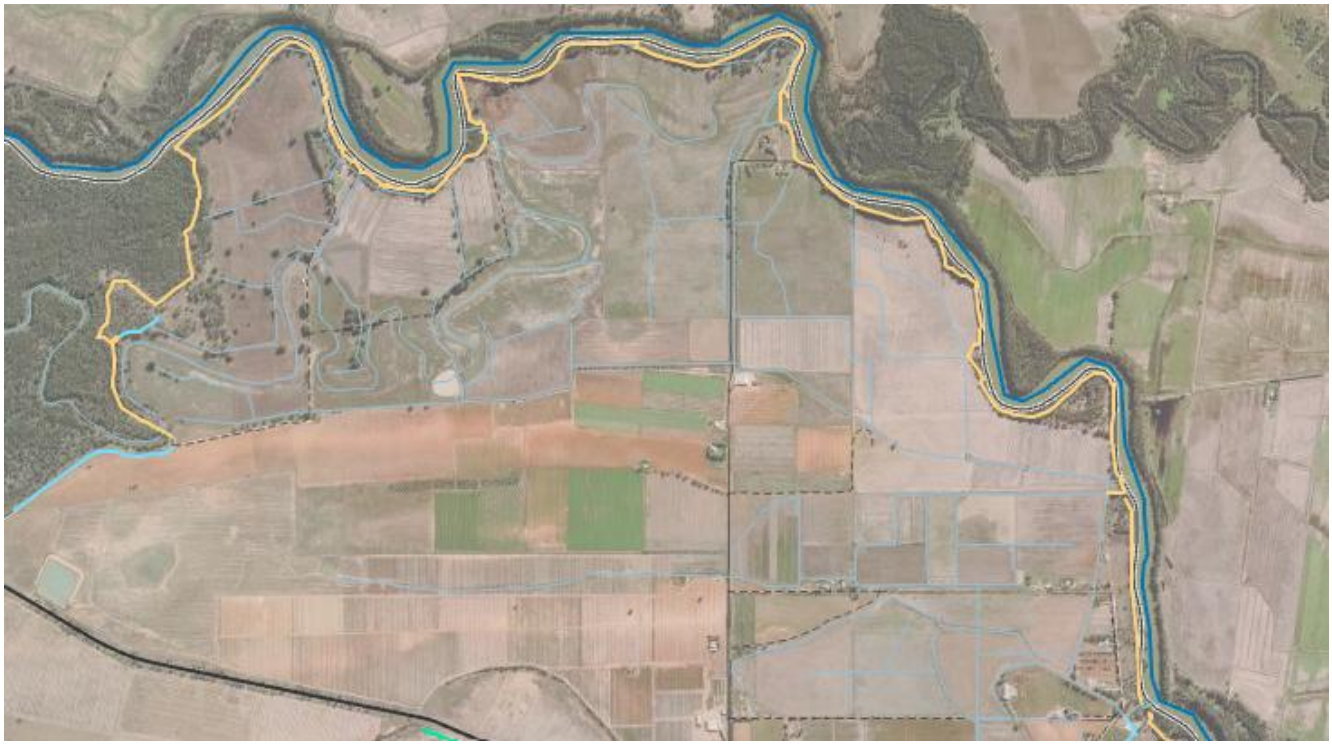
Edited Levee Alignment

M-L0054- Tyntynder Homestead & M-L0055- Takasuka Rd

Before:



After:



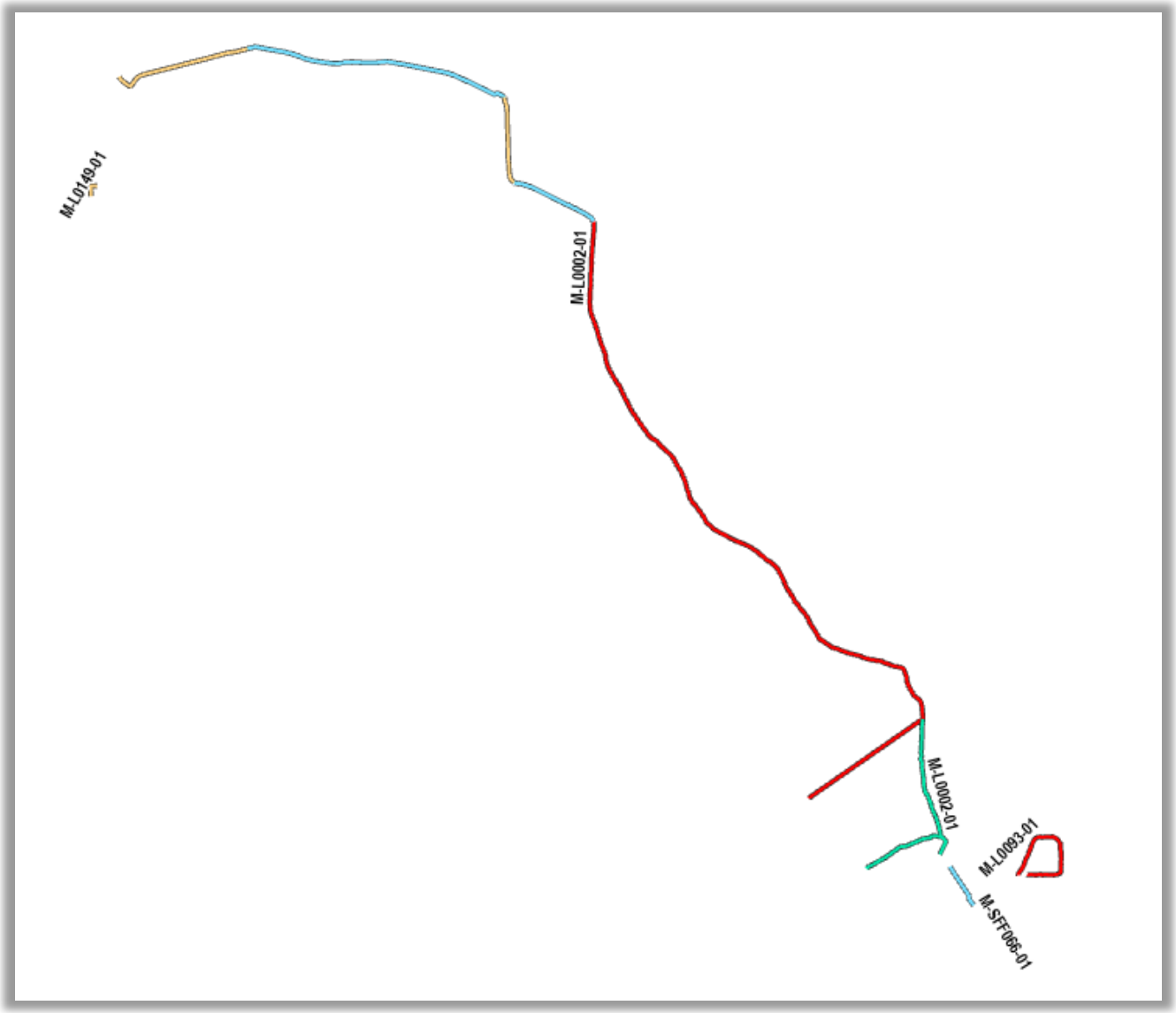
Change to Category B and extend to Tyntynder Flats levee and extend gap between Levees (one continuous levee)

M-L0002- Robinvale Levee

Before:



After:

