DOMESTIC WASTEWATER MANAGEMENT PLAN
2021-2026

CASEY.VIC.GOV.AU

Table of Contents

Introduction

The Domestic Wastewater Management Plan describes the current circumstances surrounding the management of domestic wastewater in the City of Casey and outlines the strategies Council intends implementing to improve the management of domestic onsite wastewater systems (systems that discharge less than 5000 litres per day) in the municipality as well as minimising the risks to public and environmental health associated with onsite wastewater.

There are two major guiding principles informing domestic wastewater management strategies, the first is the principle of waste management hierarchy which provides that wastes should be managed in accordance with the following order of preference (EPA Victoria 2010):

- avoidance;
- re-use;
- re-cycling;
- recovery of energy;
- treatment;
- containment;
- disposal.

The second principle is the precautionary principle which is based on the understanding that:

If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

Decision making should be guided by—
- a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and
- an assessment of the risk-weighted consequences of various options.

Background

Section 29 of the *State Environment Protection Policy (Waters)* stipulates that Councils that have onsite domestic wastewater systems within their municipality must develop and implement a domestic wastewater management plan (DWMP).

The broad purpose of a domestic wastewater management plan is to:

- Identify the public and environmental health risks associated with onsite domestic wastewater management systems and;

- Set out strategies to minimise those risks.

Though the *State Environment Protection Policy (Waters)* will cease to exist in its current form when the new *Environment Protection Act* comes into effect on 1 July 2021, the requirement for Councils to develop and maintain a domestic wastewater management plan is not envisaged to change.

What is an onsite domestic wastewater system?

An onsite domestic wastewater system is a system that treats black water (toilet waste) and/or greywater (water from the shower, bath, handwash basins, laundry and kitchen).

Onsite domestic wastewater systems that are designed to treat maximum daily flows of more than 5000L per day currently require an EPA works approval and are managed by EPA Victoria. As such, systems that are designed to treat maximum daily flows of more than 5000L per day are outside the scope of this document and the onsite domestic wastewater management plan.

Onsite wastewater systems are designed to treat and then recycle/dispose of both blackwater and greywater in unsewered areas. Greywater systems are also permitted to be installed in sewered areas.

Please note that onsite wastewater systems are commonly referred to as septic tanks. However, as a septic tank is a type of onsite wastewater treatment system, the term septic tank will only be used in this specific context in the DWMP.

Historical Context

Construction of Melbourne's sewerage system began in 1892 in response to concerns regarding the spread of disease such as typhoid, with the first homes connecting to the system in 1897 (Melbourne Water 2017). Prior to this, householders disposed of greywater directly into street drains, with toilet waste physically collected by nightmen from outhouses and cesspits. This waste often ended up being sold to market gardeners for use as crop fertiliser (Barker et al 2011).

The concept of a septic tank, a type of onsite wastewater system, is generally held to have been developed in France in the 1860s (Ojo et al 2019). Septic tanks appear to have come into use in Australia at the beginning of the 20th century (Beder 1993) as a means of treating wastewater for properties that were not connected to a reticulated sewerage system.

In Victoria, persons wishing to install an onsite wastewater system have been required to apply to their local Council for permission to do so since at least 1928 (Victorian Health Act 1928).

Prior to the introduction of the State Environment Protection Policy (Waters of Victoria) in 1988, some properties were permitted to discharge untreated greywater from kitchens and bathrooms into the environment e.g. into stormwater drains or into a nearby watercourse. These types of properties have what is commonly known as a split or water closet only system as only the toilet waste passes through the septic tank.

System types

There are 2 main types of domestic onsite wastewater systems in Victoria:

- Primary treatment systems e.g. septic tanks. Primary treatment systems use physical methods such as sedimentation to remove solid material from the liquid component of waste. Microbiological activity within the tank is also utilised to treat the waste. The resulting liquid is then disposed to land via, for example, absorption trenches.

- Secondary treatment systems e.g. an aerated wastewater treatment system (AWTS). Secondary treatment systems utilise the same principles as primary treatment systems but whereas the effluent in a primary treatment system moves directly from the tank into the dispersal field, the effluent in a secondary treatment system is subject to further treatment before it is dispersed. A secondary treatment system needs to be able to treat wastewater to a minimum water quality standard of <20 milligrams per litre (mg/L) biological oxygen demand, <30mg/L total suspended solids and where subject to disinfection, E.coli <10 colony forming units (cfu)/100ml (EPA Victoria 2016).

Legislation

There are a number of different pieces of legislation and associated documents that influence the regulation of onsite wastewater systems in Victoria.

Environment Protection Act 2017 and Environment Protection Regulations 2021

The *Environment Protection Regulations 2021* regulate onsite wastewater systems.

Only systems of a type approved by EPA Victoria can be installed. There are 4 types of approved system:

- Septic tanks
- Waterless composting toilets
- Secondary treatment systems
- Domestic greywater treatment systems

System models within each type are certified as conforming to the relevant Australian Standard by an accredited conformity assessment body. EPA Victoria maintains a list of system models that have achieved a certificate of conformity.

Additionally, the Environment Protection Regulations 2021 creates the obligation for occupiers of properties with onsite wastewater systems installed to ensure that the systems are maintained in accordance with the permit conditions.

The *Environment Protection Act 2017* imposes the general environmental duty (GED) on all Victorians, business and community members alike. The general environmental duty requires a person that is undertaking an activity that may give rise to risks of harm to human or environmental health from pollution or waste to undertake steps to minimise those risks.

Property owners that have an onsite domestic wastewater system will need to ensure that their system is managed in accordance with the GED as will regulators.

EPA Victoria Code of practice – onsite wastewater management

The Code of practice is the Victorian guideline for best practice management of onsite wastewater systems. Section 28(3) of SEPP (Waters) requires that all onsite wastewater permits issued by Council are consistent with the information provided in the Code of Practice.

The fate of the Code of practice post 1 July 2021 is unknown at this stage, though it is likely to continue on as part of the state of knowledge (EPA Victoria 2020) in relation to onsite wastewater management.

