



DECENTRALISED WATER CONSULTING

Adaptive Wastewater Solutions for Small Towns – Peshurst &
Cudgee: Final Project Report

Version 1

A stylized graphic element for the Wannon Water logo, consisting of a dark blue, curved shape that resembles a wave or a stylized landscape feature, positioned above the text 'wannonWATER'.



wannonWATER

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DOCUMENT CONTROL SHEET

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1 Introduction

Decentralised Water Consulting (DWC) worked with Wannon Water (WW), Southern Grampians Shire Council (SGSC), Moyne Shire Council (MSC) and the Department of Environment Land, Water and Planning (DELWP) to investigate and design adaptive, decentralised wastewater management options for the townships of Peshurst and Cudjee. Wastewater is currently managed by individual owner managed on-site wastewater management systems (on-site systems) in both towns with approval and performance regulated by SGSC and MSC respectively. On-site systems within these townships are of varying age, capacity and condition and previous feedback from Councils indicates the performance of these systems varies considerably.

The aim of this project was to identify feasible wastewater servicing and governance arrangements to address the impact of failing septic systems on Peshurst and Cudjee. A number of outcomes and learnings are readily transferrable to other Victoria regional towns and areas also constrained by existing wastewater management practices. In addition to addressing risks to public health and the environment, these solutions should enable future growth and development of the towns.

As part of the Domestic Wastewater Management Plan (DWMP) for each Council, key high priority towns are identified based on a number of factors including constraints / risks for onsite systems and potential future growth pressures. This project forms a critical path to identifying alternative, safe and sustainable long-term wastewater management strategies for small towns such as Peshurst and Cudjee. Specifically, wastewater solutions have been developed with consideration of key strategic objectives including;

- IWM Forum and Victoria Government objectives for greater consideration of alternative and adaptive water / wastewater management solutions.
- State Environment Protection Policy (SEPP - Waters) and Council's DWMP require the consideration of solutions, including alternative risk management or mitigation strategies, for high priority towns to maintain environmental and health protection.
- Wannon Water's statement of obligations and objectives under SEPP (Waters) outline the need to investigate potential solutions in conjunction with Councils for high risk towns.

Wannon Water, SGSC and MSC formed the core Project Control Group (PCG) for this study working in conjunction with the Great South Coast Integrated Water Management (IWM) Forum and DELWP. The project considered of four key phases (refer to Figure 1 for context), namely;

- Project Review, Background and Engagement (Why are we here and what do we want to achieve?)
 - Option Development and Assessment (Shortlist Option Packages and assess these to determine preferred options)
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- Functional Design and Cost Allocation (develop preferred option for both towns including governance / funding model)
- Project Finalisation (Present to agencies and incorporate feedback)

This is the final Project Report for the investigation which summarises the overall outcomes, key learnings, funding and governance outcomes and possible next steps for both Penshurst and Cudgee in addition to other unsewered communities in Victoria. Detailed investigations, options assessment and outcomes are contained in the following existing project deliverables.

- Background Paper (R.0352.001.01 Version 2) dated 22 November 2019.
- Options Analysis Report (R.0352.002.01 Version 2) dated 27 August 2020.
- Governance and Funding Models Summary Report dated November 2020.
- Penshurst Functional Design Report (R.0352.003.03 Version 4) dated 30 April 2021.

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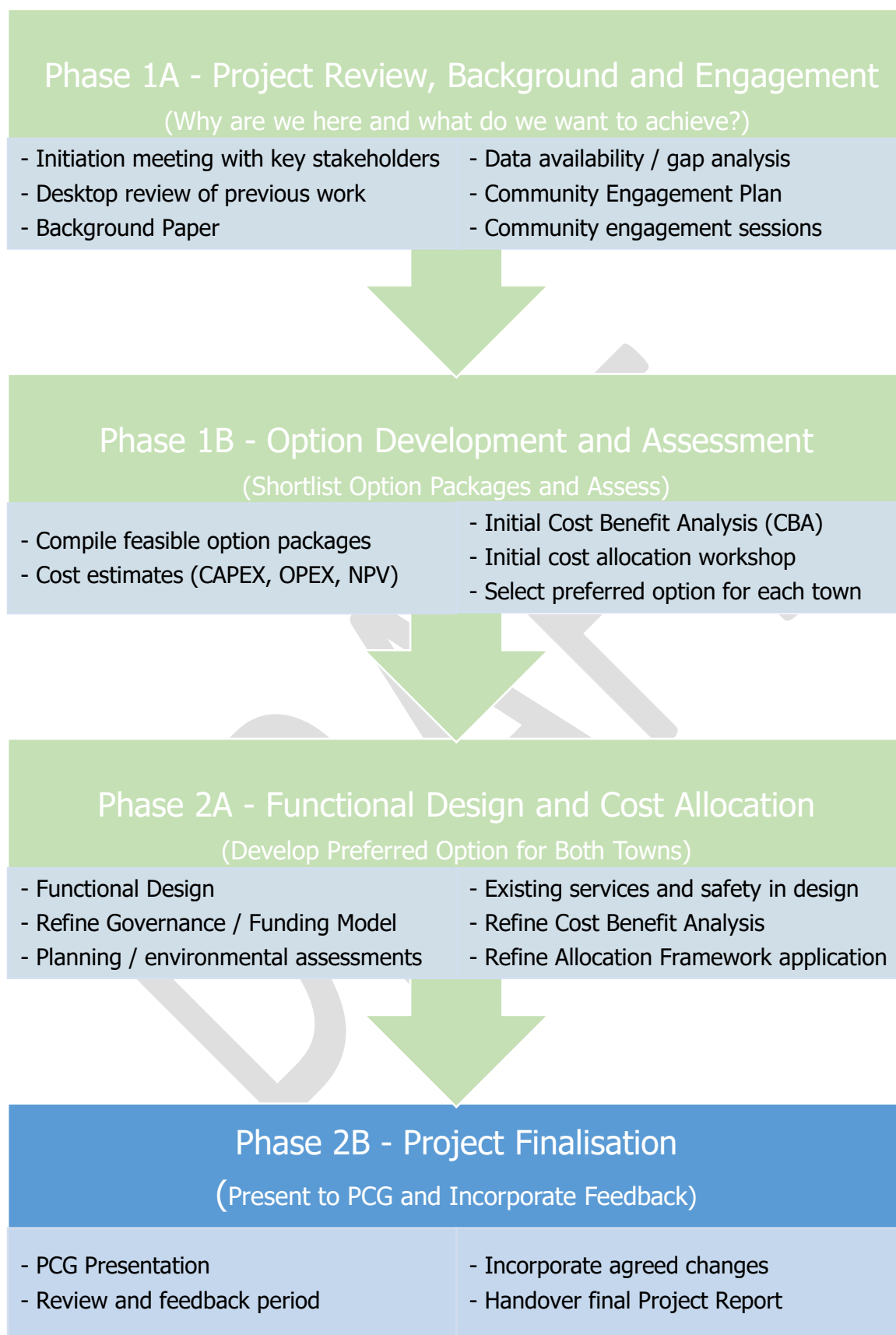


Figure 1 Structure of the Small Town Wastewater Investigation

2 Background Review & Stakeholder Engagement

The project commenced in late 2019 with a background review of the current wastewater management situation for both Penshurst and Cudgee, in addition to the broader Victorian context of wastewater management and regulatory frameworks. This included a review of the key opportunities and barriers to the adoption of alternative options beyond traditional approaches of servicing towns (i.e. owner managed on-site systems or reticulated sewerage to a central treatment facility). A stakeholder engagement plan was also developed at this time. The key deliverable from this phase was a Background Paper prepared by DWC in late 2019, which summarised the initial findings of Phase 1 of the project for the purpose of informing stakeholders prior to engagement activities.

