Whitehead & Associates
Environmental Consultants
197 Main Road Cardiff NSW 2285 Australia
Telephone +61 2 4954 4996
Email mail@whiteheadenvironmental.com.au

Colac Otway Shire Council

Domestic Wastewater Management Plan

Operational Plan

December 2021

Prepared for: Colac Otway Shire Council

Prepared by: Jasmin Kable
Whitehead & Associates Environmental Consultants Pty Ltd
197 Main Road
CARDIFF
NSW 2285

Telephone: 02 4954 4996
Email: jasminkable@whiteheadenvironmental.com.au

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Synopsis:	This Operational Plan has been developed to accompany the Technical Document (revised 2015), which together forms the Domestic Wastewater Management Plan (DWMP), to identify domestic wastewater management (DWM) issues within the Shire and recommend management actions to ensure potential risks are appropriately managed. A key component of the DWMP is a domestic wastewater management risk assessment and mapping that has been completed for the Shire. This assessment identifies prioritised districts that are in need of improved domestic wastewater management practices. The DWMP also provides technical guidance and a strategy for community education. A framework for the regulation of domestic wastewater management system performance is also provided.
Client Details	
Client:	Colac Otway Shire Council
Primary Contact:	James McDonald, Health Protection Coordinator Telephone (03) 5232 9558

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Disclaimer

The information contained in this report is based on independent research undertaken by Whitehead & Associates Environmental Consultants Pty Ltd (W&A). To our knowledge, it does not contain any false, misleading or incomplete information. Recommendations are based on an appraisal of the site conditions subject to the limited scope and resources available for this project, and follow relevant industry standards. The work performed by W&A included a limited system audit and site and soil investigation in addition to a desktop review, and the conclusions made in this report are based on the information gained and the assumptions as outlined. Under no circumstances can it be considered that these results represent the actual conditions throughout the entire Shire due to the regional scale of this study.

Copyright Note

Document Certification

This Domestic Wastewater Management Plan has been prepared following the standards and guidelines set out in the following documents, where applicable:

- EPA Victoria (2016) 891.4 Code of Practice – *Onsite Wastewater Management*;
- Department of Sustainability and Environment (2012) *Planning permit applications in open, potable water supply catchment areas*;
- *Environment Protection Act 2017* and Environment Protection Regulations 2021;
- EPA '*Regulating onsite wastewater management systems: local government toolkit'* (publication 1974: 2021);
- Municipal Association of Victoria (2014) *Victoria Land Capability Assessment Framework*, 2nd Ed; and
- AS/NZS 1547:2012 *On-site Domestic Wastewater Management* (Standards Australia / Standards New Zealand, 2012).

To our knowledge, it does not contain any false, misleading or incomplete information. Recommendations are based on an honest appraisal of the sites' opportunities and constraints, subject to the limited scope and resources available for this project.

Supporting Author

Supporting technical contribution for this document was provided by Dr. Robert Van de Graaff (Van de Graaff and Associates). Dr. Van de Graaff undertook detailed (field) soil investigation and has provided primary soil data and interpretation which has been utilised in the development of the methodology outlined in this document.

Executive Summary

Colac Otway Shire Council (COS, the 'Council' or 'Shire') has developed a Domestic Wastewater Management Plan (DWMP) to assist with the efficient and effective management of domestic wastewater within the Shire in a way which will minimise the potential risk posed by domestic effluent upon public health, the physical environment and local receiving environments. COS is committed to the monitoring and management of on-site domestic wastewater management (DWM) systems within the Shire.

Under the provisions of the State Environment Protection Policy (Waters of Victoria) (SEPP), local Councils need to develop a DWMP in conjunction with relevant Water Corporations and the community. This DWMP has been prepared to ensure COS meets the requirements of the Minister for Water's Guideline 1 - Planning Permit Applications in Open, Potable Water Supply Catchment Areas (DSE, November 2012) for DWM; to ensure existing and future development does not compromise the Declared Water Supply Catchments (DWSCs, otherwise known as drinking water catchments) and to assist in maintaining a sustainable environment

The DWMP has been prepared to recognise, respond to and link with Council policies and Plans, current legislation and regulations and the relevant direction of State Regulatory Authorities. The DWMP also addresses recent changes in Codes of Practice, Australian Standards and guidelines relating to DWM, and recent advances in technology and management practices.

The 2015 DWMP was revised in 2021 to address the following components:

- Incorporate recent legislative and policy changes relating to DWM;
- Refine the Risk Assessment Framework process in light of feedback after the first period (2015-2021) of real-use application;
- Update the individual constraints for the cadastral changes since 2015;
- Update the final Sensitivity Rating map (Figure 3);
- Incorporate revised Council priorities and projects;
- Review Council DWM procedures and processes; including the evaluation of DWM system trends;
- Incorporate any required changes with respect to technical data or recent advances in technology and management practices;
- Revise the Locality reports; and
- Update the Action Plan.

The DWMP describes the current situation relating to DWM in the Shire and identifies a range of actions Council seeks to implement. The DWMP is comprised of two documents; this Operational Plan, which contains the Action Plan, and legislative controls Council will put in place for the management of domestic wastewater in the Shire; and a Technical Document, which details the derivation of methodology for the Constraint Mapping, Sensitivity Analysis and the individual Locality Reports.

A number of key issues for DWM in COS have been identified:

- There are a number of sensitive catchments (DWSCs) within the Shire and the protection of these areas is important for the supply of potable water, maintenance of public health and the environment;
- Within the DWSCs, development is currently restricted to 1 dwelling per 40 hectares; the implementation of the DWMP by Council will enable Water Corporations to appropriately relax this restriction and assess development at a higher density within these catchments, on a case by case basis;
- Failing DWM systems have the potential to pollute the environment;

- There are a number of significant constraints, e.g. challenging soils, proximity to water bodies and existing small lots, which limit the effectiveness of DWM systems in some parts of the Shire. To enable improvements to be made in areas where existing DWM systems have historically proved problematic, Council needs to develop strategies to assist DWM system owners to upgrade or replace systems where appropriate;
- Soil assessments undertaken as part of the Land Capability Assessments (LCA) are not consistent with locality data for the region;
- Council has had issues with the quality of some LCA reports in the past, this has since improved and the relationships with LCA assessor has strengthened.
- Additional limitations have been applied by Water Corporations in respect to planning permit applications within DWSCs, setting requirements above and beyond the EPA Code of Practice, Australian Standard and DWMP;
- DWM designs should be undertaken to include all nominal rooms that can be separated by a door; this includes studies;
- Ongoing trend for split wastewater treatment with greywater treatment and irrigation;
- Physical environments (including climate patterns) may limit the effectiveness of DWM systems within the Shire and therefore many systems may require a high level of design and management to ensure each DWM system is sustainable; and
- To ensure that DWM systems associated with new development can operate in a sustainable manner, a high level of design and management is required and Council needs to develop policies and procedures to allow development to proceed in a manner which appropriately protects public health and the environment.

The fundamental purpose of any DWMP is the identification and management of the risk from DWM systems to public and environmental health. A comprehensive 6-staged Risk Assessment Framework (RAF) was developed with the aim of quantitatively and qualitatively assessing the consequences of unsewered development. The stages are outlined as follows:

- Stage 1: Data Collection - background information, legislation/regulatory/planning controls, and data collection and pre-processing.
- Stage 2: Data Analysis - development of individual constraint and informative maps for parameters that significantly impact on the degree of sensitivity of any given lot on sustainable DWM.
- Stage 3: Sensitivity Analysis - weighted analysis of individual constraints which determines the final consolidated sensitivity of the unsewered lots within the Shire, based on an algorithm that takes into account the inter-relationships between the individual constraints.
- Stages 4 & 5: Procedural - Review requirements for development assessment under Planning Scheme and administrative controls and the management of existing DWM systems.
- Stage 6: Cumulative Risk Analysis - optional component that prepares a semi-quantitative assessment of risk (Cumulative Impact) in a delineated Area-of-Concern (AOC) by comparing the probability of DWM system failure with the lots ability to contain DWM on-site (Sensitivity).

Taken together, all stages of the Risk Assessment Framework have substantial value as a development assessment tool and provide defensible identification and justification for prioritisation of existing management issues within the Shire. The RAF aims to provide Council with a reasoned and justified tool to prioritise resourcing, oversight and management for DWM systems within the Shire.

The DWMP has collated a substantial amount of information on existing DWM systems and the various environmental and built constraints that substantially impact on DWM outcomes. This information is presented as a series of constraint and thematic (informative and overlay) maps developed using Geographic Information Systems (GIS) which illustrate the significance of each element (slope, soil suitability, proximity to surface water and groundwater, etc.) to DWM within both the Shire as a whole and the targeted localities and associated towns/settlements. Individual constraints have been considered in the light of current standards for DWM as outlined in the Victorian Environment Protection Authority (EPA) current Code of Practice, Australian Standards and other commonly applied industry standards. For unsewered lots, each constraint is considered on the basis of information supplied by Council or relevant State Government agencies. DWM Sensitivity is described as Low, Moderate, High or Very High depending on the degree of sensitivity the lot presents to DWM.

This information will assist Council to prioritise actions including programmed inspections, education of owners and occupants, the need for and level of land capability assessment and reporting required to support proposals for new DWM systems, and will provide guidance in identifying minimum standards of DWM servicing and appropriate technologies. It will also provide Council with guidance by defining areas where centralised wastewater servicing is most required.

The DWMP presents a prioritised Action Plan for the Shire with proposed timeframes for completion of the various tasks. The Action Plan provides actions which will be implemented to improve the effectiveness of DWM within COS, to protect public and environmental health and to ensure that future development within the Shire is sustainable and protects the sensitive waterways and potable drinking water catchments. The DWMP will also provide a valuable tool for the assessment of planning applications within drinking water catchment areas, all unsewered localities and associated towns/settlements, and direction for owners on the requirements that will need to be met. The 2015 DWMP Action Plan was revised as part of the 2021 DWMP revision. A separate document was produced reviewing the Action Plan, including how each Action has been met and recommendations for further action. The revised Action Plan has been incorporated into the DWMP within Section 13.

The Operational Plan is supported by a more detailed Technical Document which outlines the basis on which the constraint mapping has been developed, presents the individual constraint and thematic maps for both the Shire and individual localities and towns/settlements, and presents minimum DWM treatment system and land application area sizing requirements for compliant sustainable DWM systems..

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Acronyms

AEP	Annual Exceedance Probability
ARI	Annual Recurrence Interval
AHD	Australian Height Datum
AO	Authorised Officer under Environmental Protection Act Division 5 Part IXB (1970)
AOC	Areas of Concern
AWTS	Aerated Wastewater Treatment System
CMA	Catchment Management Authority
COS	Colac Otway Shire Council
DEM	Digital Elevation Model
DEPI	Department of Environment and Primary Industries (now known as DELWP)
DELWP	Department of Environment, Land, Water and Planning
DIR	Design Irrigation Rate
DLR	Design Loading Rate
DSE	Department of Sustainability and the Environment (former)
DSM	Decentralised Sewage Model
DWM	Domestic Wastewater Management
DWMP	Domestic Wastewater Management Plan
DWSC	Declared Water Supply Catchments
EPA	Environment Protection Authority
GED	General Environmental Duty
GIS	Geographic Information System
GMAs	Groundwater Management Area
HPO	Health Protection Officer
LAA	Land Application Area
LCA	Land Capability Assessment
LGA	Local Government Area
LRA	Land Resource Assessment
MAV	Municipal Association of Victoria
PIC	Plumbing Industry Commission
SEPP	State Environment Protection Policy
SWG	Stakeholder Working Group
VCAT	Victorian Civil and Administrative Tribunal
VVG	Visualising Victoria's Groundwater (Project)
WC	Water Corporation(s)
WMIS	The Victorian Water Measurement Information System
WSPAs	Water Supply Protection Area(s)

1 Introduction

1.1 Overview and Objectives

Colac Otway Shire Council (COS, 'the Shire' or 'Council') has a geographic area of approximately 3,433km^2 and a population of approximately 21,662 in 2021 (Council Plan, 2021-25). There are approximately 2,850 on-site Domestic Wastewater Management (DWM) systems that Council has record of within the Shire. In addition, there are unsewered commercial (non-domestic) lots, such as cafes, pubs and dairy farms in the Shire, which are regulated by the EPA and Council. This Domestic Wastewater Management Plan (DWMP) covers the management of DWM systems within the Shire. Figure 1 identifies the unsewered areas of COS that forms the basis for this document.

Wastewater management in COS is undertaken to protect human and environmental health. The Shire is characterised by towns, rural residential development, farming (including forestry), national parks and state forests, and coastline; and includes large areas designated as Declared Water Supply Catchments (DWSCs) (around 30% of the Shire). The protection of surface waters, groundwater and human health are all requirements of the *Environment Protection Act 2017* (as amended). Under the provisions of this Act and other legislative guidelines, Councils are required to prepare a DWMP. This DWMP is a revision of the first DWMP created in 2007.

This DWMP has been developed in accordance with the legislation and policies outlined in Section 3, and in particular:

- *Environmental Protection Act*, *2017* (as amended);
- Ministerial Guidelines for *Planning Permit Applications in Open, Potable Water Supply Catchments*, (DSE, 2012); and
- State Environmental Protection Policy (SEPP) (Waters) 2018.

The DWMP addresses the various aspects of wastewater, including treatment, land application, and the cumulative impacts in DWSCs. This plan also covers the regulation of DWM systems, including; permits to install, permits to use, permits to upgrade and ongoing monitoring of DWM system performance.

This Operational Plan forms the major component of the DWMP and outlines how COS will manage DWM systems and work with system designers, installers, owners and maintainers to minimise risk to public and environmental health. This document is supported by a Technical Document that provides detail on the regulatory framework for DWM and the methodology used to generate constraint mapping and corresponding Sensitivity Analysis of the Shire and individual Locality Reports.

The key objectives of this DWMP are to:

- Provide strategic direction for the development and management of wastewater throughout COS;
- Develop and implement a prioritised audit program of DWM systems within declared water supply catchments (DWSCs);
- Provide guidance to, and the minimum standards for, those preparing Land Capability Assessments within COS for existing and new developments;
- Develop a risk-based decision tool to provide guidance on the development potential of unsewered localities (including the more densely populated 'towns' and 'settlements') within and outside of the DWSCs, with regards to environmental and public health risks from DWM systems;
- Clarify the circumstances in which dwellings can be constructed within DWSCs at a higher density than 1 per 40 hectares;
- Provide greater certainty for landowners about the development potential of their land;

- Provide guidance on appropriate maintenance, modifications and upgrades for under-performing and failing systems throughout the Shire;
- Provide guidance on what types of wastewater treatment and land application systems are appropriate (and inappropriate) for the physical constraints of unsewered localities;
- Provide guidance on appropriate education for DWM system owners and residents of unsewered properties;
- Provide clear direction for the assessment of new and modified DWM system applications and their ongoing compliance with legislative requirements; and
- Specify actions to achieve these objectives to ensure the DWMP delivers demonstrable results.

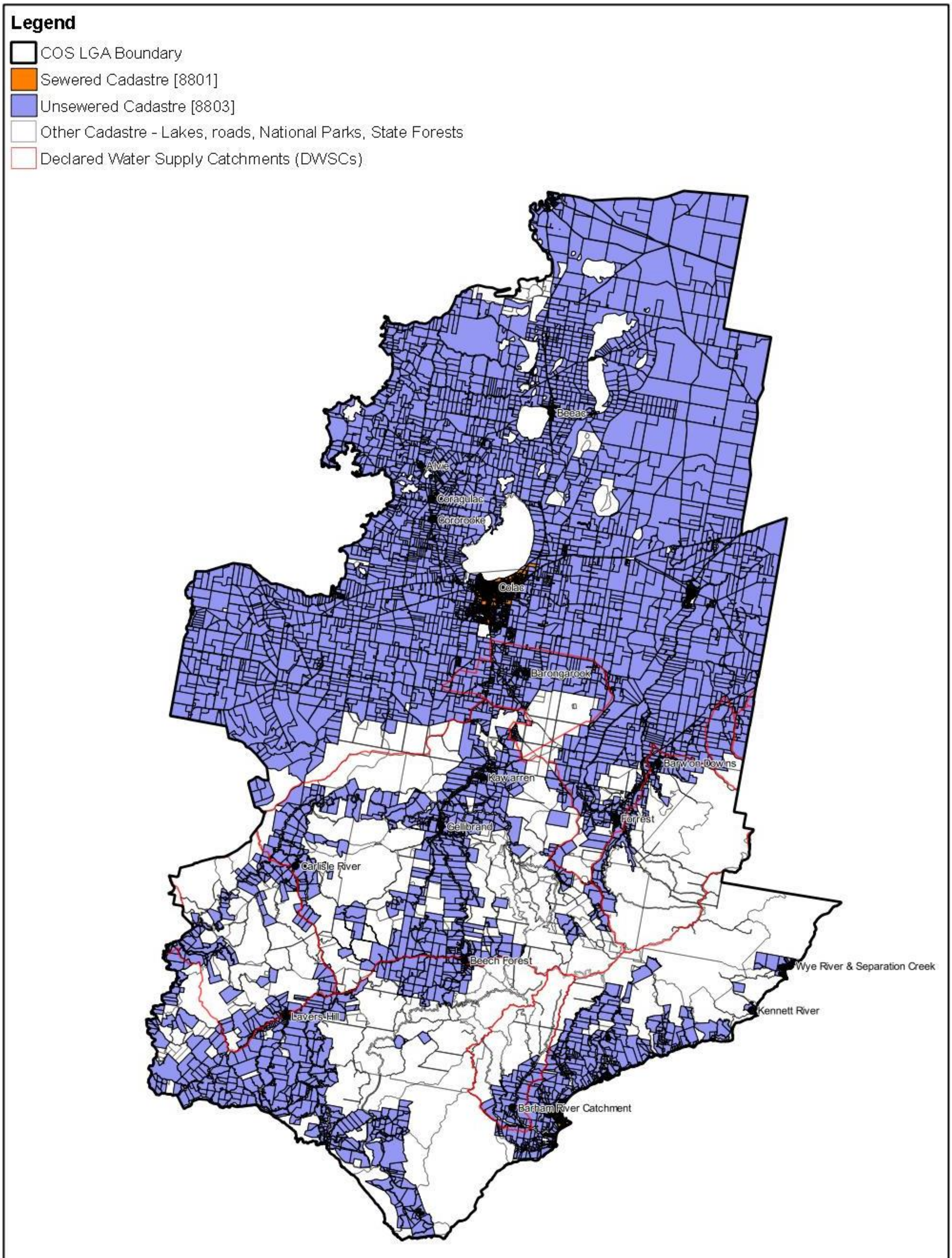

Figure 1: Sewered vs Unsewered Lots - Shire

Colac Otway Shire DWMP Review

N

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0 6 12 18 24 30 km

(Approx Scale)

Revision	3
Drawn	JK
Approved	MS

1.2 Development of the DWMP

All Councils within Victoria are required to prepare a municipal DWMP. A DWMP is a planning and management document that provides a mechanism for the development, implementation and review of programs to protect public health, the local environment and local amenity. The DWMP establishes Council's policy on and commitment to sustainable ongoing wastewater management and its programs for compliance and enforcement. The DWMP establishes processes to ensure early and comprehensive consideration of DWM in the planning cycle and Council's responsibility for the monitoring and compliance of systems.

The DWMP assists landowners and Council staff to understand the requirements for development within the Shire in respect of DWM. With the information provided by the DWMP Council staff will be able to assist landowners and developers to determine the level of assessment that is required for a proposed development. The detailed risk-based assessments of unsewered localities and towns/settlements included in the DWMP equips Council staff to assess existing and proposed DWM systems within the Shire, with the overarching objective of improving wastewater management into the future. Council staff will also be able to assess the capacity of land to manage wastewater for future development using the risk assessment framework.

A Stakeholder Working Group (SWG) was established to oversee development of the 2015 Plan, comprising officers from Council, Barwon Water, Wannon Water, Southern Rural Water, EPA, the Department of Environment, Land, Water and Planning (DELWP) and Corangamite Catchment Management Authority (CCMA).. This group helped determine the priority regions and issues with regards to DWM within COS, and to establish the methodology of the risk assessment framework. Further engagement occurred between Council, Wannon Water and Barwon Water during the 2021 review of the plan.

The field investigations undertaken by Consultant staff involved an audit of a representative sample of approximately 10% of existing on-site wastewater management systems and soil investigations in towns/settlements selected by the Stakeholder Working Group. The purpose of the investigations was to:

- confirm the nature and extent of the environmental and public health impacts associated with the existing wastewater management within the towns/settlements;
- identify the areas that may not need improvement if domestic wastewater management systems are operating effectively; and
- guide the Land Capability Assessment process to determine the capability of vacant lands within and around the towns/settlements, in terms of their suitability for sustainable on-site land application of effluent.

Summaries of the field assessment results are included in the Locality Reports included in Appendix B of the Technical Report.

Feedback from the community was sought via via community drop-in sessions across the Shire and other methods including surveys and written submissions. The concerns and suggestions most commonly raised during the community consultation process were as follows:

- Uncertainty about planning processes and time delays for obtaining development approvals, particularly for new development on small lots in the DWSCs.
- Uncertainty about Council and Water Corporations' requirements for new and upgraded DWMs, particularly within the DWSCs.
- Questioning the fairness of owners having to forgo potential lot development or sales opportunities for small or non-compliant lots in the DWSCs (i.e. regulatory controls and expectations change between buying and developing or selling).
- The view that large, rural properties do not pose a threat to drinking water quality and should be allowed to utilise primary treatment DWM systems.

- Clarification of the Lot Sensitivity rating for individual properties and the associated LCA requirements;
- Uncertainty regarding the nature and intent of 'compliance monitoring' programs, in particular how under-performing systems will be addressed;
- Questions regarding possible solutions (and associated costs) for DWM system combinations on the Otway Ridge;
- Concerns regarding the applicability of the DWMP to 'other' land use activities (i.e. agriculture);
- Concerns about the performance and accountability of non-domestic (commercial) systems on the local environment and how the DWMP will address those; and
- Questions about possible funding measures/support for improving DWM, particularly in older homes with lower disposable incomes.

Additionally, a targeted workshop was held with LCA assessors which focussed on describing and demonstrating the Risk Assessment Framework (RAF) methodology, particularly the derivation of individual Lot Sensitivity ratings. Practitioners were also briefed on the new (minimum) requirements for LCAs (site and soil investigation and DWM design). All feedback received during the public exhibition period was reviewed and either incorporated into, or used to inform the DWMP, where appropriate.

1.2.1 Guidelines – Planning Permit Applications in Open, Potable Water Supply Catchment Areas (DSE, 2012)

These Guidelines outline the requirements for development in declared water supply catchment areas (DWSC), where a planning permit is required to use land for a dwelling or to subdivide land, or to develop land pursuant to a schedule to the Environmental Significance Overlay that has a catchment or water quality protection as an object.

Guideline 1 requires that the density of dwellings should be no greater than one dwelling per 40 hectares and each lot created in a subdivision should be at least 40 hectares in area. The dwelling density is established by calculating the number of dwellings within a one kilometre radius of the site of the proposed dwelling. The density requirement of Guideline 1 does not apply where:

- Category 1: A permit is not required (i.e. outside of the DWSC/Environmental Significance Overlay);
- Category 2: If the dwelling is connected to reticulated sewerage;
- Category 3: If the development is consistent with a Catchment Policy that has been prepared for the catchment and endorsed by the relevant Water Corporation following consultation with relevant stakeholders; and
- Category 4: The Water Corporation is satisfied that Council has prepared, adopted and is implementing a DWMP in accordance with DWMP requirements.

The preparation and implementation of this DWMP and Action Plan allows COS to demonstrate that it has fulfilled the requirements of Ministerial Guideline 1. Once the Category 4 criterion is met, the Water Corporations have the ability to consider applications that would result in a higher density of development than would otherwise be permitted by Guideline 1 (currently constrained to a density of 1 in 40 ha). In order to relax this density requirement, all conditions of Guideline 1, as listed below, are to be met:

- The minimum lot size area specified in the zone for subdivision is met in respect of each lot (for subdivision applications only);
- The Water Corporation is satisfied that the Council has prepared, adopted and is implementing a DWMP in accordance with the DWMP requirements; and
- The proposal does not present an unacceptable risk to the catchment having regard to:
    a. the proximity and connectivity of the proposal site to a waterway or a potable water supply source (including reservoir);
    b. the slope of the land;
    c. the quality of the soil;
    d. the existing lot and dwelling pattern in the vicinity of the site;
    e. the existing condition of the catchment and evidence of unacceptable water quality impacts;
    f. the link between the proposal and the use of the land for a productive agricultural purpose;
    g. any site remediation and/or improvement works that form part of the application; and
    h. the intensity or size of the development or use proposed and the amount of run-off that is likely to be generated.

Items a-c are addressed through the Sensitivity Analysis as detailed in Section 4 of this DWMP. Items d-e may be addressed through the Cumulative Impact Assessment component of the RAF (Stage 6) or other methods as determined by the Council or Water Corporation. The remaining items (f-h) will be dealt with under other respective planning controls.

The preparation, adoption and implementation of a DWMP is required for the relaxation of Guideline 1. Many of the items for compliance with Guideline 1 will form part of the Operational Plan of this DWMP. These actions are identified in the DWMP and will result in the adoption of the DWMP by Council, and endorsement by the relevant stakeholders.

Table 1 outlines how this will be achieved.

For the DWMP to be considered for endorsement by the Water Corporations, COS is also required to demonstrate that suitable resourcing for implementation, including monitoring, enforcement, review and auditing, is available.

A working group comprising Council and Water Corporation delegates was formed in 2015 to discuss DWM system applications, ensure that requests for information remain uniform, and to help ensure the implementation of this plan. This group aims to meet 2-3 times per year.

Table 1: Guideline 1 Requirements

Action	Details	Completed within this DWMP	Comments/Reference
The DWMP must be prepared or reviewed in consultation with all relevant stakeholders.	Other local governments with which catchments are shared	Yes	Liaison with abutting Councils will be undertaken during the public exhibition period. Detailed in Section 1.2 of the Operational Plan.
	EPA	Yes	A representative from the EPA was a part of the original working group for the 2015 Plan. All documentation relating to the preparation of the DWMP was provided to the EPA, which was also invited to comment on all drafts developed. Detailed in Section 1.2 of the Operational Plan.
	Local Water Corporations	Yes	This DWMP was prepared and progressively reviewed by a working group that included representatives from Barwon Water, Wannon Water, Southern Rural Water and the Corangamite Catchment Management Authority. All documentation relating to the preparation of the DWMP was provided to the Water Corporations, which were also invited to comment on all drafts developed. Detailed in Section 1.2 of the Operational Plan.
The DWMP must comprise a strategy including timelines and priorities to:	Prevent discharge of wastewater beyond lot boundaries	Yes	Assessment of DWM sensitivity and assessment protocols to ensure best possible DWM system is installed. Section 6 outlines the responsibilities of lot owner's, LCA assessors and Council with regards to effective DWM system design, installation and maintenance. Continual education of the community as per Action 9. All lots will follow the LCA procedure outlined in Section 4.2 of the Operational Plan for their given Sensitivity Rating.
	Prevent individual and cumulative impacts on groundwater and surface water beneficial uses	Yes	Assessment of DWM sensitivity and assessment protocols to ensure best possible DWM system is installed. Particular considerations to slope, soil, useable lot area and climate have been addressed within the Sensitivity Analysis. Section 4 of the Operational Plan details the methodology and results of the Sensitivity Analysis for each lot within the Shire as well as providing a tool to assess the cumulative impact of DWM systems within particular areas of concern, i.e. within a sub-catchment (Stage 6).
The DWMP must provide for:	Effective monitoring of the condition of DWM systems, including compliance with permit conditions	Yes	Ongoing. Improvement of data management system to allow for effective management of existing permits and conditions. A dedicated DWM officer was employed by Council for a three (3) year period 2018-2021, completing a targeted auditing program within six (6) localities. As part of the new requirements of the *Environment Protection Act 2017* (as amended), owners and occupiers of the land on which a DWM system is located have an obligation to take reasonable steps to maintain the DWM system in good working order, including notifying Council of any failure to meet the Permit to Use conditions and undertake rectification steps. Council will continue to meet the required inspections for the issuing of Permits under this *Act* and undertake responsive inspections of DWM systems.

Action	Details	Completed within this DWMP	Comments/Reference
	The results of monitoring provided to stakeholders	Yes	Ongoing – biannually. Report shall include summary of new permits issued, systems inspected, and results of any recommended upgrade works or compliance requirements. Detailed in Actions 6 and 12a.
	Enforce action where non-compliance is identified	Yes	Ongoing – Council have also received a delegation of functions and powers from the EPA to allow councils to take action under the GED of the *Environment Protection Act 2017 (*as amended). Council has found that DWM system compliance and improvements in performance can be achieved without taking enforcement action in the majority of cases; however, Section 8 outlines enforcement actions for ongoing poor performance of systems. Council also has escalation points available to address system under-performance, with responses commensurate to the risk posed by poorly performing systems (see Section 8.4.1).
	A process review and update of the DWMP every five (5) years	Yes 2020	Biannual progress review of the DWMP proposed with the Water Corporations. Detailed in Action 12c.
	Independent audit by an accredited auditor of the implementation of the DWMP, monitoring and enforcement every three (3) years	Pending - 2024	Audit to ensure that the work undertaken is done so in accordance with the DWMP. Detailed in Action 12b.
	The results of the audit is to be provided to all stakeholders as soon as possible after the audit	Pending-2024	Results of the audit will be provided to all stakeholders for review after the audit.
	COS is required to demonstrate that suitable resourcing for implementation, including monitoring, enforcement, review and audit is in place	Yes	This is detailed in Section 7 of the DWMP and the Action Plan (Section 13).

1.3 Previous Reports and Plans

The 2015 DWMP was revised in 2021 to address the following components:

1. Incorporate recent legislative and policy changes relating to DWM:
2. Refine the Risk Assessment Framework process in light of feedback after the first period (2015-2021) of real-use application;
3. Update the individual constraints for the cadastral changes since 2015;
4. Update the final Sensitivity Rating map (Figure 3);
5. Incorporate revised Council priorities and projects;
6. Review Council DWM procedures and processes; including the evaluation of DWM system trends;
7. Incorporate any required changes with respect to technical data or recent advances in technology and management practices;
8. Revise the Locality reports; and
9. Update the Action Plan.