Planning and Environment Act 1987

The Planning and Environment Act 1987 requires Councils to ensure all land use and development is done in accordance with the municipal Planning Scheme. Victorian Planning Provision section 10, clause 19.03-3S, Integrated water management, requires Councils to ensure that sewerage is provided at the time of subdivision or to ensure lots created by the subdivision are capable of adequately treating and retaining all domestic wastewater within the boundaries of each lot.

Public Health and Wellbeing Act 2008

Section 24 of the *Public Health and Wellbeing Act 2008* requires Council to seek to protect, improve and promote public health and wellbeing within their municipal district. The effective management of the health risks posed by onsite wastewater systems is therefore critical to achieving this aim.

The public health nuisance provisions of the *Public Health and Wellbeing Act 2008* (section 58) also apply to the management of onsite wastewater systems by property owners and occupiers.

Water Act 1989

Section 183 of the Water Act 1989 provides local water authorities with the power to inspect any onsite wastewater system within its sewerage district as well the power to issue a notice to the owner of the land on which a system is located to carry out repairs or maintenance works as specified in the notice.

Section 147 of the Water Act 1989 gives local water authorities the power to require the owner of a serviced property to connect the property to the sewerage system where (i) the local water authority has consulted with the EPA and the Secretary to the Department of Health and Human Service and (ii) the local water authority is of the opinion that the connection is necessary to avoid an adverse impact on public or environmental health.

Local Government Act 2020

Section 9(1) of the Local Government Act 2020 states that a Council must in the performance of its role given effect to the overarching governance principles. Of all the overarching governance principles set out in the Local Government Act 2020, it is the third principle (section 9(2)(c)) that is of most relevance to onsite wastewater management.

Section 9(2)(c) states that the economic, social and environmental sustainability of the municipal district, including mitigation and planning for climate change risks, is to be promoted.

Climate change risks associated with onsite wastewater management are considered in section 10.

Regulatory roles and responsibilities – domestic onsite wastewater management

There are a number of regulators involved in the management of domestic onsite wastewater systems as summarized in Table 1 below:

Table 1 – Regulatory Authority Key Responsibilities

REGULATORY AUTHORITY	KEY RESPONSIBILITIES
EPA Victoria	• Provide guidance documents and advice on interpretation of these documents. • Maintain a web-based list of approved onsite wastewater systems that can be installed in Victoria.
Councils	• Issuing planning permits in accordance with the requirements of the *Planning and Environment Act 1987.* • Issuing building permits in accordance with the *Building Regulations 2006* (where a Council issues building permits). • Assessing onsite domestic wastewater applications and issuing permits to install and alter systems as well as provide approval to use these systems. • Ensure that systems are appropriately managed through compliance and enforcement activities. • Develop, implement and maintain a domestic wastewater management plan.
Water Corporations e.g. South East Water	• Plan for future community needs in relation to the provision of sewerage services. • Construct and maintain sewerage system infrastructure[1]

[1] Up to the property connection point.

Council policy context

Integrated Water Management Plan

The City of Casey's Integrated Water Management Plan seeks, among other objectives, to improve the water quality of stormwater and the water within local waterways.

Onsite domestic wastewater systems that are not operating correctly and/or are poorly maintained can contribute to a reduction in the water quality of both local waterways and stormwater. Therefore, the development and implementation of a DWMP will support the achievement of the goals of the *Integrated Water Management Plan*.

Sustainability Plan

The Council's Sustainability Plan has a number of objectives, one of which relates to the conservation of the municipality's natural environment. The development of a DWMP will aid in assisting in conserving our natural environment.

Council Plan

The development and implementation of a domestic wastewater management plan aligns with Strategic Direction 1 – Drive Stronger connections and places of the Council Plan 2021 – 2025.

Sewerage Provision with the Municipality

South East Water (SEW) is the service provider for water and sewerage services to properties within the City of Casey. South East Water is responsible for the planning and construction sewerage infrastructure.

The majority of properties within the urban areas of the municipality are connected to the reticulated sewerage system however pockets of unsewered properties remain in suburbs such as Berwick. Onsite wastewater systems become more prevalent in suburbs that are semi-rural and form the main method of wastewater treatment in the rural areas of the municipality, for example Devon Meadows.

As urban growth continues to spread out into the semi – rural/rural areas of the municipality, the availability of reticulated sewer will increase, with the numbers of properties relying on an onsite wastewater system predicted to gradually decline.

Wastewater Profile

The City of Casey covers an area of 409km2 and has an estimated population of 340,419 (ABS 2018). The municipality is a mix of urban, semi-urban and rural areas. Due to development, land that was once rural has been redeveloped into housing estates. This along with works undertaken by South East Water, for example, down in the coastal villages, has meant that a significant portion of the properties within the municipality are serviced by a reticulated sewerage system.

Onsite wastewater systems are managed through the electronic *Health Manager* database. The system contains permit records for properties that have a system that is currently in use as well as records that relate to systems that are no longer in use. According to *Health Manager*, there are a total of 4948 'current' records on the system i.e. properties with a known onsite wastewater system. However, a data cleansing exercise undertaken as part of the development of the DWMP, indicates that a more accurate figure would be an estimated 3590 properties with a known 'current' system.

Table 2 – Breakdown by suburb, properties with a known onsite wastewater system*

SUBURB	PRIMARY TREATMENT SYSTEM E.G. SEPTIC TANK	SECONDARY TREATMENT SYSTEM	GREYWATER SYSTEM	UNKNOWN	TOTAL
Beaconsfield	1	0	0	0	1
Berwick	93	66	4	57	220
Blind Bight	7	1	0	16	24
Botanic Ridge	0	1	0	11	12
Cannons Creek	10	5	0	12	27
Clyde	44	16	0	193	253
Clyde North	13	2	0	51	66
Cranbourne	12	6	0	0	18
Cranbourne East	37	3	0	11	51

Cranbourne North	0	2	0	8	10
Cranbourne South	251	74	0	248	573
Cranbourne West	3	1	0	7	11
Devon Meadows	247	42	0	232	521
Doveton	0	0	0	0	0
Endeavour Hills	18	3	0	10	31
Eumemmerring	0	0	0	0	0
Hallam	0	0	0	0	0
Hampton Park	3	1	0	0	4
Harkaway	159	34	0	115	308
Junction Village	2	1	0	0	3
Lynbrook	0	0	0	0	0
Lysterfield	2	0	0	0	2
Narre Warren	1	1	0	0	2
Narre Warren South	198	29	0	1	228
Narre Warren North	293	69	0	161	523
Pearcedale	176	58	0	270	504
Tooradin	46	19	0	127	192
Warneet	0	1	0	5	6
TOTAL	**1616**	**435**	**4**	**1535**	**3590**

*As of 20 February 2019

It must be noted that Table 2 only provides the number of known systems within each suburb. The actual number of systems for most suburbs is likely to be higher, particularly for those suburbs that are semi-rural/rural in character.