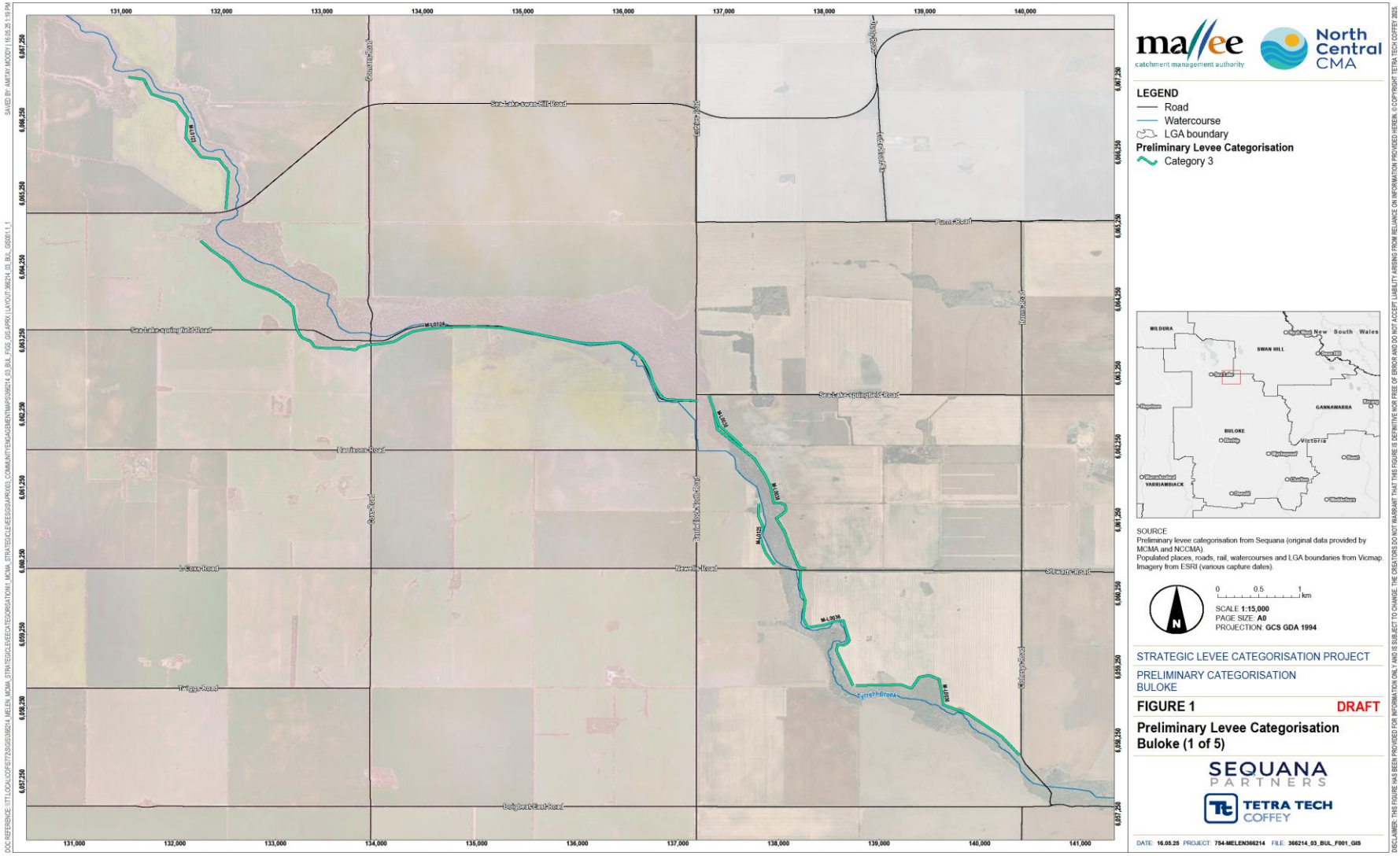


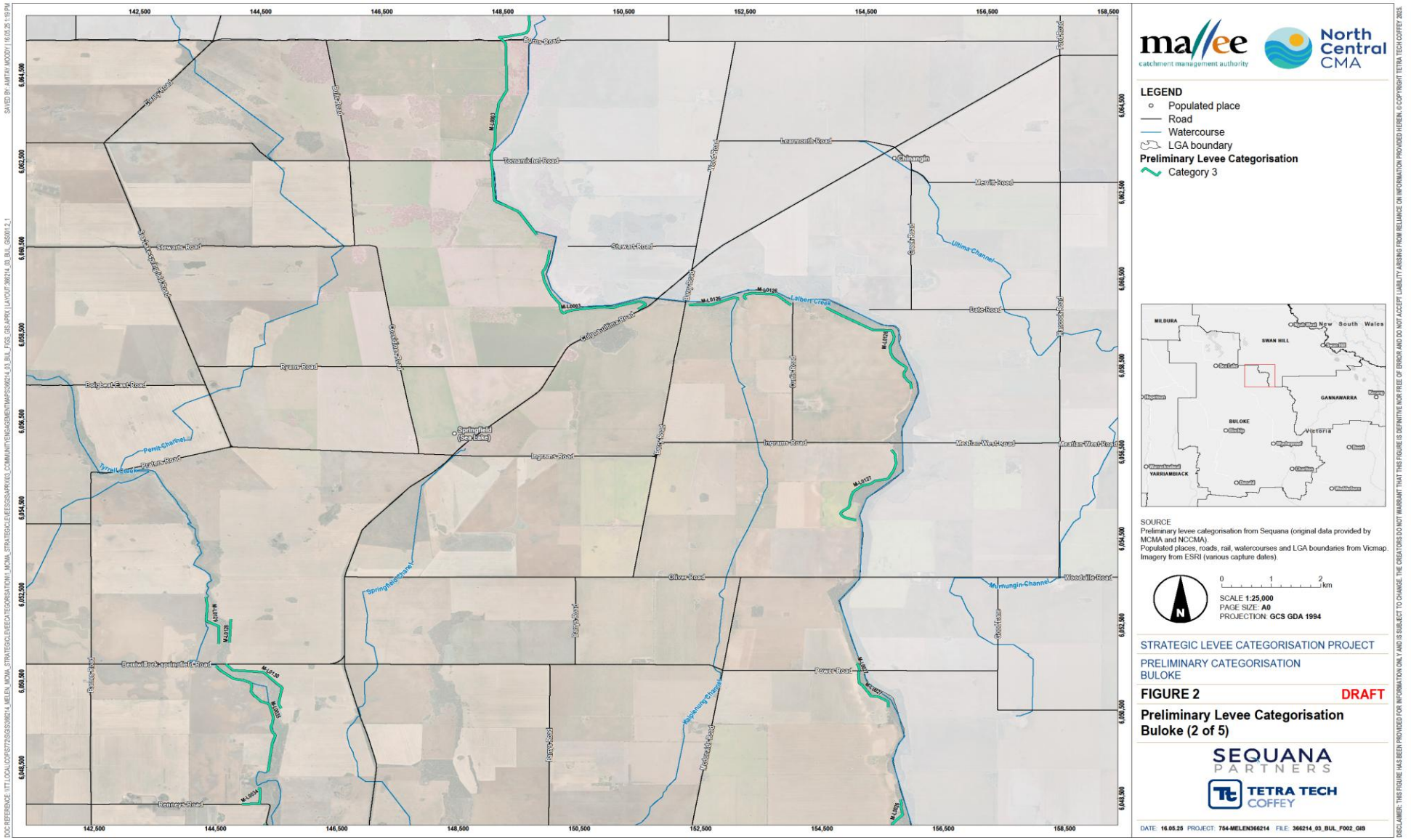
Alter Levee alignment at either end, add Cat 3 Levee (old Levee) and temporary (2C) Levees.