Community and stakeholder engagement sessions were held in late November (Penshurst and agency sessions) and January 2020 (Cudgee). Community engagement was undertaken via drop in sessions in each town in addition to a survey seeking input on community experiences with wastewater management in addition to understanding their key drivers for improved wastewater management.



Figure 2 Community Engagement Session in Penshurst

The surveys were conducted through both online platforms and hard copy mail out for members of the community who were not able to attend the relevant drop in session. The detailed outcomes of community engagement are summarised in Section 4.2 and Appendix E of the Options Analysis Report (R.0352.003.01).

2.1 Key Outcomes and Findings

The key outcomes and findings identified as part of this phase of the project included the following;

- There is a strong need and community desire for improved wastewater management solutions for towns such as Penshurst, given the various constraints to on-site wastewater management present and desire to see the town revitalised. Previous community engagement had been undertaken by SGSC, which included discussions during collection of system audit information.
- Collation and review of existing on-site system and water / groundwater quality data confirmed SGSC's feedback that issues are present within Penshurst. Land capability and lot size constraints are significant and mean on-site containment is not a sustainable and safe long-term option for Penshurst.
- Limited historical data was available for Cudgee, however it was identified that a number of potential higher risk properties were present in the centre of the township. Notwithstanding, land use zoning and lot size in Cudgee are predominantly consistent with those recommended for sustainable on-site wastewater management.
- Recent Victorian government audits and legislative changes to the Domestic Wastewater Management (DWMP) process have identified and created provisions for investigating opportunities and implementing alternative / unconventional wastewater management approaches.
- Community feedback from residents in Penshurst was very consistent in identifying wastewater management constraints as an issue for the town. They are summarised in the following table.

Table 1 Summary of Key Penhurst Community Comments

Comment	Discussion
Provide capacity for town renewal and cater for growth / business opportunities	Business and development opportunities and renewal of the existing township was identified as key elements in Penhurst which are currently limited by wastewater management. Approximately 64% of surveys (14 submitted in total) indicate that limited business and development opportunities were the most important aspect that they experience as a result of wastewater management. Furthermore, 43% of respondents identified enhancement of these opportunities as the most important aspect they were seeking from these investigations.
Protection of environmental and human health	Another high priority objective that was identified by the community (~43% of surveys indicated it was a key issue for the town). Drainage of wastewater into the Penhurst Wetland Gardens in the north of the township was of particular concern, given the potential issues of local amenities and health.
Consideration of reticulated sewerage	This has been taken forward as a potential option for consideration (in particular Solution Package 4 which is a 'traditional' sewerage option) This has taken into consideration both gravity and pressure sewer, in addition to smaller diameter effluent sewer given the ability to achieve gravity fall on majority of lots within the township.
Provide value for money	Due to the potential cost implications for the community, solutions should be developed to strike a balance between up front capital investment (to address the poor economies of scale typically associated with small town wastewater schemes) and reduction in risks to human health and the environment (high priority objectives as discussed above).
Shallow soils present in Penhurst	Concerns were raised during the community consultation session held in Penhurst regarding the shallow soil depth across the township, and the unconfined aquifer directly beneath. A number of soil test pits were excavated by DWC in town for confirmation of soil depth.
Sensitive groundwater environment	The shallow rock and wetlands in Penhurst provide a connection between surface water and the sensitive groundwater environment (via ponds at Penhurst Wetlands). This is a key design consideration for all potential options that was conveyed to the team during community engagement.
Use of treated water for local Community / Public Open Space.	A number of community members were supportive of the idea of utilising treated water for irrigation of local community areas / public open spaces.
Potential Effluent Re-Use Sites	The community identified that the Penhurst sports oval / recreational reserve and racecourse (to the north) as potential effluent re-use sites which could benefit the town.

- Community engagement in Cudgee revealed that community opinion about the significance of wastewater impacts was mixed at the time of the survey and drop-in session.

Table 2 Summary of Key Cudgee Community Comments

Comment	Discussion / Incorporation into Options
Some community members not experiencing significant wastewater management issues	The Cudgee community session and surveys indicated that a number of people within the community do not identify wastewater management as a key problem for them (~50% of respondents experience no wastewater issues). This has been considered as part of the Solution Packages, with a focus on localised wastewater issues within the main township (in which there is a number of smaller constrained properties) in which a greater level of oversight and management is likely to assist in addresses issues.
Protection of local waterways and the environment	Approximately half of the survey respondents identified the health of the local waterways and environment as being the most important outcome of the wastewater investigation. As such, the Solutions Packages aim to provide a net decrease in pollutants reaching the waterways / environment from both wastewater (and stormwater in the case of SP2) sources.
Consideration for how new development impacts the natural environment	A key discussion point was surrounding new subdivision and the management of both additional wastewater and stormwater flows. Increase in development and impervious area can result in increased overland flow heading through the main township, which may transport stormwater pollutants from properties to downstream waterways. A flood study has been commissioned by MSC to assess how flooding impacts can be mitigated through the main section of the township. It is likely that additional upslope detention and formalised drainage will be required to transmit flows down to Brucknell Creek.
Provide value for money	As with Penshurst the Solution Packages assessment has focused on providing the best value for money to the community, including potential benefits identified as part of the CBA. The potential cost of traditional wastewater infrastructure (e.g. reticulated sewage) would be significant for Cudgee given the small current size of the town. The proposed Solutions Packages were developed as lower cost options which address the localised wastewater and stormwater issues / constraints present in Cudgee.

3 Options Development & Assessment

Following the background review, DWC progressed with undertaking an option analysis for both towns. This involved development of potential wastewater servicing solutions (informed by consultation with the PCG and respective communities) and assessment of the shortlisted options for selection of a preferred by the PCG.

Integrated Water Management (IWM)

There are range of innovative systems available for wastewater, greywater and stormwater treatment both on the property and along public areas like streets and parks, these include:



Recirculating sand filter with subsurface irrigation



Reed bed – passively treats the wastewater using natural processes as it moves through vegetation.



Greywater onsite treatment



Worm farms



Textile filter system

Figure 3 Example Poster of Potential IWM Options from Shortlisting Process

This options assessment was completed using a Cost Benefit Analysis (CBA) process, undertaken by Frontier Economics, for each town. This allowed the options for improved wastewater servicing to be consistently assessed against the existing situation (called Business as Usual – BaU for this project) thereby recognising that a BaU scenario still comes at a cost to the community whilst not necessarily meeting regulatory and community objectives. In addition to a BaU scenario, it was also decided to include an option for Penshurst that represented the most feasible and lowest cost version of a conventional reticulated sewerage system with a whole of town Sewage Treatment Plant (STP). This provided an opportunity to compare both the costs and benefits of this more conventional approach with adaptive, decentralised, integrated water cycle approaches.