A good illustrative example of this is the suburb of Junction Village, located between Cranbourne and Devon Meadows. Reticulated sewerage connection has been progressively provided to properties in the area commencing in about 1987 nevertheless, not all properties are connected to sewer according to data provided by South East Water.

For example, the triangular area bound by South Gippsland Highway and Craig Road, contains 32 properties that do not have a sewer connection. Of these 32 properties, Council only has a record in its onsite wastewater database for 3 properties.

For those properties for which a record exists on Council's onsite wastewater database, the database is able to provide a variety of information to varying extents for each property including:

- Copies of maintenance records
- Copies of permits to install a system
- Copies of permits (certificate of approval) to use a system
- Information on system type where plans exist

Table 3 – Information on known onsite wastewater systems by suburb

SUBURB	NUMBER OF SYSTEMS WHICH HAVE UP-TO-DATE MAINTENANCE RECORDS (BASED ON REPORTS RECEIVED)	NUMBER OF SYSTEMS WITH PERMIT TO INSTALL	NUMBER OF SYSTEMS WITH PERMIT TO USE	NUMBER OF PROPERTIES WITH LOT SIZE <10,000M^2*	NUMBER OF PROPERTIES WITH LOT SIZE <4000M^2*	NUMBER OF PROPERTIES WITH SPLIT SYSTEMS
Beaconsfield	0	1	1	0	0	0
Berwick	71	81	55	183	3	0
Blind Bight	3	5	3	0	0	0
Botanic Ridge	0	12	12	1	1	0

Cannons Creek	6	9	4	1	0	0
Clyde	27	20	4	38	13	0
Clyde North	3	2	1	14	1	0
Cranbourne	5	7	3	10	0	0
Cranbourne East	5	7	3	42	0	0
Cranbourne North	2	0	0	0	0	0
Cranbourne South	49	80	54	69	7	67
Cranbourne West	1	1	0	2	2	1
Devon Meadows	34	68	51	168	17	21
Doveton	N/A	N/A	N/A	N/A	0	N/A
Endeavour Hills	3	12	6	9	1	0
Eumemmerring	N/A	N/A	N/A	N/A	0	N/A
Hallam	N/A	N/A	N/A	N/A	0	N/A
Hampton Park	0	2	1	2	1	0
Harkaway	29	160	56	150	95	39
Junction Village	0	1	0	3	2	1
Lynbrook	0	0	0	0	0	0
Lysterfield	1	0	0	0	0	0
Narre Warren	0	1	0	2	1	1

Narre Warren South	11	206	173	224	4	0
Narre Warren North	75	295	159	122	88	4
Pearcedale	35	157	42	50	3	15
Tooradin	10	33	17	30	8	2
Warneet	0	1	1	0	0	0
TOTAL	**370**	**1161**	**645**	**997**	**248**	**151**

*Information obtained from GIS mapping system

The age of the systems can also be estimated based on either the dates of issue of the permit/s or the dates of any system plans. This information is presented in Table 4 below.

Table 4 – Estimated age of known onsite wastewater systems

SUBURB	AGE of SYSTEM (YEARS)									
	1 - 5	6 - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 – 35	36 - 40	40+	Unknown
Beaconsfield	0	0	0	0	0	0	0	0	1	0
Berwick	15	8	1	1	7	18	36	13	8	113
Blind Bight	2	1	0	0	1	2	2	3	0	13
Botanic Ridge	0	0	0	0	0	0	0	0	0	12
Cannons Creek	4	0	0	0	2	3	2	0	0	16
Clyde	6	2	3	1	3	6	14	8	11	253
Clyde North	0	2	0	0	1	2	1	1	1	58
Cranbourne	2	0	0	1	1	4	1	0	4	5
Cranbourne East	4	0	0	0	0	5	7	8	16	11
Cranbourne North	0	0	0	0	0	1	1	0	0	8

Cranbourne South	25	12	1	2	19	16	29	33	90	346
Cranbourne West	0	0	1	0	0	0	1	0	0	9
Devon Meadows	21	27	2	1	13	27	40	34	77	279
Doveton	0	0	0	0	0	0	0	0	0	0
Endeavour Hills	1	0	0	0	0	5	6	2	4	13
Eumemmerring	0	0	0	0	0	0	0	0	0	0
Hallam	0	0	0	0	0	0	0	0	0	0
Hampton Park	0	0	0	0	0	2	0	0	0	2
Harkaway	22	6	6	0	2	23	34	28	50	137
Junction Village	0	0	0	0	0	1	0	0	1	1
Lynbrook	0	0	0	0	0	0	0	0	0	0
Lysterfield	0	0	0	0	0	0	0	0	0	2
Narre Warren	0	0	0	0	0	0	1	1	0	0
Narre Warren South	8	5	2	0	12	84	80	9	6	22
Narre Warren North	31	17	1	0	5	41	108	55	32	232
Pearcedale	33	13	1	3	8	19	36	31	19	341
Tooradin	13	3	0	1	7	5	8	1	1	153
Warneet	0	1	0	0	0	0	0	0	0	5
TOTAL	**166**	**96**	**19**	**10**	**81**	**263**	**407**	**227**	**321**	**1975**

Complaint Data

As can be seen via reference to Table 4, the age of the majority of onsite wastewater systems within the municipality is unknown (55.1%). Where the age can be estimated, 36.2% of systems are estimated to be over 20 years old with the oldest system dating to circa 1955 (based on the date written on the system plan).