1.4 Implementation and Review

The effectiveness of the DWMP and the compliance inspections will depend on the ability of Council to implement the Action Plan (Section 13).

Staff must be trained in onsite wastewater assessment and be familiar with plumbing requirements to ensure compliance with repair and/or upgrade orders that can be made for systems under the program. Follow-up visits to properties to ensure compliance are likely to be required.

The effectiveness of the DWMP will be measured by a monitoring and reporting process. Further to the requirements in the SEPP and *Environment Protection Act 2017*, Council will monitor and report biannually to the Water Corporations (Refer Section 13) on a range of performance indicators listed in this DWMP, including but not limited to:

- the number of complaints about poorly functioning DWM systems;
- the number of system inspections for each risk category;
- the number of systems needing rectification (following inspection);
- the number of systems rectified;
- the number of systems still needing rectification; and
- the assessment of the results of surface and/or groundwater quality monitoring in respect to DWM and its potential impacts on water quality;

This reporting will not only indicate the progress of Operational Plan implementation, but it will also provide an indication of the effectiveness of the actions to improve environmental and public health and cumulative DWM risk across the Shire.

The DWMP must be audited every three years (Refer Section 13) so as to ensure the DWMP is being implemented appropriately. Resource funding and time allocation must be made by Council to undertake this review.

2 Overview of Domestic Wastewater Management

2.1 What is Wastewater?

Wastewater is water-borne waste material and includes all normal wastes from residences, as well as many forms of waste matter from other establishments. Domestic wastewater is derived from household waste streams: kitchen; bathroom (basin, bath and shower); laundry and toilet. Industrial and commercial wastewater varies widely in character and often requires specialised treatment processes as it may contain substances that are harmful to the biological processes utilised for treatment processes. Domestic wastewater is commonly described in these three forms:

- Blackwater – "water grossly contaminated with human excreta" e.g. toilet water, composting toilet leachate;
- Greywater – "water that is contaminated by but does not contain human excreta" e.g. kitchen, bath and laundry water. Also referred to as 'sullage'; and
- Combined – "a combination of both black and grey water."

Domestic wastewater quality can vary greatly due to numerous factors; however, Table 2 outlines typical values for domestic wastewater quality parameters.

Table 2: Typical Domestic Wastewater and Septic Effluent Quality[1]

Parameter (mg/L)	Untreated Wastewater	Septic Effluent
Biological Oxygen Demand (BOD_5)	150-300	100-200
Total Suspended Solids (TSS)	150-300	20-100
Ammonium (NH^{4+})	~10	~40
Organic Nitrogen	~30	~15
Ammonia (NO^{3-})	4-13	<1
Ortho Phosphate	6-10	10-15
Organic Phosphorus	4-15	<4

2.2 The Historical Context

Historically the management of domestic wastewater systems, throughout Victoria, has been difficult. Local Councils are the regulatory authority for DWM and have generally been limited by time and financial support from implementing effective DWMPs. Many Councils throughout Victoria (and Australia) have previously provided very limited programs for DWM, focusing on an approval scheme for new systems and a basic system monitoring program, as time permits. There are limited cost recovery options for Councils to monitor increasingly complex and larger numbers of systems as the peri-urban areas experience rapid growth throughout Victoria. There is increasing pressure on all Councils within Victoria to improve DWM so that existing and future development does not impact on public health and the environment.

2.3 Wastewater Treatment

Wastewater is typically managed in urban environments in a community sewerage system, with treatment at a centralised wastewater treatment plant with disposal via discharge to waterways or land application. In areas where a centralised sewerage system cannot be provided,

[1] Information collated from a range of sources including AS1546.1:2008, AS1547:2012, EPA Publication 760 (2002), NRMMC (2006) and NSW DLG (1998). Note all concentrations are highly variable.

wastewater is managed on-site at each individual lot. On-site domestic wastewater is managed by a variety of treatment systems, including but not limited to:

- Septic Tanks;
- Aerated Wastewater Treatment Systems;
- Aerobic Biological Filter Systems (Wet Composting, Vermiculture);
- Membrane Filtration;
- Ozonation;
- Reed Beds;
- Sand Filters;
- Textile (fabric) Filters;
- Trickling Aerobic Filters; and
- Greywater Treatment Systems.

Appendix A provides detailed information about treatment systems. Following treatment, the effluent is then either dispersed or reused within the boundaries of the lot. The type of dispersal or reuse system depends on the type of treatment system and the quality of effluent (primary or secondary).

Current best-practice is for effluent to be treated to a secondary standard or better, particularly within the DWSCs. Any variations to this must be provided with detailed evidence and explanations to demonstrate its suitability. Most systems apply effluent within the soil profile in a dedicated area on the lot (often referred to as the Land Application Area or the dispersal area). Highly treated and disinfected greywater can be used internally for toilet flushing and cold water supply to the laundry; however such systems are not common due to relatively high costs. Further details on land application systems are provided below.

2.4 Land Application of Treated Effluent

There are a range of effluent dispersal or reuse systems that apply effluent to the soil profile. Systems that are suitable for primary-treated effluent (from septic tanks and wet composting systems) include:

- Conventional Absorption Trenches and Beds;
- Evapotranspiration-Absorption (ETA) Trenches and Beds;
- Modified ETA Trenches and Beds – such as ‘Wick Trenches’ and modified pipe systems;
- Wisconsin or Sand Mounds; and
- Low Pressure Effluent Distribution (LPED).

Systems that are suitable for secondary-treated and disinfected effluent (from accredited secondary treatment systems only) include:

- All of the above systems suitable for primary effluent (although less commonly used);
- Surface spray or drip irrigation;
- Covered surface drip irrigation; and
- Subsurface drip irrigation.

Appendix A provides detailed information about land application systems.

2.5 Environmental & Health Risks of Domestic Wastewater Management

Domestic wastewater can be highly variable in quantity and quality, which can impact on the performance of DWM treatment systems. Primary treatment in septic tank systems relies on the anaerobic breakdown of organic matter by microbes and the settling of solids. Shock loads or biocide use within the home can impact on the ability of these microbes to treat the wastewater and solids passing through the first treatment stage, resulting in poor quality of effluent being discharged to the environment.

DWM system failures are most often a result of poor system design, poor installation practices, inadequate maintenance and sometimes insufficient land area, all of which contribute to potential public and environmental health impacts. These are discussed below.

2.5.1 Human Health

The principal groups of organisms found in natural waters and wastewater include: bacteria, fungi, protozoa, rotifers, algae and viruses. Not all of these pose potential human and public health risks. Organisms with the potential to pose health risks to humans are known as “pathogenic” organisms and may be classified into three broad categories:

1. **Bacteria** – domestic wastewater contains a wide variety and concentration of pathogenic and non-pathogenic bacteria. There are many waterborne infectious diseases e.g. typhoid and cholera. Infectious doses of disease causing bacteria in wastewater can lead to illness. Testing for pathogens is difficult and expensive, therefore indicator bacteria from the intestinal tract of uninfected humans and warm blooded animals is used; for example coliform bacteria such as Escherichia coli are used as an indicator of potential pathogenic/faecal contamination in water.
2. **Parasites** – (Protozoa and Helminths). The two dominant protozoan parasites of concern in the treatment of wastewater are:
    - Cryptosporidium; and
    - Giardia.

    These are both resistant to standard disinfection methods and pose considerable risk to susceptible members of the community (children, elderly and immune–compromised). Helminths or intestinal worms, e.g. tapeworms and roundworms, are also commonly found in wastewater. These release millions of environmentally resilient eggs throughout their lifespan.
3. **Viruses** – contamination of domestic wastewater by viruses may lead to major outbreaks, such as Hepatitis A (referred to as infectious hepatitis), which is the most dominant waterborne virus. Polio Virus is also transmitted in wastewater. Viruses can cause widespread illness in epidemic patterns. Viruses are more common and diverse than bacteria in the aquatic environment.

The ability of pathogens to survive in the environment varies substantially, depending on environmental conditions and the type and life-stage of the organism. Some organisms produce highly resilient spores which can persist in unfavourable conditions for long time periods and can be transported large distances in water and groundwater.

Furthermore, nitrogen in the form of nitrate is highly mobile in the soil/water environment and can also be a potential public health risk if exposure is high (however this has not been identified as a particular risk for the relatively low-density towns of regional Australia).

Exposure to any of the above, via direct or indirect contact with wastewater, poses a human health risk.

2.5.2 Environmental

Nutrients, along with trace quantities of other elements, are essential for biological growth. Phosphorus (P) and Nitrogen (N) are the principal nutrients of concern with regard to DWM systems and are present in a range of compounds in raw wastewater and treated effluent. In excess, phosphate and nitrate encourage vigorous growth of algae and aquatic plants in surface water systems, which can lead to ecological disruptions and reduced water quality. Poor quality raw supply water is more difficult and costly to treat for drinking water purposes, compared to water taken from catchments where pollution inputs are reduced.

2.5.3 Social

The poor management of DWM systems has potential financial implications where it may adversely impact on drinking water supplies by contamination. Where DWM systems cause pollution from effluent discharges to waterways, there is a requirement for a higher level of treatment of drinking water prior to distribution. Where failing DWM systems cause odours or discharge into adjoining properties, there is an adverse impact on public amenity and these may cause a nuisance. There are financial implications for owners who have a failing DWM system and are required to complete upgrade works. New systems can be expensive and some owners may not have the finances to undertake works immediately, resulting in continuing system failures.

2.5.4 Summary

Table 3 below summarises the risks common to all DWM systems (treatment and land application components). The operation of a large number of DWM systems within a catchment may have long term negative and cumulative impacts on that particular area and on downstream water bodies. However, where systems are correctly designed, installed and managed (including upgrades to existing systems where necessary), the risks of cumulative impacts to the downstream environment are substantially reduced. As such, the sustainable density of DWM systems is higher when systems are operating optimally, compared to when a proportion (or all) systems are underperforming or failing in some way.

Table 3: Health and Environmental Risks of DWM Systems

Risk	Typical Cause	Potential Impacts
Ineffective regulation	Lack of staff/ time	Environmental, Health and Social
Off-site discharge	Failing/ poorly managed/ damaged/ unapproved treatment and/or land application system(s)/ previous approved practices for off-site discharges	Environmental, Health and Social
Disinfection failure	No disinfection (chlorine)/ poor upstream treatment	Health
Failure of treatment system	Lack of maintenance/ poor installation/ age of system	Environmental, Health and Social
Surcharge from land application area	Peak loads/ overload of system/ failure of land application system / undersized or poorly designed system	Environmental, Health and Social
Failure of land application system	Clogging layer in trenches or beds/ broken pipes/ inappropriate hydraulics	Environmental, Health and Social
Human contact with effluent	Poor OH&S in maintenance/ inappropriate disposal methods	Health and Social

Risk	Typical Cause	Potential Impacts
Owner ignorance	Lack of knowledge of system	Environmental, Health and Social
Damage to land application system	Access by vehicles or stock/ inappropriate boundaries	Health and Social
Odour	Inadequate treatment in systems/ mechanical fault	Social
Groundwater contamination	Effluent dispersal area overloaded (undersized and/or failing)	Environmental, Health and Social
Surface water contamination	Surface runoff of effluent in area with reduced setback distance buffers/ recharge from contaminated GW	Environmental, Health and Social
Human or animal disease outbreak	Direct or indirect pathogen exposure due to any of above causes	Health and Social
Degradation of soils	Undersized or failing land application system/ usually high strength effluent	Environmental and Social
Increased algae growth	Excess nitrate and phosphate in surface waters	Environmental, Health and Social
Degradation of native vegetation	Excess nitrate and phosphate in soils and/ or surface waters	Environmental and Social

3 Legislation and Policies

3.1 Council's Plans and Policies

The DWMP has been developed to fit with other Council Policies and Plans through actions identified in the Action Plan. The following lists the various Council Plans which have been included in the DWMP review, which are discussed further within the Technical Document.

- Council Plan 2021 – 2025;
- Municipal Public Health and Wellbeing Plan 2021 – 2025;
- Colac Otway Planning Scheme;
- Environmental Strategy 2010 – 2018;
- Environment Action Plan 2013 – 2015;
- Rural Living Strategy 2011; and
- Council Budget.

3.2 Legislation

A summary of the legislation and their stipulated requirements relevant to the regulation of DWM systems are detailed in the Technical Document. The relevant legislation includes:

- *Local Government Act 2020;*
- *Environment Protection Act 2017 (as amended);*
- *Water Act 1989*;
- *Safe Drinking Water Act 2003* and Regulation 2005;
- *Planning and Environment Act 1987*;
- *Public Health and Wellbeing Act 2008*;
- State Environmental Protection Policy (Waters) 2018;
- *Catchment and Land Protection Act 1994;* and
- Victorian Building Regulations 2018.

3.3 Regulatory and Legislated Authorities

DWM involves, to varying degrees, a number of regulatory agencies:

- Council (Colac Otway Shire Council);
- Environment Protection Authority Victoria (EPA);
- Plumbing Industry Commission (PIC);
- Municipal Association of Victoria (MAV);
- Water Corporations: Barwon Water, Wannon Water, and Southern Rural Water;
- Department of Environment, Land, Water and Planning (DELWP); and
- Corangamite Catchment Management Authority.

3.5 Administrative Authorities

VCAT is a tribunal which deals with civil disputes, administrative decisions and appeals that are heard before Judge or Tribunal member. It provides a dispute resolution service for both government and individuals within Victoria.

In cases throughout Victoria, VCAT has questioned the quality of LCAs for DWM, particularly where a site is located within a potable water supply catchment. VCAT has also questioned the rigour of some Council's evaluation of these LCAs and how the minimum development guideline of 1 dwelling per 40 hectares should be applied in the DWSCs (ref. 'Guidelines – Planning Permit Applications in Open, Potable Water Supply Catchment Areas' – DSE, 2012).

3.6 Standards and Guidelines

The design, operation and management of DWM systems are supported by a number of standards and guidelines:

- EPA Code of Practice – Onsite Wastewater Management, Publication 891.4 (2016);
- Land Capability Assessment – Onsite Wastewater Management, Publication 746.1 (2003);
- AS/NZS *1547:2012* Onsite Domestic Wastewater Management;
- *AS/NZS 1546.1-4* Onsite Domestic Wastewater Treatment Units;
- AS/NZS *3500.1-4:2021* Plumbing and Drainage;
- Guidelines for Development in Flood Affected Areas (DELWP, 2019);
- Auditor General of Victoria (2006) Protecting our environment and community from failing septic tanks; and
- Guidelines – Planning Permit Applications in Open, Potable Water Supply Catchment Areas (DSE, 2012).

4 Risk Assessment Framework

Risk Assessment is practiced by individuals and organisations all of the time. However, with the evolving complexity of society, a need for formal Risk Assessment has arisen since the 1950's. This began with studies of food safety and was progressively adopted in the fields of public health and environmental impact. Formal risk assessment has proven to be an effective way of making decisions in situations involving considerable complexity and uncertainty.

Formal recognition of the value, intent and application of risk assessment is provided in the international standard for formal risk management and associated guidelines (Standards Australia, 2009; IEC/ISO, 2009). AS/NZS ISO 31000:2009 (Risk Management) defines risk as the "effect of uncertainty on objectives", where an effect is a (+/-) deviation from the expected and objectives can apply to differing aspects (e.g. environmental goals) or at differing scales (e.g. strategic). In more general terms, Risk is often expressed in terms of the 'consequences' of an event or action and the associated 'likelihood' of that event/action occurring.

The fundamental purpose of any DWMP is the identification and management of risk from DWM systems to public and environmental health. A means of addressing the DWM issues raised by the unsewered towns/settlements, both within and outside of DWSCs, is to prepare a Risk Assessment tool that scientifically measures possible impacts of DWM systems on public and environmental health. A comprehensive 6-staged Risk Assessment model (Framework) (RAF) has been developed for this DWMP to assist Council in analysing risk at variable scales (Shire-wide to individual lot).

Together, all stages of the Risk Assessment have substantial value as a development assessment tool and provide a defensible identification and justification for prioritisation of existing management issues within the localities and towns/settlements. It incorporates tools that assess the bio-geophysical capability for DWM in existing unsewered localities and towns/settlements, recently developed unsewered subdivisions and undeveloped unsewered land. It will be primarily used:

- To determine the level of technical investigation to be undertaken as part of a development application in an unsewered area;
- To identify existing priority unsewered localities and towns/settlements that require more detailed investigations to determine needs (i.e. improvement actions or plans);
- As a guide to develop a monitoring strategy for existing DWM systems in the Shire; and
- As a guide to Council for strategic planning of future unsewered development.

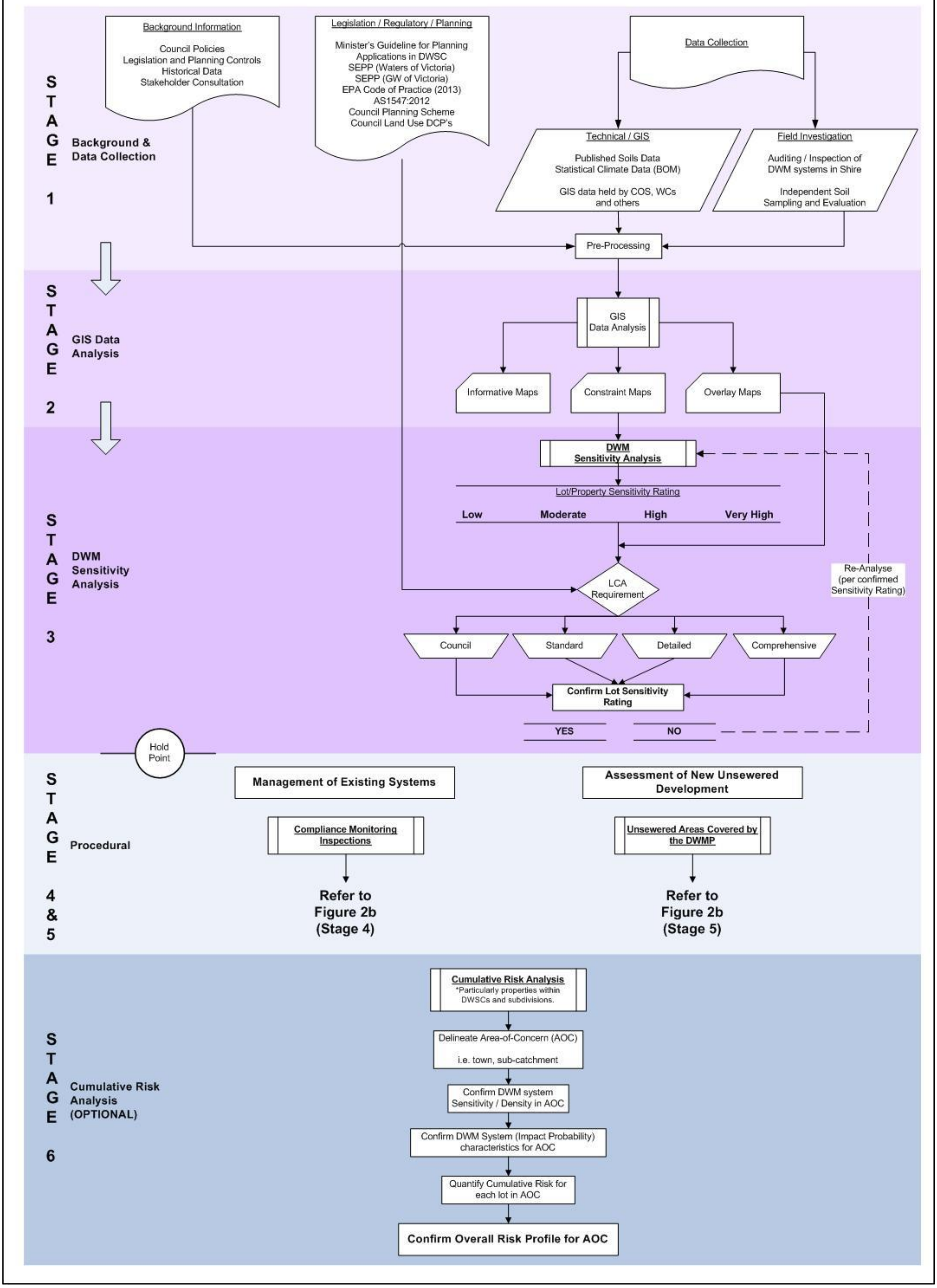
The overall Risk Assessment aims to provide Council with a reasoned and justified tool to prioritise future development, and to implement monitoring and upgrading of DWM systems within the Shire by highlighting regions with elevated DWM risk profiles (e.g. towns/settlements with a large numbers of small lots and older DWM systems). Consideration of both individual (lot) and cumulative (regional) DWM risk provides a versatile tool for:

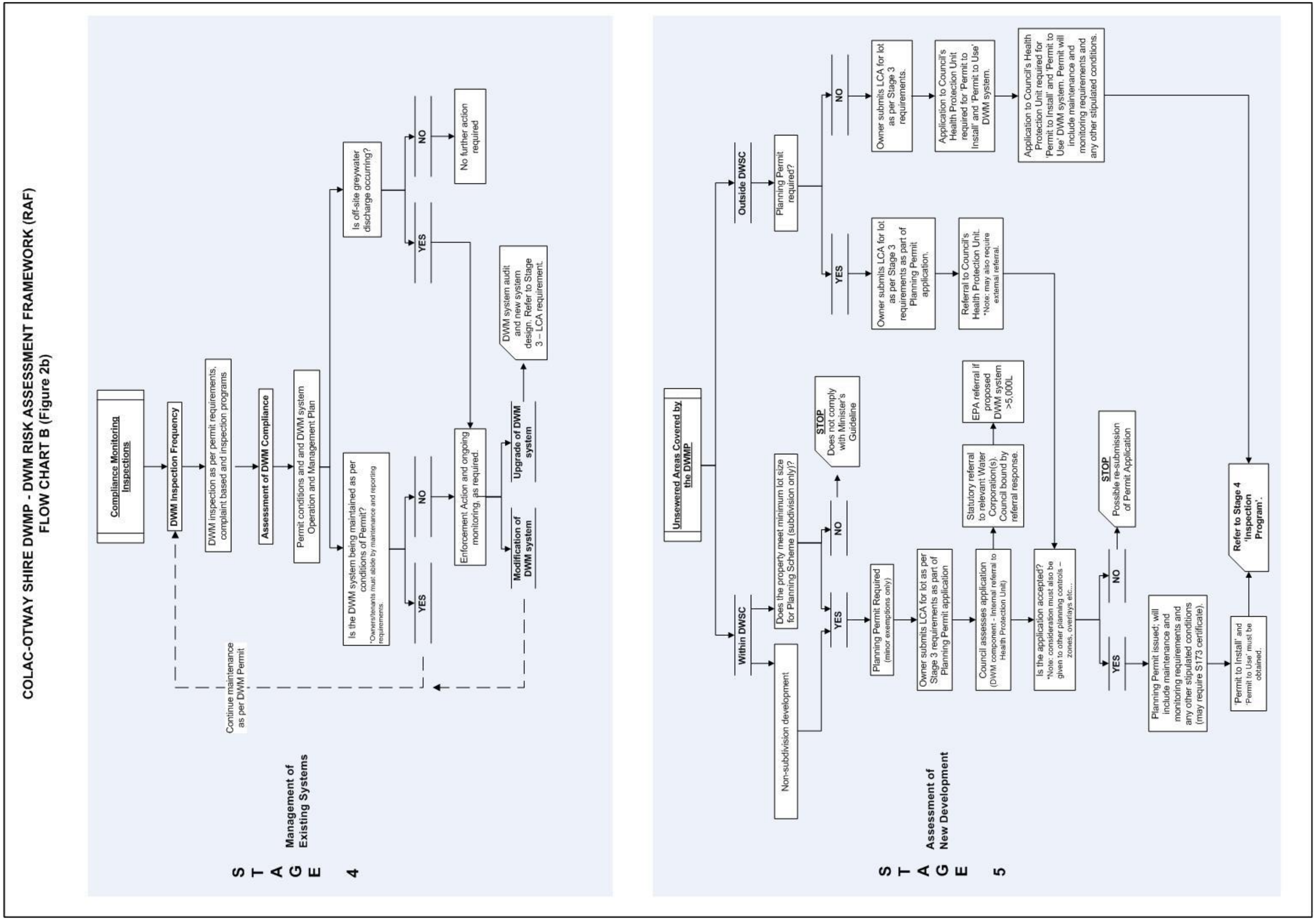
a) examining changes from an accepted 'baseline' condition (i.e. water quality or environmental indicators).

b) preparing cost/benefit analyses for upgrade/improvement options (i.e. DWM vs. sewerage).

c) comparing alternate land use/development scenarios (i.e. development density).

COLAC-OTWAY SHIRE DWMP - DWM RISK ASSESSMENT FRAMEWORK (RAF)
FLOW CHART A (Figure 2a)




COLAC-OTWAY SHIRE DWMP - DWM RISK ASSESSMENT FRAMEWORK (RAF)
FLOW CHART B (Figure 2b)
STAGE 4
Management of Existing Systems
Compliance Monitoring Inspections
DWM Inspection Frequency
DWM inspection as per permit requirements, complaint based and inspection programs
Assessment of DWM Compliance
Permit conditions and and DWM system Operation and Management Plan
Is the DWM system being maintained as per conditions of Permit?
*Owners/tenants must abide by maintenance and reporting requirements.
YES
NO
Is off-site greywater discharge occurring?
YES
NO
No further action required
Enforcement Action and ongoing monitoring, as required.
Modification of DWM system
Upgrade of DWM system
DWM system audit and new system design. Refer to Stage 3 – LCA requirement.
Continue maintenance as per DWM Permit
STAGE 5
Assessment of New Development
Unsewered Areas Covered by the DWMP
Within DWSC
Outside DWSC
Non-subdivision development
Does the property meet minimum lot size for Planning Scheme (subdivision only)?
YES
NO
STOP
Does not comply with Minister's Guideline
Planning Permit Required
(minor exemptions only)
Owner submits LCA for lot as per Stage 3 requirements as part of Planning Permit application
Council assesses application
(DWM component - Internal referral to Health Protection Unit)
Statutory referral to relevant Water Corporation(s). Council bound by referral response.
EPA referral if proposed DWM system >5,000L
Is the application accepted?
*Note: consideration must also be given to other planning controls – zones, overlays etc...
YES
NO
STOP
Possible re-submission of Permit Application
Planning Permit issued; will include maintenance and monitoring requirements and any other stipulated conditions (may require S173 certificate).
'Permit to Install' and 'Permit to Use' must be obtained.
Refer to Stage 4 'Inspection Program'.
Planning Permit required?
YES
NO
Owner submits LCA for lot as per Stage 3 requirements as part of Planning Permit application.
Referral to Council's Health Protection Unit.
*Note: may also require external referral.
Owner submits LCA for lot as per Stage 3 requirements.
Application to Council's Health Protection Unit required for 'Permit to Install' and 'Permit to Use' DWM system.
Application to Council's Health Protection Unit required for 'Permit to Install' and 'Permit to Use' DWM system. Permit will include maintenance and monitoring requirements and any other stipulated conditions.

4.1 DWM Sensitivity Analysis (Stage 3)

4.1.1 Methodology and Rationale

The primary objective of the DWMP is to assess all 'unsewered' 'developable' lots within COS to determine their suitability to sustainably manage domestic wastewater on-site in compliance with legislative (i.e. SEPPs) and regulatory (i.e. Code) requirements. The inter-relationship of a wide range of individual constraints and variables affect the specific land capability and associated limitations for sustainable on-site DWM. Understanding this inter-relationship can be difficult, particularly in terms of assessing the relative contributions of individual constraints in a broad-scale evaluation.

The DWM Sensitivity Analysis involved assessing the cumulative effect of the individual constraints detailed in Section 6 of the Technical Document: soil suitability, slope, useable lot area, climate and location (i.e. whether or not a lot is located within a DWSC) for all of the unsewered lots within COS. Each lot was assigned a rating class for each of the individual constraints based on the criteria detailed in Section 6 of the Technical Document.

The following algorithm was developed using professional judgement and reviews of current literature. The algorithm generally follows the rationale developed for the Mansfield Domestic Wastewater Management Plan Pilot Project (Mansfield Shire Council, 2014); with adaptation by the Stakeholder Working Group (SWG) to reflect COS specific concerns. It details how the individual constraints were combined to determine the final Sensitivity Rating for each unsewered lot within COS:

((Soil Suitability + Slope) x ((2 x Useable Lot Area) + Climate)) / 10

The algorithm incorporates the constraints imposed by landform and soil characteristics, as well as the local climate which will impact on the selection and sizing of DWM systems for any given location. The useable lot area refers to the physical constraints imposed by prescribed setbacks from sensitive features, such as surface waterways (permanent and intermittent); groundwater bores and flood prone land. The existing vegetation on a lot, as well as the proposed development footprint (i.e. building envelope and improvements), will also impact on the resultant useable lot area. If there is insufficient area remaining, the lot will be unable to sustainably manage the wastewater on-site and, hence, not comply with the requirements of the SEPP.

The final sensitivity value (number) derived from the algorithm for each lot was assessed to determine the appropriate 'Sensitivity Rating' ranges. Further information on the development of the Sensitivity Rating classification is provided in the Technical Document (Section 6.2.1). The following outlines the respective ranges and associated final Sensitivity Rating classes:

- Very High: > 5.5;
- High: 4 ≤ x ≤ 5.5;
- Moderate: 2 ≤ x ≤ 4; and
- Low: < 2.

Further, all lots were identified as being located within, or outside, a DWSC. This step was included to ensure that all lots located within a DWSC are subject to a LCA prior to development, as per Section 3.6 of the EPA Code of Practice 891.4 (2016). For example, for a 'low' Sensitivity Rating lot within a DWSC, the algorithm automatically increases the rating to 'moderate' to ensure that a LCA is undertaken, in accordance with the Code of Practice.

The criteria used to determine the Sensitivity Rating categories were based on previous constraint assessments for unsewered towns in Australia undertaken by W&A, and relevant Australian and Victorian guidelines for DWM. Table 4 provides a rationale for the interpretations that were used to derive the ratings, which is also discussed in Section 6.2.1 of the Technical Document.