The CBA also enabled a wider range of benefits to be considered within a consistent framework. These included non-monetary benefits such as improved health outcomes and water quality in local wetlands and rivers. It also captured non-monetary benefits considered integral to Integrated Water Management (IWM) approaches such as improved liveability and increased opportunity for town growth and viability (noting this was captured through an indirect, associated benefit).

Initial application of the early steps in the DELWP Cost Allocation Framework and consideration of governance and funding models were also completed as part of process to select a preferred option for each town.

The detailed methodology, analysis and outcomes of the options development and assessment process are captured in the Options Analysis Report prepared by DWC in 2020 (R.0352.002.01 Version 2 dated 27 August 2020).

3.1 Initial Options Consideration

DWC worked in consultation with Wannon Water/ PCG and the Community to discuss and develop a range of initial potential servicing elements / options for each town. Initial elements were identified that could potentially form a set of logical option packages relevant to each town.

The various options / elements considered;

- the scale of application (e.g. on-property, street, cluster or whole of town);
- the type of servicing element (e.g. collection, treatment, reuse, management, regulation); and
- water cycle element / source (wastewater, in addition to stormwater, water supply and discharge to waterways).

Discussions with the PCG and community were used to obtain thoughts and feedback on potential individual wastewater (or stormwater) elements and therefore guide the formation of dedicated Solution Packages.

A key intention of this option analysis stage of the project was for solutions to include consideration of the following;

- Protection of human health and natural environment from adverse impact from untreated wastewater, including waterways at Cudgee and protection of the groundwater source in Penshurst that is directly connected to the Wetland Garden ponds in the centre of town.
 - Opportunities for existing town and business renewal which would otherwise not occur without the implementation of new wastewater management options.
 - Opportunities for properties presently not able to sustainably manage domestic wastewater onsite.
 - Reuse of treated wastewater that value adds to the township's amenity and sustainability (i.e. Integrated Water Management).
 - Decentralised technologies which can provide treatment and reuse of treated effluent close to source and therefore reduce energy requirements, whilst potentially providing additional benefits such as improved liveability / local amenities.
-

- Options that leverage the existing willingness for collaboration between the State and local governments, water authority, regional agencies, and local communities.
- Provide direction on governance arrangements and funding models for the construction, ownership, operation, monitoring and maintenance and ongoing costs for each option.

Highlight outcomes and findings from this phase of the project are provided for both towns.

3.2 Penshurst

- Capital costs for all Solution Packages were found to be high on a per lot basis in comparison to typical urban sewerage infrastructure provision. This is not surprising given the lack of economy of scale, the retrofit nature of the work and the presence of shallow, volcanic bedrock throughout the town.
 - Two of the Solution Packages (SP1 and 3) included retention of existing septic tanks for use in a Septic Tank Effluent Drainage (STED) collection system in an effort to limit capital costs. Assessment of life cycle costs within a Cost Benefit Analysis framework would suggest in this case, upfront cost savings were offset by the need to regularly inspect and gradually replace the septic tanks as smaller, more sporadic works packages. This option also carried a high degree of risk and uncertainty given the age and condition of many septic tanks in Penshurst and the constructability challenges posed by existing development on small properties and shallow rock.
 - Similarly, SP1 also included acceptance of continued discharge of residual treated effluent unable to be managed on site to the stormwater drainage system in an effort to examine the cost versus benefits. Whilst this did result in lower costs (30% lower capital, 15% life cycle), improvements to water quality were only achieved by shifting impacts downstream from local wetlands and waterways to the broader catchment. By capturing this within the CBA, SP1 can be considered to have a disbenefit.
 - Consideration was given to options that utilised the capacity to manage and/or reuse treated effluent on private properties (e.g. as proposed by Barwon Water for the Forrest Wastewater Project <https://www.yoursay.barwonwater.vic.gov.au/forrest>) given this can be an effective strategy for managing cost and oversight requirements. However, lot size, shallow rock and the hydrogeology of Penshurst limit the feasibility of this approach.
 - Solution Package 3 and 4 were developed around a 'whole of town' servicing approach with SP4 the lowest cost conventional servicing approach. Through this process, it was determined that conveyance of sewage to a central location was likely to be expensive and require either deep sewers (in volcanic rock) or a significant number of sewage pump stations due to the shallow rock and topography of Penshurst. This impacted on the cost effectiveness of SP3 (STEDs sewer) and required adoption of a low pressure sewer network for SP4.
-

- Quantitative benefits able to be included in the CBA were comparable for Solution Package 2, 3 and 4 which made capital cost the primary driver for delineation between options. This was because all three of these options were designed to meet legislative objectives for protection of human health and the environment.
- However the slightly lower capital cost of Solution Package 2 combined with the additional amenity and liveability benefits associated with reuse within the township. This was not possible without significant additional capital investment under Solution Package 3 and 4 because all sewage had to be conveyed (untreated) to a central location to be treated, prior to re-distribution back to the public open space within Penhurst.
- Based on the outcomes of the options analysis, the PCG preferred wastewater servicing option was Solution Package 2 (SP2). This option consists of precinct based water reuse systems installed across the township.
- This option offers a cost-effective way to address current constraints to managing wastewater on-site for the majority of properties within the Township zone whilst also achieving other water cycle and liveability benefits by beneficially reusing 66% of wastewater, close to source to create enhanced public open space. It is a relatively low energy and low maintenance concept.
- However, the decentralised nature of the infrastructure will require adaptation with respect to design, capital delivery, governance and operation. This has been considered and refined as part of functional design and funding and governance strategies.
- Adoption of the precinct based Solution Package 2 was supported by a range of stakeholders including Southern Grampians Shire Council and Wannon Water.
- Based on technical assessments and community engagement undertaken as part of this project it has been clearly identified that continuation of the Business as Usual (BaU) wastewater management approach cannot meet long-term regulatory or community expectations for Penhurst.
- The cost to SGSC and the community for a BaU approach is estimated to be in the order of approximately \$7 Million (25yr NPV) which equates to an average cost of approximately \$25,000 per property over 25 years. Importantly this current wastewater management approach cost for Penhurst does not enable compliance for the majority of onsite systems and ensure adequate environmental and human health protection.