It must be noted that the figure of 36.2% of systems being 20 years or older may not provide an accurate indication as property owners may have installed new systems/altered systems without notifying Council.

Complaint data relating to onsite wastewater systems is recorded in Council's electronic customer request system. The oldest complaint that could found dates back to December 2013. Since this time, there have been approximately 83 complaints related to onsite wastewater systems recorded.

A breakdown in complaint types is given in Table 5 below.

Table 5 – Complaint Types

COMPLAINT TYPE	NUMBER OF COMPLAINTS
Permit issue	12
Overflow/seepage of effluent	50
Odour	7
Construction/maintenance issue	5
Reticulated sewerage issue	9

The number of complaints per suburb has also been tabulated (see Table 6 below) excluding those related to a reticulated sewerage issue.

Table 6 – Complaints by Suburb

SUBURB	NUMBER OF COMPLAINTS
Berwick	14
Clyde	3
Clyde North	1
Cranbourne	1
Cranbourne East	7
Cranbourne South	7
Cranbourne West	1
Devon Meadows	8
Endeavour Hills	2
Harkaway	2
Narre Warren North	13
Narre Warren South	7
Pearcedale	5
Tooradin	2

A review of the complaint data suggests that complaints are only made when a person experiences a direct impact, for example, wastewater from the onsite wastewater system located on the adjacent property is seeping onto a section of their property that is located near their residence. The complaint data therefore sheds little light on the environmental and health risks associated with onsite wastewater systems within the municipality.

Risks Associated with Onsite Domestic Wastewater Systems

The primary risks associated with onsite domestic wastewater systems relate to public and environmental health.

Amenity can also be negatively impacted by poorly managed onsite wastewater systems.

Amenity

Effluent run-off and seepage from systems that are not working properly can both look unsightly and be odoriferous. The data presented in Table 5 indicates that onsite wastewater systems have triggered complaints regarding odour in the past.

The number of complaints would suggest that the impact from a community perspective is likely to be low.

Public health risks associated with domestic onsite wastewater systems

Untreated or inadequately treated domestic wastewater poses a public health risk. The gravity of this risk is clearly demonstrated by recalling that one of the primary drivers behind the construction of sewerage systems around the world including Melbourne's (Melbourne Water 2017), was the disease and mortality rate associated with water contamination by human faecal waste.

There are four types of microbial pathogen that can be found in wastewater: viruses, bacteria, protozoans and helminths (Toze 1997). Transmission of disease is via the faecal – oral route i.e. the pathogen enters the body via ingestion, for example by ingestion of contaminated water or food. The consequences of infection can range from mild through to life threatening depending on the organism and on the host, with certain members of the population being more vulnerable than others, for example, children and the elderly.

Numerous disease outbreaks have been linked to onsite domestic wastewater systems internationally particularly in the United States, with a large portion of the cases associated with contamination of groundwater used for drinking purposes by effluent (Cogger 1988, Scandura and Sobsey 1997), with areas possessing sandy soils in conjunction with a high water table being at most risk.

Groundwater refers to water that is located beneath the earth's surface in pores and crevices in rock and soil. Sites where this water is found in useable quantities are called aquifers. Water bores do exist within the municipality in rural areas, where they seem to be primarily used for the purposes of crop irrigation and domestic and stock water supply (Visualizing Victoria Groundwater 2020).

According to Department of Natural Resources and Environment's Major Agricultural Soils of the Cranbourne – Koo Wee Rup Region map (1996), the predominant soil type located down in the coastal villages is what is described as Cranbourne sand. The depth to the water table in this region is stated as being less than 5m (Department of Environment, Land, Water and Planning 2019) however what, if any impact onsite wastewater systems in the area may be having on the level of microbes in the groundwater is unknown.

Surface waters such as creeks and dams can also be subject to contamination from onsite wastewater systems as can stormwater drains. This may either be as the result of:

1. Direct discharge of untreated greywater into these receiving waters, for example by properties that do not have an onsite disposal system;
2. The discharge of inadequately disinfected effluent into these receiving waters again by properties that do not have an onsite disposal system;
3. Run off from failing systems and (4) inappropriately designed/installed systems, for example systems that do not comply with the minimum setback distances from a waterbody specified in the EPA Victoria Code of Practice.

Disease outbreaks involving suspected faecal pollution of surface waters from onsite wastewater systems have occurred in Australia. One of the most famous cases is that of Wallis Lake, NSW in 1997. An outbreak of Hepatitis A occurred that was linked to the consumption of oysters grown in Wallis Lake that had been contaminated with sewage. Though the exact source of the sewage contamination was not identified, it was suspected that failing onsite wastewater systems that were located within the vicinity of a river that flowed into Wallis Lake was the cause. There were 444 reported cases of Hepatitis A, including one death.

Locally, effluent discharge from split systems is known to be entering Grasmere Creek in Harkaway (Council records dating from the 1970s indicate that the effluent from some onsite wastewater systems in the area was approved to be discharged into Council's stormwater drains, which subsequently discharge into the creek). The risk to public health in this instance is likely to be limited to persons that may come into direct contact with the water e.g. a person doing maintenance works on the creek. Whether other waterways within the municipality are being impacted by onsite wastewater systems is unknown.

Effluent is also known to be entering Council stormwater drains in certain areas of the municipality. Not only does this have a negative impact on the stormwater quality but it also influences the frequency and volume of water that the drain must deal with. Where water flow in drains is poor, pooling of nutrient rich wastewater may also increase the likelihood of the site becoming a mosquito breeding ground.

Contamination of waterways is not the only means by which food intended for human consumption may be potentially impacted by effluent from onsite wastewater systems. The Legislative Assembly of New South Wales's 2012 report into the regulation of domestic onsite wastewater systems in NSW makes reference to observations made by Council inspectors of a number of market garden properties in NSW where effluent from overflowing systems was observed entering crop areas, where crops were encroaching on buffer zones

and where effluent was being redirected to crops rather than into the dispersal field.
The City of Casey contains a number of market gardens in areas serviced by onsite wastewater systems. As routine inspections of onsite wastewater systems are not undertaken by Council's Environmental Health Officers it is unknown if similar issues exist locally. This is an area that is worthy of further investigation.