The final Sensitivity Ratings give guidance towards the DWM requirements as stipulated by Council. For existing DWM systems, the level of sensitivity will commonly reflect the level of challenge that has been experienced in managing the system. This information will help guide owners and Council in the ongoing management of existing systems.

Table 4: Sensitivity Rating Descriptions

Very High	Constraints are present at a very high level and this significantly restricts opportunities for sustainable DWM. Traditional systems are 'typically' not appropriate and a detailed site and soil evaluation would be required to determine if DWM is achievable at all. If achievable, specialised, advanced treatment and land application systems may be required to overcome the constraint.
High	Constraints are present at a high level and this substantially restricts opportunities for sustainable DWM. Traditional systems (i.e. septic tanks and trenches) are 'typically' not appropriate and a detailed site and soil evaluation would be required to determine if they are supported. Otherwise, specialised, advanced treatment and land application systems may be required to overcome the constraint.
Moderate	Constraints are present at a moderate level and this limits the range of DWM options that are appropriate for the site. A detailed site and soil evaluation is required to identify the most appropriate DWM system and mitigation measures to be employed.
Low	Constraints are present at a low level and are unlikely to substantially limit opportunities for DWM. In most cases appropriately designed and managed conventional systems will be accepted.

The terms relate to the underlying level of sensitivity to DWM posed by the lot. These factors are used to direct management (planning) decisions and subsequently, the level or intensity of site-specific investigation (LCA) required.

4.1.2 Sensitivity Analysis Mapping

The final Sensitivity Rating for each individual unsewered lot within COS is shown in Figure 3 and Table 5, which detail the results of the Sensitivity Analysis for the Shire. The final Sensitivity Rating and final map for each of the targeted localities and associated towns/settlements are detailed in the respective Locality Reports in Appendix B of the Technical Document. The targeted localities were highlighted as priority regions of investigation by Council and the SWG. The localities considered in this DWMP are: Alvie, Barham River Catchment (Apollo Bay locality hinterland), Barongarook, Barwon Downs, Beeac, Beech Forest, Carlisle River, Coragulac, Cororooke, Forrest, Gellibrand, Kawarren, Kennett River, Separation Creek and Wye River. The towns represent the developed 'centre' of each locality and are predominantly zoned Township Zone. Barham River, Barongarook and Kawarren, which are within the Rural Living Zone and Rural Conservation Zone, are referred to as 'settlements'. The town/settlement boundaries were primarily based on the zoning boundaries.

The parcels within each town/settlement include both commercial and domestic DWM systems without distinction. Town/settlement boundaries may also, on occasion, transect a given parcel. In that instance the parcel is considered to be within the town/settlement boundary and its Sensitivity Rating will be applied to the entire parcel.

Council maintains a database of the calculated Sensitivity Ratings for all the unsewered properties within the Shire.

An owner can contact Council to obtain the data for the final Sensitivity Rating of their land. As per the Action Plan, Council have added the DWM Sensitivity Overlay to the interactive mapping interface available for all residents on the Council's website. The mapping can be accessed here:

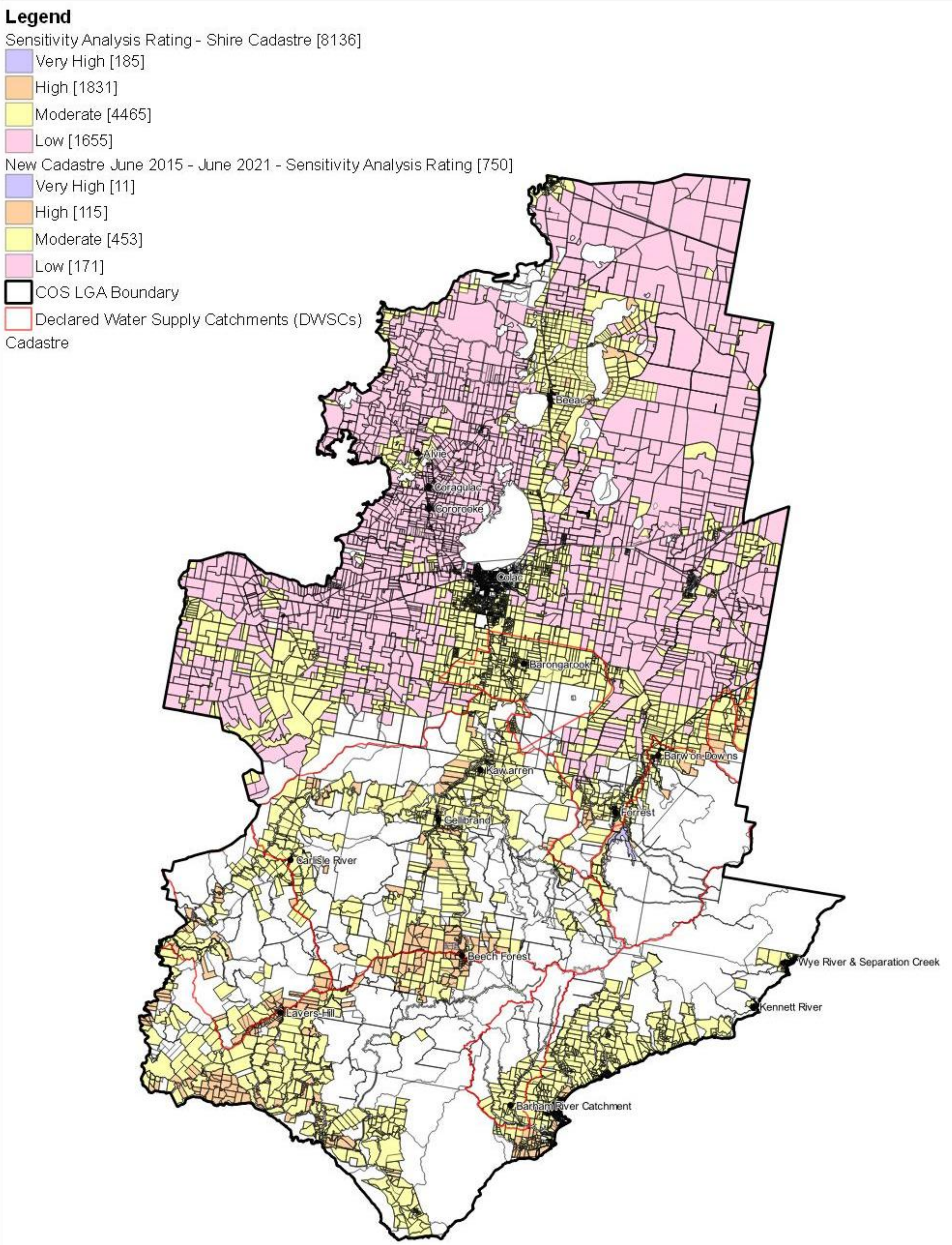
http://cos.cerdi.com.au/cos_map.php; with the layer located within the ‘Planning- Domestic Wastewater’ folder.

Whilst every effort is made to consider all relevant factors in the sensitivity mapping, information used may not account for relevant features present on the lot. For example, some waterways such as surface farm dams may not be captured in the mapping which may impact the final Sensitivity Rating and Useable Land for effluent application on a given lot.

Table 5: Final Sensitivity Rating Summary

	Total Lots[2]	Total Number in Final Sensitivity Rating*			
		Very High	High	Moderate	Low
Shire (Overall)	8,136 (750)	185 (11)	1,831 (115)	4,465 (453)	1,655 (171)
Alvie Town (Locality)	33 (161)	0 (0)	3 (8)	22 (73)	8 (76)
Barham River (Apollo Bay) Settlement (Locality)	78 (392)	0 (12)	21 (146)	57 (234)	0 (0)
Barongarook Settlement (Locality)	101 (262)	0 (0)	2 (7)	99 (255)	0 (0)
Barwon Downs Town (Locality)	85 (260)	0 (1)	24 (57)	61 (201)	0 (1)
Beeac Town (Locality)	256 (642)	0 (0)	187 (241)	69 (355)	0 (46)
Beech Forest Town (Locality)	142 (332)	97 (119)	42 (153)	3 (60)	0 (0)
Carlisle River Town (Locality)	25 (246)	0 (0)	0 (38)	25 (205)	0 (3)
Coragulac Town (Locality)	73 (188)	0 (0)	0 (0)	43 (70)	30 (118)
Cororooke Town (Locality)	123 (285)	0 (0)	0 (0)	110 (146)	13 (139)
Forrest Town (Locality)	167 (349)	0 (9)	14 (43)	153 (284)	0 (13)
Gellibrand Town (Locality)	69 (265)	0 (2)	19 (61)	50 (202)	0 (0)
Kawarren Settlement (Locality)	72 (215)	0 (0)	12 (35)	60 (180)	0 (0)
Kennett River Town (Locality)	180 (183)	0 (0)	174 (175)	6 (8)	0 (0)
Lavers Hill Town (Locality)	84 (194)	29 (40)	53 (131)	0 (23)	0 (0)
Separation Creek Town (Locality)	117 (129)	0 (0)	105 (109)	13 (20)	0 (0)
Wye River Town (Locality)	373 (389)	0 (0)	360 (364)	13 (25)	0 (0)

[2] Shire (original (new since 2015)); townships (town (locality)).



Whilst every effort is made to consider all relevant factors in the sensitivity mapping, information used may not account for relevant features present on the property/parcel.

Figure 3: Sensitivity Analysis - Shire

Colac Otway Shire DWMP Review

Whitehead & Associates Environmental Consultants

0 6 12 18 24 30 km

(Approx Scale)

Revision	8
Drawn	JK
Approved	MS

4.1.3 Evaluation of Final Sensitivity Analysis

The Sensitivity Analysis resulted in the lots throughout the majority of the Shire being assigned a Moderate Sensitivity Rating. The final Sensitivity Analysis map highlights the inherent relationship that results in only one or two individual constraints (e.g. soil suitability) generally affecting any given lot. This relationship is described further in the individual Locality Reports (Appendix B, Technical Document). Each locality and associated town/settlement has particular DWM constraints that need to be addressed.

The mapping identifies approximately:

- 20.6% of lots within the Shire with a Low Sensitivity Rating;
- 55.3% of lots with a Moderate Sensitivity Rating;
- 21.9% of lots with a High Sensitivity Rating; and
- 2.2% of lots with a Very High Sensitivity Rating.

The spatial distribution of the levels of sensitivity appears to be distinctly influenced by topographical features, such as the Otway Ranges. The northern half of the Shire appears to pose a lower sensitivity to sustainable DWM, whereas, the southern half of the Shire, including the coastline, generally poses a moderate sensitivity to sustainable DWM. Therefore, prioritisation should be towards the areas that pose a higher level of sensitivity.

According to the individual constraint maps as detailed in the Technical Document, the parameters contributing the greatest limitation to DWM within the Shire are soil suitability (which is often due to clayey soils derived from the basaltic parent rocks), slope, climate and useable lot area, (generally associated with surface waterways, particularly within the DWSCs in the Otway Ranges).

It is essential that the limitations of the data used to compile these maps are recognised when using the Sensitivity Analysis map. Whilst individual lots have been assigned a Sensitivity Rating, it is not sufficiently detailed to allow determination of individual system performance or land capability for individual lots. This is why the term Risk Assessment is used to describe the methodology and resultant outputs. An allotment categorised as having a Very High Sensitivity rating will not necessarily be totally unsuitable for on-site DWM or currently be experiencing poor system performance or system failure; however, it is likely to contain a number of significant limitations to the safe operation of on-site DWM systems assessed at a very broad scale.

Overall Sensitivity Ratings should be used to justify the requirement for more detailed individual lot LCAs, more rigorous assessment of development proposals and to target investment in the inspection and management of existing on-site DWM systems, rather than to define system performance or land capability.

Furthermore, the degree of risk depends on the type of effluent dispersal system and generated effluent quality (e.g. subsurface irrigation can be installed on slopes up to 15 – 20% in some cases, but this would be impractical for trenches). This relationship is detailed further in Section 6.2.5 of the Technical Document. Physical constraints can often be overcome or substantially mitigated by a range of measures (such as terracing, importing topsoil fill, installing stormwater diversions, removing vegetation or planting nutrient tolerant vegetation), thereby increasing the ‘suitability’ of the available area.

4.2 Land Capability Assessment (Stage 3)

A Land Capability Assessment (LCA) is required when submitting a Planning Permit application for a development or subdivision on a Moderate, High or Very High Risk lot (or for Low Risk lots within a DWSC), or when a Certificate to Install a DWM system is required.

A LCA must be conducted in accordance with the minimum standards outlined in the current EPA Code of Practice and *AS/NZS 1547:2012* and should be guided by the Victorian Model Land Capability Assessment Framework (MAV & DSE, 2006) (as amended). A LCA needs to demonstrate that the requirements of the SEPP will be met.

The Sensitivity Rating determined by the Sensitivity Analysis will act as the default LCA standard for lots as defined by this DWMP. Copies of the minimum requirements for assessment and reporting for each level of LCA are provided in Appendix C. It is important to note that there may be circumstances where the desktop sensitivity analysis results do not correlate perfectly with actual site conditions. In these circumstances, an increase or decrease in the Sensitivity Rating and LCA requirements may occur at the discretion of Council through completing a Site Inspection and Field Investigation. Therefore, the results of site-specific LCAs will constantly update the Sensitivity Analysis database held by Council, which will improve site understanding and validity of results. A Sensitivity Pro-forma Checklist, as shown below in Table 7 (also attached in Appendix B), can be used by the LCA assessor to accommodate any request to Council to alter the Sensitivity Rating of a lot.

It may be suitable for accredited LCA assessors to provide a clause within the contract warning clients of a potential fluctuation of requirements, and hence cost, that is dependent on Sensitivity Rating confirmation of the lot. The current EPA Code of Practice states that Council's Health Protection Officers (HPOs) or other Authorised Officers (AO) can determine what comprises a satisfactory LCA.

The MAV has developed a model LCA report and procedures to assist LCA assessors and regulators. As a minimum, LCAs should follow the 12-stage best practice model detailed within the current EPA Code of Practice and Victorian LCA Framework (MAV, 2014). The specific LCA requirements for the determined Sensitivity Ratings (Very High, High, Moderate and Low) are detailed below.

Table 6: Sensitivity Pro-forma Checklist Example

Parameter	Site specific input
PFI Identification Number[3]	(e.g. 5763482)
Lot Address	(e.g. 57 Main Road)
Locality	(e.g. Barongarook)
Zoning and Overlay	(e.g. Township Zone)
Area (ha)	(e.g. 4ha)
Soil Texture	Soil Category as per AS/NZS 1547:2012 (e.g. Category 4 - Clay loam)
Soil Depth (m)	Depth to limiting layer (1.7m)
Soil Structure	Weak, moderate, strong, massive or apedal (e.g. weak)
Soil Limitations	(e.g. sodic and low fertility)
Permeability (Ksat) (m/day)	Indicative as per AS/NZS 1547:2012 or directly measured in-situ (e.g. 0.1m/day) using approved methodology (i.e. AS/NZS 1547:2012, Appendix G)
Slope (%)	Average slope (e.g. 4%)
Presence of Surface Waters	Distance to nearest surface waters
Useable Lot Area (ha)	Apply all relevant setback distances (e.g. 1.5ha)

With regards to DWM system selection and sizing, the permeability and corresponding 'design' loading rate for the most limiting soil horizon within 600mm from the base of the LAA must be used. This conservative approach ensures that the loading of wastewater on the soil can be supported for the entire soil profile to ensure that surface runoff and excessive deep drainage does not occur. The DWM systems should be sized either:

- as per the System Sizing Tables (Section 7 of the Technical Document) if permitted by this DWMP; or
- by site-specific design as detailed by the respective LCA requirements explained below.

4.2.1 Requirements for Low Sensitivity Lots

For Low Sensitivity Rating Lots, it is envisaged that a LCA will generally not be necessary, unless deemed so by Council staff. Council may request for a Soil Assessment to be provided in addition to a Site Plan on a case-by-case basis. Applications for Low Sensitivity lots can be assessed using the Sensitivity Pro-forma Checklist (Table 6 and Appendix B) and/or the 'Site Information Sheet' template in Appendix D of AS1547:2012 to confirm and record the site and soil characteristics. If available for the location, the proposed treatment and land application system combination can be selected from the System Selection (Appendix A) and Sizing Tables (Locality Reports in Appendix B of the Technical Document).

Council may visit the site to confirm site and soil details are as per the Pro-forma detail and that the proposed DWM treatment and land application system is appropriate for the site. If a Low Sensitivity Rating lot is located within a region of increased sensitivity or DWM constraint, Council staff may require, at their discretion, a Standard LCA Assessment and Report to be completed

[3] Either parcel or property identifier.

(Table C1, Appendix C). This may include lots that are located in areas prone to landslip, high groundwater regions, Groundwater Water Supply Protection Areas (i.e. Warrion), or Groundwater Management Areas.

For Low Sensitivity Rating lots located within a DWSC, a LCA is mandatory as per Section 3.6 of the EPA Code of Practice 891.4 (2016); therefore, they are automatically required to complete a Standard LCA as detailed in Table C1, Appendix C.

For Moderate, High and Very High Sensitivity Rating lots, or other properties where Council has ordered that a LCA should be prepared, the following guidelines (or as amended) should be adhered to by the consultant preparing the LCA on behalf of the owner:

- EPA Code of Practice – On-site Wastewater Management, Publication 891.4 (2016);
- *AS/NZS 1547:2012*; and
- Municipal Association of Victoria – Model Land Capability Assessment Framework (2014).

4.2.2 Requirements for Moderate Sensitivity Lots

For Moderate Sensitivity Rating Lots, a Standard LCA is required (Appendix C, Table C1) which includes Site Inspection and Field Investigations. However, where appropriate, system design can be determined using the System Selection (Appendix A) and Sizing Tables (Section 7 and the Locality Reports in Appendix B of the Technical Document). For Moderate Sensitivity Rating lots located outside of a DWSC, Council may at its discretion not require an LCA to be completed and the procedure as per Low Sensitivity Rating lots to be followed.

A provision is made for Moderate Sensitivity Rating lots located within Climate Zone 4 (Otway Ridge region) that they must complete Section 6 'System Selection and Design' as per the Detailed LCA procedure, as site-specific design is required for system sizing. This is to ensure that the sensitivity of the Otways and increased difficulty in DWM design due to high rainfall is taken into consideration.

4.2.3 Requirements for High Sensitivity Lots

For High Sensitivity Rating lots, a Detailed LCA is required (Appendix C, Table C2) which requires information in addition to the Standard LCA. The main requirement of a Detailed LCA is to undertake a monthly water balance for sizing the DWM system. More comprehensive soil testing is also required to assist with appropriate system selection and ensuring any necessary mitigation measures are implemented into the site management plan.

System Selection and Sizing Tables are not available for High Sensitivity Rating lots.

4.2.4 Requirements for Very High Sensitivity Lots

For Very High Sensitivity Rating lots, a Comprehensive LCA is required (Appendix C, Table C3) which understandably requires a higher level of assessment and reporting due to the inherent constraints and risks associated with sustainable DWM on the lot. A Comprehensive LCA requires in-situ permeability testing, soil chemical analysis, conservative monthly or daily water balance, an annual nutrient balance and a detailed site specific hydraulic design in addition to the standard LCA requirements. Council is implementing an in-situ permeability testing protocol that must be followed.

4.2.5 Generic LCA Requirements - Overlays

As detailed in Stage 1 of each LCA procedure (Appendix C), confirmation of any relevant sensitivity overlays (e.g. landslip) with Council is required. If any sensitivity is identified, this needs to be specifically addressed within the LCA. Discussion with Council is required to determine the necessary requirements to be met. If the site is located within an identified landslip region, then a geotechnical report (DWM relevant) will likely need to be completed; refer to Step 4 [pp.35] of the 12-step LCA procedure in the EPA Code of Practice 891.4 (2016) for detail.

If the site is located within a known shallow groundwater region, the depth to (permanent and shallow) groundwater will need to be determined and discussed within the LCA report.

Additional LCA requirements:

- All Low Sensitivity Rating lots within a DWSC are required as a minimum to do a Standard LCA as per the current EPA Code of Practice requirements;
- If the lot is applying for an alteration and located within a DWSC, OR the lot is located within a DWSC and does not generate an Environmental Significance Overlay (ESO) 3 trigger, than a minimum of 20/30 secondary treatment standard is required regardless of the Sensitivity Rating of the lot; and
- All lots located within Climate Zone 4, associated with the higher rainfall in the Otway Ridge (i.e. Lavers Hill, Fergusson and Beech Forest), are required to undertake site-specific design and cannot use the System Sizing Tables.

It should be noted that a LCA may indicate that it is not be possible to design an appropriate DWM system for a given site and sometimes costs for construction may be prohibitive. However, the onus of justification rests with the LCA assessor who may demonstrate to Council/WC satisfaction that the risk from a proposed DWM system combination has been adequately addressed by design or management measures.

4.2.6 Subdivision LCA Requirements

It is very important that an LCA is performed early in the planning phase of land development before rezoning or subdivision as it achieves a more sustainable result, because areas with higher degrees of limitation can be appropriately zoned and subdivision layouts can make best use of the constraints and opportunities of the land. It is also a requirement under the Planning Scheme to be able to demonstrate that the land is suitable for the development of a dwelling prior to subdivision approval. Chapter 5 of the MAV Model Land Capability Assessment Framework (2014) broadly discusses LCAs for subdivisions.

Regardless of the scale of an LCA, the objective is the same, that is, the determination of a sustainable DWM strategy for **each** proposed lot to reduce potential impacts to the local receiving environments. Different management strategies may be required within the same subdivision due to varying constraints identified through the LCA across the site.

Only concept DWM system designs are necessary at this stage to determine the minimum size of the land application area. Options may be left as broad technology types suitable for the lots, with detailed system design required at the individual lot development stage.

The LCA requirements detailed within Section 4.2 are applicable to all scales of development planning and assessment. The Sensitivity Rating of the existing lot will direct the level of detail required for an LCA for a subdivision or rezoning of a lot.

4.3 Sensitivity Analysis Summary

The recognised limitations emphasise that the Sensitivity Analysis should only be used as a guide to distinguish regions within the Shire with relatively higher levels of sensitivity to DWM related public and/or environmental health outcomes. The results can be used to target more detailed investigations into suitability for on-site DWM. The Sensitivity Analysis maps help to target the main bio-physical DWM constraints associated with a specific lot which, with appropriate individual assessment and design, can potentially be mitigated or overcome.

Useable lot area, irrespective of total lot size, plays a key role in determining a lots capacity for sustainable long-term on-site DWM and influences the selection of appropriate systems. As a general rule, the smaller the lot, the less land that will be available for effluent management after allowing for other development of the land. It is difficult to define the minimum lot size that would be required throughout the Shire to ensure long-term on-site DWM without further detailed study. This will vary depending on the physical constraints of the lot and the nature of the development as well as the type of treatment and land application system used.

The Minister for Water's Guideline 1 requires that the density of unsewered dwellings should be no greater than one dwelling per 40 hectares and each lot created in a subdivision should be at least 40 hectares in area within DWSCs. In order to allow for consideration of a relaxation of this Guideline, a LCA needs to demonstrate that DWM is sustainable with no off-lot discharges and that the minimum zoning lot size requirements (for subdivisions only) in the Planning Scheme are met. Further assessment on sustainable lot densities within specific sub-catchments is required.

It is also evident that variability in constraint exists between the different unsewered localities within the Shire. Further detailed studies into the performance of existing on-site DWM systems within each of the targeted unsewered towns/settlements is recommended to verify the findings of this broad-scale assessment, to provide a more detailed study on maximum lot development density and hence minimum lot size in proposed development areas. This will aid Council in ensuring future development will not adversely impact environmental and public health.

4.4 Prioritisation of Investigation Areas

A key role of the DWMP and Action Plan is to guide the systematic investigation and management of unsewered development within the Shire. Investigation may include:

- Improving and expanding the existing Council DWM database through inspection of undocumented properties;
- Focussing compliance and monitoring activities in areas where risk to public and environmental health is greatest, i.e. highly sensitive lots within DWSCs;
- Developing a greater understanding of the risks of increasing unsewered development density within an Area-of-Concern, which may be described at various scales (i.e. town/settlement, off-take, catchment area etc.); and
- Guiding strategic planning initiatives to enhance environmental objectives (i.e. water quality targets) or to examine alternative wastewater servicing solutions for unsewered areas.

It is not feasible to deal with the requirements of the entire Shire simultaneously, so a process for ranking the priority of 'core' and 'non-core' Areas-of-Concern (AOCs) for investigation effort is required.

'Core' areas include the targeted towns/settlements (as agreed by the Stakeholder Working Group) and delineated sub-catchments within the DWSCs (following the methodology detailed in Section 7 in the Technical Document). 'Non-Core' areas comprise remaining areas within the Shire boundary (residual regions) which were assigned based on their geographic location (i.e. north or south). Prioritisation involved analysis at varying scales to address the variable goals of COS and the WCs.

Priority is based on the density of DWM sensitivity (Sensitivity Density) within each AOC. Sensitivity Density is reported as the aggregated DWM sensitivity (value) per unit area (km^2). The methodology for calculating Sensitivity Density within each AOC is as follows:

a) Delineate the AOC (i.e. town/settlement, sub-catchment or residual region);
b) Confirm the number of unsewered lots within the AOC;
c) Calculate the cumulative 'Sensitivity Value' for the investigation lots within the AOC (sum of all values);
d) Calculate the cumulative area of the investigation lots within the AOC (sum of individual lot areas);
e) Calculate the DWM Sensitivity Density for each AOC (cumulative DWM 'Sensitivity' value per unit area - km^2); and
f) Assign the priority ranking of each AOC based on the assigned sensitivity density value.

Lot priority is based on the 'DWM Sensitivity Density' of all unsewered lots within the delineated town/settlement boundaries. Sub-catchment priority reflects the 'DWM Sensitivity Density' for all unsewered lots within the designated sub-catchment, less the lots already included in the town/settlement analysis. This approach follows the intention of the *Guidelines for Planning*

Permits in Open Potable Water Supply Catchment Areas (DSE, 2012) where any development proposal must demonstrate that “the proposal does not present an unacceptable risk to the quality and quantity of water generated by the catchment [all land uses] having regard to the land capability assessments, land condition and management conditions of the site and catchment”. Lots that were located within more than one sub-catchment were included in both sub-catchments to ensure conservatism as it is unknown at a regional scale where the development, or potential, is located on the lot.

To complete the picture for the Shire, those areas within the LGA boundary that have not been accounted for in the town/settlement or sub-catchment priority analyses are included as residual regions. These areas are outside of the DWSC boundaries to the north and south of the Shire.

The prioritisation will assist in decision making and planning for future development within the AOCs. Additional detailed analysis and compliance regimes can then be developed with the aim of protecting the environment and public health, whilst allowing for development consistent with Council strategies and planning controls.

Table 7 outlines the results and rankings of the Prioritisation Analysis for each AOC in descending order based on cumulative sensitivity to DWM.

The priority ranking (by Sensitivity Density) will *inform* operational priority which also accommodates other factors in prioritising work, such as objectives in the Council Plan.

4.5 Management of Unsewered Development in COS

Stages 4 and 5 of the Risk Assessment Framework are ‘procedural’ steps for determining the management requirements for existing unsewered development or the need for further investigation and analysis for new development.

4.5.1 Management of Existing Systems (Stage 4)

Existing DWM systems in COS will be managed through the inspection program as described in Section 7 of this DWMP. Stage 4 (Figure 2b) outlines the procedural framework under which COS will prioritise, inspect and, if necessary, require/enforce management of DWM systems in the Shire.

4.5.2 Assessment of New Development (Stage 5)

Proposals for development exempt from planning permit requirements (e.g. dwelling in Township Zone that is not covered by any overlays) will proceed directly to the preparation of a LCA as per the requirements set out in Section 4.2 of this document.

Development and planning proposals for lots located within the DWSC must comply with the minimum lot size specified for the current zoning as per the Planning Scheme (subdivision only). If a lot does not achieve the minimum area, then it is deemed as non-compliant with the Minister for Water’s Guidelines. Assuming the proposal is compliant with minimum lot size criteria, COS or the WCs may consider proceeding to the (Stage 6) Cumulative Risk procedure to develop a baseline condition by which the proposal may be assessed.

Finally, irrespective of where or how development will proceed within COS, Council may consider examining the ‘Cumulative Risk’ of all unsewered development areas using the proposed methodology as part of a longer term goal for managing domestic wastewater systems in the Shire.