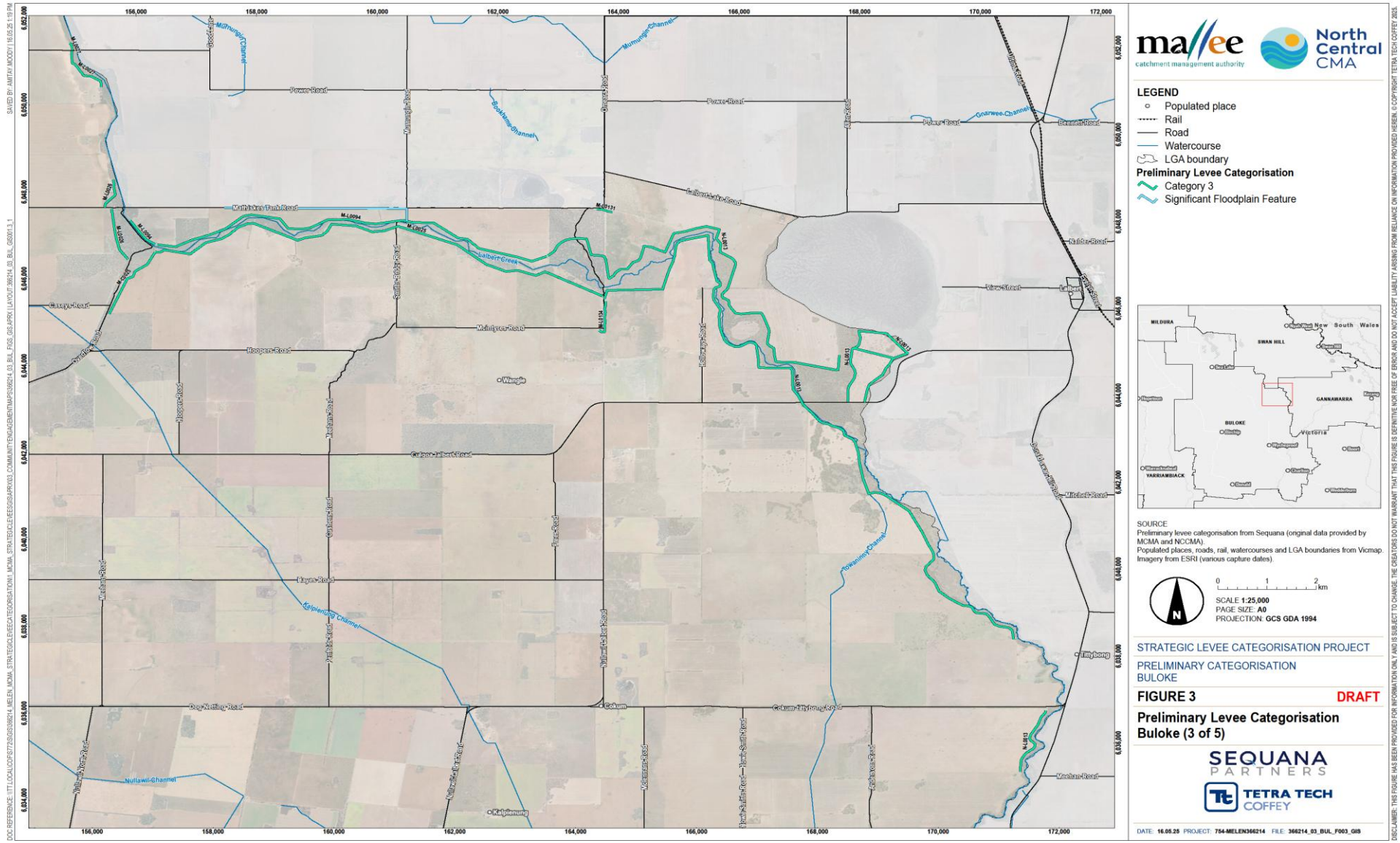
Additional workshop actions that did not involve changing the alignment or adding additional Levees (and therefore were not captured in map screenshot) are listed the table below.

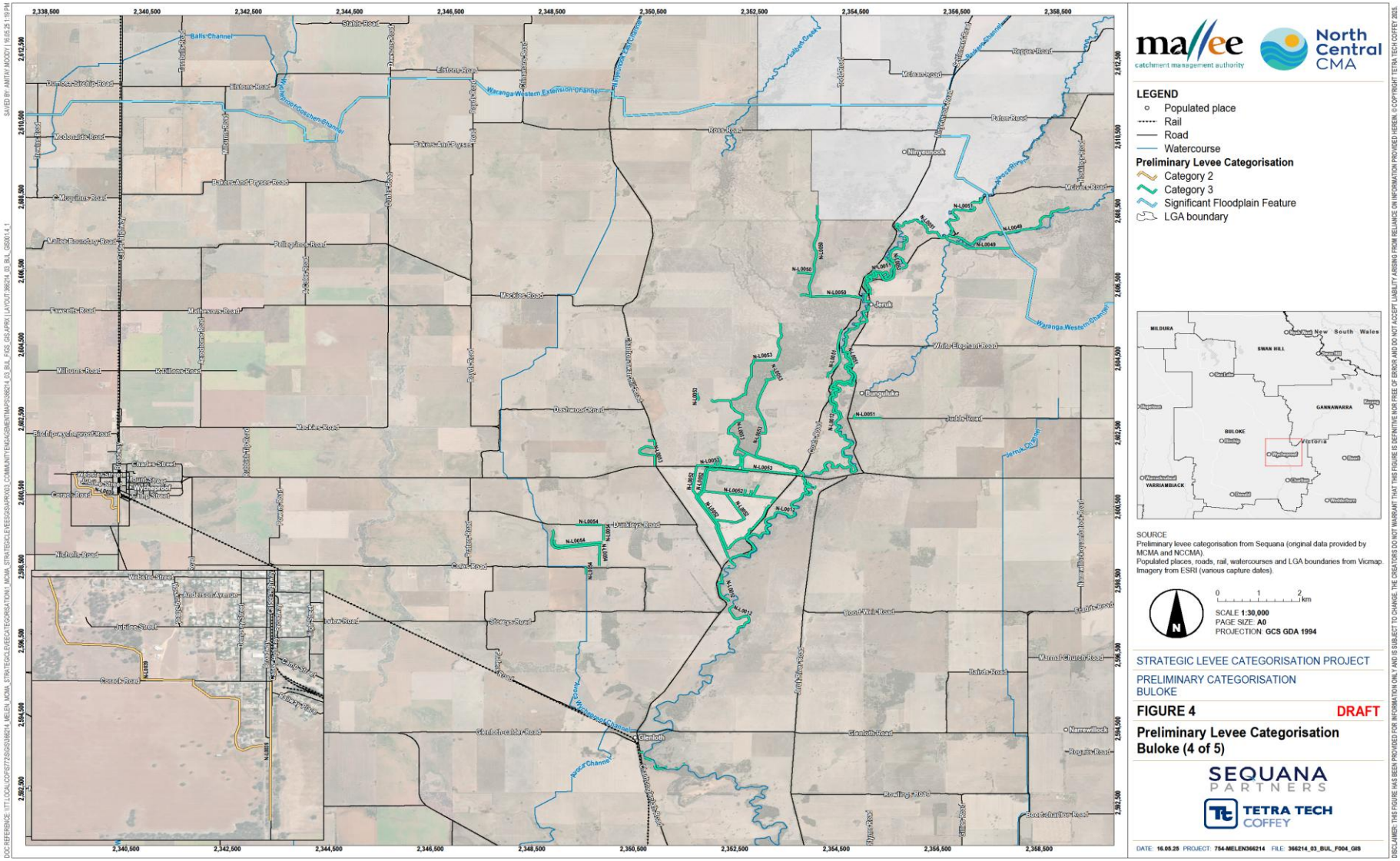
LEVEE ID	LEVEE NAME	WORKSHOP ACTION/ COMMENT
M-L0004	Hewetson Lane	**Change to Cat 3**
M-L0008	Vinifera Forest	**Change to Private**
M-L0015	Hattah - Robinvale Road	**Change to Private**
M-L0054	Tyntnder Homestead	**Change to Cat 2**
M-L0055	Takasuka Rd	**Change to Cat 2**
M-L0061	Clarke Lane South	**Change to Cat 3**
M-L0062	Clarke Lane / Kentish Lane	**Change to Cat 3**
M-L0063	Kentish Lane South	**Change to Cat 3**
M-L0064	Kentish Lane to Tooleybuck Rd	Talk to Roads regarding this levee, could road we instead raised and managed. **No change**
M-L0065	Tooleybuc Rd	Talk to Roads regarding this levee, could road we instead raised and managed. **No change**
M-L0080	Graveyard Bend, Scotty Lane	Noted these sections are fairly unknown but also important to this area. **No change**
M-L0080	Graveyard Bend, Scotty Lane	**Change to a Type B**
M-L0090	Bonyarciall Creek	**Change to Private**
M-L0093	Robinvale Pumping Station	Agreed importance, not currently formally managed. **No change**
M-L0139	Nyah Pony Club	**Change to Private**
M-L0140	Wood Wood Boat Ramp	**Change to Cat 3**
M-L0142	Branson Lane	**Change to Cat 3**
M-L0143	East Burra Creek	Talk to Roads regarding this levee, could road we instead raised and managed. **No change**
M-L0145	Buchanan Lane East	**Change to Private**
M-L0146	Buchanan Lane West	**Change to Private**
M-L0147	Millers Swing	**Change to Private**
M-L0148	Invincible Bend	**Change to Private**
M-L0151	Connell Road	**Change to Private**
M-L0152	Tammit Bend	**Change to Private**
M-L0153	Staley Road	**Change to Private**