Environmental health risks associated with domestic onsite wastewater systems

Domestic wastewater can contain a wide variety of chemical pollutants ranging from nitrogen and phosphorus to pharmaceuticals.

Though nitrogen and phosphorus are essential nutrients for plant and animal growth, excessive levels in water bodies can result in increased growth of aquatic plant life, leading to a reduction in the amount of dissolved oxygen. This in turn, can lead to the death of other aquatic life such as fish.

The environmental impact of other chemicals such as pharmaceuticals that can be found in domestic wastewater have been subject to scientific study with a range of effects reported including delayed development in fish and frogs as well as changes in their reproductive behaviour (Deziel 2014).

It is known from information contained within the City of Casey's *Integrated Water Management Plan* that the index stream condition of waterways within the municipality is generally poor.

The index stream condition is based on 5 factors (Department of Environment and Primary Industries 2013):

- Hydrology (the amount of water in a waterbody)
- Physical form (includes factors such as the condition of the banks of the waterway, instream habitat and the presence of any artificial barriers such as dams)
- Streamside zone (characteristics of vegetation within 40 metres of a waterway's edge)
- Water quality (total phosphorus, turbidity, salinity and pH)
- Aquatic life (number and types of aquatic life found in a waterbody)

Table 7 provides a list of suburbs and their associated catchment areas. The water contained within these creeks and drains ultimately ends up in either Port Philip or Western Port Bays (Melbourne Water 2018).

Table 7 – Drain catchment by suburb*

SUBURB	CATCHMENT
Berwick Harkaway Narre Warren North	Cardinia Creek
Blind Bight Cannons Creek Clyde Clyde North Cranbourne East Cranbourne South Devon Meadows Pearcedale Warneet	Coastal creeks
Endeavour Hills Narre Warren North	Dandenong Creek
Cranbourne West	Eastern Contour Drain
Harkaway Narre Warren North	Eumemmerring Creek
Berwick Cranbourne North Harkaway Narre Warren South Narre Warren North	Hallam Main Drain
Tooradin	Sawtel Inlet

*Information adapted from the Draft Background Paper – Casey Domestic Wastewater Management Plan

Effluent from onsite wastewater systems could make a negative contribution to both the water quality and aquatic life components that comprise the measurement of the index stream condition. As previously discussed, effluent discharge from split systems is known to be entering Grasmere Creek in the Harkaway area. Water sampling of the creek in this area has commenced. Based on the information collected thus far, the levels of nitrogen are elevated to some extent. Water sampling undertaken by South East Water has also shown high levels of other contaminants which could be linked to onsite wastewater system failure (South East Water, personal communication, 4 June 2020).

Quantifying the risks posed by onsite domestic wastewater systems within the municipality

The risk posed to public and environmental health by onsite wastewater systems within the City of Casey is, as with any risk, a function of likelihood vs consequence.

The potential consequences can be severe and in a worst-case scenario, even life threatening however actual consequences are unknown due to the limited data available.

In terms of the likelihood of risk to public and environmental health, there is some data available that relates to factors that contribute to the likelihood of there being a risk, namely:

- Design and installation of systems
- Maintenance of systems
- Lot sizes
- Age of systems

Design and installation of systems – influence on likelihood of risk

Onsite wastewater systems that are inadequately designed and/or installed increase the likelihood that the systems will not perform effectively in terms of wastewater treatment and/or disposal.

It is important to note that historical system designs whereby the effluent is not retained onsite but rather is discharged offsite e.g. into a stormwater drain, exist and continue to operate within the municipality.

Design of systems

There are two main factors that need to be considered in the design of a modern onsite wastewater system, the type of treatment system and the disposal system.

In Victoria, only treatment system types that are approved by EPA Victoria can be installed. The disposal system needs to be designed considering:

- Hydraulic capacity of the soil i.e. how easy it is for water to move through the soil.
- Hydraulic load – the volume of wastewater that needs to be handled.

Different types of soil have different hydraulic capacities. For example, water can move more readily through sandy soil than clay. Therefore, in order to adequately design a wastewater disposal system, you need to know the characteristics of the soil at a property in which the system is to be installed.

Onsite wastewater disposal system designers should base their design for the disposal field upon the results of a land capability assessment (LCA). With the exception of areas located in Special Water Supply Catchments for which an LCA is mandatory (there are no Special

Water Supply Catchments in the City of Casey), the Victorian Land Capability Assessment Framework (Municipal Association of Victoria et al 2014) recommends that an LCA be undertaken for all unsewered property developments unless for lot sized developments a Council is satisfied that the site is low risk or if adequate site and soil information has been gathered through other means such as a township based LCA.

It is the role of Council to assess the design of onsite wastewater systems and if satisfied that the system design is adequate, issue a permit to install. This is an important regulatory control point as evidenced by the fact that it is illegal under the Victorian environment protection legislation for a person to construct, install or alter a system unless they have received a permit to install from Council. The environment protection legislation also empowers Councils to refuse to issue a permit to install if they deem the system unsuitable.

Of the 3590 known onsite wastewater systems, an estimated 32.3% have a permit to install. Thus, the majority of systems that are in operation appear to have not been formally assessed as being of a suitable design by Council.

It is also worth noting that few LCA or soil permeability reports can be found in Council records in relation to applications to install an onsite wastewater system. Given that no township based LCAs are known to have been commissioned for the purposes of onsite wastewater management for the City of Casey, there seems to be a significant reliance on 'local knowledge' as a means of determining soil performance. Such an approach is more likely to be associated with a higher rate of error than one that is based upon the use of data generated as the result of the application of standardized soil testing processes.

Installation of systems

Onsite wastewater systems that have been improperly installed have a greater potential for system failure and therefore risk to public and environmental health.

Under the Victorian *Environment Protection Regulations*, a person must not use a system until the local Council has inspected the system and issued a certificate approving its use (also known as a permit to use).