Table 7: Prioritisation Summary

Priority Ranking	Area of Concern (AOC)	Location/ Description	Unsewered Lots within AOC	Cumulative Sensitivity Rating	AOC area (km^2)	Sensitivity Density (per km^2)
Towns						
1	Kennett River	Outside DWSC	180	865	0.26	3,327
2	Wye River and Separation Creek	Outside DWSC	498	2,386	0.72	3,314
3	Beech Forest	Within DWSC; Sub-catchments E, V and outside	150	917	0.49	1,871
4	Beeac	Outside DWSC	269	1,008	0.63	1,600
5	Lavers Hill	Within DWSC; Sub-catchments T and outside	84	444	0.38	1,168
6	Cororooke	Outside DWSC	112	300	0.35	857
7	Forrest	Outside DWSC; Sub-catchment N (slightly)	167	522	0.72	725
8	Barwon Downs	Within DWSC; Sub-catchments K, L and outside	89	253	0.41	617
9	Gellibrand	Within DWSC; Sub-catchments E, V and U	71	250	0.45	556
10	Alvie	Outside DWSC	33	87	0.19	457
11	Coragulac	Outside DWSC	69	165	0.59	280
12	Carlisle River	Within DWSC; Sub-catchments W and G	26	70	0.27	258
13	Kawarren	Within DWSC; Sub-catchment U	72	225	2.01	112
14	Barongarook Settlement	Within DWSC; Sub-catchments Q and P	101	251	2.99	84
15	Barham River Catchment Settlement	Within DWSC; Sub-Catchments D and S	81	316	18.08	17
SUB-CATCHMENTS						
1	B - West Gellibrand River	Offtake	2	7.2	0.03	240
2	O - Gellibrand River	Discharge	115	362.2	43.67	98.7
3	W - to Carlisle River	Discharge	129	488.1	46.88	70.9
4	H - East Barwon Diversion Gates	Offtake	35	145	3.83	37.9
5	M - to King Creek	Discharge	19	66.8	2.84	23.5
6	F - Wyelangta Depot and North Arkins Creek	Offtake	16	62.6	2.76	22.7
7	N - to Barwon River West Branch	Discharge	58	256.4	12.47	20.6
8	L - to Callahan Creek North Branch	Discharge	31	97.2	5.06	19.2
9	K - to Dewings Creek (Wurdi Boluc Inlet Channel)	Discharge	44	134.7	9.61	14
10	E - Gellibrand Pump Station	Offtake	119	463.8	33.56	13.8
11	V - to Gellibrand River and Charleys Creek	Discharge	242	887.8	65.18	13.6
12	T - to Chappell Creek and Gellibrand River	Discharge	204	845.4	67.83	12.5
13	X - to Gellibrand River (near Sheepyard Creek)	Discharge	67	248.4	23.42	10.6
14	R - to Deans Creek	Discharge	43	107	10.7	10
15	I - Callahans Creek	Offtake	1	4.2	0.43	9.8
16	P - Boundary Creek	Discharge	171	386.7	40.18	9.6
17	G - North Otway River Raw WPS	Offtake	29	93.5	9.89	9.5
18	Q - to Barongarook Creek	Discharge	109	283.7	31.81	8.9
19	J - to Matthews Creek (to the north)	Discharge	57	151.6	24.27	6.2
20	D - Barham River Pump Station 2	Offtake	7	23.7	3.85	6.2
21	S - to Barham River West Branch	Discharge	7	24.4	4.33	5.6
22	U - to Love Creek	Discharge	228	690.6	60.31	1.5
23	A - Olangolah	Offtake	0	0	0	0
24	C - Barham River Pump Station 1	Offtake	0	0	0	0
Residual Regions						
1	Southern	Residual area outside DWSC	1,018	3,782	255.6	14.8
2	Northern	Residual area outside DWSC	4,049	8,780	1,597.50	5.5

4.6 Cumulative Impact Assessment of DWM

Cumulative Impact Assessment (CIA) is an indicative risk assessment tool used to provide guidance on potential risks associated with existing or proposed development in unsewered areas. It provides a means of quantifying risks and comparing them with identified benchmarks (i.e. baseline or pre-developed conditions) or performance targets (i.e. water quality indicators). The CIA looks at existing DWM systems within an area and determines the environmental and health impacts that could occur from changes in DWM management (i.e. compliance monitoring), increasing density of DWM systems (i.e. development) or other improvements (i.e. DWM system upgrades).

> Example1: CIA would allow Council to test the benefits of implementing a targeted (DWM) improvement program in an AOC (e.g. town/settlement).
>
> Following site inspection, Council would analyse the combined outcome of DWM sensitivity and (DWM) system combination for each lot in the AOC using the procedure described in Section 4.6 (below). The derived value combinations for each lot would then be inserted into a Cumulative Risk Analysis matrix (see Figure 5) to determine the underlying DWM 'Risk Profile' for the AOC.
>
> Quantification of this 'baseline' dataset would then allow Council to examine the sensitivity of the 'cumulative risk' of the AOC to alternate improvement scenarios (i.e. householder education, increased monitoring effort, voluntary system upgrades etc.) and test the benefits of each approach using only desktop investigation tools.

The Minister for Water's Guidelines state that a DWMP must provide a strategy to prevent both individual and cumulative impacts on groundwater and surface water beneficial uses and to also prevent discharge of wastewater off-lot.

Further, the EPA Code of Practice (Section 1.6) states:

"While this Code primarily refers to single allotments, the ***cumulative impact of all wastewaters within a subdivision, a commercial precinct or a township should be taken into account when assessing the capability of a lot to absorb treated effluent without negatively impacting its surroundings****. This is particularly important in areas scheduled as open potable water supply catchments (DSE 2012).*

To minimise the cumulative impact of wastewater, effluent must be contained onsite within the boundaries of the allotment. This aims to prevent the transport of nutrients, pathogens and other pollutants to surface waters and to prevent any negative impacts on 'groundwater beneficial uses' within the catchment (Clause 32, SEPP WoV 2003).

For existing ***premises with an offsite discharge or a failing system on a small lot the wastewater management system should be upgraded*** *to contain as much of the effluent as possible on the allotment".*

There is no pro-forma methodology for completing CIA for DWM. It is possible to use extensive modelling of DWM system performance and catchment run-off and pollutant characteristics to estimate the potential human health and environmental impacts of multiple DWM systems. However, the level of detail and complexity can be varied to reflect the potential risk (a function of the likelihood and/or consequence of failure) a specific proposal poses to human and ecosystem health.

This DWMP proposes a semi-quantitative approach using the outcomes of the Sensitivity Analysis, (DWM) system detail and compliance/performance information to develop an adaptable DWM 'Cumulative Risk' analysis procedure.

The following sections detail a methodology to develop procedural and management systems within and throughout the DWMP implementation process that will allow for integration of strategic information (i.e. planning schemes or proposals), generated data (i.e. DWM Sensitivity Analysis) and collected data (e.g. water quality, system inspection information) into a usable risk assessment tool.

It is acknowledged that this type of procedure is "aspirational" in nature and should be considered an **OPTIONAL** component of the DWMP. However, this limitation should not detract from the consideration and value of such an undertaking. Risk Assessment is a two-dimensional analysis that reflects not only the consequence of an event or action (DWM Sensitivity Analysis), but also the likelihood of that event/action occurring. The proposed 'Cumulative Risk' procedure provides a flexible (semi-qualitative) approach to measuring the likelihood of an adverse (DWM-related) event in an AOC. This attribute is referred to as the 'Impact Probability' rating hereafter in this document.

4.6.1 Cumulative Risk Analysis (Stage 6)

The potential for DWM systems to result in consequential degradation of both surface water and groundwater resources depends on the nature of the discharge (i.e. surface or subsurface) and the capacity of the lot to assimilate the effluent and attenuate associated pollutants such as nitrogen, phosphorous and pathogens. System age, selection, sizing and design, as well as correct operation and maintenance, also contribute to the potential under-performance[4] of a DWM system.

Programs need to be put in place to minimise DWM system under-performance and to rapidly identify and address events when they occur. The following methodology assesses the cumulative impact of DWM systems on environmental and public health by comparing the probability of DWM system under-performance with the ability to contain DWM on-site (Sensitivity Rating).

As part of Council's compliance monitoring, detailed in Section 7, a database of DWM system information will be constantly updated and managed to assess the current situation and prioritise improvements or upgrades. From knowing details about a particular DWM system, the probability of under-performance can be estimated. Key DWM system attributes used to estimate the probability of system under-performance are:

- The treatment system (e.g. septic tank) and land application system (e.g. leach drain) combination in operation;
- The expected wastewater volume (loading) treated by the DWM system; and
- The system's age and assumptions about the effluent quality proposed/likely to be produced.

The probability of under-performance of a DWM system is based on its degree of potential to cause environmental or public health impacts. Figure 4 (following) presents an 'Impact Probability' matrix based on the attributes previously described. The rating is presented on a scale of one to five representing recently constructed, heavily designed or highly managed systems (e.g. publicly managed community systems) at the lower end of the scale (1) through to ageing, outdated and un-managed systems (e.g. split black/grey water systems) at the other (5).

Example 2: A domestic all–waste system, such as an AWTS (with disinfection), discharging to an irrigation land application area. If the system was installed within the last 5 years it would be expected to hold a current EPA Certificate of Approval and be capable of reliably achieving secondary effluent quality standards. The land application area would be expected to have been designed, sized and located according to current best-practice procedure (i.e. EPA Code of Practice), with irrigation by way of subsurface or covered drip application. This system would be expected to be managed by contractual arrangement with a qualified system maintainer, with regular reporting to Council. The likely 'Impact Probability' rating for this system would be:

[4] Identified deficiency (management, structural or operational) leading to actual or potential off-site discharge of untreated or poorly treated (DWM) effluent in such a manner or quantity that it may cause consequential impact to off-site environmental resources (water quality) or public health outcomes.

(2) Low-Moderate probability that hydraulic (surface/subsurface), organic and nutrient safeguards (design, performance, mitigation) may not be sufficient to prevent consequential impact to off-site environmental resources (water quality) or public health outcomes.

If the same system was >10 years old, the AWTS may no longer hold an EPA Certificate of Approval (or may no longer be manufacturer supported). The technology/design of the system may not be able to reliably achieve secondary effluent quality standards and may not include disinfection. The land application area would likely have been designed, sized and located according to outdated procedures, with irrigation by way of surface (i.e. sprinkler type) application. There is a reduced likelihood that this system would be managed by contractual arrangement with a qualified system maintainer. The likely 'Impact Probability' rating for this system would be:

(5) High probability that hydraulic (surface/subsurface), organic and nutrient safeguards (design, performance, mitigation) may not be sufficient to prevent consequential impact to off-site environmental resources (water quality) or public health outcomes.

The extent and resultant impact of DWM system under-performance varies greatly, and the consequences for water quality will depend primarily on the degree and spatial density of events in the AOC. Under some conditions, even when a DWM system under-performs, effluent will still be retained on-lot. However, in other circumstances, DWM system under-performance may be minor but may quickly enter a sensitive environment (e.g. creek) and cause detrimental effects.

Therefore, it is important to determine the particular sensitivity of each AOC. In some cases (i.e. highly developed or degraded areas) the 'tolerable' level of DWM system under-performance may be greater than expected in an AOC of greater resource value (i.e. DWSC). The tolerable under-performance level will vary between AOC's due to the wide range in environment dynamics, system combinations and sensitivities.

The key objective being determined by the SEPP requirements of "On-site domestic wastewater needs to be managed to prevent the transport of nutrients, pathogens and other pollutants to surface waters and to prevent any impacts on [water/groundwater] beneficial uses". Beneficial use being defined as "a use of the environment which is conducive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges".

The beneficial uses relating to this DWMP, and also Colac Otway Shire generally (including DWSCs), include:

- water suitable for human consumption;
- water based recreation;
- water suitable for agriculture;
- aquatic ecosystems; and
- water suitable for the consumption of aquatic organisms (e.g. fish).

The *Policy Impact Assessment* (PIA) for the SEPP (WoV), prepared by the EPA (2003), describes how setting targets to measure the environmental quality of waterways should aim to drive continuous improvement (Section 6.4 Policy Purpose), stating that:

"This guidance helps [these] organisations understand what they need to do to improve environmental quality and protect beneficial uses. The goals provide some specific areas of focus for the next 10 years, to ensure that actions important to protect beneficial uses are implemented. This does not mean however that all environmental quality objectives need to be attained or actions fully implemented within that timeframe, but that progressive improvement is made towards their attainment. Therefore, actions in the attainment program need to be implemented in a priority-driven and practicable manner".

It is particularly important within DWSCs to ensure that the quality of the resources is maintained; therefore, the overall cumulative impact of DWM on a sub-catchment should be assessed to ascertain particular risks and implement correct operational and management procedures to reduce any potential risks.

4.6.1.1 Pilot Study (Separation Creek)

To demonstrate the benefit and applicability of the CIA approach to DWM system management in COS, a small ‘pilot’ study was conducted for the Separation Creek town (AOC). Council holds a substantial database of DWM system records for the coastal towns of Wye River and Separation Creek and a number of other environmental and water quality investigations have been prepared for the area in recent years (e.g. SKM 2014). This analysis was conducted prior to the 2015 bushfires.

The Separation Creek (DWM) data set was analysed and interpreted to determine Impact Probability ratings for each of the 123 unsewered lots identified within the town boundary. Using the methodology described previously, these values were then correlated with the corresponding Sensitivity Ratings for each lot using a ‘Cumulative Risk Analysis’ matrix. A copy of the matrix prepared for the pilot study is provided as Figure 5.

As shown, the underlying **Risk Profile** for Separation Creek is ‘High-Very High’ based on existing information. Where available information on system type/age/performance has been limited, the analysis has taken a conservative ‘worst-case’ approach. The data set would be improved based on site-specific investigation and compliance monitoring as part of the DWMP implementation. Where ‘0’ values are recorded, the lot has been identified as ‘vacant’.

The pilot study has shown the use of the CIA procedure is a useful component of a holistic assessment of DWM risk within the Shire. Using the existing situation (baseline condition) as a starting point, Council is able to compare and contrast a range of options to address DWM impacts from the town. Changes from baseline condition can be confirmed by follow up investigations of environmental/water quality or other indicator targets (as defined).

System Combination			System Age: < 5years	System Age: 5-10 years	System Age: > 10 years	System Age: Unknown
			Treatment system / Land application combination designed, sized and located according to current best-practice (CoP or similar). Both hydraulic and nutrient loading considered in land application sizing. Current technology. Current VIC Certificate of Approval. Contractual maintenance arrangement in place (secondary effluent standard or better). Infrastructure (tanks, pipes, pumps etc.) located and recorded and expected to be in 'near new' condition.	Treatment system / Land application combination may be designed, sized and located according to superceded standards. Nutrient loading not likely considered in land application sizing. Treatment system may no longer hold current VIC Certificate of Approval. Contractual maintenance arrangement may be in place (secondary effluent standard or better). Infrastructure (tanks, pipes, pumps etc.) generally locatable and may contain non-visible, unidentified or unreported damage.	Treatment system / Land application combination likely designed, sized and located according to outdated standards. Nutrient loading not likely considered in land application sizing. Treatment system may no longer hold current VIC Certificate of Approval. Contractual maintenance arrangement may not be included (secondary effluent standard or better). Infrastructure (tanks, pipes, pumps etc.) location may be unknown and likely to contain non-visible, unidentified or unreported damage.	System details not available or confirmed. Assumes worst-case environmental/public health risk outcome until determined otherwise.
Domestic System - single-residential dwelling or equivalent (<2,000L/day)	Split	Split-waste system. Blackwater septic tank followed by subsurface disposal (trench or pipe). Greywater discharge typically to stormwater system (may include sand-filter treatment prior) or uncontrolled discharge.	**4**	**5**	**5**	**5**
	Primary	All-waste system (black/greywater). Treatment in septic tank, composting/vermiculture system (or similar) to primary effluent standard, followed by discharge to subsurface trench/bed or LPED (below-ground application).	**3**	**4**	**4.5**	**5**
	Secondary	All-waste system (black/greywater). Treatment in AWTS, membrane and/or biological or media filter system to secondary effluent standard (including disinfection), followed by discharge to subsurface or surface land application.	**2**	**3**	**4**	**4**
	Tertiary	All-waste system (black/greywater). Treatment in secondary treatment system (as above) but demonstrably achieving advanced secondary effluent standard (including nutrient removal) suitable for high-quality uses (surface / subsurface landscape irrigation).	**2**	**3**	**3.5**	**4**
Commercial System - large scale (>2,000 L/day) systems managing combined wastewater from multiple dwellings or non-residential landuses	Primary	All-waste system (black/greywater). Treatment in single or multiple septic tank(s), composting/vermiculture system (or similar) to primary effluent standard, followed by discharge to subsurface trench/bed or LPED (below-ground application).	**3**	**4**	**5**	**5**
	Secondary	All-waste system (black/greywater). Treatment in commercial AWTS, membrane and/or biological or media filter system to secondary effluent standard (including disinfection) followed by discharge to subsurface or surface land application.	**2**	**3**	**4**	**5**
	Tertiary	All-waste system (black/greywater). Treatment in secondary treatment system (as above) but demonstrably achieving advanced secondary effluent standard (including disinfection and/or nutrient removal) suitable for high-quality uses (surface / subsurface landscape irrigation).	**2**	**3**	**3.5**	**4**
Community System - reticulated sewer, STEP/STEG, low-pressure/vacuum sewer or similar	Variable	Decentralised collection/treatment/land application system(s) servicing multiple dwellings, properties and/or landuses. May include local collection/treatment (on-lot infrastructure) and remote land application options. Centralised management by Water Authority or contracted entity.	**1**	**1**	**2**	**3**

5	High probability that hydraulic (surface/subsurface), organic and nutrient safeguards (design, performance, mitigation) may not be sufficient to prevent consequential impact to off-site environmental resources (water quality) or public health outcomes.
4	Moderate-High probability that hydraulic (surface/subsurface), organic and nutrient safeguards (design, performance, mitigation) may not be sufficient to prevent consequential impact to off-site environmental resources (water quality) or public health outcomes.
3	Moderate probability that hydraulic (surface/subsurface), organic and nutrient safeguards (design, performance, mitigation) may not be sufficient to prevent consequential impact to off-site environmental resources (water quality) or public health outcomes.
2	Low-Moderate probability that hydraulic (surface/subsurface), organic and nutrient safeguards (design, performance, mitigation) may not be sufficient to prevent consequential impact to off-site environmental resources (water quality) or public health outcomes.
1	Low probability that hydraulic (surface/subsurface), organic and nutrient safeguards (design, performance, mitigation) may not be sufficient to prevent consequential impact to off-site environmental resources (water quality) or public health outcomes.
User Defined	User' may interpret matrix based on individual site or system characteristics and present (decimal) value within assigned range (qualitative assessment).

Figure 4: DWM Impact Probability Matrix

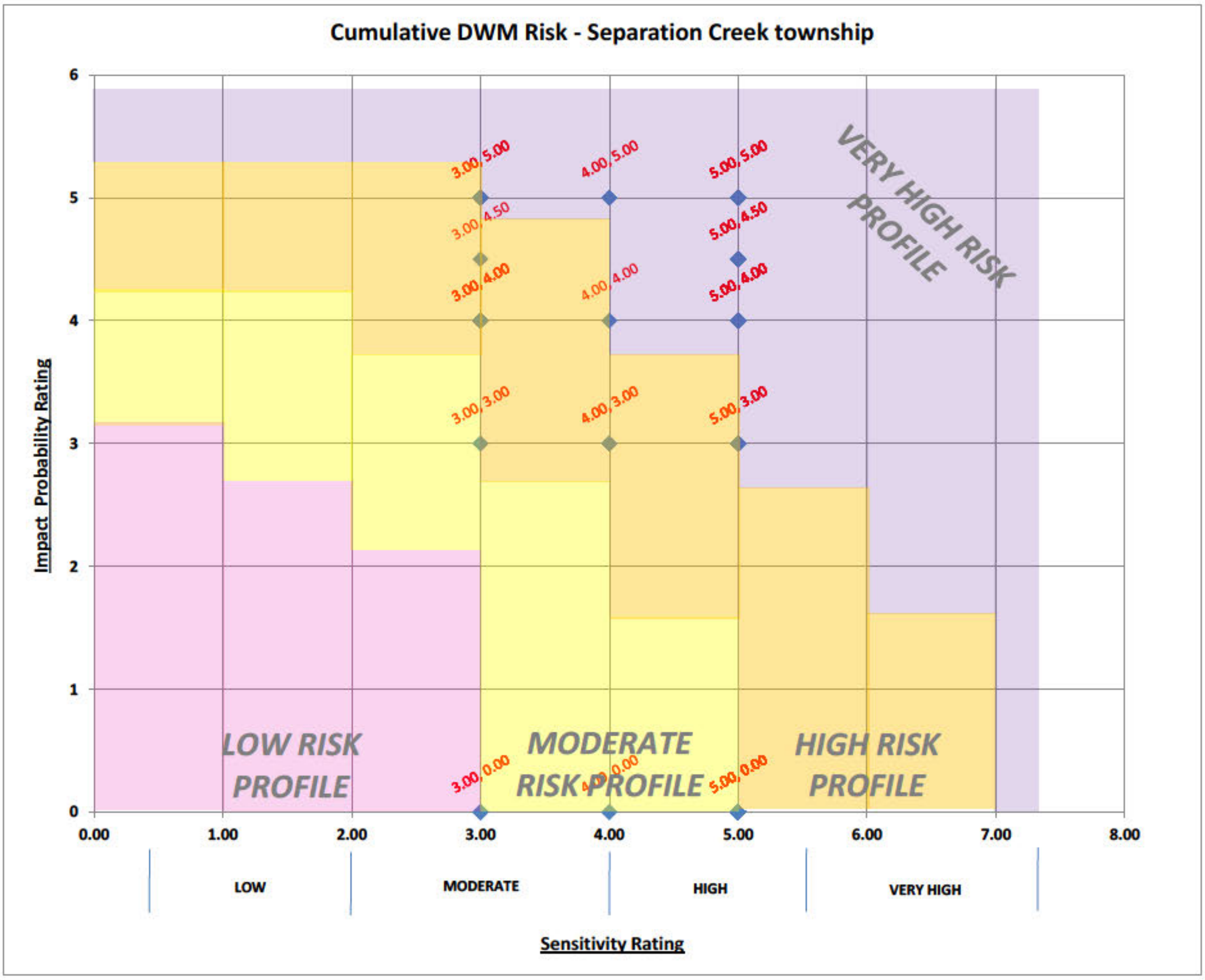


Figure 5: Cumulative Risk Analysis (Matrix)

4.7 Limitations of the Risk Assessment Framework

There are several limitations inherent in the methodology adopted to assess the variation in on-site domestic wastewater related sensitivity throughout the Shire. Briefly, these are due to:

- The use of broad-scale mapping and desktop analysis, with only limited field-truthing of physical attributes;
- A lack of digital data in some areas;
- The present level of scientific understanding and uncertainties relating to the physical and chemical processes and their implications for sustainable on-site DWM. Current best practice derived from wide experience in Australia, New Zealand and the United States was used in this assessment;
- The limited availability, quality and accuracy of attribute data; and
- Limitations in the method of assessing the inter-relationship and cumulative effect of individual attributes and constraints.

The recognised limitations emphasise that the Sensitivity Analysis mapping should only be used as a preliminary attempt to distinguish regions within the Shire with relatively higher levels of risk to public and/or environmental health and with the objective of determining preliminary priority for future wastewater servicing. The Sensitivity Analysis can be used to target more detailed investigations into suitability for on-site DWM as detailed in Section 4.5.2.

5 Development Planning and Assessment

Common issues associated with development planning and assessments include:

- Development pressure on small lots (typically <2,000m^2) that were subdivided before the formal regulation of DWMs was introduced;
- Development pressure for new unsewered subdivisions on marginal land with limitations to DWM;
- Adoption of consistent and sustainable minimum lot size for new unsewered subdivisions;
- Establishing a minimum lot size that allows for the long-term repair and replacement of DWM system components;
- The enforcement of connection to existing sewerage systems for new subdivisions on the fringes of towns such as Colac and Apollo Bay;
- Meeting the Water Corporation requirements for development within DWSCs;
- Maintaining a consistent standard of installation and construction of DWM system components; and
- Ensuring on-site DWM system designs incorporate appropriate technologies for the site(s).

5.1 Assessment of DWM Proposals

Council's procedures for assessing DWM proposals are detailed in Sections 4, 6 and 7 of this Operational Plan. All DWM proposals must be submitted to Council with a 'Permit to Install' application form for the proposed treatment and land application systems. DWM proposals in Declared Water Supply Catchments (DWSCs) will be referred to the relevant Water Corporation (and other agencies, as required). The Action Plan (Action No. 1) includes a review and finalisation of Council procedures for the assessment of DWM proposals.

A LCA will not be necessary for Low Sensitivity lots located outside of DWSCs (as identified by the Sensitivity Analysis mapping), unless Council considers it is necessary due to site-specific factors. The minimum Sizing Tables (in the Locality Reports in Appendix B of the Technical Document) will be appropriate for Low and Moderate Risk lots outside of the DWSCs and not within Climate Zone 4 (unless otherwise determined by Council). LCAs and detailed designs will be required for all lots located within DWSCs and all High and Very High Sensitivity Rating lots (and any other lot as determined by Council).

Records of development and rezoning applications in unsewered localities provides useful data about development pressures across the Shire and can be used to inform strategic land use and development planning decisions in the unsewered towns/settlements and their surrounds. As per Action No. 7a of the Action Plan (Section 13), the Locality Reports in Appendix B of the Technical Document were reviewed in addition to system inspection data to inform planning decisions in unsewered towns. It is important to ensure that the broader planning processes and decisions take into consideration the DWMP and ongoing inspections and therefore all the Planning and EHO should be briefed on the requirements (Action No. 7b).

5.2 Development Potential in Unsewered Localities

The Colac Otway Shire Rural Living Strategy (2011) investigated existing localities for their future development potential. It identified 'moderate' development potential in Forrest, Beeac, Alvie, Cororooke (apart from Langdons Lane), and Coragulac (all of which are located outside of DWSCs). Detailed assessments and maps of each of these towns/settlements (which include the surrounding locality area) are provided in the Locality Reports in Appendix B of the Technical Document. The results of the Sensitivity Analysis mapping indicate that these localities are generally of Low to Moderate Sensitivity for DWM and therefore could support further expansion with appropriate planning. Obviously other factors such as bushfire implications would also have to be considered.

The Rural Living Strategy (2011) identified Gellibrand, Lavers Hill and Beech Forest as having ‘deferred’ growth potential, dependent on water catchment constraints and bushfire hazard being satisfactorily addressed. Detailed assessments and maps of each of these localities (including the towns/settlements) are provided in the Locality Reports in Appendix B of the Technical Document. The results of the Sensitivity Analysis mapping indicate that of these three localities, Gellibrand has the most development potential, with a higher proportion of Low and Moderate Sensitivity lots across the broader locality area compared to Lavers Hill and Beech Forest. This is primarily due to higher rainfall and typically steeper slopes in Lavers Hill and Beech Forest compared to Gellibrand. However, where the long-term sustainability of proposed DWM systems can be supported by appropriately detailed LCA and DWM system design, expansion of these towns is not precluded by the Sensitivity Analysis mapping.

5.3 Minimum Lot Size for New Developments

The Sensitivity Analysis mapping will assist Council in planning for future development and determining minimum lot sizes for future subdivisions. The assessment of a site for DWM potential is important as it can assist in understanding the site’s potential for development. Historically, wastewater management was overlooked in early planning stages and it has resulted in a number of subdivided parcels within towns and low density residential areas (i.e. settlements) being significantly undersized. Due to small lot size, these parcels have been given a High Sensitivity Rating in the Sensitivity Analysis and generally wastewater management on these parcels is constrained and potentially unsustainable. This does not automatically preclude them from development; however, appropriately detailed LCA and design will be required to the satisfaction of Council and other stakeholders, including the relevant Water Corporation (in accordance with the Sensitivity Rating). Where DWM is not supported on small lots, consolidation with adjacent undeveloped lots (where feasible) is the most likely pathway to allowing development proposals to be considered on the land subject to appropriate zoning of the lots in question, and approval by Council and other relevant stakeholders. Such approval will also take into account other planning controls relating to the land.

Where rezoning of land is being considered or Structure Plans are being developed, Council can use the Sensitivity Analysis to determine suitable development potential and density. The results of the Sensitivity Analysis mapping and DWM system inspections carried out in September 2014, support a general minimum lot size of 0.4ha (4,000m^2), assuming that there is adequate ‘useable’ land for DWM, including a sustainable effluent dispersal or reuse system contained entirely within the lot boundary. This minimum lot size is a broad guideline only; detailed LCAs must be carried out for all subdivision and single-lot developments within all DWSCs. The EPA Code of Practice 891.4 (2016) recommends considering the feasibility of providing a reticulated sewerage system for the development of individual lots and for subdivision proposals that would result in allotments <1ha, which is a recommended risk threshold rather than minimum lot size.

Constrained properties, such as those with steep slopes, very shallow soils or in close proximity to surface waters or groundwater bores, will need to demonstrate that they have adequate available land for the sustainable application of treated effluent. 0.4ha may be too small in such instances; however, innovative building design and lot layout can mitigate constraints on previously undeveloped or redevelopment sites.

5.4 Stormwater Management

The field investigations in September 2014 identified stagnant stormwater in road drains in towns/settlements following wet weather, which was exacerbated by the inflow of greywater directly discharged from properties. Improvements to street drainage can be investigated on a needs basis for towns/settlements following the incremental upgrading and/or replacement of DWMs in towns/settlements. However, generally speaking, there is no urgency to upgrade street drains or improve street drainage while greywater connections to street drains persist.

Where greywater is found to be discharging to stormwater drains during onsite system inspections, upgrade works will be required to the discretion of Council to redirect greywater to the onsite wastewater system and land application area under the *Environment Protection Act 2017* (as amended). The progressive upgrade of stormwater drains will improve stormwater drainage in the Shire and would require discussions between the relevant Council departments and fall under the Colac Stormwater Development Strategy (2019).

6 DWM System Design, Approval, Installation and Operation

This section broadly describes how planning and operation of DWM systems should be carried out by owners and occupiers of the land in unsewered localities of the Shire, with reference to the Sensitivity Analysis and Risk Assessment Framework described in detail in the Technical Document. The level of detail required to support a proposal for DWM on an unsewered lot is outlined in the relevant LCA procedure (Section 4.2), which reflects the lots Sensitivity Rating.

6.1 Council's Responsibilities

The amended *Environment Protection Act 2017* (supported by the R*egulations 2021*) is used to regulate DWM systems within Victoria. Council is responsible for issuing permits for new and altered DWM systems under the amended *Environment Protection Act 2017*. Council is also responsible for the management of all DWM systems within the Shire; this includes the inspection of existing systems and ensuring compliance with Council, EPA and legislative requirements (including the *Public Health and Wellbeing Act 2008*). Council will be utilising the new EPA '*Regulating onsite wastewater management systems: local government toolkit'* (publication 1974:2021) to assist them in regulating DWM systems within COS and adhering to the new Act. The flowchart for investigating DWM under the *Environment Protection Act 2017* and Regulations as detailed in Appendix 3 of the toolkit is replicated here as it gives a good overview of Council's directions in DWM.

The new legislation introduces the general environmental duty (GED), under which, anyone conducting an activity that poses a risk to human health and the environment is required to minimise those risks, so far as reasonably practicable. A delegation of functions and powers from EPA to Council under the new Act will allow for Council to support compliance and take required action under the GED.

The Regulations 2021, will provide criteria for Councils to consider when assessing permit applications, including suitability of the site, the DWM system, the proposed use, and the findings of any LCA. This provides Councils the flexibility and discretion to assess applications appropriately and provides transparency and consistency in decision making. Circumstances when a permit must be refused are also provided. Permits will be issued for a maximum five (5) years.