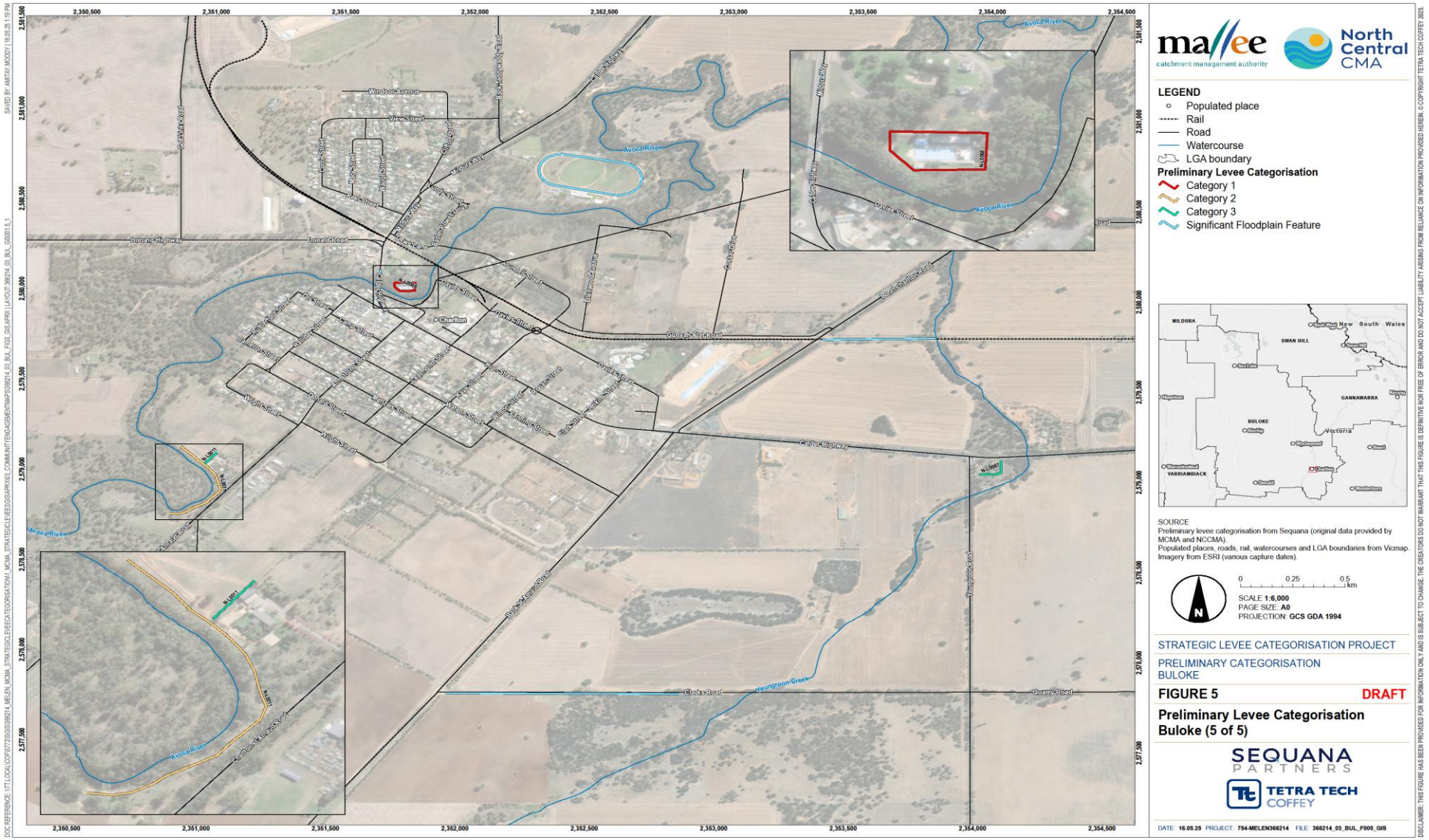
APPENDIX 3. COMMUNITY ENGAGEMENT MAPS

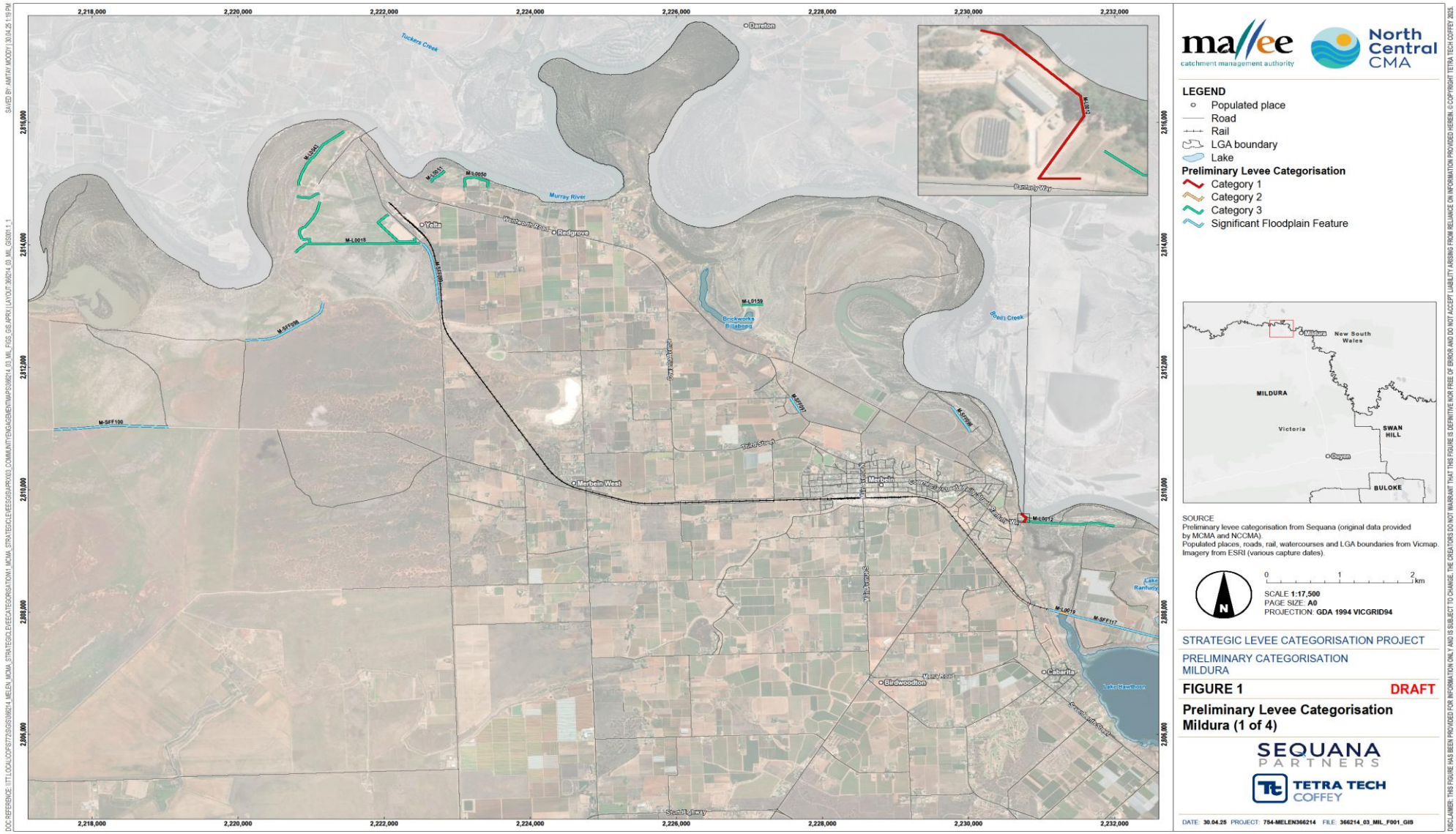



LEGEND
Populated place
Road
Watercourse
LGA boundary
Preliminary Levee Categorisation
Category 3
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and LGA boundaries from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:25,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
BULOKE
FIGURE 2
DRAFT
Preliminary Levee Categorisation
Buloke (2 of 5)
SEQUANA PARTNERS
TETRA TECH COFFEY
DATE: 16.05.25 PROJECT: 754-MELEN366214 FILE: 366214_03_BUL_F002_GIS
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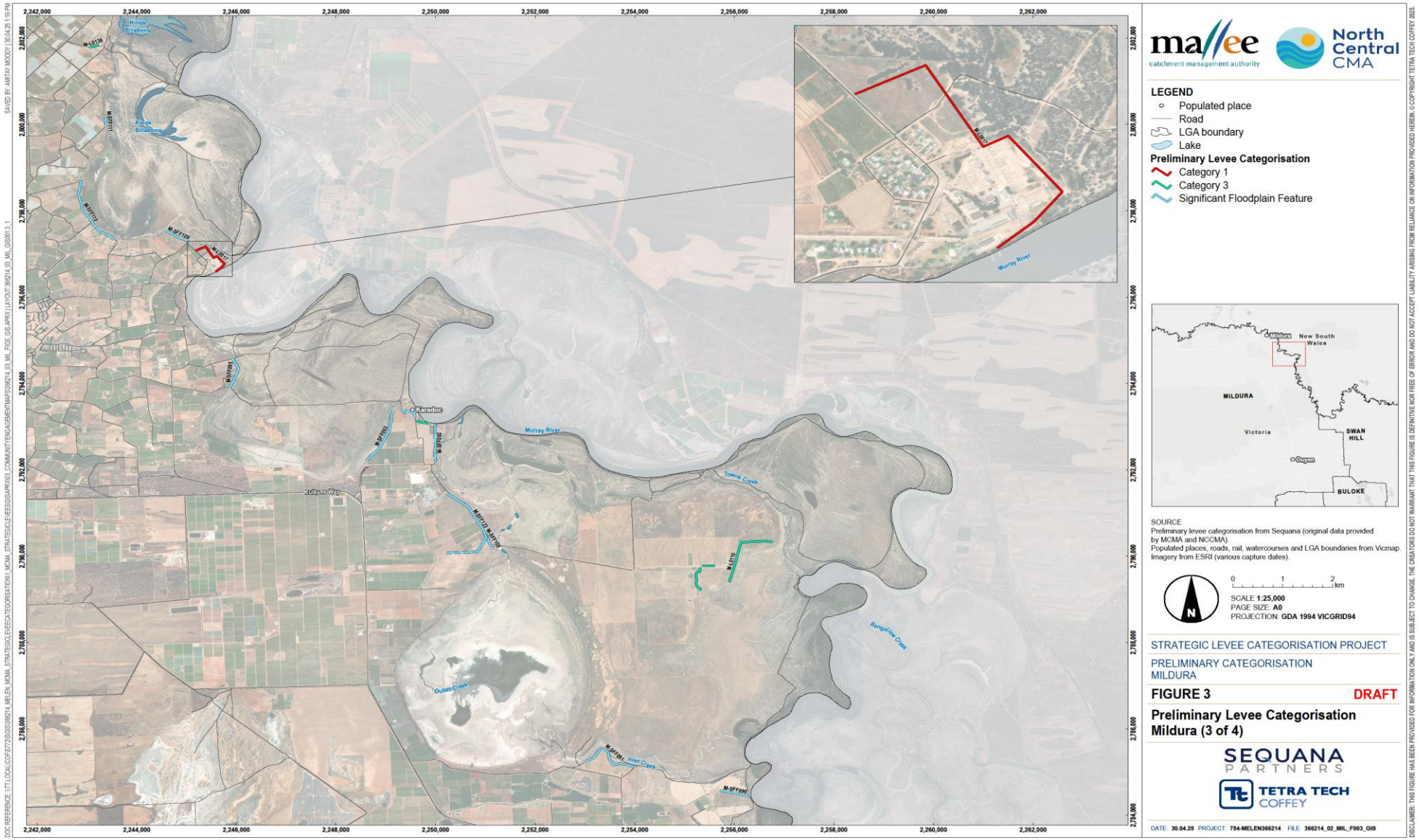

LEGEND
Populated place
Rail
Road
Watercourse
LGA boundary
Preliminary Levee Categorisation
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and LGA boundaries from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:25,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
BULOKE
FIGURE 3
DRAFT
Preliminary Levee Categorisation
Buloke (3 of 5)
SEQUANA PARTNERS
TETRA TECH COFFEY
Power Road
Mathiesons Tank Road
Lalbert Creek
Casey's Road
Hoopers Road
Wangie
Culgoa-Lalbert Road
Michael Road
Tchum Lake