Of the estimated 3590 known onsite wastewater systems, approximately 18% of systems have a permit to use. Again, the majority of systems appear to have not been formally approved for use by Council.

Onsite wastewater system maintenance - influence on likelihood of risk

Council has up-to-date maintenance records for approximately 10.3% of known systems.

Secondary treatment systems typically require servicing on a quarterly basis as they are more complicated in design. Manufacturers of secondary treatment systems specify in their operation manuals the required service frequency for their systems. Failure to service the system at the required frequency will lead to a deterioration in the performance of the system over time and is likely to shorten the operating life of the unit.

Primary treatment systems such as septic tanks are generally simpler in design and if the system is used correctly, generally only require desludging (removal of the layer of sludge that builds up in the tank) on average every 3 - 5 years depending on factors such as tank size and wastewater volume generated by a property. Failure to remove the sludge will result in a deterioration in the performance of the system over time and is likely to shorten the operating life of the system.

Under the Victorian *Environment Protection Regulations*, it is the occupier of a premises on which an onsite wastewater system is located that is responsible for maintaining the system in accordance with the requirements set out in the system's Council permit. Permit conditions will typically set out the required service frequency and the requirements for reporting back to Council the service outcomes. In practice, it is often the service technician that does the service/desludge that submits the service report to Council on behalf of their client.

The very low number of known systems for which Council has up-to-date maintenance records may indicate:

- That the systems are not being maintained,
- That service technicians/property occupiers are failing to submit the service reports to Council.
- A lack of awareness in relation to notifying Council when system maintenance is undertaken.

Lot sizes - influence on likelihood of risk

The EPA *Code of Practice – Onsite wastewater* states that lot sizes smaller than 10,000m2 may be unable to retain all wastewater onsite with properties with land sizes of less than 4000m2 needing to actively minimise the amount of wastewater generated in order to be able to contain all wastewater onsite (EPA 2016).

It has been estimated that there are approximately 997 properties with known onsite wastewater systems that are smaller than 10,000m2 in size within the City of Casey. Of these 248 properties are less than 4000m2 in size. This latter group of properties are primarily located in the suburbs of Harkaway and Narre Warren North. These two suburbs are the two remaining South East Water sewer backlog areas in the City of Casey (South East Water, personal communication, 9 June 2020).

It is important to note that the property land size for many of the 248 aforementioned properties are no larger than an average suburban block. In some instances, the properties do not physically possess enough land to allow them to retain wastewater onsite. Bellbird Avenue, Harkaway provides a relevant case study.

Bellbird Avenue contains 19 properties. With the exception of one property that is approximately 69,000m2 in size, all the other properties range in size between 937m2 – 1,928m2. An investigation undertaken by Council's Environmental Health contractor in 2005 (Kernow Environmental Services Pty Ltd) established that 13 of the properties discharged their greywater wastewater offsite into a Council stormwater drain, with 9 properties also discharging effluent from their septic tank (the properties have split systems where by only the blackwater generated by the property passes through the septic tank) into the Council stormwater drain.

Water sampling of the stormwater outlet that the above properties connect to and the creek (Grasmere Creek) into which the stormwater outlet discharges has been undertaken. The elevated levels of nitrogen and E.coli, a faecal contamination indictor organism were found in the creek water at both the stormwater discharge point as well as downstream of this point.

The presence of E.coli in water is an indicator that other disease-causing organisms may be present. Elevated levels of nitrogen in water can result in increased growth of aquatic plants and organisms like algae. This in turn can lead to a reduction in the amount of oxygen in the water (due to uptake by these organisms/plants), which can have a negative impact on other forms of aquatic life that are dependent on oxygen e.g. fish.

Age of installed onsite wastewater systems - influence on likelihood of risk

Onsite wastewater systems can have a limited lifespan. As the age of an onsite wastewater system increases, the likelihood of failure becomes more probable (Geary 2019). Generally, with primary treatment systems, it is the effluent dispersal field that is the limiting factor in terms of the system lifespan (Ahmed et al 2005).

Secondary treatment systems are more complex in structure than primary treatment systems, for example there are more moving parts. As such the typical warranty for these systems provided by manufacturers is within the vicinity of 15 years for the tank and 2 years for electrical components assuming that the system is serviced at the recommended intervals and used in accordance with the manufacturer's instructions.

As previously discussed, based on the available data approximately 36.2% of known systems are more than 20 years old thus the likelihood of potential system malfunction is therefore increased.

Likelihood of Risk – Summary

Table 8 provides a summary of data relating to the factors discussed above by suburb as well as an overall likelihood of risk rating^ to public and environmental health for each suburb.

Table 8 – Data summary: Factors contributing to likelihood of a risk to public and environmental health by suburb (area within vicinity of systems)

SUBURB	TOTAL NUMBER OF SYSTEMS	% OF SYSTEMS WITH A PERMIT TO INSTALL	% OF SYSTEMS WITH A PERMIT TO USE	% OF PROPERTIES WITH A SYSTEM THAT ARE <10,000M² IN SIZE	% OF SYSTEMS WITH UP-TO-DATE MAINTENANCE RECORDS	% OF SYSTEMS THAT ARE OVER 20 YRS OF AGE	% OF SYSTEMS UNKNOWN AGE	PROPERTIES WITH KNOWN DISCHARGE OFFSITE (YES/NO)	LIKELIHOOD OF RISK^
Beaconsfield	1	100%	100%	0%	0%	100%	0%	No	Low
Berwick	220	36.8%	25%	83.2%	32.3%	37.3%	51.4%	Yes	High
Blind Bight	24	20.8%	12.5%	0%	12.5%	33.3%	54.2%	No	Low
Botanic Ridge	12	100%	100%	8.3%	0%	0%	100%	No	Low
Cannons Creek	27	33.3%	14.8%	3.7%	22.2%	29.5%	59.3%	No	Low
Clyde	253	7.9%	1.58%	15%	10.7%	16.6%	78.7%	No	Medium
Clyde North	66	3%	1.5%	21.2%	4.5%	9.1%	87.9%	No	Medium - high
Cranbourne	18	38.9%	16.7%	55.6%	27.8%	55.6%	27.8%	No	Medium
Cranbourne East	51	13.7%	5.9%	82.4%	9.8%	70.6%	21.6%	No	High
Cranbourne North	10	0%	0%	0%	20%	20%	80%	No	Low
Cranbourne South	573	14%	9.4%	12%	8.6%	32.6%	60.4%	No	Medium
Cranbourne West	11	9.1%	0%	18.2%	9.1%	9.1%	81.8%	No	Low
Devon Meadows	521	13.1%	9.8%	32.2%	6.5%	36.7%	53.6%	No	Medium
Doveton	0	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A
Endeavour Hills	31	38.7%	19.4%	29%	9.7%	54.8%	41.9%	No	Low - medium
Eumemmerring	0	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A
Hallam	0	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A