Council will update and prepare procedures (refer to the Action Plan in Section 13: Action No. 1) in line with the relevant requirements. The legal requirements of Council include (but are not limited to):

- Application for a 'Permit to Install/Alter' must be completed by the owner/builder/installer and submitted to Council for assessment;
- The system must comply with current Standards and the current EPA Code of Practice;
- For DWM systems in DWSCs, Council cannot issue a 'Permit to Install' until it has received comment and/or conditions from the applicable Water Corporation;
- Council must issue a 'Permit to Install/Alter' before a DWM system can be installed;
- A Council officer assesses the application and plans and conducts site inspections. Further information may be requested from the applicant;
- Council issues a 'Permit to Install' with approved plans and conditions or refuses application;
- The system must comply with permit conditions and its relevant EPA Certificate of Conformance;
- The system is inspected by a Council officer during installation;
- Council must issue a 'Permit of Use' before the DWM system can be used;

- Council can issue fines to a system owner if an installation permit is not complied with; and
- Council can issue infringement notices (fine) under Regulation 171, and can issue improvement notices (Section 271 of the *Act*) and prohibition notices (Section 272 of the *Act*), if they have reasonable belief that any of the grounds listed in those sections of the *Act* are satisfied, to ensure the system ceases to operate and/or is upgraded to appropriately reduce the risk of human or environmental health impacts under the GED.

Inspection staff may inspect the site of a proposed DWM system at multiple stages during the assessment and installation process, as determined on a case-by-case basis. Key site inspection milestones can include (but are not limited to):

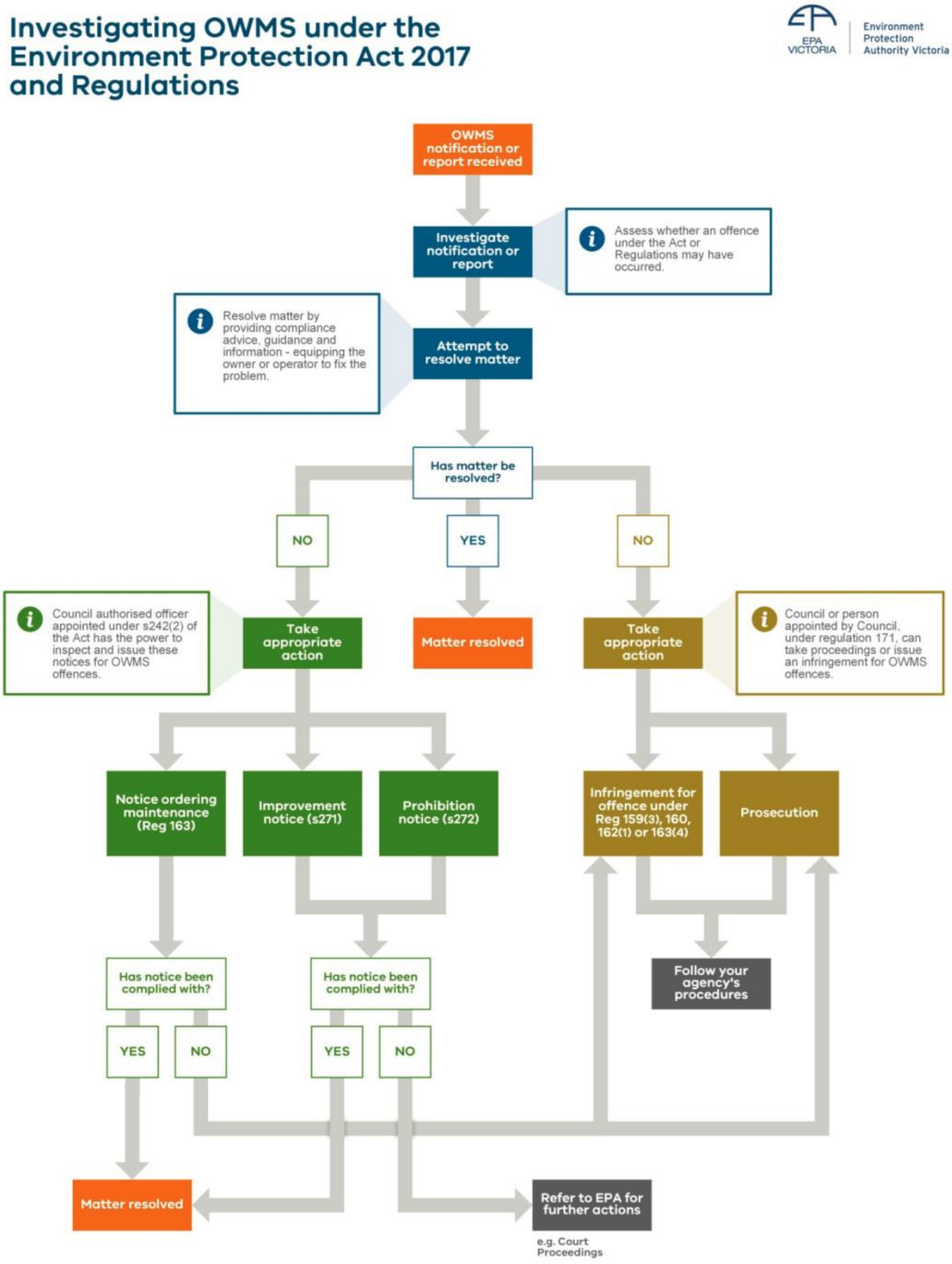
1. Pre-installation site inspection to ensure the site is suitable for the proposed DWM system (i.e. ground-truthing of the Land Capability Assessment);
2. Inspection during the installation stage, before excavations are back-filled (i.e. trenches are open and the wastewater treatment system has been installed but not backfilled, and not yet turned on), to ensure the system has been installed correctly; and
3. A post-installation inspection to ensure that the installation is complete and that the system is operating correctly.

The number of inspections carried out must be weighed against the available resources (staff time) to carry out the inspections. Low risk sites may require just one inspection, whereas high risk sites may require three or more inspections, depending on the circumstances of each proposal.

Upgrade options for poorly performing systems are discussed in further detail in Section 8.

Appendix 3: Investigation flowchart

Investigating OWMS under the Environment Protection Act 2017 and Regulations



6.2 Owners' and Occupiers of the Land Responsibilities

The operation and maintenance of DWM systems (both new and legacy) will be managed under the GED. The GED requires any person that operates a DWM system (owner and occupier of the land) to take all reasonably practicable steps to eliminate or reduce risks of harm to the environment and human health so far as reasonably practicable. Part 5.7 of the *Regulations 2021*, states that for persons in management or control of land which a DWM system is located, including legacy systems that do not have a permit that were installed pre-1970 superseded Act; have an obligation to take reasonable steps to maintain the DWM system in good working order, a duty to keep maintenance records, respond to any problems that arise, and notify Council of a failure and rectification steps.

The owners and occupiers of the land (i.e. tenants) of unsewered dwellings and commercial operations have primary responsibility for the operation and maintenance of the DWM system. In accordance with the EPA Code of Practice, owners and occupiers must ensure that the DWM system is operated, maintained and monitored in accordance with Council requirements. This requires a proactive approach from owners and residents, with Table 2 of the new EPA '*Regulating onsite wastewater management systems: local government toolkit'* (publication 1974:2021) outlining the requirements for the operation and maintenance of a DWM system for both the owner and occupier of the land. As a minimum:

- familiarise themselves with the type of system (treatment and land application components);
- identify the location of all system components on the site;
- regularly inspect their system for any signs of problems;
- regularly maintain their system to prevent problems from occurring (or worsening) (i.e. desludging, pipe integrity, comply with manufacturer specifications and recommendations, repair and replace components and fittings);
- follow any instructions issued by Council pertaining to their system;
- ensure that the contents of the DWM system does not overflow;
- notify the Council as soon as practicable after the person becomes aware, or reasonably should have been aware, that the system poses a risk to human health or the environment, or is in otherwise not in good working order (i.e. disposal area becomes sodden, wastewater runoff from disposal area, order, drain or toilet running slowly, grease trap full or blocked);
- keep and hold all records of maintenance activities carried out on the system, including any pump out and service records, for five years after each activity. These must be made available for inspection if Council requests it under sub-regulation (1); and
- to upgrade or replace their system where insurmountable problems are occurring.

Owners of land on which a DWM system is located must provide written information to a person in management or control of the DWM system (i.e. tenant/ occupier) regarding the correct operation and maintenance of that system.

Details on appropriate DWM system maintenance are provided in Section 6.6 and Section 8 of this Operational Plan. Details on options for upgrading and replacing DWM systems are provided in Section 8 of this Operational Plan. Objectives to achieve better DWM system management in the Action Plan (Section 13) include:

- ✓ Action 1 – development of Council policies and procedures;
- ✓ Action 4b – ongoing management of the planning map interface on Councils website for the Sensitivity Mapping, allowing owners to determine individual lot Sensitivity ratings;

- ✓ Action 6 – compliance audits, monitoring and necessary upgrades or modifications based on existing DWM system permit conditions to ensure compliance; and
- ✓ Actions 8 and 9 – development of a community and owner education program.

6.3 LCA Assessor/System Designer's Responsibilities

The EPA Code of Practice outlines minimum requirements for land capability assessors (Section 1.8.3) with regards to qualifications, experience, association, insurances and independence.

The professional engaged to undertake the LCA and the DWM system design has a responsibility to prepare a site-specific DWM design and supporting documentation that demonstrates that the requirements of the SEPP and the *EP Act 2017* will be achievable. The LCA must include sufficient information regarding treatment performance (effluent standard) and land application area (sizing and layout) to allow for an appropriate DWM system design to be provided with an application.

The assessor/designer is required to undertake the level of investigation and reporting appropriate to the Sensitivity Rating applied to the lot, as prescribed in Appendix C: Land Capability Assessment Checklists. The following sections provide general advice on design, installation and maintenance of DWM systems, that applies to all unsewered properties in the Shire.

6.4 DWM System Design

6.4.1 Treatment Systems

Where a new system or major upgrade works are proposed in COS, the system must comply with the current Standards and Code of Practice. Where an existing system is operating effectively but does not comply with the current EPA Code of Practice or Standards, the system will be monitored; however, unless a failure occurs or a contravene of the GED, the owner will not be required to upgrade or replace the system.

For the installation of new proprietary systems, the selected system must have a current certificate of conformity from a conformity assessment body, conforming to the relevant Australian Standard. The appropriate standards for the different types of treatment systems is as follows:

- Septic tanks (and vermiculture systems) – AS/NZS 1546.1:2008, on-site domestic wastewater treatment units, Part 1: Septic tanks.
- Waterless composting toilets – AS/NZS 1546.2:2008, on-site domestic wastewater treatment units, Part 2: Waterless composting toilets.
- Secondary treatment systems – AS/NZS 1546.3:2017, on-site domestic wastewater treatment units, Part 3: Secondary treatment systems.
- Sand filters – AS/NZS 1546.3:2017, on-site domestic wastewater treatment units, Part 3: Secondary treatment systems and s459 exemption applications for transitional arrangements.
- Domestic greywater system – AS/NZS 1546.3:2016, on-site domestic wastewater treatment units, Part 4: Domestic greywater treatment systems.

EPA holds a register of the DWM systems with valid Certificates of Conformance within Victoria (www.epa.vic.gov.au/your-environment/water/onsite-wastewater). Transitional arrangements will also apply to previously issued certificates that have not expired by 1 July 2021. For innovative DWM systems, an exemption from these requirements may be granted to a permit applicant by EPA under section 459 of the Act, inclusive of sand filters as per transitional arrangements between Council and the EPA.

As part of a permit application to Council, the applicant will need to include a copy of the certificate of conformity.

Appendix C of the EPA Code of Practice 891.4 (2016) provides useful guidance on factors to consider when selecting an EPA-approved DWM system. Site constraints (including for effluent dispersal or reuse) are a major factor when deciding on a treatment system.

6.4.2 Land Application Systems

The key issues that influence the selection and design of land application systems (domestic or commercial) are:

- The level of treatment of the effluent (primary, secondary or advanced secondary);
- Soil characteristics (particularly texture, structure, depth, dispersibility and phosphorus adsorption capacity);
- Site characteristics (particularly slope, aspect and shading); and
- Proximity to sensitive receiving environments (such as surface waters and groundwater).

The degree of constraint for sustainable land application of effluent can be a major factor in selecting a treatment system.The design of the land application system must be carried out consistently with the two guidelines cited in 6.4.1 above, as well as the *Australian Standard 1547:2012*. Table 2 of the EPA Code of Practice (891.4) details the permissible DWM treatment and land application system options.

It is preferable to design the land application area based on both a water and nutrient balance (as described in the MAV Model LCA, 2014); however, the level of detail required depends on the risk category of the lot and any other factors as determined by Council and/or the LCA assessor. For Low and Moderate Risk properties, the standard Sizing Tables (Appendix B of the Technical Document) may be used to determine the minimum area for the chosen land application system, based on climate and soils.

There are various options to mitigate constrained sites. For example, it may be appropriate to import lighter-textured topsoil (to appropriate depths) to the land application area in order to increase the DLR/DIR and thereby reduce the minimum required area of the system.

The Sizing Tables for each system type were created using monthly average water balances, using methods described in MAV Model LCA, 2014. Further details are provided in Appendix B of the Technical Document.

6.5 Installation

Often system failures will occur as a result of poor installation practices. The installation of DWM systems must be undertaken by a licensed plumber or system installer who is familiar with the requirements of Council, the Guidelines and Standards, and has experience in installing DWM systems. Issues such as poor drainage around tanks and uneven distribution of effluent throughout trenches or irrigation systems can all result in effluent ponding, runoff or impacts on human and environmental health which can easily be avoided.

6.6 Maintenance

For a system to operate and perform as it was designed, the system must be installed in accordance with the manufacturer's requirements and regular maintenance must be undertaken in accordance with the maintenance procedures outlined in Section 8.2 of this Operational Plan. By undertaking these regular maintenance tasks a system can operate effectively without major problems; however, a lack of care for any one, or all, of these items can result in system failures.

Secondary treatment systems such as Aerated Wastewater Treatment Systems (AWTS) rely on primary treatment as well as the addition of oxygen for the aerobic breakdown of organic matter by aerobic microbes in a secondary stage which is generally followed by disinfection, usually by chlorine. If there has been poor primary treatment of effluent, it can be detrimental to the secondary treatment process and most commonly disinfection will not be effective. These systems require regular maintenance and monitoring by a qualified service agent in accordance with specific EPA Certificates of Approval.

7 Compliance Monitoring

7.1 Record Keeping

Electronic database records of applications and permits for DWM systems in the Shire date back to 2002 and hardcopies to the 1970s. The current record system for DWM system applications and permits is as follows:

- Application and permits are electronically registered in the Health Manager database. Details of the type of system, the permit conditions, the issue dates and the inspection results are kept on the database. This register dates back to 2002**.** The electronic database is linked to Council's main lot database which allows for the effective integration and recovery of information.
- Hard copy records of plans, permits and inspections notes are kept on the relevant lot files**.** It is thought that information should be available for most of the DWM systems that have been installed since 1970 (and all since 2002).
- Hard copies of active files are kept by the Health Protection Unit.

7.2 Electronic Records of Inspections

The use of a paper based records system for field work can be time consuming and requires extra staff to enter the details into the database upon return to the office. It is recommended that the proposed monitoring program and the existing records database are supported by a portable, hand-held device (e.g. tablet or small laptop) loaded with software that includes the system inspection pro-forma (i.e. the inquiry fields to be completed by the Council Officer). The device would also record the GPS coordinates of the system components (tank and application area/s).

In addition, it is recommended that COS investigates the feasibility of an online system linked to the central database whereby service agents and plumbers can log in to record an AWTS service or system maintenance report. This would enable Council staff to cut down on some of the administration duties and increase productivity elsewhere.

However, if resources are limited, the above options should be delayed in order to ensure that adequate staff time is allocated to complete the system inspections, record data and implement the follow-up actions as required by the compliance monitoring.

In the absence of electronic inspection software, hard-copy inspection checklists have been developed based on existing templates in use by COS and current best practice.

7.3 Fees or Charges for DWM System Owners

Many rural and regional Council's with a high proportion of DWM systems have introduced an annual fee or charge for owners of unsewered properties, to help resource inspection programs as well as education programs. Adequate resourcing is a prerequisite to implementing the DWMP and monitoring its effectiveness.

7.4 Inspections

7.4.1 Overview

The effective management of DWM systems requires a robust and well-resourced inspection and compliance program for existing and future systems. The below factors trigger inspections of any DWM system, including:

- A complaint made by a member of the public in relation to a system;
- The owners of a system lodge a planning permit to alter the associated dwelling or commercial premises;
- Council reasonably suspects there is a nuisance caused by a system; or

- Where it is a condition of approval that the system be maintained to a certain standard (systems approved since 1996).

It is important that all DWM systems are inspected as part of the compliance monitoring program; however, the short-term focus (refer to Action No. 6 of the Action Plan in Section 13) is on those properties where the environmental and human health impact is likely to be the greatest, and the required permit inspections associated with planning approvals. It must be recognised that many DWM systems are 10-30 years old on lots that are largely unsuitable for DWM. These systems are a historical legacy of Council and whilst it is now clear that such systems are not appropriate or may be creating unacceptable risks, there does need to be an acknowledgement that many of these problems will take time to rectify.

7.4.2 Legislation

There are two pieces of legislation applicable to management of domestic onsite wastewater management, the *Public Health and Wellbeing Act 2008* and amended *Environment Protection Act 2017*, which deals with new septic systems, historic systems with permits and the setting of current standards for onsite waste management, and the legacy older systems that were not required to obtain a permit and pose, or may pose, a risk to human health or the environment, or are not, or may not be, in good working order.

Each piece of legislation has different, but compatible objectives, and requirements for the exercising of powers by authorised officers and mechanisms that may apply to improvement of septic systems.

7.4.3 Inspection Program

Council has carried out inspections of all (except for the historical records entered into the database, e.g. pump-out receipt records) existing DWM systems with permits within the Shire to date; at least once for each system. However, records are not available for every inspection carried out (particularly older systems). All system inspection records are to be incorporated into the Health Manager database.

The inspection program involves:

1. Permit approval inspections;
2. Unpermitted system detection and capture;
3. Ad-hoc inspection by request or nuisance complaint; and
4. Compliance inspection, including mandatory audits of systems located within DWSCs.

Permit approval process:

Following the review of the proposed system, if it is deemed suitable for the site, Council will issue a ‘Permit to Install’ and stipulate any conditions. Council inspects a DWM system prior to approving it for use and issues a ‘Permit to Use’.

Unpermitted system detection and capture:

Identification of improved properties without a record of permit will be undertaken using indicative data. An approach based on a case-by-case basis will be used to ensure these unpermitted systems comply with current legislation.

Ah-hoc inspection by request or complaint:

Inspections can be made in response to nuisance complaints from system owners or the general public or in response to other actions as Council deems appropriate, on a case-by-case basis.

Audit Program and Compliance Inspection:

Council’s audit and compliance program will continue. The DWM Sensitivity Ratings, as determined in Section 4, are used to inform compliance and auditing scheduling. Council will use this priority to inform the order of the audits and inspections in addition to relevant information gained as part of its audit program. The Very High and High Sensitivity Rating lots with aand where there has been identified non-compliance, should be assessed first as a priority before other lots. Table 8 in Section 4.4 details the prioritisation for the targeted localities with regards to their DWM sensitivity.

Various factors need to be taken into consideration with regards to audit and compliance inspections of individual DWM systems to prioritise staff resourcing, projects and townships; including:

- Lots that have a higher Sensitivity Analysis Risk Rating;
- Lots located within the DWSCs;
- Lots or properties that have been identified as non-compliant.
- Lots with septic tanks and trenches (primary treatment) should be inspected as a priority within each lot Sensitivity Analysis Risk Rating;
- Properties older than 30 years (pre 1985) should be inspected prior to newer systems within each lot Sensitivity Analysis Risk Rating;
- All properties with a Section 173 Agreement under the *Planning and Environment Act 1987* relating to DWM will be inspected as a priority;
- Additional inspections can be made in response to nuisance complaints from system owners or the general public or in response to other actions as Council deems appropriate.

A DWM audit and compliance inspection program has been developed for all lots located within the DWSCs as detailed in Action 6d of the Action Plan (Section 13). COS have developed a ‘standard operating procedure’ as part of Action Plan Item 1 that will outline the approach and procedures for the DWM system audits. COS are to allocate 40 officer days per year to undertake the DWM system audits for lots located within the DWSCs.

7.4.4 Inspection Protocol

Appendix D provides an example system inspection pro-forma covering virtually all possible attributes that may be used to record details and observations in the field, for entering into Council’s Health Manager database.

In summary, the inspection should record key DWM system information, including (but not limited to):

- exact location and GPS coordinates of system components
- type of treatment and land application systems
- performance and compliance of systems (e.g. if there are any maintenance issues which need to be addressed, and their urgency)

The results of inspections are highly valuable for improving and refining the risk assessment tools and for providing a rationale for the rectification or replacement of poorly functioning DWM systems.

Section 8 outlines the various methods for rectification or upgrade works which may be required following an inspection of a system.

8 Onsite System Maintenance and Upgrade Options

This section aims to provide information and direction on the range of options available for improving and rectifying failing or poorly operating DWM systems. It is provided for informative purposes only and does not represent a rigid or exhaustive list of troubleshooting options.

8.1 Non-compliant Systems

The potential management strategies for failing systems include the repair, improvement or replacement of systems (or components). The high priority localities (detailed in Table 8, Section 4.4) will form the focus of improvement works in terms of the implementation of this DWMP. Every effort will be made to ensure owners and occupiers of the land are aware of their responsibilities and are willing to commit resources to such projects.

However, it is recognised that many existing DWM systems are several decades old and/or are located on lots that may be unsuitable for DWM. Existing systems may be undersized or have direct greywater discharge off-lot, in most cases approved by Council at the time they were installed. While it is now clear that such practices are no longer appropriate and may be creating unacceptable risks, it is acknowledged that many of these problems will take time to rectify.

8.1.1 Addressing Compliance

Stage 4 of the Risk Assessment Framework (see Figure 2b) outlines the procedure for managing existing DWM systems in the Shire through regular inspection, monitoring and improvement (upgrade or rectification). Actions 9a-d of the Action Plan (Section 13) outline Council's objectives, intentions and resource commitments in this regard.

It is not intended that the inspection and compliance monitoring take a 'hard-line' approach and require all under-performing systems to be upgraded immediately. However, a commitment is required from owners, Council, and State and regional management entities to improve DWM practices in a progressive and incremental manner, with a focus on high-priority localities and/or systems. Sections 8.3 to 8.5 (following) outline the range of options available to COS to improve DWM performance in the Shire.

Implementation of the DWMP will be reviewed internally by Council every 3 years.

8.2 Maintenance of Existing Systems

The following maintenance actions should be undertaken by the owner or occupier of the land, or a qualified service agent in order to minimise the risk of system failure (compliant and under-performing systems alike):

- Regular desludging of septic or primary tank as required by EPA Certificates of Conformance for each type of system. The 2007 Plan noted that failure to regularly desludge septic tanks caused the majority of preventable problems with onsite systems, as evidenced by plumbers servicing unsewered areas. A pump-out should significantly improve performance; however, this will not rectify existing damage to the dispersal areas resulting from excess suspended solids;
- Checking of all system chambers and other checks as required by system manufacturers for secondary systems;
- Addition of chlorine for disinfection where an AWTS with chlorination is used;
- Ensuring householders do not discharge chemicals used within the house to the system i.e. bleaches, antibacterial cleaning products, paints, dyes etc.;
- Ensuring that the system is not turned off at any time;
- Responding to system alarms as this usually indicates a system failure or problem;
- If the secondary treatment system (of any type) is more than five years old, then effluent samples should be collected for analysis of BOD_5, TSS and faecal coliforms/*E. coli* to

assess whether the system is still functioning to its specification and achieving the target effluent quality as prescribed by EPA Victoria; and

- Ensuring sprinklers or irrigation area is maintained, i.e. lawn mowing, checking that sprinklers/distribution lines are not damaged and that flushing of lines is undertaken periodically.

By undertaking these regular maintenance tasks, a compliant system can be expected to operate effectively without major problems. Maintenance measures can also benefit under-performing systems by mitigating the risks posed by the system failure (e.g. if an irrigation area is surcharging effluent, it is preferable that the effluent is disinfected).

System modification and upgrade options for failing or undersized systems are discussed below.

8.3 Modifications for Existing Systems

In some cases, it is not necessary to replace of all of the system components. Risks from defective DWM systems can be appropriately managed by modifying a system. The required modifications should be determined on a case-by-case basis, and discussed with Council prior to implementation. If existing septic tanks are to be modified or repaired, they must be structurally sound and adequately sized for the number of bedrooms in the dwelling. Otherwise, they should be replaced with an adequately sized septic tank.

Typical modifications are discussed below.

8.3.1 Install Service Riser for Septic Tank Access

Inaccessible tanks (those that have been buried or built over) are highly unlikely to be inspected or pumped out as regularly as is required for optimum system performance (3-5 years for pump outs as recommended by *AS/NZS 1547:2012*). Tanks are often installed completely below ground to achieve minimum fall for gravity drainage from the dwelling; however, buried septic tanks often result in owners not knowing where the septic tank is (especially after properties change ownership). Non-accessible tanks were common in the audits of existing systems in the Shire undertaken by the consultants and were deemed to be in an unsatisfactory condition as a result, due to the very high likelihood that the tank had not been adequately serviced or desludged.

Service risers are typically made from concrete or high density plastic and must be installed by a suitably experienced professional (such as a plumber). Care should be taken to ensure that tank and riser lids, and any other potential inlet points, are protected from groundwater and surface water ingress.

8.3.2 Minor Repairs

The structural integrity and design of the septic tank also determine its suitability for continued use. Generally, the older a septic tank, the more likely it is to have cracks, missing components (e.g. outlet 'T junctions'), poorly sealed access openings, corrosion, or other physical problems. It is possible to mitigate or repair these issues, and the estimates have assumed a nominal cost of $500 per identified tank to carry out minor repairs. Repairing cracks will need to be done when the tank is empty (after it has been pumped out), with care taken to ensure that all cracks are identified and repaired.

AWTS and sand filter components can often require repair or replacement following flooding, electrical faults or pump failure. Pumps can be removed and replaced when necessary and internal pipes can be replaced where necessary if they have been dislodged or damaged. A suitably qualified service agent or the system manufacturer should undertake these repairs.

8.3.3 Install Outlet Filters in Septic Tanks

The simplest way to improve the performance of a standard septic tank is to retrofit the outlet pipe with an outlet filter. Filters of various designs are commercially available and can provide significant solids retention. Filters have a large surface area to limit clogging and reduce maintenance requirements. Filters can reduce the impacts of solids carry over to the land application area or secondary treatment system. Filters should be removed and cleaned (hosed onto grass or gardens with limited human and animal contact) and replaced in the septic tank at least twice per year.

8.4 Upgrade/Replacement of Existing Systems

Where a new system, or major upgrade works, are required (i.e. substantial repair, expansion or replacement of either the treatment system and/or land application system), the system must comply with the current Standards and EPA Code of Practice.

Where an existing system is shown to be operating effectively but does not comply with the current EPA Code of Practice or Standards, then the system should be monitored. However, unless a failure occurs (contravening the GED), effluent is discharging off-site (particularly within a DWSC), or a house extension/modification is proposed, the owner should not be required to upgrade or replace the system as long as it is performing as per the original permit conditions (this situation is common for older homes where trenches may be undersized for the number of bedrooms, but only one or two people are living in the dwelling).

Replacement of systems and system components should be carried out according to the site-specific conditions and requirements of the lot, and by an appropriately qualified and experienced person. Common upgrade and replacement options for DWM systems are discussed below.

8.4.1 Enforcement of Upgrade Works

Under the amended *Environment Protection Act 2017*, local government is the primary agency responsible for the management of DWM systems. Under this Act, a property owner or occupier of the land cannot construct, alter or install a DWM system without a local government permit. Local Government use permits to regulate the installation, maintenance and monitoring of DWM systems within their LGA. Council is also responsible for identifying failing DWM systems that are causing environmental, public health and amenity risks.

The new EP legislation introduces the general environmental duty (GED), which is a criminally enforceable preventative duty. A delegation of functions and powers from EPA to Council under the new Act will allow for Council to take action under the GED. Under the *Environment Protection Act 2017*, Councils have the power to enforce compliance with Council permits, Certificate of Conformance conditions and issue penalty infringement notices to premises where owners do not have their system regularly maintained by a professional service technician.

Part 5.7 of the *Regulations 2021*, states that for persons in management or control of land which a DWM system is located, including legacy systems that do not have a permit and were installed pre-1970 superseded Act; have an obligation to take reasonable steps to maintain the DWM system in good working order, a duty to keep maintenance records, respond to any problems that arise, and notify Council of a failure and rectification steps. Council can issue infringement notices (fine) under Regulation 171, and can issue improvement notices (Section 271 of the *Act*) and prohibition notices (Section 272 of the *Act*), if they have reasonable belief that any of the grounds listed in those sections of the *Act* are satisfied. COS will endeavour to liaise with an occupier to ensure upgrade works are undertaken; however, in some circumstances enforcement will be required to ensure compliance with the amended *Environment Protection Act 2017*. Where a Council authorised officer has detected alleged non-compliance with an improvement notice or prohibition notice that they have issued, they may refer the alleged offence(s) to EPA for consideration of further enforcement action.

8.4.2 Replacement of Septic Tanks

It is envisaged that where simple repairs and pump-outs fail to meet compliance standards, existing septic tanks will require complete replacement, due to being undersized, structurally unsound and/or discharging effluent inappropriately.

Where appropriate, septic tanks can be replaced with another septic tank, in accordance with a LCA report and design for the lot's specific circumstances. However, for permanently-occupied premises, it is likely that an upgrade to a secondary treatment system will be the preferred outcome (in accordance with a site-specific LCA and design report by an appropriately qualified professional).

All proprietary treatment systems must have current accreditation from the EPA, which is called a Certificate of Conformance.

Secondary treatment systems allow greater flexibility for land application options for the treated effluent. The existing trenches can be used to receive the secondary effluent from a new treatment system, with or without trench rejuvenation (discussed below) as required. Alternatively, the existing trenches can be decommissioned (and rehabilitated with clean soil where required) and replaced with a different land application system (including irrigation systems).