Lalbert
Tittybong
Coltum
Coltum-Tittybong Road
Kaipienung
Nullawil-Channel
Kaipienung Channel
Rowanimey Channel
Gnarwee Channel
Bookham Channel
Mumungie Channel
Mildura
Swan Hill
Gannawarra
Buloke
Yarriambiack


LEGEND
Populated place
Rail
Road
Watercourse
Preliminary Levee Categorisation
Category 2
Category 3
Significant Floodplain Feature
LGA boundary
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and LGA boundaries from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:30,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
BULOKE
FIGURE 4
DRAFT
Preliminary Levee Categorisation
Buloke (4 of 5)
SEQUANA PARTNERS
TETRA TECH COFFEY

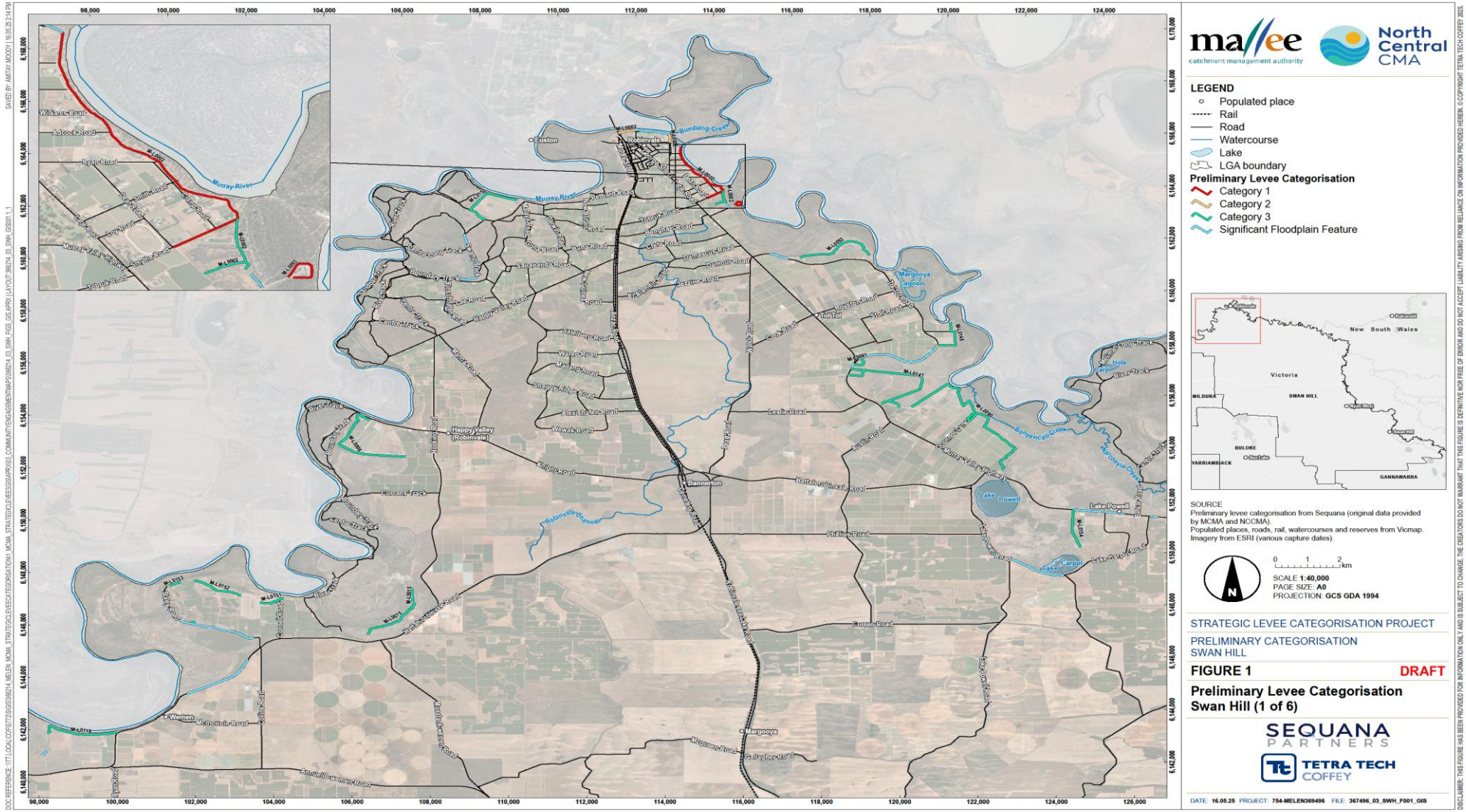

LEGEND
Populated place
Rail
Road
Watercourse
LGA boundary
Preliminary Levee Categorisation
Category 1
Category 2
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and LGA boundaries from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:6,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
BULOKE
FIGURE 5
DRAFT
Preliminary Levee Categorisation
Buloke (5 of 5)
SEQUANA PARTNERS
TETRA TECH COFFEY
Avoca River
Charlton
Borung Highway
Donald Road
Calder Highway
Quarry Road
Youngroom Creek