Hampton Park	4	50%	25%	50%	0%	50%	50%	Yes	High
Harkaway	308	51.9%	18.2%	48.7%	9.4%	44.5%	44.5%	Yes	Very High* (township area)
Junction Village	3	33.3%	0%	100%	0%	66.7%	33.3%	No	Medium
Lynbrook	0	N/A	N/A	N/A	N/A	N/A	N/A	No	N/A
Lysterfield	2	0%	0%	0%	50%	0%	100%	No	Low
Narre Warren	2	50%	0%	100%	0%	100%	0%	No	Medium - high
Narre Warren South	228	90.4%	75.9%	92.4%	4.8%	83.8%	9.6%	Yes	High
Narre Warren North	523	56.4%	30.4%	23.3%	10.1%	47.2%	44.4%	Yes	High
Pearcedale	504	31.2%	8.3%	9.9%	6.9%	22.4%	67.7%	No	Medium
Tooradin	192	17.2%	8.9%	15.6%	5.2%	10.9%	79.7%	No	Low - medium
Warneet	6	16.7%	16.7%	0%	0%	0%	83.3%	No	Low

*Environmental monitoring data (water sampling results of Grasmere Creek) is available for the Harkaway township area. The data indicates that wastewater from onsite systems within the township area are contaminating the creek.

^ The estimation of the likelihood of risk is based on several assumptions and has several limitations, increasing the degree of uncertainty (Victorian Managed Insurance Authority 2016). As more data is collected and knowledge levels increase, the risk rating will be subject to change. The likelihood of risk will be used as the starting point to prioritise environmental monitoring and compliance monitoring activities.

Assumptions: (1) the greater the number of systems, the greater the potential impact due to cumulative effects; (2) that the permit to install process would have identified any significant design flaws, thus reducing the likelihood of a system having a negative impact all other factors being equal; (3) that the permit to use process would have identified any significant installation flaws, thus reducing the likelihood of the system having a negative impact all other factors being equal; (4) properties with lot size greater than 10,000m^2 would have minimal impact in terms of broader environmental and public health impacts. This is not to say that these systems are not having an impact at a property level; (5) that having up-to-date maintenance records equates satisfactory system function; (6) that the older a system is, the more likely failure will occur; (7) that discharge offsite is associated with negative environmental impacts.

Limitations: (1) environmental monitoring data (water sampling results) are only available for one area located within one suburb; (2) the likelihood risk analysis is based on 8 factors. There are other factors that influence the likelihood of risk e.g. proximity to a local drinking water catchment, soil type etc. Some of these other factors have been discounted, for example the municipality does not contain land that forms part of a potable water supply catchment or have been excluded due to the paucity of data currently available e.g. soil types. (3) The data set itself has several inherent limitations e.g. records are incomplete and many cases several decades old.

Changing climate and onsite wastewater management

According to the Victorian Department of Environment, Land, Water & Planning (2015), Victoria is expected to experience increased temperatures year around as well reduced rainfall coupled with more intense downpours when it does rain as a result of our changing climate.

It is predicted that climate change may have an impact on the ability of onsite wastewater treatment systems to effectively treat wastewater (Hughes et al 20212). Specifically, the climate change may:

- Result in changes to the performance of the absorption field as the result of changes to the soil structure secondary to a rise in temperature.
- Increased temperatures may result in lower oxygen solubility and higher soil microbial oxygen consumption, which could impact the ability of soil microbes to treat wastewater.
- More intense downpours may result in the soil becoming periodically saturated, impacting on its ability to absorb wastewater, leading to periodic overflows and seepage.
- For coastal areas of the municipality, rising sea-levels may lead to a rise in groundwater tables which in turn could increase the likelihood of saturated soil and thus negatively impact the ability of the soil to absorb wastewater.
- A reduction in overall rainfall may lead to the drying of soils, which in turn could lead to cracking of underground structures such as pipework, resulting in leakage or system failure. Reduced overall rainfall as a result of our changing climate may also see a surge in interest in the installation of greywater treatment systems, which are also a form of onsite wastewater system.

The City of Casey's Climate Change Action Plan is currently under development and will seek to set out Council's climate change mitigation and adaption responses, including addressing wastewater management risks and opportunities.

[2] Though set in a New Zealand context, the research paper by Hughes et al 2021 has application in an Australian context as the principles of how onsite wastewater treatment systems operate are universal. No Australian research papers could be found on the topic.

Strategies to manage onsite wastewater within the municipality

The City of Casey has identified the following strategies for the management of onsite wastewater within the municipality.

The specific action items for each strategy can be found in the accompanying document: Domestic Wastewater Management Action Plan.

1

Implement a risk-based compliance monitoring program for onsite wastewater systems commencing in areas identified as giving rise to a higher likelihood of risk.

A risk-based compliance monitoring program for onsite wastewater systems is necessary for the effective regulation of onsite wastewater systems.

2

Implement an environmental water quality monitoring program commencing in areas identified as giving rise to a higher likelihood of risk.

Environmental water quality monitoring can provide invaluable data regarding the functioning of onsite wastewater systems in a location, as well as data regarding the impacts of wastewater on the local environment. This data can then be used to prioritise compliance monitoring activities as well as assist in the planning of the provision of sewerage infrastructure by the local water authority.