3.3 Cudgee

- Feedback from the Cudgee community indicated less concern from the current arrangement of on-site wastewater management. This included both environment and health impacts and constraints to development. However stormwater management and in particular flooding issues were identified as an item of concern as new development continues in the town.
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- The most significant outcome of the option analysis for Cudgee was recognition that the BaU scenario was unlikely to be resulting in significant impacts on public health, the environment based on available information, nor was it considered to be placing significant constraints on the desired growth and development in Cudgee. This was strongly influenced by Land Capability and the larger typical property size (4,000-5,000m²) consistent with the Low Density Residential Zone (LDRZ) surrounding the immediate town area.
 - Similarly, no constraint to growth was identified within the large extent (150 ha) of developable LDRZ land surrounding the main township. Given an unsewered minimum lot size of 4,000m² is the current minimum for sustainable on-site wastewater management, land capability assessment, design, construction and operation in accordance with the EPA Code of Practice for On-site Wastewater Management can be expected to meet regulatory requirements.
 - Feedback from community engagement identified indicated that some residents of Cudgee enjoy the low density, semi-rural character of Cudgee and were in fact averse to any increased housing density.
 - The ultimate impact of these findings on the Benefit Cost Ratio was to render the relative benefit of investment in improved wastewater management servicing minimal in comparison to the BaU. As a consequence, it did not take a significant capital investment to result in extremely low Benefit Cost Ratios (≤ 0.1).
 - The PCG preferred option was continuation of the current situation of owner managed on-site systems with oversight by MSC (Business as Usual – BaU). However, recommendations included supporting this option with a more active regulatory inspection program and potential grant funding to upgrade systems on constrained, higher risk sites where investment benefits are greater.
 - Consideration was also given to an option involving upgrade of constrained on-site systems and construction of stormwater treatment and detention measures as a more holistic solution to the key water cycle management issues facing Cudgee (Solution Package 2).
 - Such as solution can be considered an Integrated Water Management approach and involved constructing multi-purpose water infrastructure to address both the modest residual off-site impacts of on-site systems and the overland flow of stormwater. This Solution Package required a significantly higher capital investment but delivered substantial water cycle benefits and resulted in a Benefit Cost Ratio of 0.9.
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4 Functional Design

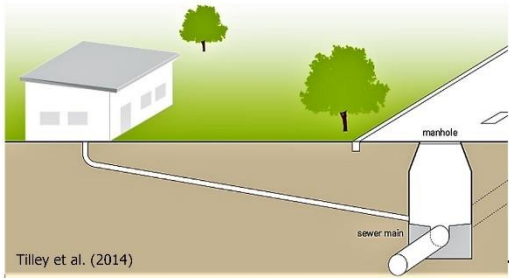
4.1 Penshurst

Based on the outcomes of the options analysis phase, a Functional Design was developed for an adaptive, precinct-based wastewater solution for Penshurst township. The Penshurst Water Recycling Solution functional design report was prepared in late 2020 (finalised early 2021) and outlined how this adaptive option would be taken forward. The Functional Design is summarised in Figure 5 and Figure 4 with full detail found in the Functional Design Report (R.0352.003.03 Version 4 dated 30 April 2021).

The following is a summary of the key observations and findings from the Functional Design process for Penshurst.

- A key adaptive element of the design came from identification of the substantial public open space throughout the town relatively unused and well suited to water reuse by subsurface irrigation.
 - The precinct delineation was another adaptive element which was strongly driven by the topography of Penshurst and logical sewer catchments.
 - Precinct size was also influenced by efforts to balance between the number of precincts and the volumes of wastewater required to be managed at each precinct. This enabled lower maintenance, low energy treatment technologies to be considered whilst also ensuring recycled water volumes were manageable without the need for storage dams and discharge to waterways.
 - A growth strategy was included in the Functional Design that highlighted the benefits of a precinct / decentralised approach as it enables investment in infrastructure upgrades to adapt to the uncertainty associated with the distribution and rate of growth.
 - This was also enabled through adoption of relatively modular precinct technologies which reduces the magnitude of upgrades.
 - Approximately 25-30% of the gravity sewer is located on existing private property. This is not an issue that Wannon Water are required to manage on a regular basis and as such, new business rules and approaches will be required to enable this.
 - Following engagement with the EPA, the recycled water and effluent management strategy was adapted to not strictly follow the Reclaimed Water Guidelines but still meet overarching legislative objectives for wastewater management and protection of the environment and public health. This enabled a reduction in capital cost and recognised that the overall outcome for the Penshurst and broader Victoria community justified this slight compromise.
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Adaptive, Precinct-Based Wastewater Solution for Penshurst



All wastewater from properties within Penshurst township will be collected and transported by a new Gravity Sewer system. This will include all greywater and blackwater.

Existing onsite (septic) systems will be decommissioned once connected to the sewer.



Treatment of wastewater will occur at local Precinct Water Recycling Systems (e.g. Rhizopods).

These natural based systems allow water to be taken up by plants or evaporated (like in a wetland). They can also allow water to be stored within the treatment pods during colder, wetter periods.



Recycled water to be stored for Irrigation when conditions are favourable e.g. drier weather.

The storage has been sized for each Precinct to make sure overflow discharge is not necessary during colder, wetter periods.



Where there is excess recycled water, this can also be used to irrigate other community areas such as the playing field.

This will be done on an as-needs basis depending on how much water is available.



Recycled water to be used to green Public Open Space via Irrigation below the ground.

This will happen at night, underground to minimise any potential contact with the recycled water.

Why has this system been proposed and what are the benefits?

- This system applies proven small scale natural based technologies to treat and manage recycled water locally within the town.
- Penshurst is well suited to a Precinct based solution due to topography and the cost and complexity of conveying sewage to a single location. Importantly a large, costly treatment facility will not be required.
- Using Local Precinct Treatment Systems will provide Recycled Water for greening areas across the town while significantly minimising the costs needed to collect and treat it.
- The systems have been designed to be modular and can be built to service each Precinct as needed, both currently and into the future.
- The Recycled Water System has been designed factoring in the various constraints across the town such as shallow rock and groundwater usage.
- The Recycled Water System will drastically reduce the current nutrient loads entering the Penshurst Wetlands and nearby waterways, thereby improving the local ecology.

Total Community Cost Estimates (25yrs)