Where existing septic tanks are performing adequately (or have this capability), they can be retained and used as part of the secondary treatment system. The suitability of the existing tank for this purpose needs to be thoroughly assessed by a suitably qualified wastewater professional. In most cases, it will be more straightforward to decommission the septic tank and replace it with a new treatment system. Disposal options for decommissioned septic tanks include collapse and in-fill, removal to off-site landfill, or appropriate sterilisation for non-potable water storage; in accordance with the current EPA Code of Practice.

8.4.3 Upgrades, Extensions and Replacements for Trenches

Trenches and beds have relatively small footprint areas and rely substantially on effluent absorption, thus imposing high loading rates on the soil. This increases the risk of systems being overloaded and failing hydraulically in the long term, with potential adverse health and environmental impacts. Furthermore, prolonged effluent application through absorption systems increases the risk of soil degradation by increasing salinity and sodicity, as well as the development of a ‘clogging layer.’ Over time, the organic load in effluent forms a clogging layer in the soil around the trench, which reduces the porosity of the soil and limits soil absorption of effluent. Higher suspended solids concentration in the primary-treated effluent increases the rate of development of the clogging layer. The suspended solids concentration of septic tank effluent generally increases as the pump out rate decreases (particularly if there is no outlet filter installed).

A range of options for upgrading or replacing trenches and beds is provided below. Site constraints, particularly available suitable space, will determine what options are feasible, and will be determined on a case by case basis as part of the recommended servicing strategy. Properties with inadequate suitable space to replicate or extend their trenches will be most suited to trench rejuvenation, and potentially replacement of the septic tank with a secondary treatment system.

Trench Rejuvenation

Provided the trenches are structurally sound and the clogging layer is not excessively developed, it is possible to ‘rejuvenate’ existing trenches by oxidising the clogging layer, either using an oxidising chemical, physical aeration (compressed air blowers) or both. This technique in combination with septic tank pump-out (if required) and installation of an outlet filter has good potential to improve overall system performance, and is relatively low-cost. This solution will only be appropriate as a long-term solution on lots with adequate available space for effluent dispersal and if the existing trench system is appropriately sized for the number of occupants or number of bedrooms. However, it could be a valuable interim solution for lots without adequate available space, prior to implementation of a compliant solution.

Replace, Replicate or Expand Trenches

Where rejuvenation is not an option (e.g. if trenches are physically damaged or collapsed), there is scope for trenches to be excavated and replaced in-situ, using imported materials including topsoil (preferably loam or sandy loam) and improving the existing subsoils (see below). This is the most feasible option for small lots, or where other areas have been used for other improvements.

If there is adequate available space elsewhere on the lot that has not been used for trenches previously, it is likely to be more straightforward and cost-effective to replicate the trenches in this area. This is more likely to be achievable on larger lots.

If the existing trenches are undersized, and there is adequate suitable space adjacent to the terminal ends of the trenches, then the trenches can be extended to the minimum required size (as described in the Sizing Tables). The existing section of trench can also be rejuvenated to improve performance, or replaced if required.

Soil Amelioration

In practice, the most limiting layer to water movement is usually the heavier textured, clayey subsoil in the profile. Quite often, the soil chemistry of this layer is dominated by adsorbed sodium ions and/or magnesium ions, causing the clay particles to be easily dispersed and mobilised when in contact with water. When used for effluent dispersal these clay particles move down with the percolating water and clog up the fine pores, thus reducing the soil's permeability.

Subsoil clay that is dispersive must be treated with gypsum (calcium sulphate) to counteract the excessive sodium and magnesium and bring about a strong flocculated condition of the clay particles.

Shallow topsoil or topsoil that is too sandy may also limit the growth of the vegetation in the land application area. For optimal growth of typical vegetation used with DWM systems, the topsoil should be at least 250mm deep and have at least 5% organic matter.

Alternative Trench Designs

Over the years there have been various modifications to conventional absorption trenches and beds, some of which have been developed into proprietary 'off-the-shelf' products including various brands of self-supporting arch drains and the *Advanced Enviro-Septic*™ modular trench.

Other modified designs are based on existing technologies which, although not all are formally approved, have been shown to enhance performance. One recent example of this is the 'Wick' trench, developed for use in clay soils as an alternative to standard absorption trenches (referred to in the current EPA Code of Practice as a 'Wick trench or bed'). This system can be described as a conventional absorption trench adjacent to a shallower evapotranspiration/absorption bed, with a continuous layer of geotextile fabric laid under the trench and up into the evapotranspiration bed. The geotextile acts as a wick, using capillary movement, to distribute some of the effluent over the transpiration bed adjacent to the trench. This provides a larger surface area than would be available using the trench alone, with a greater potential for evapotranspiration and greater infiltration capacity. Typically, the evapotranspiration/absorption bed is approximately twice the width of the trench. This option requires a larger area than conventional trenches, but smaller than that required for irrigation.

8.5 Decentralised or Clustered Wastewater Management

Where local conditions (including dwelling density and layout) allow, it may be feasible for small groups of properties to enter into a decentralised servicing arrangement whereby raw wastewater or primary-treated effluent is collected from each lot in a common pipe, for off-site treatment and discharge, or treatment and discharge on one or more of the serviced lots. Systems include pressure sewer, vacuum sewer and Common Effluent Discharge (CED) systems.

This option is unlikely to be further explored by landowners due to the complexity involved. This option would best be classified as a commercial wastewater system and would require investigations and approvals by a range of stakeholders (including, but not limited to, Council and the relevant Water Corporations). Off-site treatment and/or disposal is likely to trigger the regulatory involvement of the EPA. EPA Works Approval and licencing is discussed below. Options for connection to reticulated sewerage or a decentralised cluster system are typically more expensive when compared to onsite alternatives.

9 Commercial Wastewater Management Systems

9.1 Overview

Wastewater Treatment Systems with a design capacity between 5,000 - 100,000L/day require Works Approval from the EPA. From 1 July 2021, the EPA works approval will be replaced by a development licence and operating licence (unless an exemption applies). Systems in this range which discharge solely to land in accordance with specification acceptable to EPA are exempt from ongoing licensing. Acceptable practices are defined in guidance material, the EPA Vic Guidelines for Wastewater Re-Use, Publication 464.

The *Environment Protection (Regulations 202*1 define which activities require EPA Works Approval and licensing under the *Environment Protection Act* 2017. A Works Approval is statutory document which allows scheduled works to be constructed, subject to whatever conditions the EPA deems appropriate as part of the assessment process. As part of the approval process, the EPA assesses any potential environmental impacts from the proposal, ways to mitigate any impacts, compliance with policy requirements (including protection of beneficial uses), and comments from referral agencies and the general public.

Systems with a design capacity greater than 100,000 L/day are subject to works approval as above and also to ongoing licensing from the EPA. The EPA licences set acceptable waste discharge and management criteria. They are publicly available documents that can be viewed at http://www.epa.vic.gov.au/our-work/licences-and-approvals/search-licence. In some cases, the EPA may approve an exemption from the need to obtain Works Approval for current licence holders who are upgrading an existing system. The EPA periodically inspects all licenced sites, with the frequency informed by a range of factors related to the degree of environmental risk posed by the site. Targeted inspections can also be made based on intelligence and pollution report information. Licenced sites are required to submit an Annual Performance Statement detailing their performance against the licence conditions. These are also public documents that can be searched on the above link. The EPA conducts a combination of targeted and random assessments of Annual Performance Statements. As of May 2015, the EPA notified Council that there are 3 licenced wastewater discharge sites in COS.

There are other types of industrial activity (not wastewater treatment) that are not directly regulated under the *Environment Protection Regulations 2021* that still have potential to impact on water quality. Examples include dairy farm effluent management and stormwater from commercial and light industrial operations, particularly in unsewered areas. The EPA has a role in pollution prevention and response in these activities. The EPA's approach to these issues is outlined in the Compliance and Enforcement Policy, Publication 1388. The Compliance and Enforcement Policy articulates the EPA's approach, method and priorities for ensuring compliance with Council's Acts and carrying out Council's compliance and enforcement powers

Council is responsible for the management of all wastewater systems <5,000L/day, which includes some commercial systems. It is important to note that commercial enterprises, such as small factories and cafes operating in unsewered areas, often generate less than 2,000L of wastewater per day and therefore are regarded from an operational perspective as domestic systems. The characteristics of the wastewater will differ from a typical residential dwelling, but the wastewater is expected to contain the same broad ranges of contaminants (unless the commercial enterprise is producing high strength or unusual wastes, such as small-scale food, alcohol or chemical processing, in which case it should be regarded as a commercial development). Commercial enterprises generating up to 5,000L/day in Colac Otway Shire include (but are not limited to) restaurants, pubs, tourist accommodation, adventure parks, dairies, breweries and food processing facilities.

There is limited available information on the performance of commercial systems in the Shire. COS have identified importance of gathering all of the commercial system data for the Shire which is noted as Action No. 5 in the Action Plan. Commercial systems within COS will be managed as per the same criteria as domestic systems, with some consideration for the specific waste stream.

Generally speaking, commercial treatment plants are often the same age as the development they service, and are upgraded or replaced only when a noticeable problem is observed, and/or the development is modified to alter (usually increase) design flows (e.g. expanding operations).

Without proactive enforcement from the regulator, system maintenance, monitoring and record-keeping can become lax over time, with system performance suffering as a result. Generally speaking, older commercial systems are often non-compliant with current expectations and standards (e.g. are licenced to discharge treated effluent to surface watercourses or within watercourse buffers). However, they continue operating until improvements are triggered, typically by the identification of problems, the redevelopment of the premises, or proactive intervention by regulators, local government or other agencies.

Whilst COS do not have ultimate regulatory responsibility for all commercial systems in the Shire, the DWMP identifies the importance of actively managing commercial system data for the Shire. Objectives to achieve better management of larger DWM systems in the Action Plan (Section 13) include:

- ✓ Action 5a – scheduled audits of all commercial systems (2,000 - ≤5,000L/day); and
- ✓ Action 5b – regularly updating details of EPA licenses for all commercial systems (>5,000L/day) in the Shire, including provision of O&M plans where applicable.

COS will work closely with EPA to ensure the database remains current.

9.2 Risks Associated with Commercial Systems

The most common causes of failure or underperformance of commercial wastewater treatment systems include the following:

- Surge loads, e.g. peak holiday seasons or production cycles in factories;
- Irregular and/or ineffective maintenance and upgrades;
- Inadequate desludging; and
- AWTS and other aerobic systems being switched off for long periods of time, leading to die-off of aerobic microorganisms and delayed start-up and poor performance when switched back on.

The most common causes of failure or underperformance of commercial effluent dispersal or reuse systems include the following:

- Inappropriate design, including undersized land application area for peak loads (without appropriate load buffering);
- Inadequate setback buffers from sensitive receptors, such as watercourses, which no longer meet the minimum buffers in the current EPA Victoria Code of Practice;
- Poor or inappropriate installation;
- Inadequate maintenance, including regular back-flushing of irrigation systems with clean water to prevent solids build-up and delays to repairs (e.g. broken sections of pipe); and
- 'Creeping failure' of trench and bed systems as soils and media become blocked with suspended solids from poorly designed and/or poorly maintained treatment systems.

9.3 Management Strategies for Commercial Systems

9.3.1 Wastewater Treatment Systems

All commercial wastewater treatment systems should have an up-to-date Operation and Maintenance (O&M) Plan or Manual which includes a diagram of the system and provides instructions for all maintenance schedules required for the system, and details of who is responsible for the management and maintenance of the system.

Regular maintenance by appropriately trained staff and/or contractors is essential. Depending on the scale and complexity of the treatment system, and the nature of the wastewater to be treated, daily low-level maintenance may be required. This can often be carried out by regular, appropriately trained, staff (e.g. checking effluent levels, visually checking and/or testing samples of effluent for treatment performance, etc.). More specialised maintenance must be carried out by appropriately qualified and experienced personnel.

Routine inspections of the wastewater treatment and land application systems at EPA-licenced commercial properties should be carried out by an appropriately qualified and experienced contractor. The contractor should be independent, i.e. not an employee or regular contractor of the owner of the premises. More recent EPA licences typically include a schedule of inspections.

Council is responsible for monitoring commercial systems <5,000L/day. These systems should be included in the Council inspection program and, where problems or complaints are received, Council should assess and manage the system in a similar fashion to a domestic system and also inform the EPA of the investigation. The EPA is responsible for carrying out additional investigations at its own discretion, including in response to complaints about a system from Council or members of the public.

Council is required to maintain a database of all commercial systems within COS; this data base will also include a list of EPA Works Approved sites as well as EPA licenced premises. This database will be maintained and updated annually and include any maintenance records of the premises (commercial 2,000-5,000L/day) under Council control. This is included in the Action Plan (Action No. 5b).

9.3.2 Effluent Management Systems

The issues surrounding selection, design, installation and maintenance of commercial-scale effluent management systems are largely the same as for domestic systems. However, potential problems associated with scale and flow-balancing are introduced with large and/or irregular effluent flows. For seasonal developments, part of the effluent land application area may need to be switched off, or alternatively the off-season (reduced) effluent load can be distributed throughout the entire area over longer time periods using a flow sequencing control system.

All effluent management areas require regular maintenance and should be closely monitored to ensure effective operation and even distribution of effluent. An Operation and Maintenance Manual or Plan should be developed (if not in existence) and regularly referred to by staff and contractors. Land application areas that are turfed will require regular mowing (and lawn clippings removed from the area). Other vegetation types should be pruned and maintained as necessary to ensure nutrients are being removed by plant uptake.

Commercial systems less than 5,000L/day should be serviced and maintained in accordance with the system manufacturer's requirements. Secondary treatment systems will require servicing quarterly; however, some commercial systems will require daily monitoring by an onsite system operator. Results of system servicing should be submitted to Council on a quarterly basis or in accordance with the system conditions of approval to operate. Where system maintenance records are not supplied to Council as required, follow up action should be taken by Council to ensure the system is serviced appropriately.Commercial systems which are licensed by the EPA will require effluent quality monitoring (at the outlet point of the treatment system) to ensure the effluent quality meets the requirements for its end use. For example, surface irrigation requires disinfection (indicated by concentrations of pathogen indicator organisms, as well as residual chlorine levels, if chlorine is the method of disinfection used).

10 Educational Programs

COS currently uses DWM systems inspections as an opportunity to educate system owners 'one-on-one' in order to improve system maintenance and performance. In addition, the COS website has an extensive section dedicated to DWM in the Shire, which explains how owners and residents of unsewered properties can best manage their systems in order to protect human and environmental health. This online content is supported by printed publications which are available at Council offices and are given to owners and residents during system inspections where appropriate. There is scope for printed and online information to be updated to reflect the revised DWMP and Victorian government documents (including the current EPA Code of Practice) and to provide more useful guidance and information for home owners and residents. The education program is outlined in the Action Plan in Section 13 (Action Numbers 8 & 9).

11 Downstream Water Quality Monitoring

COS has historically undertaken regular sampling of waterways to monitor the level of *E. coli* contamination of recreational waterways. CCMA sponsored WaterWatch community groups undertake water quality testing (excluding bacterial) at a variety of locations (e.g. electrical conductivity (EC), sodium concentration, pH and nutrients). High pH, EC and sodium together can indicate the presence of greywater contamination as laundry products are typically alkaline and have a high salt content (as a filler in powder detergents). However, *E. coli* is not human-specific and high concentrations can be caused by other animals (including livestock) and birds (including wetland birds), and the forestry industry can impact on downstream water quality.

The EPA is responsible for environmental monitoring and the Catchment Management Authorities also undertake water quality monitor programs.

COS should review existing water quality data collected by other authorities in the Shire (including Water Corporations), where this data is relevant and available. A detailed water quality monitoring program is beyond the scope of this DWMP and could form part of a broader water quality monitoring program that considers a range of regional stakeholders and objectives.

It is recommended that human-specific contamination indicators should be targeted for downstream water quality testing, to rule out non-human sources of generic contaminants (pathogens, nutrients and chemical compounds). Commonly used indicators include:

- Optical brighteners used in laundry detergents (especially soaking detergents); and
- Faecal sterol compounds.

While it is desirable that a monitoring program is undertaken to at least establish a baseline for future analysis, improving septic system performance will positively impact water quality and reduce the impact of human specific contamination.

Targeted sampling is more costly and can be carried out periodically (e.g. every two years).

12 Risk Mitigation in DWM Design and Installation

The DWM risks identified across unsewered areas in the DWMP are based on the predominance of standard (primary) septic tanks with conventional absorption trenches throughout the Shire (as confirmed by Council records and supported by field investigations). The summary table below outlines some possible ways these risks can be mitigated.

Table 8: Risk Mitigation for Various Constraints

Risk Category	Issue	Possible solutions	Methods	Benefits
Soils	Poor soils make it difficult for the site to contain effluent.	Enhanced treatment of effluent.	Septic System and Sand Filter.	Passive system; only uses electricity for pumps. Sand life should exceed 10 years before replacement.
			AWTS 20/30.	Higher standard of treatment suitable for sub- surface effluent dispersal in poorer soils.
			AWTS 20/30/10.	Disinfection stage decreases public health risk. Higher standard of treatment suitable for sub-surface effluent dispersal in poorer soils.
		Remediate soils.	Addition of gypsum/lime as per LCA recommendation.	Can assist in improving effluent adsorption capabilities of dispersive soil.
		Import better quality soils.	Sandy loams, loams and clay loams with <10% gravel content.	Soils can be selected for suitable characteristics (e.g. permeability) and also increase profile depth.
Slope	Steep slopes can be destabilised by effluent, and it is difficult to contain effluent onsite.	Terracing.	Reduce slopes by creating flatter areas (ensure soil depth is adequate if using cut and fill).	Ease of access and maintenance (e.g. mowing) and other controls (e.g. erosion).
Lot size	The smaller the lot the less area is available for	Reduce house size (number of bedrooms).	To be done at the planning and design stage.	If a house is smaller with fewer occupants, it will generate less wastewater.

Risk Category	Issue	Possible solutions	Methods	Benefits
	effluent management.	Reduce footprint of house and other improvement s.	To be done at the planning and design stage.	To ensure there is enough area to use for effluent dispersal, reduce the space occupied by the house, shed, driveway etc.
		Consider mound system as land application option.		Permits highest effluent loading rate per square metre.
Water-courses/ Groundwate r Bores	The Code has setback distances from watercourses and groundwater bores.	Ensure entire system (including house) is located outside of setbacks and consider treatment options.	Increase wastewater treatment standard.	Setbacks can be reduced when higher treatment standards (e.g. advanced secondary with disinfection) are used.
Flood Prone Land	Wastewater should not be disposed of in flood prone land.	Ensure entire system (including house) is located away from flood prone land.		Waters are protected from contamination. System is protected from inundation of water which eliminates the potential need for costly system replacement.

13 Action Plan Timeline

This Action Plan Timeline outlines the management strategies and actions to address priorities. The Health Protection Unit will have the primary responsibility for the coordination and implementation of the recommendations. Council's Planning, Environment, Infrastructure, Building and GIS staff will assist them. This Action Plan was updated in 2021 to reflect the changes in requirements associated with the amended *Environment Protection Act 2017*.

Item Number	Action	Description	Term	Due Date	Responsibility	Resource Funding
1	**Preparation of policies and procedures**	Prepare (or revise/finalise) and document the following to ensure they are in line with this DWMP: • DWM system inspection procedure and program. • Non-compliance with inspection procedure. • Complaint inspection procedure. • Rectification/upgrade works procedure. • Issuing of fines/notice procedure. • 'Permit to Install' procedure. • Approval to Use procedure. • Compliance and Enforcement Policy.	Short	March 2022	Health Protection Coordinator	Within current resourcing
2	**Fees and Charges**	In order to fund the Actions in this Plan, Council will need to consider sustainable options for ensuring appropriate resources.	Short	March 2022	Planning, Building and Health Manager	Within current resourcing
3a	**Continuation of improvement of data collection**	Update a GIS layer for DWM systems in the Shire. Ensure cadastre (lot data) is routinely updated.	Medium	July 2023	GIS Officer	Within current resourcing
3b		Development of geo-referencing of "as constructed plans" and incorporated as a GIS layer.	Ongoing)	Ongoing	Health Protection Coordinator; IT/GIS (assistance)	Budget bid / within current resources

Item Number	Action	Description	Term	Due Date	Responsibility	Resource Funding
4a	**Sensitivity Analysis Mapping**	Regularly update Sensitivity Rating spreadsheet with any additional comments on constraints following a system inspection or LCA report.	Ongoing	Ongoing	GIS Officer & HPO	Within current resources
4b		Update the Council planning map interface on the Council's website with the updated Sensitivity mapping reviewed in 2021. Printed maps to be updated at least annually.	Short	November 2021	GIS Officer, HPO	Within current resources
5	**Commercial Systems**	Identify all commercial premises and commence priority auditing of commercial systems (2,000 - ≤5,000L/day).	Short-ongoing	November 2022	HPO	Within current resources
6a	**Septic Tank (DWM system) Permit Conditions and Compliance**	Undertake compliance audits of new installations.	Ongoing	Ongoing	Health Protection Coordinator; HPO	Within current resources
6b		Enforce upgrades of poorly performing systems, as required (case-by-case).	Ongoing	Ongoing	Health Protection Coordinator; HPO	Within current resources
6c		Enforce mandatory maintenance of systems (depending on system type).	Ongoing	Ongoing	HPO	
6d		Undertake compliance audits of lots located within DWSCs with prioritisation based on the DWM risk rating.	Ongoing	Ongoing	Health Protection Coordinator; HPO	Within current resources with dedicated 40 EHO audit days/ year
7a	**Locality Investigations and Planning**	Review Locality Reports in DWMP and system inspection data to inform planning decisions regarding unsewered towns.	Short	Completed in 2021 review	Planning, Building and Health Manager; Health Protection	Within current resources

Item Number	Action	Description	Term	Due Date	Responsibility	Resource Funding
					Coordinator; HPO	
7b		Brief all Planning staff on the DWM by providing a summary document or meeting briefing.	Short	August 2022	Health Protection Coordinator; HPO	Within current resources
8	**System Owners Education Program**	Discuss individual systems with owners during the application process and in response to enquiries from owners. Develop mechanisms to prompt pro-active education upon purchase of lot.	Short and Ongoing	March 2023-ongoing	HPO; Health Protection Coordinator	Within current resources
9a	**Broader Community Education Program**	• Provide details about permit process on Council's website. • Promote policies and educational materials to the community and service providers. • Educate future/potential owners of homes with DWM systems.	Short	June 2022	Health Protection Unit and Community Relations Officer	Within current resources
9b		• Revise existing educational material for distribution to residents and on website. • Develop new educational material for distribution to residents and on website.	Short	November 2022	Health Protection Unit and Community Relations Officer	Within current resources
10	**DWM Professionals Briefing**	Conduct a briefing session, potential training, and/or annual meetings with local DWM & LCA consultants, plumbers and system maintenance contractors to inform and educate on the new requirements of the DWMP and to discuss any recurring questions/issues.	Ongoing	Ongoing	Health Protection Coordinator; Professional Consultant	2 x sessions Whitehead & Associates; within current resources
11	**Resource Allocation**	Investigate budget requirements for the implementation of the DWMP including system monitoring, compliance and enforcement of DWMP (& this Action Plan). • Implementation phase.	Immediate	March 2022	Planning, Building and Health Manager and Health	Within current resources

Item Number	Action	Description	Term	Due Date	Responsibility	Resource Funding
		• Ongoing administration of DWMP.			Protection Coordinator	
12a	**Reviews**	Biannual progress review of 2021 DWMP and meeting with the Water Corporations to ensure the effective management of planning referral process under the DWMP.	Ongoing	Biannual	Health Protection Coordinator and Stakeholders	Within current resources
12b		Major (three-yearly) external audit and	Long	2024	Health Protection Coordinator; Stakeholders and External Auditor	Within current resources
12c		Review of 2021 DWMP after five (5) years.	Long	2026		Within current resources

14 Glossary of Terms

Term	Definition
Aerobic treatment	Biological treatment processes that occur in the presence of oxygen (i.e. aerobic bacteria digest wastewater contaminants). Aerobic bacteria are organisms that require oxygen to survive and grow.
Anaerobic treatment	Biological treatment processes that occur in the absence of oxygen.
Blackwater	Wastewater grossly contaminated with faeces (i.e. from a toilet).
Desludging	Removal of the semi solid waste from a tank.
Effluent	Water discharged from a treatment plant.
Evapotranspiration	Transfer of water from the soil to the atmosphere through evaporation and plant transpiration. Calculated using the FAO Penman-Monteith method to derive (ET_0).
GED	General Environmental Duty associated with the amended *Environment Protection Act 2017*
Greywater	Wastewater from showers, baths, sinks, washing machines, dish washers.
Hardpan	A hardened, compacted and/or cemented horizon.
Locality	The broader locality surrounding a town (place name within mapped boundaries).
Non-Potable	Water not suitable for human consumption.
Organic Matter	Material that comes from the tissues of organisms (plants, animals, or microorganisms) that are currently or were once living.
Parcel	The smallest unit of land able to be transferred within Victoria's cadastral system, usually having one proprietor or owner (land.vic.gov.au). For the purposes of this DWMP, parcel and lot are given to have the same meaning.
Peds	An aggregate of soil particles.
Permeability	The ability of the soil to allow water to pass through.
P-sorb	Phosphorus adsorption capacity of a soil.
Property	Land under common occupation (land.vic.gov.au). May include multiple parcels.
Sensitivity	The 'likely' consequence of off-site (DWM) impacts based on the cumulative effect of individual lot constraints (soil suitability, slope, useable lot area, climate and location) and variables affecting the

Term	Definition
	specific land capability and associated limitations of the lot to sustainably manage wastewater in compliance with SEPP objectives.
Settlement	An area of residential development within the Rural Living Zone (Barongarook and Kawarren) or Rural Conservation Zone (Barham River).
Sewage	Solid and liquid wastewater conveyed through sewers.
Sewerage	A system of sewers.
Town	The town servicing a locality, which is predominantly, zoned Township Zone. It contains both residential and commercial development.

15 References (Cited and Used)

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Environment Protection Authority Victoria (1991) Guidelines for Wastewater Irrigation, Publication 168.

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Environment Protection Authority Victoria (2003) State Environment Protection Policy - Waters of Victoria.

Environment Protection Authority Victoria (2003) Guidelines for Environmental Management: Use of Reclaimed Water, Publication 464.2.

Environment Protection Authority Victoria (2013) Code of Practice for Onsite Wastewater Management, Publication 891.3.

Hazelton, P. and Murphy, B. (2007) Interpreting soil test results – what do all the numbers mean? CSIRO Publishing.

Isbell, R.F. (1996) The Australian Soil Classification. CSIRO Publishing, Melbourne.

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Municipal Association of Victoria, Department of Environment and Sustainability and EPA Victoria (2014) Victorian Land Capability Assessment Framework.

SKM (2014) Wye River and Separation Creek: Quantitative Microbial Risk Assessment and Ecological Risk Assessment, VW07110.

Standards Australia/ Standards New Zealand (2012) AS/NZS 1547:2012 On-site domestic-wastewater management.

Standards Australia/ Standards New Zealand (2008) AS/NZS 1546.1:2008 On-site domestic-wastewater treatment units – Septic tanks.

USEPA (2002) Onsite Wastewater Treatment Systems Manual. United States Environmental Protection Agency.

Appendix A

Evaluation of Wastewater Management Systems

1. Overview

This Section provides a review of the range of accredited wastewater treatment systems and available land application systems available for domestic and commercial application in Victoria, with particular consideration given to their suitability for use in the study area.

EPA Victoria will continue to regulate under the *Environment Protection Act 2017 (as amended)* what types of DWM systems are approved for use. The new legislation will be in operation from 1 July 2021. DWM treatment system brands and models will need to be certified by an accredited conformity assessment body as conforming to the relevant Australian Standard. This accreditation will be given by the Joint Accreditation System of Australia and New Zealand or any other accreditation body approved by the Authority (assessment body). The assessment body must certify the treatment system as conforming to the relevant Australian and New Zealand Standard. The appropriate standards for the different types of treatment systems is as follows:

- Septic tanks (and vermiculture systems) – AS/NZS 1546.1:2008, on-site domestic wastewater treatment units, Part 1: Septic tanks.
- Waterless composting toilets – AS/NZS 1546.2:2008, on-site domestic wastewater treatment units, Part 2: Waterless composting toilets.
- Secondary treatment systems – AS/NZS 1546.3:2017, on-site domestic wastewater treatment units, Part 3: Secondary treatment systems.
- Sand filters – AS/NZS 1546.3:2017, on-site domestic wastewater treatment units, Part 3: Secondary treatment systems.
- Domestic greywater system – AS/NZS 1546.3:2016, on-site domestic wastewater treatment units, Part 4: Domestic greywater treatment systems.

EPA holds a register of the DWM systems with valid Certificates of Conformance within Victoria, with the EPA website to be regularly consulted for an up-to-date list of accredited systems. Transitional arrangements will also apply to previously issue certificates that have not expired by 1 July 2021. For innovative DWM systems, an exemption from these requirements may be granted to a permit applicant by EPA under section 459 of the Act.

Please note that Council approval is required prior to the installation, alteration or rectification of any DWM system.

2. Exclusions and Variations

These guidelines do not relate to the mass production of manufactured proprietary treatment systems approved by EPA Victoria. Information and standards for the internal design and manufacturing of such units should be obtained from EPA Victoria and the relevant Australian/ New Zealand Standard.

However, these guidelines do address the design and installation of on-site wastewater management components that are subject to meeting the system type EPA Victoria Certificate of Conformance. Some aspects of this document vary from the standard requirements of the relevant Certificates of Conformance. These variations are considered appropriate for the following reasons:

- Because they represent a higher standard of practice than that included in the Certificates of Conformance that can be justified by current best practice from around the world.
- Because they may reduce risk to public health and the environment in comparison to current practice.
- Because they will increase the capacity for achieving the performance objectives set out in the *State Environment Protection Policy (Waters of Victoria)* and *Environment Protection Act 2017*.

- Because they reflect a more site specific approach utilising local conditions to set requirements.