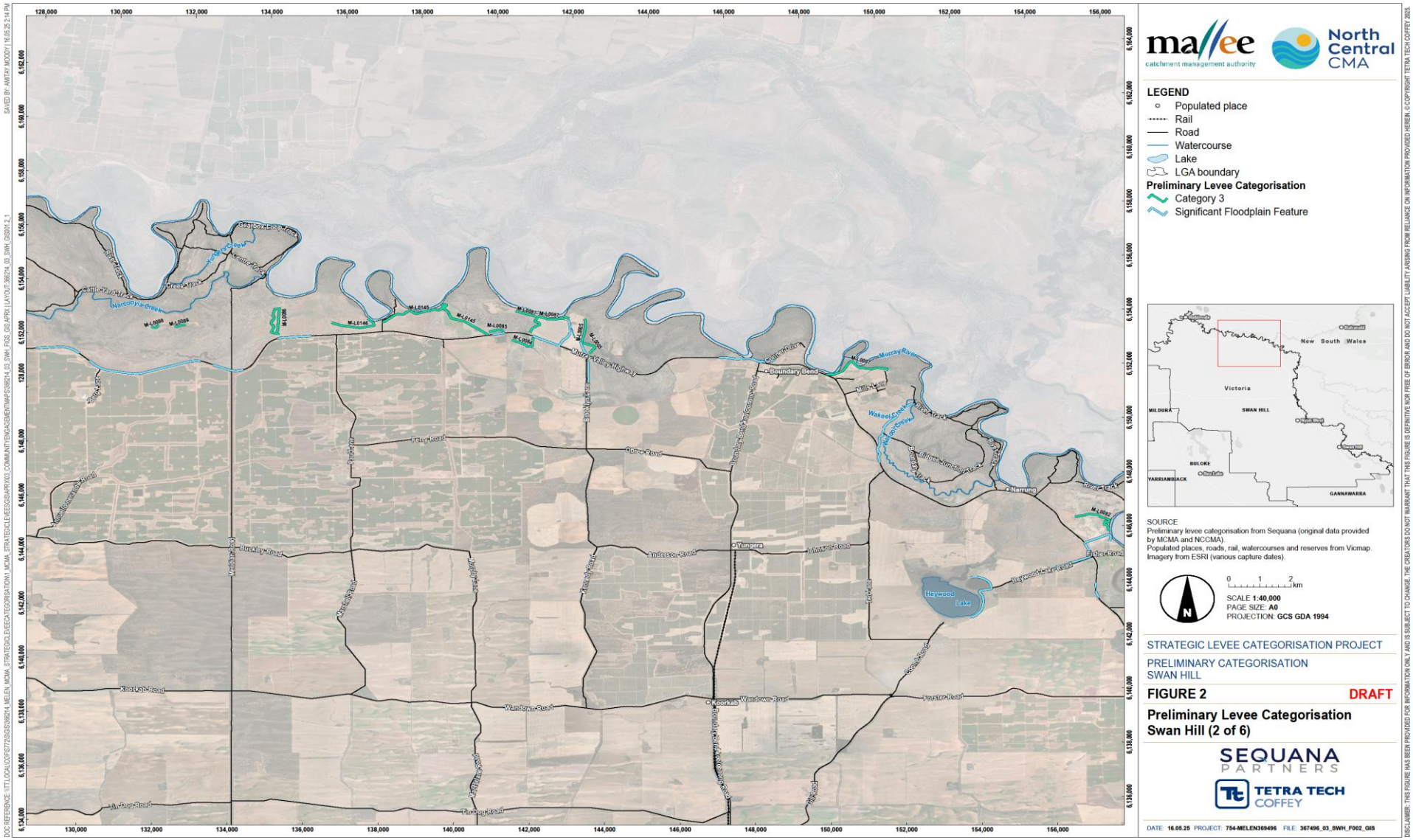

LEGEND
Populated place
Road
Rail
LGA boundary
Lake
Preliminary Levee Categorisation
Category 1
Category 2
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and LGA boundaries from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:17,500
PAGE SIZE: A0
PROJECTION: GDA 1994 VICGRID94
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
MILDURA
FIGURE 1
DRAFT
Preliminary Levee Categorisation
Mildura (1 of 4)
SEQUANA PARTNERS
TETRA TECH COFFEY
DATE: 30.04.25 PROJECT: 754-MELEN366214 FILE: 366214_03_MIL_F001_GIS
Tuckers Creek
Murray River
Darelton
Yelta
Redgrove
Merbein West
Merbein
Birdwoodton
Cabarita
Lake Ranfurly
Lake Rawdon
Brickworks Billabong
Bell's Creek
Ranfurly Way
Stuart Highway
Mildura
New South Wales
MILDURA
Victoria
SWAN HILL
Ouyen
BULOKE

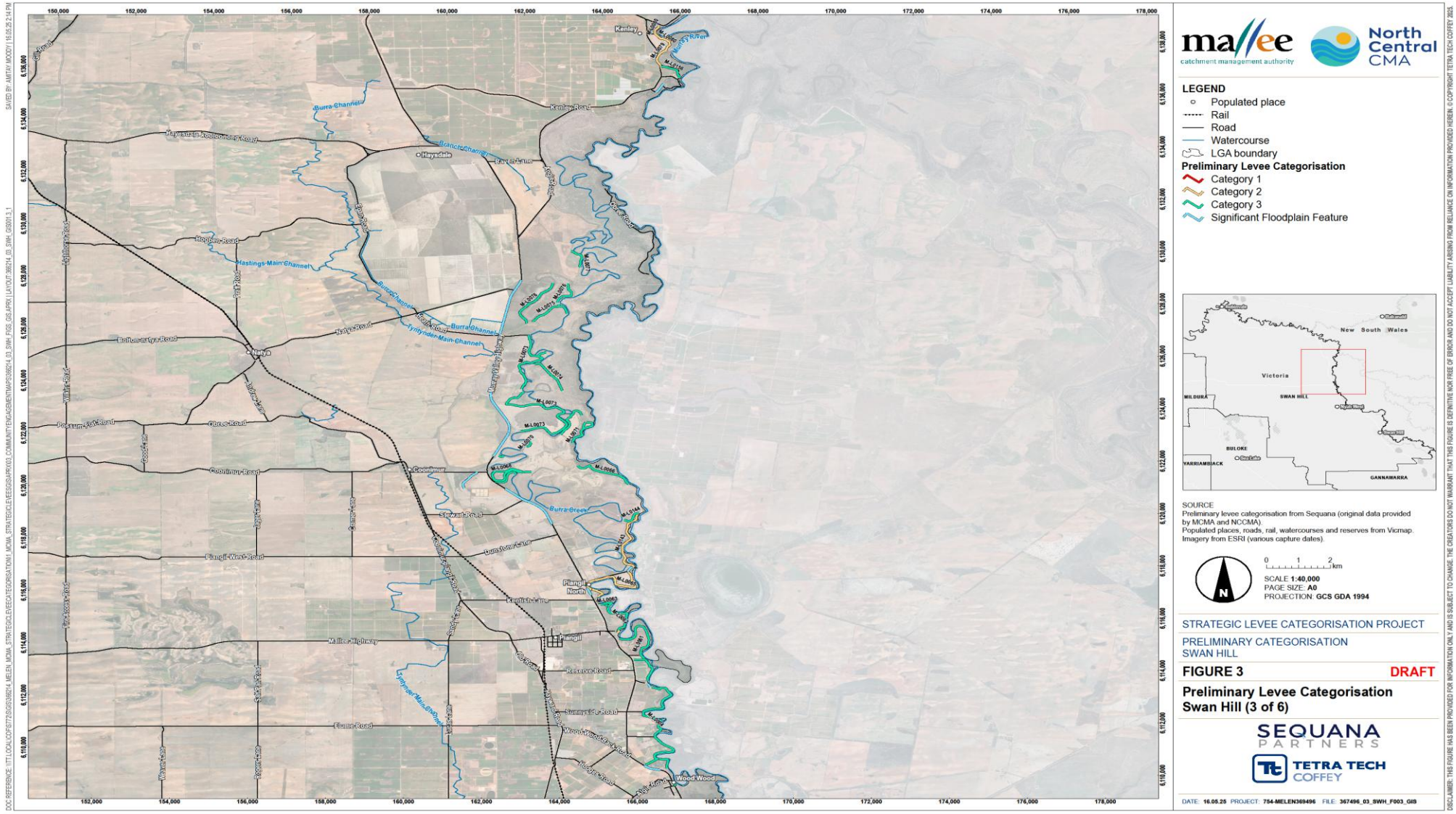

LEGEND
Populated place
Road
Rail
LGA boundary
Lake
Preliminary Levee Categorisation
Category 1
Category 2
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and LGA boundaries from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:17,500
PAGE SIZE: A0
PROJECTION: GDA 1994 VICGRID94
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
MILDURA
FIGURE 2
DRAFT
Preliminary Levee Categorisation
Mildura (2 of 4)
SEQUANA PARTNERS
TETRA TECH COFFEY
DATE: 30.04.25 PROJECT: 754-MELEN366214 FILE: 366214_02_MIL_F002_GIS
Mildura
New South Wales
MILDURA
Victoria
SWAN HILL
BULOKE
Boeill Creek
Murray River
Lake Ranfurly
Lake Hawthorn
Nichols Point
Kings Billabong