CAPEX: \$13.53 - \$15.74 million

OPEX: \$186,900 per year

Renewal: \$754,000

Life Cycle Cost (NPV) \$15.56 - \$17.68 million

Figure 4: Penshurst Wastewater Solution Summary

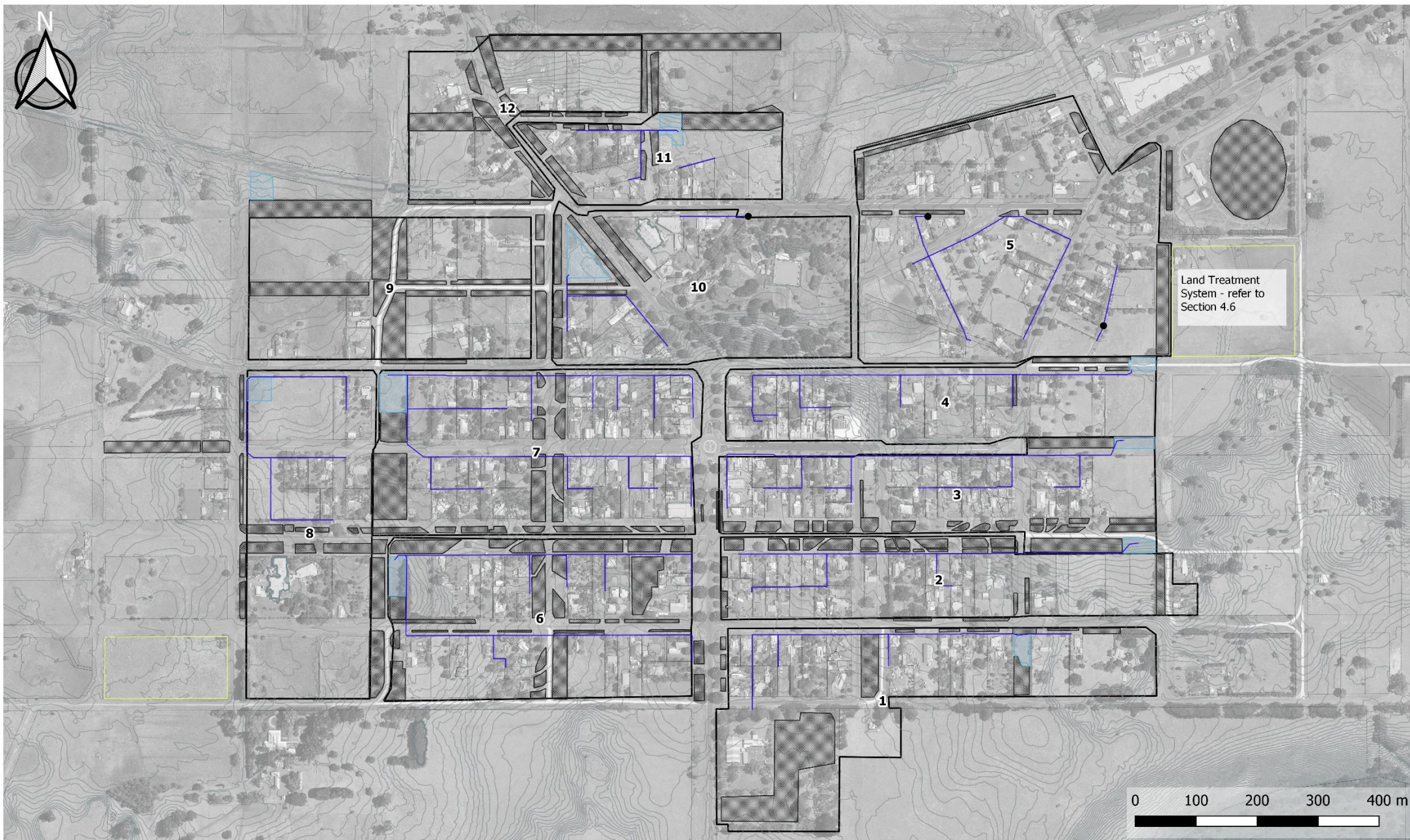


Figure 3: Penshurst Recycled Water Scheme Overview

Legend

- | | | |
|---|-----------------------------------|---|
| Public Open Space Subsurface Irrigation | Precinct Recycling Systems | Potential Land Treatment Facility for Excess Recycled Water |
| Property Boundaries | Precinct Boundaries | Pump Station (Septic Tank Effluent Pump - STEP) |
| Sewer Alignment | Elevation Contours (approx. 0.5m) | |

- Importantly, analysis of a full beneficial reuse irrigation scheme as an alternative (including a storage sized to prevent overflow in the 90th percentile rainfall year) actually indicated that the adopted approach for the Penshurst Functional Design achieved an equivalent level of beneficial reuse and avoided any point discharges to waterways.
- There are opportunities to enhance existing public open space throughout Penshurst through greening and establishment of recreational and visual amenity features. However, this does inevitably encumber some areas with respect to acceptable activities, traffic and access.
- This will need to be worked through with both the community and managing agencies for the public land to ensure the reuse areas are an acceptable balance between utility and cost effective reuse of water.

4.2 Cudgee

As the outcomes of the option analysis for Cudgee involved a continuation of BaU (selected by the PCG), a functional design was not prepared. However the CBA, Cost Allocation and Funding / Governance models were refined by Frontier to provide potential pathways forward for both Cudgee and other similar small towns. These outcomes are discussed in Section 5.2.

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5 Governance and Funding Models

Governance and funding are always critical elements of an infrastructure delivery project. Their importance for projects involving non-standard, decentralised wastewater solutions for existing unsewered towns is particularly pronounced. A suitable and agreed model for both governance and funding of the Penshurst Adaptive Wastewater Solution has been gradually developed over the duration of the project. It should be noted that the governance and funding model is an 'in principle' structure based on the following.

- Legislative and policy obligations and drivers for small town wastewater and integrated water management.
- Outcomes of the Cost Benefit Analysis.
- Application of the DELWP *Cost Allocation Framework for IWM Projects* to develop a stakeholder agreed allocation of the costs and benefits of the project between parties.
- Testing of some assumed external funding contributions based on the cost allocation outcomes to examine the impact on costs for the broader Wannon Water customer base.
- Financial modelling by Wannon Water of the preferred governance and funding model to determine the net shortfall in revenue for Wannon Water based on varying levels of external funding.

Governance and funding models for the Business as Usual scenario for Cudgee have been evaluated and discussed in the final economic assessment note for Cudgee from Frontier Economics (dated 28 January 2021). This Economic Note has been provided in Appendix A of this report. Whilst a full cost allocation model could not be developed (due to adoption of the BaU or baseline of the cost benefit analysis), costs for the BaU for households and council have been presented below and in Appendix A. In addition, consideration was given to the costs and potential benefits of loan or grant schemes to potentially incentivise the bringing forward of on-site wastewater management system upgrades on the small number of constrained sites in Cudgee.

5.1 Penshurst

5.1.1 Governance

The Project Control Group have finalised the preferred governance structure for the Penshurst Adaptive Wastewater Solution. Wannon Water have been nominated as the preferred party to deliver and manage the Solution. The preferred governance model would see Wannon Water owning and managing the sewerage, treatment and recycled water irrigation assets. It was agreed that ongoing management (e.g. mowing) of Public Open Space irrigation areas themselves be undertaken by Southern Grampians Shire Council.

There are thirty (30) properties (of a total of 280 in the proposed service area) that require one of two on-property wastewater management components.

- Twelve (12) properties would be serviced by an upgraded on-site wastewater management system either permanently or until the sewer is extended to their location. It is not cost effective to extend the sewer to these properties under the initial scenario of development.
- Eighteen (18) properties would require either a grinder pump unit or Septic Tank Effluent Pump (STEP) tank to pump sewage into the gravity sewer to avoid excessively deep sewers.

Both capital and operational costs to deliver these units has been included in the Penshurst Solution business case. However, it is yet to be determined who will be the owner of these assets (with the decision being between the property owner and Wannon Water) and how the operation, maintenance and monitoring costs will be dealt with.

The upgraded on-site systems form part of the adaptive elements of the solution and were clearly identified as being the lowest community cost approach to managing risks on these properties. It should be noted these 12 properties are zoned Township and are less than the recommended 4,000 m² for sustainable on-site wastewater management. As such they will require a more advanced system upgrade and a higher level of oversight and management.

The delineation of ownership between parties for the proposed governance structure is illustrated in the following diagram.