A proposed installation or rectification that does not conform to the standard drawings contained in this guideline may be acceptable, providing it:

- is assessed by, and deemed acceptable to, Council; and
- can achieve the performance objectives set out in Part IV, Section 32 of the *State Environment Protection Policy (Waters of Victoria).*

It is recommended that Council be consulted on any variation from this document in the installation of DWM system components.

3. Plumbing and Drainage Work

This appendix does not address standards of work for plumbing and drainage as they relate to DWM components. The *Plumbing Regulations* 2018 set out these requirements and generally require plumbing and drainage work to be carried out in accordance with *AS/NZS 3500 – National Plumbing and Drainage Code of Practice.* A licensed plumber is required to carry out all plumbing and drainage work up to the connection point to the treatment system. This document does not eliminate any requirement to comply with the EPA Code of Practice.

4. Key issues for System Selection and Design

4.1 Wastewater Treatment

For domestic and commercial wastewater management systems alike, the key issues that determine the selection of wastewater treatment systems are:

- Flow volumes/loads;
- Flow rates and peaks (including intermittent usage);
- Wastewater strength (particularly organics); and
- The degree of constraint of the site for land application of effluent.

Depending on the nature of the development, these aspects of wastewater management can vary significantly and pose challenges to the system designer and owner. Specialist design is typically required for commercial wastewater streams and for seasonal fluctuations in flows (such as holiday rental properties). Section 6 below discusses each of the treatment technologies widely available, and their opportunities and limitations.

In addition, there are considerations relating to costs and practicalities, such as system footprint and ease of installation and servicing. Appendix C of the EPA Code of Practice 819.4 (2016) provides useful guidance on the factors to consider when selecting an EPA-approved DWM system.

4.2 Land Application of Effluent

The key issues that influence the selection and design of land application systems (domestic or commercial) are:

- The level of treatment of the effluent (primary, secondary or advanced secondary);
- Soil characteristics (particularly texture, structure, depth, dispersibility and phosphorus adsorption capacity);
- Site characteristics (particularly slope, aspect and shading); and
- Proximity to sensitive receiving environments (such as surface waters and groundwater).

For constrained sites, the preferred effluent management strategy can dictate the level of wastewater treatment required. For example, a small lot with insufficient area to apply the entire effluent load may require a composting toilet with advanced greywater treatment for beneficial reuse to reduce volume of treated effluent being applied to the limited available space. In some cases, there may be no suitable solution, or a pump-out tank may be required to tanker wastewater off-site for disposal at an approved facility.

5. Pump-out Systems

Pump-out systems convey raw wastewater or septic tank effluent to a holding tank (also known as a pump-out tank or collection well) for removal by licenced tanker (pump-truck) for disposal in an approved sewer main access hatch or municipal sewage treatment plant (under contract). They are generally regarded as a last resort, typically used to service properties where:

- there is inadequate available space to sustainably assimilate treated effluent by land application;
- existing land application systems have failed and cannot be safely used to apply effluent; or
- the lot will be connected to sewer in future (i.e. an interim solution).

The EPA Code of Practice 891.4 states that a pump-out tank must not be permitted for a new development, allotment or building.

Adequate sizing of holding tanks is important to ensure that adequate storage capacity is provided to allow lead time to arrange a licenced pump-out contractor.

Holding tanks should be fitted with high water level alarms and must incorporate both audible (buzzer) and visual (strobe) alarm components. The following minimum standards are required for high water alarm systems:

- a muting facility for the audible alarm is to be incorporated into the alarm design. The muting facility shall reset to audible after 24-hours;
- the alarm panel shall be located in a visible position within the building or other location approved by Council;
- the float switch shall be set at a level such that on activation, two (2) days storage remains within the collection well; and
- provision of an information sign that provides contact names and telephone numbers should the alarm be activated.

All wastewater or effluent holding tanks should be installed with adequately sealed lids, and positioned, so that they do not impact on existing structures or neighbouring properties and stormwater is diverted around the tanks. Stormwater ingress must be avoided, as it can result in excessive pump out costs and may result in displacement of raw wastewater to the ground surface, posing a significant human health and environmental risk. The tanks must be positioned to allow access by a pump-truck and its vacuum hose attachment.

AS/1546.1:2008 is broadly applicable to the design, installation and maintenance of holding for domestic and small commercial systems.

6. Wastewater Treatment Systems

There are currently five (5) broad categories of wastewater treatment system types that are accredited by the EPA:

1. *AS 1546.1* – Septic Tanks (and vermiculture systems);
2. *AS 1546.2* – Waterless Composting Toilets (and dry composting toilets);
3. *AS 1546.3* – Secondary Treatment Systems;
4. *AS 1546*.3 – Sand Filters; and
5. *AS 1546.4* – Domestic Greywater Treatment Systems.

A brief summary of each is provided below. For more detailed information, consult the current EPA Code of Practice and the EPA website –

http://www.epa.vic.gov.au/yourenvironment/water/onsite-wastewater. Tables comparing the specific types of treatment and land application systems, and their suitability for use within various areas of the Shire, are provided at the end of this Appendix.

6.1 Greywater Treatment Systems

Greywater treatment systems are accredited to treat laundry, shower, bath, hand-basin and kitchen greywater only. Blackwater (toilet waste) must never be treated in greywater treatment systems. It is preferable that kitchen water is kept separate from the other greywater streams and treated with the blackwater stream, as kitchen greywater can be relatively high in contaminants compared to other greywater streams. Greywater treatment systems can be useful for upgrading direct-diversion greywater systems where blackwater is to be kept separate, particularly if kitchen wastewater can be re-plumbed to the blackwater septic tank to prevent it entering the greywater treatment system.

If a greywater treatment system is utilised at a site, the blackwater also needs to be treated and disposed of onsite in an appropriately designed and accredited system. A justification is required within the LCA by the assessor, but the greywater typically accounts for 65% of the total wastewater load for a domestic development. The blackwater stream accounts for the remaining 35%, or appropriate leachate if opting for a waterless blackwater system (i.e. composting toilet).

Greywater that is treated to advanced secondary standard, in accordance with the current EPA Code of Practice and *AS 1546.4*, is of ‘advanced secondary’ standard that can be used for toilet flushing, cold water supply to clothes washing machines, and surface and subsurface irrigation. Advanced secondary effluent must achieve the following criteria:

- Biochemical Oxygen Demand (BOD_5): <10mg/L
- Total Suspended Solids (TSS): <10mg/L
- *E. coli* or thermotolerant coliforms (if disinfected): <10cfu/100mL

This is also referred to as the 10/10/10 standard by EPA Victoria. The nutrient removal performance varies considerably between and within advanced secondary treatment system types. Only greywater systems are accredited by EPA Victoria to achieve this standard as per *AS 1546.4*. The operational costs of greywater systems can outweigh the benefits of reusing the recycled water. For this reason, they are most commonly used when potable water supply is not reliable (e.g. for households supplied by rainwater tank in a low-rainfall area).

6.2 Collection/ Pump Wells and Wastewater Pumps

Collection/ pump wells must be designed and constructed to comply with *AS/NZS 1546:2008*. The capacity of domestic collection/ pump wells shall be calculated based on the dosing requirements of the downstream component (e.g. subsurface irrigation area, trench or additional treatment system such as a sand filter). A minimum of 12 hours retention time must be provided above the operating level of the flat switch for emergency storage. The storage capacity of a pump well must also be adequate to handle the peak hourly flow form the system (when considering pump capacities). All pump wells must have a minimum capacity of 1,000L. Collection/ pump wells installed in commercial or industrial premises shall be designed and sized according to the projected demand by a suitably qualified person. A high level alarm light and/or audible device (bell or buzzer) must be located on the premises so that failure of the pump set is easily detected.

Pump wells may be configured as demand dosing or timer dosing. This will depend on the need for flow balancing/ equalisation. Float switches do not provide any flow balancing capabilities to a system.

- Tank size for timer dosing systems must be calculated using a cumulative storage assessment to make sure flow balancing can be sustained. Consideration will need to be given to variations in incoming hydraulic load and the maximum daily loading rate of the receiving component.
- A high level alarm light and/or audible device (bell or buzzer) must be located on the premises so that failure of the pump set is easily detected.

- Standby pumps which incorporate automatic cut-in devices must be installed in all systems except those serving single dwelling houses or premises where the daily flow is less than 1500 litres.
- Pump sets and control switches shall be installed in accordance with the manufacturer's specifications and to the requirements of the electricity supply authority.

6.2.1 Pumps

Pumps must be designed and warranted by the manufacturer for use in wastewater and should have a design life of at least five (5) years. Components will need to be corrosion resistant and capably of transferring wastewater with characteristics that match the job. Typically a pump will be designed to convey wastewater with predicted characteristics, including raw wastewater (significantly large solids), primary treated effluent (some solids), secondary treated effluent ('dirty water') or advanced secondary treated effluent ('clean water'). Systems that utilise chlorine for disinfection will have a greater potential for pump corrosion. Domestic wastewater pumps must be warranted by the manufacturer to operate at the duty required for the job (i.e. frequently but for short periods, or constantly). Pumps must be capable of delivering wastewater at simultaneous flow rate and pressure that matches the hydraulic characteristics of the target component. The required flow rate and total dynamic head must be calculated for all pressurised components (i.e. dosing manifolds). The total dynamic head must be calculated for all non-pressurised components (i.e. transfer pumps between non-pressurised treatment components and pump dosed trenches and beds).

6.2.2 Dosing Siphon

If there is a desire to avoid the use of electricity and mechanical devices, a dosing siphon can be used to pressure dose system components. Automatic dosing siphons consist of a single apparatus with no moving parts installed in a collection tank that can trigger a siphon action when effluent rises to a predetermined level. The siphon resets itself when the level drops to a predetermined level prior to the next cycle. Requirements for the use of dosing siphons include:

- dosing siphons for single domestic houses should be installed in a 250L collection well.
- alternative sizes for the collection well will be necessary if doses that are larger or smaller than typical domestic loads are required.
- a minimum fall of 0.5m will be required between the outlet of this well and the distribution manifold of the pressurised component.

6.3 Primary Treatment Systems

According to the EPA, there are four (4) broad categories of primary treatment systems (for use with combined wastewater, blackwater only or as pre-treatment for greywater treatment systems):

1. Septic tanks;
2. Incinerating toilets (toilet waste only);
3. Wet composting systems (combined wastewater); and
4. Dry composting toilets (toilet waste only).

Primary-treated effluent quality can vary considerably, depending on a broad range of factors, and there are no minimum standards specified by EPA Victoria. Incinerating toilets do not produce effluent and composting toilets produce a concentrated leachate, to which effluent quality standards do not apply.

6.3.1 Septic Tanks

Septic tanks (for combined wastewater or blackwater only) are traditionally the most common type of treatment system in established localities without reticulated sewerage. They can also be used as pre-treatment for greywater treatment systems, although this is far less common. The technology is passive, whereby wastewater is gravity fed to a single tank (typically concrete or plastic), ideally fitted with a baffle and inlet and outlet 'T-pieces' to prevent extrusion of solids into the trenches or backflow to the inlet. All new septic tanks shall be fitted with an effluent outlet filter that fits into the outlet square of the tank. Some tanks may require minor modification of the access hole to allow for maintenance of the filter. Where possible, an outlet filter shall be installed on existing septic tanks during rectification or modification work to a system. Dense solids settle to the bottom of the tank to form sludge, while a lower-density scum forms at the surface (comprised of cellulose, fats, oils, grease and other materials). Anaerobic digestion of colloidal and dissolved organic solids occurs, and some nitrogen and phosphorus is also removed. The primary-treated effluent is discharged by gravity for further treatment in a secondary treatment system or to a land application system suitable for primary effluent (such as trenches, beds or a mound).

Septic tanks should be pumped out before sludge build-up or scum thickness reduces the available capacity for wastewater detention to the point where treatment efficacy is being impacted. Depending on tank capacity, household occupancy and influent strength, the pump-out period would be required every 3-5 years for combined wastewater and blackwater septic tanks (the EPA currently requires septic tanks be desludged every three years to ensure maximum effectiveness), and about 10-15 years for greywater only.

Septic tanks are subject to *AS 1546.1:2008* (On-site domestic wastewater treatment units – septic tanks) as well as the current EPA Code of Practice and current system type EPA Certificate of Conformance.

6.3.2 Incinerating Toilets

Incinerating toilets are rarely installed and are most suited to situations where a very small footprint and nil water use (and wastewater generation) are required. There are few models on the market, but all are similar in design and operation: wastewater is captured in a cone-shaped bowl or void, generally upon a fresh paper liner for each use system. With the push of a lever or button, the waste drops into the electric incineration chamber below which is sealed off from the bowl, but is vented to the outdoors (or to an approved ventilation system). A small amount (approximately 1 tablespoon) of ash is produced with each use and the ash collection trap must be cleaned approximately weekly (depending on frequency of use). The energy costs of this system are very high compared to other treatment systems.

6.3.3 Wet composting systems (combined wastewater)

Wet composting systems are also known as ‘worm farms’ and ‘biological filters’ and have increased in popularity over the past decade. Raw wastewater is discharged directly to the top of the filter (contained in a plastic tank similar to a septic tank) and a rich humus layer develops that separates the solids from liquid prior to composting the solids with the aid of soil micro- and macro-fauna, including earthworms. The liquid is discharged by gravity to absorption trenches and the composted solids are periodically removed by maintenance staff (every two years). Unless otherwise directed by Council, the composted humus material is to be buried within the confines of the premises. The cover of soil over the deposited humus must be at last 75mm deep. Compost must not be buried in an area used for the cultivation of crops for human consumption, unless: compost is placed in a separate lidded composting bin providing aeration for at least three (3) months with no further addition; or compost has been seasoned underground for at least three (3) months. The system is a passive, biologically-driven treatment process that mimics processes occurring in nature.

Wet composting toilets (or vermiculture systems) are subject to *AS 1546.1:2008* as well as the current EPA Code of Practice and current system type EPA Certificate of Conformance.

6.3.4 Dry Composting toilets (waterless or low-flush)

The EPA list refers to only dry (waterless) composting toilets; however low-flush models are also available, although they are less common. Composting toilets are generally installed for water saving or lifestyle reasons (e.g. ‘eco homes’ or remote homes with limited water supply). They are very rarely retrofitted into existing homes, and require a separate greywater treatment system to treat all greywater streams (including kitchen greywater).

Any liquid in the system (including urine) forms a concentrated leachate which is disposed of by gravity drainage to a small absorption trench, which has long-term sustainability implications and is not suitable for areas with shallow soils, heavy-textured soils or high water tables. Alternatively, the leachate can be collected in a sealed container for disposal at a licenced wastewater treatment facility.

Waterless composting toilets are subject to *AS 1546.2:2008* ('On-site domestic wastewater treatment units – waterless composting toilets') as well as the current EPA Code of Practice and current system type EPA Certificate of Conformance.

6.4 Combined Wastewater Secondary Domestic Treatment Systems

According to the EPA, there are four (4) broad categories of domestic secondary treatment systems:

- Aerated wastewater treatment systems (AWTS)
- Membrane Filters
- Reedbeds
- Sand and other Media Trickling Filters

The technologies used in domestic-scale systems are also often used in commercial systems (discussed in 6.4.5 below). The minimum standards for secondary effluent quality in Victoria (as per the current EPA Code of Practice) are as follows:

- Biochemical Oxygen Demand (BOD_5): <20mg/L
- Total Suspended Solids (TSS): <30mg/L
- *E. coli* or thermotolerant coliforms (if disinfected): <10cfu/100mL

Nutrient removal performance varies considerably between secondary treatment systems and largely depends on design and operation (as well as influent nutrient concentrations).

6.4.1 Aerated wastewater treatment systems (AWTS)

Domestic AWTS are pre-fabricated, mechanically aerated wastewater treatment systems designed to treat wastewater flows of <2,000L/day. They are tank-based systems, comprising either one or two discrete tanks that typically employ the following processes:

- settling of solids and flotation of scum in an anaerobic primary chamber or separate primary tank (effectively operating as a septic tank). This stage is omitted in some models.
- oxidation and consumption of organic matter through aerobic biological processes using (active or passive) mechanical aeration.
- clarification – secondary settling of solids.
- disinfection – usually by chlorination but occasionally using ultraviolet irradiation.
- regular removal of sludge to maintain the process.

AWTS are typically supplied as stand-alone, proprietary systems. They require regular maintenance in accordance with the EPA Certificate of Conformance for the specific model (usually quarterly) to ensure satisfactory performance and adequate disinfection. The operating (power) costs of AWTS are relatively high compared to more passive systems such as trickling filters and reed beds, as the aerobic treatment phase requires air blowers to be run for several hours each day.

AWTS are generally <u>**not**</u> suitable for premises with intermittent use or surge loads, such as holiday homes and commercial premises with very low flow/high flow wastewater cycles. AWTS must not be switched off when not in use as the deprivation of oxygen will kill the aerobic bacteria within a few days and populations can take weeks to be re-established when the system is turned on and wastewater supply resumes. Some AWTS models have a low-flow switch which re-circulates effluent to keep aerobic bacteria alive when not in use.

All AWTS must be installed with an alarm that has visual and audible components to indicate mechanical and electrical malfunctions. The alarm shall have one signal next to it and another in a suitable position attached to the house. The alarm shall incorporate a warning lamp, which may be reset only by the service agent.

Prior to the installation of a system, the owner must enter into an annual service contract for the AWTS with a service agent authorised by BBSC.

AWTS are subject to *AS1546.3:2017* (Secondary Treatment Systems)) as well as the current EPA Code of Practice and current system type EPA Certificate of Conformance.

6.4.2 Membrane Filters

Membrane filters provide advanced secondary treated effluent using microfiltration or reverse osmosis membranes, usually following primary and secondary treatment in separate chambers or tanks. Use of membranes requires high energy use and therefore the ongoing costs as well as upfront costs of membranes systems which are high when compared to other systems. Furthermore, the systems require regular, ongoing maintenance to ensure membranes are not damaged or remain fouled.

6.4.3 Reedbeds

The wastewater influent must first undergo primary treatment (e.g. a septic tank) prior to being treated in a reed bed. A reed bed is also known as subsurface-flow reed bed or constructed wetland and is designed to ensure that effluent flows beneath the gravel media surface, within the root zone of wetland plants, to ensure there is no standing water in the system. The system is lined with an impermeable membrane and constructed so that effluent flows horizontally through the media, via gravity. The wetland plants (macrophytes) and microbiological biofilms that develop on roots and gravel surfaces remove contaminants and pathogens from the effluent as it passes through. The treated effluent drains to a collection sump, from which it is pumped or discharged by gravity to the land application area (e.g. subsurface irrigation or absorption trench).

Reed beds are generally much more effective at nitrogen removal than phosphorus removal, with phosphorus removal expected to decline over time as the substrate becomes P-saturated. Although they are often touted as ‘maintenance-free,’ periodic replacement of the filter media assists in ongoing phosphorus removal.

Reedbeds are suitable for intermittent use and low-flow scenarios; however very high strength wastes (particularly BOD_5 and nutrients) can overwhelm the system and lead to poor treatment. For consistently high-strength influent wastewater (such as food or dairy processing premises), an additional primary treatment stage or secondary pre-treatment stage may be required, with the reed bed providing final effluent ‘polishing’.

Any proposal to install a reed bed must be accompanied by a design report that includes the following:

- surface area (m^2);
- hydraulic residence time (days);
- length and width; and
- any site specific recommendations regarding suitable plant species.

The report should be written by a suitably qualified person in accordance with recognised standards such as Headley & Davison (2003) and the NSW Department of Land and Water Conservation (1998).

The ground surface surrounding the reed bed is to be finished so as to allow for the free flow of stormwater away from the unit. This may require the installation of diversion drains.

6.4.4 Sand and other Media Trickling Filters

For all sand and media filters, the influent must first undergo a minimum of primary treatment (e.g. a septic tank). Sand and textile media filters are configured to provide a very large surface area to volume ratio, which hosts aerobic microorganisms that treat the effluent as it passes over the sand or media, usually by gravity. Proprietary filter systems typically incorporate the primary treatment tank into a stand-alone unit and recirculate a proportion of the treated effluent through the filter to improve effluent quality. The system is typically located below or at ground level. Sand filters can also be single-pass (i.e. non-recirculating) and therefore require a larger surface area to ensure adequate hydraulic residence time (HRT) of effluent.

Sand and textile media filters are generally more resilient to intermittent flows and shock loading than AWTS, and can have significantly lower operating costs. Recirculating systems (textile and some sand filters) have a relatively small footprint (and demand for materials) compared to single-pass sand filters; however, single pass filters can be designed with passive (gravity) dosing, requiring no electricity to operate. Site-specific hydraulic designs are required to support passive dosing systems.

Sand filters must comply with the requirements outlined in Appendix G of EPA Code of Practice (891.4). The maximum dosage rate that the sand filter is to be sized on is dependent on the type of wastewater being treated, but is typically a dosage rate of 50L/m^2/day.

For consistently high-strength influent wastewater (such as food or dairy processing premises), an additional primary treatment stage or secondary pre-treatment stage may be required, with the filter providing final effluent ‘polishing’.

6.4.5 Combined Wastewater Secondary Commercial Treatment Systems

These systems are for predominantly human waste (minimal trade wastes) with flows 2,000-5,000L/day (in accordance with EPA 2015 regulations). The treatment technologies used are broadly similar to those used in domestic wastewater treatment systems, but are expanded in scale. Some systems are modular in design, using numerous small treatment units either in series or in parallel, allowing expansion of treatment capacities where required (including bringing standby units online for peak loads or permanent increases in influent loads). In many cases, companies will provide systems to both the domestic and the commercial market.

7. Land Application Systems for Treated Effluent

The range of available land application systems is discussed below; and tables at the end of this Appendix provide a summary of DWM treatment and land application systems available, and their suitability for use in various regions of the Shire (with consideration of system compatibility, and seasonal variance of flows from intermittently occupied holiday dwellings and seasonally-operating small businesses).

The location of the land application system and the preferred land application option must be determined based on the outcomes of the appropriate level of Land Capability Assessment as per Section 4.2.

7.1 Absorption Trenches and Beds

Conventional absorption trenches and beds have conventionally been used for land application of septic tank effluent. Both options rely substantially on effluent absorption to the soil and impose relatively high loading rates on the soil (compared to irrigation). This increases the risk of systems being overloaded and failing hydraulically in the long term, with potential adverse health and environmental impacts. Furthermore, prolonged effluent application through absorption systems increases the risk of soil degradation by increasing salinity and sodicity, as well as the build-up of impermeable or slowly-permeable ‘bio-mats’ which can prevent movement of effluent into the soil, leading to ‘creeping failure’. These disposal systems offer very limited opportunity for effective reuse of effluent and do not represent current best practice.

Over the years there have been various modifications to conventional absorption trenches and beds, some of which have been developed into proprietary ‘off-the-shelf’ products including various brands of self-supporting arch drains and the *Advanced Enviro-Septic*™ modular trench.

Absorption trenches and beds are considered inappropriate for sites with shallow soils, high groundwater or heavy-textured (clay-based) soils, due to limited infiltration capacity. They are also generally not suitable for gravels and sands, as the very high permeability of these materials can inhibit beneficial treatment within the soil profile and allow effluent to rapidly percolate to the groundwater table. Areas with high rainfall are also at high risk of surface and groundwater contamination from conventional trenches and beds. Absorption trenches and beds can also be used with secondary-treated effluent, which can be dosed at a higher rate than primary-treated effluent (in accordance with Table 9 of the EPA Code of Practice (2013) and Table 5.2 of *AS1547:2012*).

Absorption trenches/ beds must be inspected by Council;

- prior to backfilling; and
- after completion of all work (and landscaping/ turfing).

7.2 Evapotranspiration-Absorption Trenches and Beds

Evapotranspiration-absorption (ETA) beds are essentially shallower absorption trenches or beds that allow some plant uptake of the effluent from the soil profile, reducing the amount of effluent that is leached to deeper soils and groundwater. They can improve environmental and public health outcomes for areas with heavy-textured or shallow soils, or high watertables, compared to absorption trenches and beds. However, they are prone to similar problems to conventional absorption trenches, including build-up of bio-mats and rapid percolation in highly-permeable soils. ETA systems are suitable for both primary and secondary treated effluent; however the DLRs nominated by both the current EPA Code of Practice and *AS1547:2012* do not vary with the level of treatment (as is the case for absorption systems).

ETA beds must be inspected by Council:

- prior to backfilling; and
- after completion of all work (and landscaping/ turfing).

7.3 Modified ETA Trenches and Beds

In recent years, there have been several proprietary and custom-built modifications to standard ETA trenches and beds, which further optimise evapotranspiration of effluent and minimise deep drainage. The most common example is the custom-made geotextile-wrapped and/or lined arch or pipe trenches, which use capillary action in the geotextile to ‘wick’ effluent into the topsoil and root zone above (referred to in the current EPA Code of Practice as a ‘wick trench or bed’). Wick trenches/beds are generally considered suitable for low-permeability soils. Like standard ETA systems, the modified versions are suitable for both primary and secondary treated effluent. The EPA Code of Practice nominates Design Loading Rates (DLRs) for wick trenches using secondary-treated effluent. For primary-treated effluent, however, the nominated DLRs for standard ETA systems in Table 5.2 of AS1547:2012 should be adopted. The long term performance of modified ETA systems has not been tested as they are a relative recent innovation. Use of primary-treated effluent could result in clogging of geotextile materials over time.

7.4 Mounds

Sand mounds, also known as Wisconsin mounds, are often an appropriate on-site solution for lots with limited space, shallow soil profiles, poor drainage or high water tables. Mounds are effectively raised soil absorption systems comprising layered fill, into which effluent is dosed. Effluent receives further treatment as it percolates down through the mound and is then absorbed by the natural soils below the mound. A properly designed mound can have a higher evapotranspiration potential than an ETA bed of equivalent size, further enhancing effluent disposal on constrained lots.

The basal footprint of a domestic mound is typically in the order of 7m wide by at least 20m long, and there are considerable up-front cost in the materials and construction of mounds. Mounds are suitable for primary or secondary treated effluent, and provide further treatment of effluent as it moves through the sand profile.

In addition, there are proprietary mound systems which use a modified fill media primarily from industrial waste products of aluminium or iron smelting, which have a very high phosphorus adsorption capacity. When designed, installed and maintained correctly, these systems can present a good solution for constrained sites. However, the success of these systems has been variable in the past, largely due to inappropriate design and installation. Table 9 of the EPA Code of Practice (2013) and Table 5.2 of *AS/NZS 1547:2012* provide DLRs for mounds. Mounds must be inspected by Council;

- once the basal area of the mound has been prepared
- prior to covering the distribution manifold and before the agricultural pipe has been placed over the pressure manifold. At this inspection the squirt height from all orifices will be measured. There should be no more than 15% variation in squirt height across the whole manifold; and
- after completion of all work and landscaping/ turfing.

7.5 Low Pressure Effluent Distribution (LPED) Irrigation

LPED irrigation systems were originally developed for use in Category 1 and 2 soils (as per *AS/NZS 1547:2012*) where conventional absorption beds can result in overloading of soils at the proximal section of the trench while under-loading the remainder of the trench. Note that Table 9 of the EPA Code of Practice 891.4 (2016) prohibits the use of LPED systems in Category 1 soils (gravels and sands) and Category 2a soils (weakly structured sandy loams). LPED systems can be beneficial for Category 5 soils; however, the large area they must occupy for such soils would be better served by subsurface irrigation (using secondary treated effluent) – see Section 5.7 below.

In LPED systems, effluent is discharged into 25-30mm perforated pipes contained within 50-100mm slotted pipes, to distribute effluent more evenly into the surrounding aggregate and to prevent soil intrusion into the perforations. The pipes are laid in narrow, shallow trenches (filled with aggregate and capped with topsoil), in order to optimise contact with aerobic bacteria in topsoil and to facilitate plant uptake of effluent. The system can be pressurised using a pump or a passive dosing device (i.e. a Flout™ or a siphon), with a detailed hydraulic design to ensure even distribution throughout the system. LPED irrigation can be used with either primary or secondary effluent, but is more commonly used as an alternative to trench and bed systems for primary effluent. It is recommended that an outlet filter is installed on primary treatment systems to reduce the amount of suspended solids and organics being conveyed into the LPED system. Table 9 of the EPA Code of Practice 891.4 (2016) and Table 5.2 of AS1547:2012 provide DLRs for LPED systems (one rate for both primary and secondary effluent). Detailed design and installation advice is provided in Auckland Regional Council (2004) Technical Publication 58 (however the local DLRs must be used instead of those specified by ARC).

7.6 Surface Spray Irrigation

Surface spray irrigation (using mist or droplet sprinklers) while increasing in popularity over the past 20 years, is now considered an outdated technology that can pose unacceptable public and environmental health risks due to potential exposure and also surface runoff during rainfall. Often, an inadequate number of sprinklers are installed to ensure even coverage over an adequately large area; and commonly the sprinklers are not fixed and must be frequently moved by the resident to reduce over-loading (which is often neglected over time). In addition, surface irrigation is not considered appropriate for slopes greater than 10%, as the risk of runoff increases. Surface spray irrigation is more suitable for relatively large and flat areas, with limited access to the irrigation field and large buffer distances to surface watercourses and drains. For typical domestic and small commercial sites, subsurface or covered-surface (i.e. under mulch) drip irrigation is considered best practice. Table 9 of the EPA Code of Practice 891.4 (2016) and Table 5.2 of

AS1547:2012 provide Design Irrigation Rates (DIRs) for surface irrigation systems. Council does not permit any new surface irrigation systems to be installed, but permits the existing surface irrigation systems to be managed as per their current permit.

7.7 Subsurface or Covered-surface Drip Irrigation

Subsurface drip irrigation or covered-surface drip irrigation systems are becoming more popular in recent years. Properly designed systems apply effluent at much lower volumetric rates and over larger areas than absorption or ETA trenches/beds or mounds.

Effluent is applied in the root zone of plants (100-150mm below the surface) at a rate that more closely matches plant and soil requirements (evapotranspiration), leading to more effective effluent reuse. The reliance on soil absorption is relatively low and hence the risk of contaminants accumulating in the soil or leaching to groundwater is also low.