3

Continue to engage with South East Water in relation to their planning of sewerage services within unsewered areas of the municipality.

In some instances, the provision of and connection to a sewerage system maybe the only viable long-term solution to address negative environmental impacts associated with onsite wastewater systems. As a regulatory authority, it is Council's role to identify high risk areas and advocate for the installation of sewerage systems in these areas.

4

Enhance relationships with key stakeholders including but not limited to EPA, Melbourne Water, South East Water and local environmental groups from an engagement and information sharing perspective in relation to onsite wastewater issues.

The ability to share information in relation to local domestic onsite wastewater issues amongst key stakeholders should lead to the development of a more comprehensive understanding of local onsite wastewater issues. This in turn will enable the ongoing refinement of Council's domestic wastewater management plan.

5

Continue to educate onsite wastewater system owners/operators on the management of onsite wastewater systems.

Owners/operators of onsite wastewater systems need to have a basic level of knowledge in relation to how their system operates in addition to maintenance requirements in order to minimise the risks associated with onsite wastewater systems and comply with their general environmental duty requirement under the forthcoming amendments to the *Environment Protection Act*.

References

Ahmed W, R Neller and M. Katouli (2005): Evidence of septic system failure determined by a bacterial biochemical fingerprinting method, Journal of Applied Microbiology, vol. 98, pp. 910-920.

Auditor General Victoria (2006): Protecting our environment and community from failing septic tanks, available at: https://www.parliament.vic.gov.au/papers/govpub/VPARL2003-06No205.pdf

Barker F, R Faggian and A Hamilton (2011), A History of Wastewater Irrigation in Melbourne, Journal of Water Sustainability, vol.1, issue 2, pp. 183 – 202

Beder K (1993): From sewage farms to septic tanks: Trials and Tribulations in Sydney, Journal of the Royal Australian Historical Society vol. 79, parts 1 and 2, pp. 72 – 95.

Cogger C (1988): On-site Septic Systems: The risk of groundwater contamination, Journal of Environmental Health, Vol. 51, No. 1, pp 12-16.

Department of Environment, Land, Water and Planning (2019): Groundwater resource reports, available at: https://www.water.vic.gov.au/groundwater/groundwater-resource-reports

Department of Environment, Land, Water and Planning (2015): Climate Ready Victoria. Available at: https://www.climatechange.vic.gov.au/__data/assets/pdf_file/0018/60750/Statewide-Victoria.pdf

Department of Environment and Primary Industries (2013): Index of Stream Condition – The Third Benchmark of Victorian River Condition, available at: https://www.water.vic.gov.au/water-reporting/third-index-of-stream-condition-report

Department of Natural Resources and Environment (1996): Major Agricultural Soils of the Cranbourne and Koo-Wee-Rup Region, available at: http://vro.agriculture.vic.gov.au/dpi/vro/portregn.nsf/pages/ppw_soil_cranbourne_west/$FILE/Soils_of_the_Cranbourne_KooWeeRup_region-West.pdf

Deziel N (2014): Pharmaceuticals in Wastewater Treatment Plant Effluent Waters, Scholarly Horizons: University of Minnesota, Morris Undergraduate Journal Vol. 1, No. 2, Article 12.

EPA Victoria (2010): Applying the Environment Protection Principles in Waste Management Regulation. Publication 1360. Available at: https://www.epa.vic.gov.au/about-epa/publications/1360

EPA Victoria (2016): Code of practice – onsite wastewater management. Publication 891.4. Available at: https://ref.epa.vic.gov.au/our-work/publications/publication/2016/july/891-4

EPA Victoria (2020): State of knowledge and industry guidance. Available at: https://www.epa.vic.gov.au/about-epa/laws/new-laws/state-of-knowledge-and-industry-guidance

Geary P (2019): Failing Systems: Tracers and Source Tracking [Powerpoint presentation] Centre for Environmental Training.

Hughes J, K Cowper-Heays, E Olesson, R Bell and A Stroombergen (2021): Impacts and implications of climate change on wastewater systems: A New Zealand perspective, Climate Risk Management, vol. 31.

Legislative Assembly of New South Wales Committee on Environment and Regulation (2012): Inquiry into the Regulation of Domestic Wastewater, Report 1/55, available at: https://www.parliament.nsw.gov.au/ladocs/inquiries/1806/Report%20on%20the%20Regulation%20of%20Domestic%20Wastewater%20FI.pdf

Municipal Association of Victoria, Department of Environment and Primary Industries and Environment Protection Authority (2014): The Victorian Land Capability Assessment Framework, 2nd edition. Available at: https://www.mav.asn.au/__data/assets/word_doc/0011/7220/Victorian-land-capability-assessment-framework.docx

Melbourne Water (2017) – History of sewerage. Available at: https://www.melbournewater.com.au/community-and-education/about-our-water/history-and-heritage/history-sewerage

Melbourne Water (2018) – Healthy Waterways Strategy 2018. Available at: https://www.melbournewater.com.au/about/strategies-and-reports/healthy-waterways-strategy

Ojo A, K Lasisi, S Nurudeen, O Akinmusere and J Babatola (2019), Engineering design of combined septic tank with treatment facilities for partial treatment of wastewater, Journal of Applied Science, vol. 19, issue 1: 39 – 47.

Scandura J and Sobsey M (1997): Viral and bacterial contamination of groundwater from onsite sewage treatment systems, Water Science and Technology, vol. 35, issue 11-12: 141-146.

Toze S (1997): Microbial Pathogens in Wastewater – Literature Review for Urban Water Systems Multi-divisional Research Program, Technical Report No.1/97. Available at: http://www.clw.csiro.au/publications/technical97/tr1-97.pdf

Victorian Health Act (1928) – available at: http://www.austlii.edu.au/au/legis/vic/hist_act/ha192869.pdf

Victorian Managed Insurance Authority (2016) – Victorian Government Risk Management Framework Practice Guide, available at: https://www.vmia.vic.gov.au/tools-and-insights/tools-guides-and-kits/victorian-government-risk-management-framework

Visualizing Victoria's Groundwater (2020), available at: https://www.vvg.org.au/cb_pages/vision.php