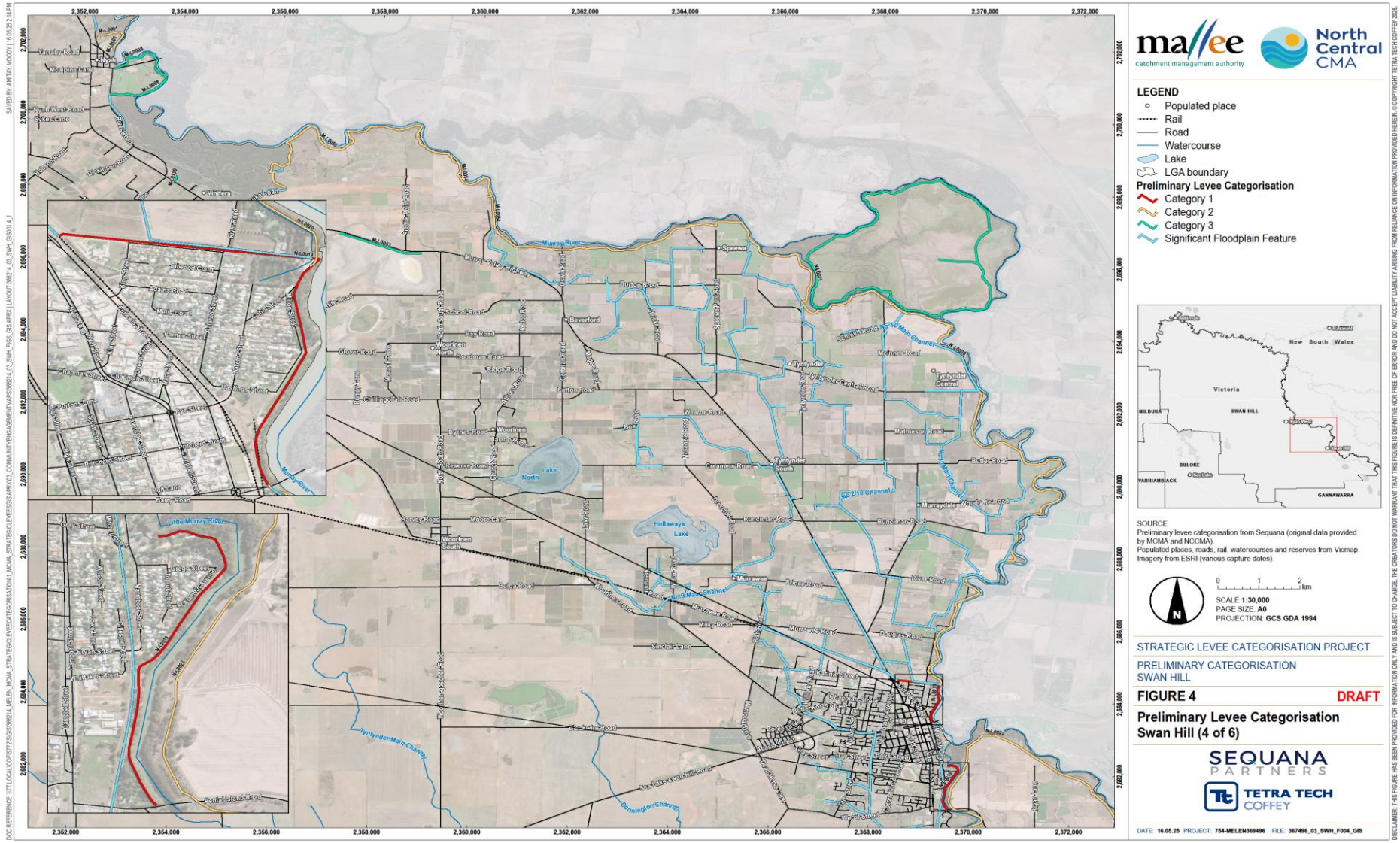

LEGEND
Populated place
Road
LGA boundary
Lake
Preliminary Levee Categorisation
Category 1
Category 3
Significant Floodplain Feature
Karadoc
Murray River
Townie Creek
Bungalow Creek
Outlet Creek
Inlet Creek
Kings Billabong
Kulkyne Way
MILDURA
SWAN HILL
BULOKE
Victoria
New South Wales
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and LGA boundaries from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:25,000
PAGE SIZE: A0
PROJECTION: GDA 1994 VICGRID94
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
MILDURA
FIGURE 3
DRAFT
Preliminary Levee Categorisation
Mildura (3 of 4)
SEQUANA PARTNERS
TETRA TECH COFFEY