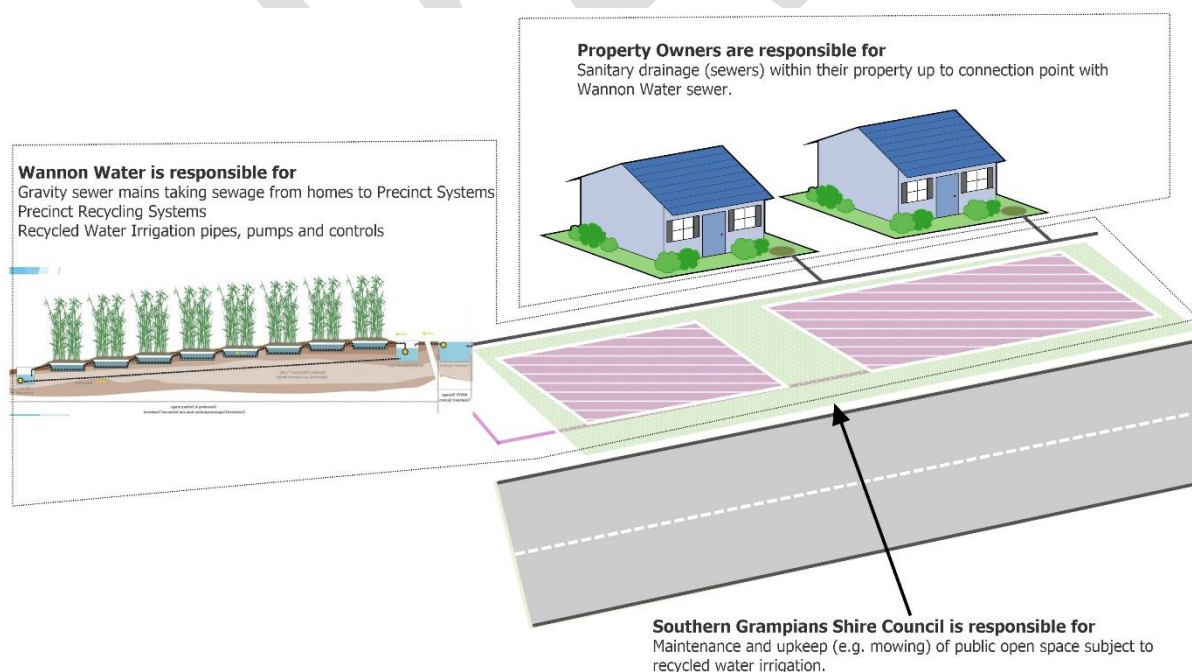


Figure 6 Proposed Governance for the Penshurst Adaptive Wastewater Solution

5.1.2 Cost Allocation and Funding

Development of an appropriate funding program for the Penshurst Adaptive Wastewater Solution was initiated by the application of the DELWP *Cost Allocation Framework for IWM Projects* (DELWP, 2017). This process takes the identified benefits from the CBA and assigns them to the most appropriate party in the project. Costs are initially assigned based on the agreed governance model. From this, potential transfers between parties, commensurate with the benefit obtained can be identified and used to guide potential contributions.

The PCG and DWC sought initial input into this process in April 2020 at the Great South Coast IWM Forum No. 7 from key stakeholders from a range of organisations. The focus of these discussions was on the accepted governance model (see Section 5.1.1). This was used by the PCG, DWC and Frontier Economics as the starting position for the cost allocation work.

Following completion of the Functional Design the cost and benefit inputs to the CBA process were refined and used as the basis for a 'first pass' cost allocation model. This first pass model was then presented to relevant staff and senior management of SGSC and Wannon Water (along with DELWP, CMA and other representatives) on 27 November 2020. The outcomes of this process are detailed in the following reports provided in Appendix B of this report.

- *Penshurst Adaptive Wastewater Solution Governance and Funding Models: Summary Report November 2020*: Prepared by DWC.
- *Updated Penshurst CBA Results and Funding Case 28 January 2021*: Prepared by Frontier Economics.

These documents form the basis for a business case for the Penshurst Adaptive Wastewater Solution along with the Functional Design. Following refinement of the design and the resulting reduction in life cycle costs the revised Benefit Cost Ratio (BCR) for the Penshurst Adaptive Wastewater Solution was ~1.2 for the central case and remained the highest amongst the four evaluated options.

5.1.2.1 Outcomes of Cost Allocation

Key outcomes of the cost allocation process were as follows.

- The main beneficiaries of the project were identified as;
 - Penshurst residents through avoided costs for wastewater management, health and amenity benefits (including increased ability to develop and improve properties);
 - The broader regional or Victorian community through improved water quality and reduced environmental impacts.
- Funding scenarios were examined that considered the following two options to capture the benefits (and subsequent transfers) attributable to the broader Victorian community:

- Scenario 1 and 3 attributed these to the Victorian Government as the party representing the broader community (e.g. DELWP).
- Scenario 2 and 4 attributed these to Wannon Water’s broader customer base as regional beneficiaries of the improved environmental outcomes.
- Under the agreed governance model Wannon Water bear the majority of the cost (~85%) for delivery of the solution with residents and SGSC contributing the remainder.
- The following transfer mechanisms were included in the different funding scenarios:
 - Up front contribution to connection (e.g. plumbing) costs on private property by the direct users of the Penshurst Wastewater Solution.
 - Payment of regulated sewerage charges by the direct users of the Penshurst Wastewater Solution (Option A-C: \$723 p.a. Option D: \$217 p.a.).
 - Up front and/or on-going contributions by DELWP (as representative of the broader Victorian community), Southern Grampians Shire Council.
 - Contribution by the broader Wannon Water customer base (representing regional beneficiaries) through an increase in the regulated sewerage charge.

This resulted in four potential funding options or scenarios as presented in Table 4 (reproduction of Table 17 from the Frontier economic note in Appendix B).

Table 3 Potential Funding Scenarios: Penhurst Adaptive Wastewater Solution

(Blue cells are up front or one-off contributions. Green cells are on-going contributions)

	Option A	Option B	Option C	Option D
Penshurst property owners				
Net present value of costs	\$1.46 m	\$1.46 m	\$1.46 m	\$1.46 m
Net present value of transfers	\$3.37 m	\$3.41 m	\$3.34 m	\$1.09 m
Total net present value of costs	\$4.83 m	\$4.87 m	\$4.80 m	\$2.55 m
Estimated upfront expenditure per household	\$5,201	\$5,201	\$5,201	\$5,201
Estimated ongoing costs per year per household (Total sewerage charge)	\$733.20	\$740.70	\$724.00	\$235.00
Other Wannon Water sewerage customers				
Net present value of costs	-	-	-	-
Net present value of transfers	\$6.1 m	\$11.1 m	\$1.09 m	\$13.39 m
Total net present value of costs	\$6.1 m	\$11.1 m	\$1.09 m	\$13.39 m
Cost per property per year (change in sewerage charge)	\$8.50-\$9.50	\$15.00-\$18.00	\$1.50-\$1.70	\$18.40-\$21.50
Southern Grampians Shire Council				
Net present value of costs	\$0.628 m	\$0.628 m	\$0.628 m	\$0.628 m
Net present value of transfers	-	-	\$4.9 m	-
Total net present value of costs	\$0.628 m	\$0.628 m	\$5.58 m	\$0.628 m
Victorian Government				
Net present value of costs	-	-	-	-
Net present value of transfers	\$5.13 m	-	\$5.21 m	-
Total net present value of costs	\$5.13 m	-	\$5.21 m	-

5.1.2.2 Funding Model Discussion

Given the significant avoided base case costs for the local Penhurst Community, introducing the Wannon Water sewerage connection charge is a justifiable funding option following a beneficiary pays approach. Under all funding options assessed, the Penhurst community are still net beneficiaries even with the higher sewerage connection charge. The sewerage charge will represent a significant incremental change in water bills for the Penhurst Community, approximately \$723-\$740 increase

per year. Under the base case however, the costs per property are once-off \$20,000 upgrades, with some ongoing maintenance and pumping costs. For many households, this change in the type of cost may have major financial implications.