Subsurface drip irrigation typically comprises a network of proprietary, pressure-compensating drip-irrigation line that is specially designed for use with effluent and contains specially designed emitters that reduce the risk of blockage, biofilm development and root intrusion. Subsurface irrigation virtually eliminates the risk of people inadvertently coming into contact with effluent and also minimises the risk of effluent being transported off-site, even during rain. Subsurface irrigation may be installed on sloping lots, provided the application rate is reduced accordingly to ensure that effluent migration down slope is taken up adequately within the root system (as per Table M2 of *AS 1547:2012*).

When properly designed, installed and operated, the system will ensure good distribution of effluent at uniform, controlled application rates. By properly sizing the land application areas to ensure sustainable hydraulic and nutrient loading rates, water and nutrients can be effectively utilised and are unlikely to seep to groundwater or run-off to surface waters. Care must be taken in designing and installing irrigation systems in areas that experience temperatures below freezing. Table 9 of the EPA Code of Practice (2013) and Table 5.2 of *AS1547:2012* provide Design Irrigation Rates (DIRs) for subsurface irrigation systems.

Subsurface irrigation areas must be inspected by Council prior to:

- occupation of a new dwelling; and
- commissioning of the treatment system.

8. System Selection

The following tables provide an overview of the range and application of EPA-accredited wastewater treatment system types, their compatibility with land application systems, and their suitability for use across unsewered areas of the Shire (based on soil characteristics only). Individual proprietary systems (i.e. brands) are not discussed. Similarly, Table 2 of EPA Code of Practice 891.4 (2016) details DWM system compatibility.

The influence of climate patterns on land application system sizing is addressed in the Land Application System Sizing Tables which are included in the Locality Reports in Appendix B of the Technical Document. Note that the assessment of land application system suitability is based on the type and depth of soils identified in the locality, not the water balance for the locality. The Sizing Tables identify situations where the water balance does not resolve itself and minimum application areas cannot be determined using the water balance approach.

However, it may be possible to design and construct these systems in areas with high rainfall, following detailed LCA and system design, and potential mitigation measures such as the importation of topsoils to reduce effluent loading rates.

Table 9: DWM System Compatibility Matrix

Onsite Wastewater Management System	Absorption Trenches/Beds	Standard and Modified ETA Trenches/Beds	Mounds	LPED Irrigation	Surface or Subsurface Irrigation[1]	Toilet flushing and cold water supply to washing machines
PRIMARY TREATMENT						
Septic Tanks	YES	YES	YES	YES	NO	NO
Wet Composting Systems/Biological Filters	YES	YES	YES	YES	NO	NO
SECONDARY TREATMENT						
Aerated Wastewater Treatment Systems	YES	YES	YES	YES	YES	NO
Membrane Filters	YES	YES	YES	YES	YES	NO
Reed Beds	YES	YES	YES	YES	YES	NO
Sand or Media Trickling Filters	YES	YES	YES	YES	YES	NO
ADVANCED SECONDARY TREATMENT						
Greywater Treatment Systems	YES	YES	YES	YES	YES	YES

[1] pressure-compensating, subsurface drip irrigation is preferred to surface spray or drip irrigation.

Table 10: Effluent Management Suitability by Locality

Locality	AS/NZS 1547:2012 Category of Limiting Soil Horizon	Indicative Soil Depth (m)[1]	Absorption Trenches/Beds	Standard and Modified ETA Trenches/Beds	Mounds	Surface or Subsurface Irrigation[2]	LPED Irrigation
Alvie	4 and 5	1.5	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Barham River Catchment (within Apollo Bay)[3]	5 and 6	1.2 (variable)	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Barongarook[3]	4 and 5	2.0	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Barramunga[3,5]	4		POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Barwon Downs[3]	5 and 6	2.0 (variable)	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Beeac	5 and 6	2.0	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Beech Forest[3,4,5]	4 and 5	<0.9	NOT SUPPORTED	POSSIBLE Secondary Wick Trench recommended	NOT SUPPORTED	NOT SUPPORTED	NOT SUPPORTED
Carlisle River[3,5]	5 and 6	>2.0	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Coragulac	5	1.5	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Cororooke	4	1.5	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Ferguson[3,4,5]	4 and 5	0.9	NOT SUPPORTED	POSSIBLE Secondary Wick Trench recommended	POSSIBLE	POSSIBLE	POSSIBLE
Forrest[35]	4 and 5	2.0	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Gellibrand[3,5]	5	0.9-2.0 (variable)	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Kawarren[3,5]	4 and 5	2.0	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Kennett River	4	0.9	NOT SUPPORTED	NOT SUPPORTED	POSSIBLE	POSSIBLE	POSSIBLE
Lavers Hill[3,4,5]	4 and 5	0.9	NOT SUPPORTED	Secondary Wick Trench only	NOT SUPPORTED	NOT SUPPORTED	NOT SUPPORTED
Weeaproinah[3,4,5]	4 and 5	0.9	NOT SUPPORTED	POSSIBLE Secondary Wick Trench recommended	NOT SUPPORTED	NOT SUPPORTED	NOT SUPPORTED
Wye River/ Separation Creek	1 (delta) - OR	0.9	NOT SUPPORTED	NOT SUPPORTED	NOT SUPPORTED	POSSIBLE	NOT SUPPORTED
	4 (slopes)		POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE	POSSIBLE
Wyelangtah[3,4,5]	4 and 5	0.9	NOT SUPPORTED	Secondary Wick Trench only	NOT SUPPORTED	NOT SUPPORTED	NOT SUPPORTED

[1] Soil profile information taken from Robinson *et al* (2003) study as used in Soil Suitability Sensitivity Analysis. This data was confirmed, where relevant, with field assessment of representative site's in each locality by Dr. Robert Van de Graaff in August 2014 and/or W&A in September 2014. Note that soil depth generally changes with slope. Only the most dominant soil landscape details are given for the town/settlement; hence, variability with soil type and depth may occur spatially throughout the locality. LCA investigations may identify differing soil conditions at individual locations.

[2] Pressure-compensating, subsurface drip irrigation is preferred to surface spray or drip irrigation

[3] All or Part of locality is within a DWSC.

[4] Towns/settlements in this locality are on the Otway Ridge (Climate Zone 4), system applicability improves as elevation reduces.

[5] The best-practice approach in DWSCs is (minimum) secondary treatment (min. 20/30 standard) with subsurface drip irrigation, or (for highly constrained properties/parcels) a Wick Trench/Bed system.

Appendix B

Sensitivity Pro-forma Checklist

Parameter	**Site specific input**
PFI Identification Number	
Lot Address	
Locality	
Zoning	
Area (ha)	
Soil Texture	
Soil Depth (m)	
Soil Structure	
Soil Limitations	
Permeability (Ksat) (m/day)	
Slope (%)	
Presence of Surface Waters	
Useable Lot Area (ha)	

Appendix C

Land Capability Assessment Checklists

Table C1: Minimum Requirement for a Standard LCA and Report

Report Element	Standard Requirements	Completed
1. Introduction and Background	Report summary/ executive summary.	☐
	Confirmation of Sensitivity Rating.	☐
	Confirmation of any relevant sensitivity overlays (e.g. landslip) as per communications with Council.	☐
	Confirmation that lot(s) meets minimum lot size criteria for COS Planning Scheme Zone.	☐
	Current land use and development overview (including occupancy); single lot, increase in building entitlements (subdivision) or non-domestic development.	☐
	Name, contact details and qualifications (insurances) of LCA assessor (author).	☐
	Site location (including address and lot details) and owner.	☐
	Lot area.	☐
	Proposed/existing water supply.	☐
	Availability of sewer.	☐
	Locality map showing the site in relation to surrounding region.	☐
2. Site Inspection and Field Investigations	Gather information on relevant Council, Water Corporation, Catchment Management Authority and State Government requirements, including restrictions and caveats on title, and planning/building/bushfire/flood controls, e.g. zones and overlays. Note Environmental Significant Overlays, potable water supply and DWSCs. Impose this information on a base map (or site plan) which shows their location with respect to title boundaries.	☐
	Broad overview of locality and landscape characteristics that may pose a constraint to the sustainable application of wastewater on the site and adjacent land, e.g. climatic information, groundwater and bore water information. (Refer to stage 3 pp.35 EPA Code of Practice 891.4 (2016)).	☐
	Details of date, time and methodology of site inspection and field investigations.	☐
	Site assessment that considers all of the parameters as per Table 1 of the Victorian LCA Framework (2014). Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints.	☐
	Minimum of two soil test pits or auger holes within the identified available effluent management area(s), with additional test pits required for more than one soil type (multiple soil landscapes or facets) as per the current EPA Code of Practice.	☐
	Soil assessment that considers the following parameters from Table 2 of the Victorian LCA Framework (2014): • colour and mottling; • electrical conductivity; • Emerson Aggregate Class; • permeability and design loading rate (using soil texture); • pH; • rock fragments; • soil depth; • soil texture (field textural analysis); and • depth to watertable (if required). Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints.	☐

Report Element	Standard Requirements	Completed
3. Available Area and Setback Distances	Calculation of available effluent management area and location on the Site Plan.	☐
	Discussion regarding the achievability of the applicable setback distances (Table 5 of the EPA Code of Practice 891.4 (2016)). Justification required.	☐
4. LCA Confirmation	Contact Council if the LCA assessor disagrees with the final Sensitivity Rating for the site.	☐
5. Cumulative Impacts	Using the desktop and site assessment information for the site, comment on any possible cumulative detrimental impacts that the development may have on beneficial uses of the surrounding land, surface water and groundwater.	☐
6. System Selection and Design*	Design maximum wastewater load (generation rates) and organic load for the proposed development.	☐
	Description of existing system (if applicable).	☐
	Target effluent treatment quality.	☐
	Description and location of applicable DWM treatment system options (refer to relevant Locality Report and EPA website for list of currently approved systems).	☐
	List of effluent land application options and detailed description of preferred option and location (as per relevant Locality Report). Sizing of land application area as per the system Sizing Tables detailed in the Technical Document.	☐
7. Mitigation Measures	Detailed discussion of mitigation measures to overcome any site or soil constraints posed to the sustainable treatment and application of wastewater on-site. This may include the following: • Storm water management • Soil amelioration; and • Vegetation establishment and management.	☐
8. Site Management Plan	Description of ways to improve wastewater and DWM system performance for residents' reference.	☐
	Operation and Management Plan.	☐
9. Conclusion	Conclusion summarising all the important design, sizing and mitigation requirements to ensure sustainable on-site DWM.	☐
10. Site Plan Requirements	Site address, including lot number and street number.	☐
	All title boundaries.	☐
	All relevant zones and overlays and/or restrictions (e.g. Council zoning and overlays, including Environmental Significant Overlays and DWSCs).	☐
	Type of catchment (e.g. potable or other special water supply catchment).	☐
	North arrow.	☐
	Location of groundwater bores.	☐
	Contour lines (at maximum 1 in 10m intervals), direction of slope and grade.	☐
	Location of soil test pits or auger holes.	☐
	Location of other utilities i.e. electricity, gas, telecommunications (which must be located outside the land application areas)	☐
	Location of any significant site features e.g. rock outcrops or waterlogged regions.	☐
	Location of intermittent and permanent surface waterways (dams, creeks, reservoirs and springs).	☐

Report Element	**Standard** Requirements	Completed
	Location of 1% and 5% Annual Exceedance Probability flood level contours lines (if applicable).	☐
	Location, depth and specified use of groundwater bores on the site and adjacent properties from the register of the relevant Rural Water Corporation. Depth to groundwater table in winter (if less than 2.1m deep).	☐
	Vegetation cover (can use aerial image as base map).	☐
	Relevant setback distances as per Table 5 EPA Code of Practice 891.4 (2016).	☐
	Location of existing and proposed buildings, sheds, driveways, paths and any other improvements.	☐
	Available effluent management area(s).	☐
	Location of proposed land application area (sized to scale).	☐
	Location of proposed stormwater cut-off drains adjacent to the land application area.	☐
	Location of proposed DWM system (nominal).	☐
	Location of reserve land application area (sized to scale).	☐
11. Appendices	Figures	☐
	Site Plan	☐
	Soil bore logs for all test pits or auger holes	☐
	Certificate of Title(s) for lot (plan)	☐
	Proposed building plans	☐
	Planning Permit application (where applicable)	☐

** If site is located within Climate Zone 4, then site specific design is required and the Sizing Tables cannot be used. This is due to the higher rainfall and the need to utilise a water balance for design purposes. The LCA is to remain the same, except Stage 6 is to follow the requirements set out in the Detailed LCA Pro-forma.*

*** Lots with a Low Sensitivity Rating that are located within a DWSC are required to complete this Standard LCA as per the current EPA Code of Practice requirements.*

Table C2: Minimum Requirements for a Detailed LCA and Report

Report Element	Detailed Requirements	Completed
1. Introduction and Background	Report summary/ executive summary.	☐
	Confirmation of Sensitivity Rating.	☐
	Confirmation of any relevant sensitivity overlays (e.g. landslip) as per communications with Council.	☐
	Confirmation that lot(s) meets minimum lot size criteria for COS Planning Scheme Zone.	☐
	Current land use and development overview (including occupancy); single lot, increase in building entitlements (subdivision) or non-domestic development.	☐
	Name, contact details and qualifications (insurances) of LCA assessor (author).	☐
	Site location (including address and lot details) and owner.	☐
	Lot area.	☐
	Proposed/existing water supply.	☐
	Availability of sewer.	☐
	Locality map showing the site in relation to surrounding region.	☐
	Site survey plan (2m contours) will need to be conducted by a qualified surveyor.	☐
2. Site Inspection and Field Investigations	Gather information on relevant Council, Water Corporation, Catchment Management Authority and State Government requirements, including restrictions and caveats on title, and planning/building/bushfire/flood controls, e.g. zones and overlays. Note Environmental Significant Overlays, potable water supply and DWSCs. Impose this information on a base map (or site plan) which shows their location with respect to title boundaries.	☐
	Broad overview of locality and landscape characteristics that may pose a constraint to the sustainable application of wastewater on the Site and adjacent land, e.g. climatic information, groundwater and bore water information. (Refer to stage 3 pp.35 EPA Code of Practice 891.4 (2016)).	☐
	Details of date, time and methodology of site inspection and field investigations.	☐
	Site assessment that considers all of the parameters as per Table 1 of the Victorian LCA Framework (2014). Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints.	☐
	Minimum of two soil test pits or auger holes within the identified available effluent management area with additional test pits required for more than one soil type (multiple soil landscapes or facets) as per the current EPA Code of Practice.	☐
	Soil assessment that considers all of the parameters in Table 2 of the Victorian LCA Framework (2014): • colour and mottling; • electrical conductivity; • Emerson Aggregate Class; • permeability and design loading rate (using soil texture); • pH; • rock fragments; • soil depth; • soil texture (field textural analysis); • watertable (depth to); • cation exchange capacity (CEC); • sodicity (Exchangeable Sodium Percentage ESP); and	☐

Report Element	**Detailed** Requirements	Completed
	• Sodium Absorption Ratio (SAR). Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints. Soil permeability testing conducted in situ for the soil within the available effluent management area as per constant head well permeameter method (AS/NZS 1547:2012) can be undertaken if desired, otherwise soil texture classification and application of effluent using the loading rates within the AS/NZS 1547:2012 is satisfactory.	
	Detailed review of available published soils information for the site. Soil landscapes and different soil facets should be mapped on the Site Plan.	☐
3. Available Area and Setback Distances	Calculation of available effluent management area and location on Site Plan.	☐
	Discussion regarding the achievability of the applicable setback distances (Table 5 of the EPA Code of Practice 891.4 (2016)). Justification required.	☐
4. LCA Confirmation	Contact Council if the LCA assessor disagrees with the final Sensitivity Rating for the site.	☐
5. Cumulative Impacts	Using the desktop and site assessment information for the site, comment on any possible cumulative detrimental impacts that the development may have on beneficial uses of the surrounding land, surface water and groundwater.	☐
6. System Selection and Design	Design maximum wastewater load (generation rates) and organic load for the proposed development.	☐
	Description of existing system (if applicable).	☐
	Target effluent treatment quality.	☐
	Assess the capacity of the land to assimilate the treated wastewater based on the data collected and the total dissolved salts (TDS) in the potable water supply (see Section 2.3.4 and Appendix H of EPA Code of Practice 891.4 (2016)) for both levels of effluent quality, primary and secondary.	☐
	Description and location of applicable DWM treatment system options (refer to the EPA website for list of currently approved systems).	☐
	List of effluent land application options and detailed description of preferred option and location.	☐
	Monthly water balance sizing the preferred effluent land application area. 70^{th} percentile climate data must be used for your location within the relevant Climate Zone, as detailed in Section 6.2.2 of Technical Document. A copy of the 70^{th} percentile climate data is attached in Appendix C of the Technical Document. All inputs, results and justification to be shown in the report.	☐
7. Mitigation Measures	Detailed discussion of mitigation measures to overcome any site or soil constraints posed to the sustainable treatment and application of wastewater on-site. This may include the following: • Storm water management • Soil amelioration; and • Vegetation establishment and management.	☐
8. Site Management Plan	Description of ways to improve wastewater and DWM system performance for residents' reference.	☐
	Operation and Management Plan.	☐

Report Element	Detailed Requirements	Completed
9. Conclusion	Conclusion summarising all the important design, sizing and mitigation requirements to ensure sustainable on-site DWM.	☐
10. Site Plan Requirements	Site address, including lot number and street number.	☐
	All title boundaries.	☐
	All relevant zones and overlays and/or restrictions (e.g. Council zoning and overlays, including Environmental Significant Overlays and DWSCs).	☐
	Type of catchment (i.e. potable or other special water supply catchment).	☐
	North arrow.	☐
	Location of groundwater bores.	☐
	Contour lines (at maximum of 2m intervals), direction of slope and grade.	☐
	Location of soil test pits or auger holes.	☐
	Location of other utilities i.e. electricity, gas, telecommunications (which must be located outside the land application areas)	☐
	Location of any significant site features e.g. rock outcrops or waterlogged regions.	☐
	Location of intermittent and permanent surface waterways (dams, creeks, reservoirs and springs).	☐
	Location of 1% and 5% Annual Exceedance Probability flood level contours lines (if applicable).	☐
	Location, depth and specified use of groundwater bores on the site and adjacent properties from the register of the relevant Rural Water Corporation. Depth to groundwater table in winter (if less than 2.1m deep).	☐
	Vegetation cover (can use aerial image as base map).	☐
	Relevant setback distances as per Table 5 EPA Code of Practice 891.4 (2016).	☐
	Location of existing and proposed buildings, sheds, driveways, paths and any other improvements.	☐
	Available effluent management area(s).	☐
	Location of proposed land application area (sized to scale).	☐
	Location of proposed stormwater cut-off drains adjacent to the land application area.	☐
	Location of proposed DWM system (nominal).	☐
	Location of reserve land application area (sized to scale).	☐
11. Appendices	Copy of the monthly water balance calculations.	☐
	Figures.	☐
	Site Plan.	☐
	Soil bore logs for all test pits or auger holes.	☐
	Certificate of Title (s) for lot (plan).	☐
	Proposed building plans.	☐
	Planning Permit application (where applicable).	☐

Table C3: Minimum Requirements for a Comprehensive LCA and Report

Report Element	Comprehensive Requirements	Completed
1. Introduction and Background	Report summary/ executive summary.	☐
	Confirmation of Sensitivity Rating.	☐
	Confirmation of any relevant sensitivity overlays (e.g. landslip) as per communications with Council.	☐
	Confirmation that lot(s) meets minimum lot size criteria for COS Planning Scheme Zone.	☐
	Current land use and development overview (including occupancy); single lot, increase in building entitlements (subdivision) or non-domestic development.	☐
	Name, contact details and qualifications (insurances) of LCA assessor (author).	☐
	Site location (including address and lot details) and owner.	☐
	Lot area.	☐
	Proposed/existing water supply.	☐
	Availability of sewer.	☐
	Locality map showing the site in relation to surrounding region.	☐
	Site survey plan (2m contours) will need to be conducted by a qualified surveyor.	☐
2. Site Inspection and Field Investigations	Gather information on relevant Council, Water Corporation, Catchment Management Authority and State Government requirements, including restrictions and caveats on title, and planning/building/bushfire/flood controls, e.g. zones and overlays. Note Environmental Significant Overlays, potable water supply and DWSCs. Impose this information on a base map (or site plan) which shows their location with respect to title boundaries.	☐
	Broad overview of locality and landscape characteristics that may pose a constraint to the sustainable application of wastewater on the Site and adjacent land, e.g. climatic information, groundwater and bore water information. (Refer to stage 3 pp.35 EPA Code of Practice 861.4 (2016)).	☐
	Details of date, time and methodology of site inspection and field investigations.	☐
	Site assessment that considers all of the parameters as per Table 1 of the Victorian LCA Framework (2014). Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints.	☐
	Minimum of two soil test pits or auger holes within the identified available effluent management area with additional test pits required for more than one soil type (multiple soil landscapes or facets) as per the current EPA Code of Practice.	☐
	Soil assessment that considers all of the parameters in Table 2 of the Victorian LCA Framework (2014): • colour and mottling; • electrical conductivity; • Emerson Aggregate Class; • permeability and design loading rate (using soil texture); • pH; • rock fragments; • soil depth; • soil texture (field textural analysis); • watertable (depth to); • cation exchange capacity (CEC); and • sodicity (Exchangeable Sodium Percentage ESP).	☐

Report Element	Comprehensive Requirements	Completed
	Phosphorous Sorption Capacity is also required to be measured for the soil to which the effluent will be applied to. Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints. Soil permeability testing conducted in situ for the soil within the available effluent management area as per constant head well permeameter method (*AS/NZS 1547:2012*) must be undertaken to determine the sustainable daily effluent loading rates.	
	Detailed review of available published soils information for the site. Soil landscapes and different soil facets should be mapped on the Site Plan.	☐
3. Available Area and Setback Distances	Calculation of available effluent management area and location on Site Plan.	☐
	Discussion regarding the achievability of the applicable setback distances (Table 5 of the EPA Code of Practice 891.4 (2016)). Justification required.	☐
4. LCA Confirmation	Contact Council if the LCA assessor disagrees with the final Sensitivity Rating for the site.	☐
5. Cumulative Impacts	Using the desktop and site assessment information for the site, comment on any possible cumulative detrimental impacts that the development may have on beneficial uses of the surrounding land, surface water and groundwater.	☐
6. System Selection and Design	Design maximum wastewater load (generation rates) and organic load for the proposed development.	☐
	Description of existing system (if applicable).	☐
	Target effluent treatment quality.	☐
	Assess the capacity of the land to assimilate the treated wastewater based on the data collected and the total dissolved salts (TDS) in the potable water supply (see Section 2.3.4 and Appendix H of EPA Code of Practice 891.4 (2016)) for both levels of effluent quality; primary and secondary.	☐
	Description and location of applicable DWM treatment system options (refer to EPA website for list of currently approved systems).	☐
	List of effluent land application options and detailed description of preferred option and location. Land application area to be sized on the most limiting balance as detailed below.	☐
	A water balance is required to size the preferred effluent land application area for the proposed development scenario. A monthly water balance using the prescribed 70th percentile climate data must be used for your location within the relevant Climate Zone, as detailed in Section 6.2.2 of the Technical Document. Alternately, a daily water balance model (i.e. MEDLI) using a minimum 30-year data period may be undertaken. A copy of the 70th percentile climate data is attached in Appendix C of the Technical Document. All inputs, results and justification to be shown in the report.	☐
	Undertake an annual nutrient balance (refer to pp.33 MAV (2014) for example methodology) for the proposed development scenario. All inputs, results and justification to be shown in the report.	☐
	Prepare a site specific detailed hydraulic design for the land application area suitable for supplier quotation and construction.	☐

Report Element	Comprehensive Requirements	Completed
7. Mitigation Measures	Detailed discussion of mitigation measures to overcome any site or soil constraints posed to the sustainable treatment and application of wastewater on-site. This may include the following: • Storm water management • Soil amelioration; and • Vegetation establishment and management.	☐
8. Site Management Plan	Description of ways to improve wastewater and DWM system performance for residents' reference.	☐
	Operation and Management Plan.	☐
9. Conclusion	Conclusion summarising all the important design, sizing and mitigation requirements to ensure sustainable on-site DWM.	☐
10. Site Plan Requirements	Site address, including lot number and street number.	☐
	All title boundaries.	☐
	All relevant zones and overlays and/or restrictions (e.g. Council zoning and overlays, including Environmental Significant Overlays and DWSCs).	☐
	Type of catchment (e.g. potable or other special water supply catchment).	☐
	North arrow.	☐
	Location of groundwater bores.	☐
	Contour lines (2m intervals from survey plan or Council provided data), direction of slope and grade.	☐
	Location of soil test pits or auger holes.	☐
	Location of other utilities i.e. electricity, gas, telecommunications (which must be located outside the land application areas)	☐
	Location of any significant site features e.g. rock outcrops or waterlogged regions.	☐
	Location of intermittent and permanent surface waterways (dams, creeks, reservoirs and springs).	☐
	Location of 1% and 5% Annual Exceedance Probability flood level contours lines (if applicable).	☐
	Location, depth and specified use of groundwater bores on the site and adjacent properties from the register of the relevant Rural Water Corporation. Depth to groundwater table in winter (if less than 2.1m deep).	☐
	Vegetation cover (can use aerial image as base map).	☐
	Relevant setback distances as per Table 5 EPA Code of Practice 891.4 (2016).	☐
	Location of existing and proposed buildings, sheds, driveways, paths and any other improvements.	☐
	Available effluent management area(s).	☐
	Location of proposed land application area (sized to scale).	☐
	Location of proposed stormwater cut-off drains adjacent to the land application area.	☐
	Location of proposed DWM system (nominal).	☐
	Location of reserve land application area (sized to scale).	☐
11. Appendices	Copy of the water (hydraulic) balance calculations.	☐
	Copy of the nutrient balance calculations.	☐
	Figures.	☐
	Site Plan.	☐

Report Element	Comprehensive Requirements	Completed
	Soil bore logs for all test pits or auger holes.	☐
	Copy of the Survey Plan.	☐
	Certificate of Title(s) for lot (plan).	☐
	Proposed building plans.	☐
	Planning Permit application (where applicable).	☐

Appendix D

Example System Inspection Pro-forma

Date & Time of Inspection		**GPS Coordinates of LAA**				
Property Address		South		East		Aspect:
Property Owners/Contact		**Owner Present**				
Inspected By		Yes		No		
Inspection Protocol						
Risk Rating		Low (1)	Medium (2)	High (3)	N/A	**Upgrades Required / Comments**
Treatment System						
Grease Trap						
Is Grease trap adequately sized, maintained and functioning?		Yes	No			
Greywater						
Is greywater directed to street/drain?		No		Yes		
If fitted, is greywater diversion device operating correctly?		Yes	No	No		
Septic Tank						
Is the tank(s) accessible for inspection and maintenance?		Yes	No			
Do the tank(s) and lid(s) appear structurally sound?		Yes		No		
Is the tank(s) adequately sealed?		Yes		No		
Is the tank area subject to stormwater or groundwater inundation?		No		Yes		
Do any tank(s) require urgent repair or replacement?		No		Yes		
Tank dimensions:						
Type	Plastic Concrete Other:					
Volume (L)						
Baffle?	Yes No Damaged	Yes	Damaged	Damaged		
Outlet height (mm)						
Liquid height (mm)						
Scum Depth (mm)						
Sludge Depth (mm)						
Operation:	Are Both T pieces (junctions) attached and working?	Yes	No			
	Does the tank require desludging?	No	Yes			
	Is septic tank providing adequate anaerobic treatment?	Yes	No	No		
Pump/ pump wells/controls						
Is the pumpwell(s) of adequate capacity (e.g. emergency storage)?		Yes	No			
Is the system fitted with a high level alarm?		Yes		No		
Are there any electrical hazards / issues with the system?		No		Yes		
Is there a suitable control system for the pump?		Yes	No			
Is the pump operational and in a satisfactory condition?		Yes	No	No		
Is pump well in satisfactory condition? (Yes - Low, No - Medium or High)		Yes	No	No		
AWTS						
Is the AWTS operating satisfactorily? (Yes - Low, No - Medium or High)		Yes	No	No		
Are the blowers working?		Yes	No			
Is there sludge or scum accumulation in aeration chamber, clarification chamber or irrigation chamber?		No	Yes	Yes		
Is the chlorine dispenser filled and functioning?		Yes	No	No		
Resdiual Chlorine (mg/L)						
Is system regularly serviced by a contractor?		Yes	No	No		

Land Application Area						
Absorption Trenches/Beds						
Dimensions (m)	Slope (%) approx.	<8%	8-12%	>12%		
Is the land application area of adequate size?		Yes	No	No		
Is there a suitable vegetation cover over the land application area?		Yes	No	No		
Is there adequate exposure of the land application area? (i e. not too shaded, or southerly aspect?)		Yes	No			
Is the land application area wet or boggy?		No	Yes	Yes		
Is there evidence of surface ponding or runoff from the land application area?		No	Yes	Yes		
Is the area prone to poor drainage, flooding or high groundwater?		No	Yes	Yes		
Are there any damaged or collapsed sections of the land application area?		No	Yes	Yes		
Is there evidence of or access for vehicle and animal traffic?		No	Yes			
Does the land application area appear to be level and in line with contours?		Yes	No	No		
Are buffer distances to trenches/beds adequate?		Yes	No	No		
Surface/Subsurface Irrigation						
Dimensions (m^2)	Slope (%) approx.					
Is the land application area wet or boggy?		No	Yes	Yes		
Is there evidence of surface ponding or runoff from the land application area?		No	Yes	Yes		
Are buffer distances to irrigation area adequate?		Yes	No	No		
Are all sprinklers working?		Yes	No	No		
Overall Assessment						
Were you able to locate and access the whole system?		Yes	No	No		
Was the system discharging effluent to the ground surface in an unsatisfactory manner?		Yes	No	No		
General Condition of system	Good (Low) Satisfactory (Medium) Unsatisfactory (Hi	Good	Satisfactory	Unsatisfactory		
Proximity to Sensitive environments (streams, rivers)		>100m	50-100m	<50m		
Located within a drinking water catchment? Y/N Distance to reservoir/stream:						
Overall Highest Risk Rating						
Are works required on the system?		**Minor**	**Moderate**	**Major**	**Nil**	
Details of Required Works						