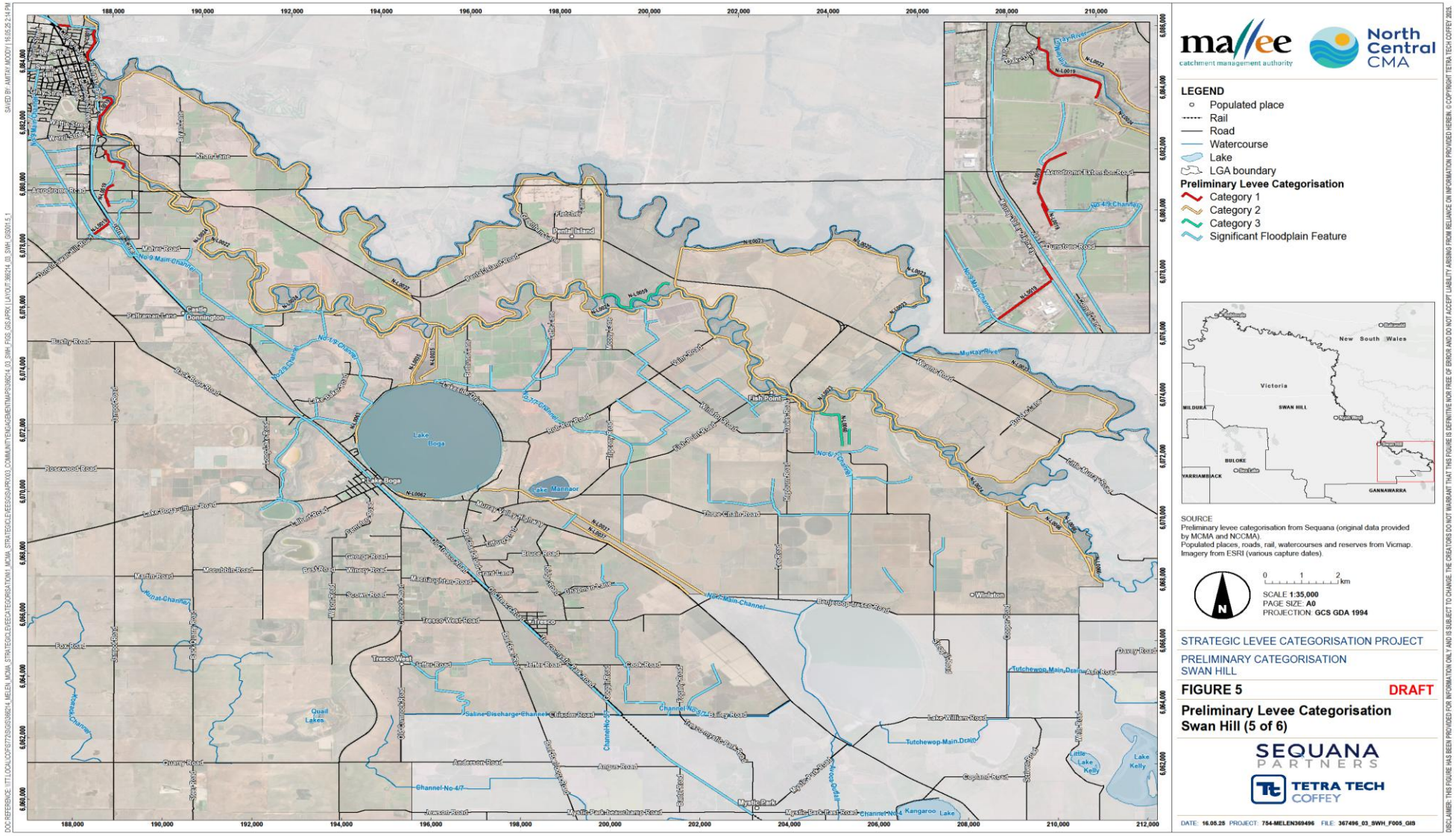

LEGEND
Populated place
Road
LGA boundary
Lake
Preliminary Levee Categorisation
Category 2
Category 3
Significant Floodplain Feature
Irrak
Nangiloc
Colignan
Murray River
Bungalow Creek
Chalka Creek
MILDURA
Victoria
New South Wales
SWAN HILL
BULOKE
Gayan
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and LGA boundaries from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:25,000
PAGE SIZE: A0
PROJECTION: GDA 1994 VICGRID94
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
MILDURA
FIGURE 4
DRAFT
Preliminary Levee Categorisation
Mildura (4 of 4)
SEQUANA PARTNERS
TETRA TECH COFFEY

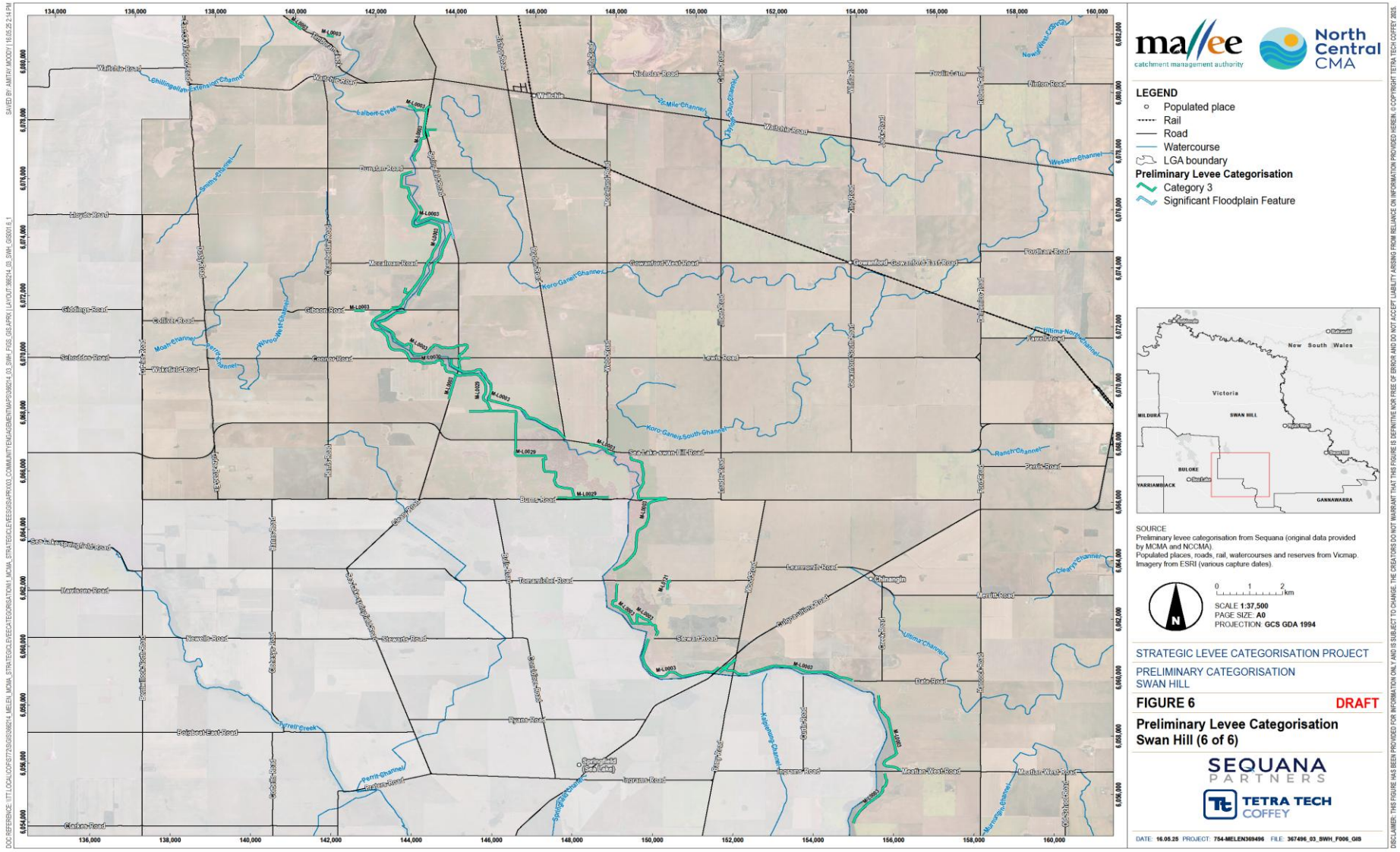

LEGEND
Populated place
Rail
Road
Watercourse
Lake
LGA boundary
Preliminary Levee Categorisation
Category 1
Category 2
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and reserves from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:40,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
SWAN HILL
FIGURE 1
DRAFT
Preliminary Levee Categorisation
Swan Hill (1 of 6)
SEQUANA PARTNERS
TETRA TECH COFFEY
Murray River
Swan Hill
Robinvale
Happy Valley (Robinvale)
Dennenton
Lake Powell
Margooya
Women
Victoria
New South Wales
MILDURA
BULOKE
YARRIAMBIACK
GANNAWARRA


LEGEND
Populated place
Rail
Road
Watercourse
Lake
LGA boundary
Preliminary Levee Categorisation
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and reserves from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:40,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
SWAN HILL
FIGURE 2
DRAFT
Preliminary Levee Categorisation
Swan Hill (2 of 6)
SEQUANA PARTNERS
TETRA TECH COFFEY
Boundary Bend
Yungera
Heywood Lake
Koorlong
Murray River
Victoria
New South Wales
MILDURA
SWAN HILL
BULOKE
YARRIAMBIACK
GANNAWARRA


LEGEND
Populated place
Rail
Road
Watercourse
LGA boundary
Preliminary Levee Categorisation
Category 1
Category 2
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and reserves from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:40,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
SWAN HILL
FIGURE 3
DRAFT
Preliminary Levee Categorisation
Swan Hill (3 of 6)
SEQUANA PARTNERS
TETRA TECH COFFEY
DATE: 16.05.25 PROJECT: 754-MELEN369496 FILE: 367496_03_SWH_F003_GIS


LEGEND
Populated place
Rail
Road
Watercourse
Lake
LGA boundary
Preliminary Levee Categorisation
Category 1
Category 2
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and reserves from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:30,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
SWAN HILL
FIGURE 4
DRAFT
Preliminary Levee Categorisation
Swan Hill (4 of 6)
SEQUANA PARTNERS
TETRA TECH COFFEY


LEGEND
Populated place
Rail
Road
Watercourse
Lake
LGA boundary
Preliminary Levee Categorisation
Category 1
Category 2
Category 3
Significant Floodplain Feature
SOURCE
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and reserves from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:35,000
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
SWAN HILL
FIGURE 5
DRAFT
Preliminary Levee Categorisation
Swan Hill (5 of 6)
SEQUANA PARTNERS
TETRA TECH COFFEY


LEGEND
Populated place
Rail
Road
Watercourse
LGA boundary
Preliminary Levee Categorisation
Category 3
Significant Floodplain Feature
SOURCE:
Preliminary levee categorisation from Sequana (original data provided by MCMA and NCCMA).
Populated places, roads, rail, watercourses and reserves from Vicmap.
Imagery from ESRI (various capture dates).
SCALE 1:37,500
PAGE SIZE: A0
PROJECTION: GCS GDA 1994
STRATEGIC LEVEE CATEGORISATION PROJECT
PRELIMINARY CATEGORISATION
SWAN HILL
FIGURE 6
DRAFT
Preliminary Levee Categorisation
Swan Hill (6 of 6)
SEQUANA PARTNERS
TETRA TECH COFFEY
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APPENDIX 4. COMMUNITY LETTER AND PETITION

File Name: Appendix 4 - Community Submission - Karadoc Av.pdf

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