Funding the scheme through an increase in the base sewerage charge requires the costs to be shared across all sewerage customers – even if the benefits are not allocated to these customers in the distributional analysis. Depending on the amount of funding from other sources, bill impacts for existing sewerage customers will be approximately \$1-\$22 per year in real terms.

There is scope for State Government funding as a representative of the broader community due to the significant environmental benefits. The State Government typically fund these improvements through Catchment Management Authorities and the Environment Levy. The State Government may choose to provide a capital contribution up to the value of \$13.35 million, which would represent a justifiable contribution given the distribution of benefits. For the Options we considered the Victorian Government contributions as the remainder required after funding was received from other parties, with contributions around \$5.15 million. The Victorian Government may choose to fund more as a representative of Traditional Owner values, or to help support the local community's health and amenity benefits.

The incremental benefits and costs for the Southern Grampians Shire Council balance out in most funding options. Southern Grampians Shire Council has some avoided base case costs in managing non-compliant septic tanks, which balances out with the incremental capital and operating costs for mowing and maintenance of the public open space subject to recycled water irrigation. Option 3 requires a contribution of \$4.9 million in net present value, but we consider this unlikely due to the capacity to pay of the Council. Because of this, we do not see merit in establishing a transfer between Wannon Water and Southern Grampians Shire Council at this stage. However, they may choose to contribute more than outlined in the Options recognising the qualitative benefits.

5.1.2.3 Wannon Water Financial Modelling

Initial modelling was completed by Wannon Water in late 2020 to provide an indication of the potential financial viability of the proposed Penshurst Wastewater Solution. This involved internal Wannon Water Price Modelling for a 10 year period (2018 – 2028) to forecast its potential impact on Wannon Water's revenue and customer base in the short to medium-term. Wannon Water modelled five scenarios with outcomes summarised in the table below.

Table 4 Initial Wannon Water Financial Analysis (10 Year Price Modelling Period)

Scenario	CAPEX	Upfront Capital Contributions to WW ¹	OPEX (p.a.)	Average Additional Revenue (p.a.)	Average Revenue Shortfall (p.a.)
Scenario 1 – Lower	\$11.24 mil	\$0	\$133k	\$220k	\$559k
Scenario 2 – Upper	\$13.42 mil	\$0	\$173k	\$220k	\$679k
Scenario 3 – Lower, 25% CAPEX Contribution	\$11.24 mil	\$2.81 mil	\$133k	\$220k	\$399k
Scenario 4 – Lower, 50% CAPEX Contribution	\$11.24 mil	\$5.62 mil	\$133k	\$220k	\$239k
Scenario 5 – Lower, CAPEX Contribution for Environmental Benefits ²	\$11.24 mil	\$8.6 mil	\$133k	\$220k	\$71k

Note 1: Contributions to Wannon Water from external third parties (yet to be determined). Likely to be the Victorian Government and/or SGSC

Note 2: Refer to Cost Allocation analysis for further details.

The outcomes of this initial financial analysis suggest that implementation of the Solution would result in a 0.1 – 0.9% effective increase in operating expenditure (as a result of the revenue shortfall) for Wannon Water. These values align well with the outcomes of the cost allocation work in terms of effective increase in costs across Wannon Water’s entire customer base. External contributions of 50% or more of CAPEX result in minimal increases in operating costs, suggesting the Solution is viable, subject to further investigations and analysis (e.g. willingness to pay consultation).

5.2 Cudgee

Moyne Shire Council (MSC) elected to retain the Business as Usual (BaU) wastewater servicing scenario for Cudgee. Based on the outcomes of the Cost Benefit Analysis (CBA), investment beyond the BaU in improved wastewater management was not considered justifiable. On-site wastewater management is considered a viable option for the majority of properties within the Cudgee study area and the impact of the small number of systems not containing on-site (typically on smaller lots in the centre of the township) is very localised and incremental in nature.

MSC did consider Solution Package 2 (BaU plus stormwater quantity and quality improvements) as a potential IWM solution for Cudgee. Whilst MSC have elected not to proceed with SP2 at this time, acceptance of the BaU does not preclude such an approach at some point in the future.

5.2.1 Governance

It is recommended that Moyne Shire Council continue to lead wastewater management in Cudgee for both the base case and SP2. This is because both options continue with on-site containment of wastewater, which under legislation is typically the responsibility of councils. Stormwater treatment and detention measures under SP2 are also typically the responsibility of Councils. Wannon Water can continue to provide support in considering fit for purpose wastewater management in the township, including support on design, delivery and implementation.

An alternative option is for Wannon Water to provide governance and management for the approximately twenty (20) constrained households in Cudgee. Households would still own the assets, and Council would still be ultimately responsible for their compliance. However, under this arrangement Wannon Water can leverage on its capability to manage the wastewater systems. This recognises that a shared governance approach may be an option where there are a number of constrained households within a township.

5.2.2 Funding Models

Under the base case (BaU), it is assumed that onsite systems are replaced or renewed gradually over the appraisal period by property owners. This is the most appropriate option for Cudgee where there is only a smaller number of constrained properties and where the impacts of poorly performing on-site system is considered to be relatively minor.

However, the community may be willing to encourage a faster renewal program to bring forward potential environmental and amenity benefits. There are also likely other regional communities where a faster renewal program can deliver significant benefits, and that a program that can incentivise a faster uptake would be beneficial for the community.

Grant and loan schemes provide options to incentivise voluntary replacement and renewal of septic tanks. Both options can reduce the costs for households in Cudgee, however both come at an incremental cost for Wannon Water.

The final Economic Note for Cudgee from Frontier Economics is provided in Appendix A and documents the economic and financial implications of both a grant and loan scheme for Cudgee. The outcomes show that from an whole of society economic perspective, a grant or load scheme do not alter the overall cost of BaU. They simply speed up the process of upgrading on-site systems on constrained sites.

There are additional risks associated with grant and loan programs:

- A grant or loan scheme may not encourage a faster uptake of new onsite systems. For example, there is the risk that those accessing the grants and loans are more informed about the management of their onsite systems, and would have replaced the onsite systems regardless of outside funding or financing. A loan or grant scheme should therefore be sufficiently targeted to encourage a faster uptake than without the loan or grant program.
 - There is the risk that Wannon Water cannot recover costs under a grant or loan program. Offering grants and loans for onsite systems is likely to fall outside of Wannon Water's regulated business, and so costs cannot be recovered through regulated water and sewerage charges. If Wannon Water would like to pursue this option as part of its regulated business, sufficient support from customers and prudence in investment must be demonstrated to the ESC. The incremental benefits of a faster uptake of onsite systems for Cudgee have not been modelled for this assessment, however it is likely that a faster uptake would only deliver minor environmental and health benefits for the community relative to a scenario where uptake is slower. In this case strong customer support will need to support the program in Cudgee, or alternative funding arrangements will need to be secured.
 - A loan scheme comes with additional risks including bad debt. It also requires Wannon Water to offer services that they do not currently offer, coming with additional project management and bill management costs.
 - A grant or loan scheme targeted just for the Cudgee township might be difficult to establish, and it is likely similar grants or loans may need to be offered to townships with onsite management. This is also relevant if the grant/loan program is offered by Moyne Shire Council or the Victorian Government.
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6 Penshurst Pilot Project

The Penshurst Adaptive Wastewater Solution is a largely untested servicing concept for a small town wastewater solution that will require flexibility and the adoption of non-standard approaches and processes for regulators, Wannon Water, SGSC and the community. The precinct-based design of the solution offers a viable opportunity to test the whole of town servicing concept at a smaller, measurable and lower risk scale via a Pilot Project. Engagement with the EPA on the Functional Design identified that the impending revision to the *Environment Protection Act* includes provision for issue of 'Pilot' licences for wastewater management and water recycling systems that are being used to test and measure new technologies and servicing approaches. The PCG and DWC have begun development and design of a Pilot project that would enable the following outcomes.

- Testing and development of processes for the design, approval, construction and operation of a precinct based wastewater and water recycling system.
- Collection of real data on costs, constructability, energy use and performance.
- Detailed monitoring of the environmental and health protection performance of the system to demonstrate achievement of target performance.
- Opportunities to understand, collect data and develop processes for community engagement and buy in for a precinct based solution. This will be particularly relevant given treatment and recycled water irrigation is proposed.

Given the modular nature of the proposed solution, a pilot project including one or a small number of precincts would provide a cost effective method to refine the concepts, processes and procedures needed to ensure a successful whole of town solution. It also provides a valuable opportunity to achieve buy in from the EPA and community at a much smaller financial risk.

This Pilot Project is proposed as a partnership between Wannon Water and Southern Grampians Shire Council. In addition to providing a local and relevant evidence base to determine feasibility and performance, this Pilot project would have significant benefits for Victoria in providing an on-ground case study and data source for other towns and regions with similar challenges. It also provides opportunity to co-ordinate with other water authorities and councils also progressing small town wastewater and IWM projects to leverage off an increasing shared knowledge and experience base.

A small, pilot project approach is consistent with the innovation ethos of "fail small, learn big" in that it recognises that it is not possible to successfully innovate without obtaining real evidence from real tests of new or novel approaches. At a small scale, risks to customers, Wannon Water, Council and the broader community can be much more readily monitored and controlled. It then enables sufficient agility to iterate the project as learnings and evidence of costs, risks and performance accumulate.

7 Key Learnings for Small Town Wastewater

The Existing Situation and Characterisation of the Problem

- The challenges associated with managing impacts from on-site systems in rural communities are difficult to overcome in the current regulatory and funding framework because both the problem and the solutions do not align with traditional and conventional wastewater management paradigms. This was evident from both the background review and feedback from stakeholders and the community.

Outcome: Wannon Water, SGSC and MSC to work with DELWP and the EPA and use the outcomes of the project to drive discussion on pathways for affordable, improved wastewater management practices.

- Public health protection, clean water and opportunities for development and town growth are the key drivers for community concern around wastewater management practices.

Outcome: There is potential to better understand community attitudes and expectations around wastewater management in unsewered small towns. This may include collecting data on the willingness to pay for an improved service and increasing awareness of the real cost of the Business as Usual scenario.

- Cudgee and Penshurst present two very different scenarios in terms of both existing and future wastewater management strategies. This made them effective as case studies, particularly because they represent two relatively common overall themes observed in other Victoria towns.

Outcome: Learnings documented in project deliverables can provide guidance for future projects in other areas of the region and Victoria.

- In examining the value of increased investment in wastewater management a long-term Business as Usual (BaU) scenario must be understood. This is not a 'do nothing' scenario and comes at a cost to property owners, councils and the broader regional community. Cost to property owners over a nominal 25 year period were estimated to be ~\$25k under the BaU.

Outcome: SGSC and MSC to continue to improve the understanding and evidence base to characterise and understand the costs and impacts of the BaU scenario.

Options Assessment

- 'Whole of town' servicing solutions were consistently identified as higher cost without delivering significant quantifiable benefits to a community in the cases of Penshurst and Cudgee. This was driven by the lack of economy of scale due to low number of properties in comparison to urban and residential (greenfield) development.
- Land capability, local topography, existing development extents and construction constraints played a significant role in guiding options and influencing the Benefit Cost Ratio. This further emphasises the need for adaptive, IWM approaches when developing options for small unsewered communities.
- Decentralised, precinct based options provided flexibility to manage the uncertainty associated with future town growth without the need for significant sunk costs in larger infrastructure that may never be needed.
- Notwithstanding, these approaches do not currently align directly with delivery models and regulatory frameworks for small town wastewater management. These projects have identified a range of ways in which this can be addressed.
- The options assessment for Cudgee was worthwhile because it identified that infrastructure investment is not an effective strategy for managing wastewater risks in LDRZ areas.
- By taking an IWM / whole of water cycle approach, it was possible to identify that flooding and stormwater management were the main driver between the small number of poorly performing on-site systems in Cudgee. In LDRZ areas, this is more appropriately managed through Land Capability Assessment, increased design scrutiny and on-going oversight of on-site wastewater management systems.

Functional Design

- Functional design for adaptive solutions requires consideration of local conditions, existing development and community expectations and desired outcomes. A 'cookie cutter' approach whereby standard sewerage designs are applied is unlikely to lead to an effective or affordable solution.
- There is a need to continue to develop processes for the design, siting and regulatory assessment of decentralised / IWM solutions. The location of IWM infrastructure within communities inevitably creates new challenges and requires new procedures and approval approaches.
- This project has been a successful example of a water authority and council working with the EPA to identify opportunities to achieve significant improvements in environment and health protection whilst managing the cost of implementation of wastewater servicing strategies

Governance and Funding

- The application of the *Cost Allocation Framework for IWM Projects* was a useful tool for navigating the complex nature of governance and funding for a project of this nature.
- Cost allocation assessments for Penshurst identified a split in beneficiaries between the residents receiving the service and the broader Victoria community in the form of improved environmental outcomes.
- The appropriate funding mechanism to represent this broader benefit may be via the state government (i.e. whole of Victoria) or Wannon Water's broader customer base (i.e. regional communities within the catchments in question).
- Local councils have no existing mechanism for obtaining revenue for the provision of wastewater management services which makes it challenging for them to provide on-going contributions to small town wastewater projects.
- Identification and recognition by stakeholders of the broader, often difficult to quantify benefits associated with town growth, tourism and regional viability through the cost allocation and funding process was useful in ensuring they were considered as part of decision making processes.
- Understanding the willingness to pay for water quality, health, amenity and town growth benefits amongst Wannon Water customers and/or Victorian citizens is critical to the viability of these schemes.
- Preliminary financial modelling for the Penshurst scheme for a 10 year period indicates that subject to *some* external funding for capital works, the revenue shortfall (or increased operating expenditure) for Wannon Water may be manageable.
- Further strategic planning is required to understand the implications of this should additional towns also require servicing.

Appendix A Economic Assessment for Cudgee (Final)

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Appendix B Economic Assessment, Funding and Governance Summary Report for Penshurst

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