



CWMS Innovation – On-site Solids Liquid Separation

Investigation Report

City of Onkaparinga

6 March 2026

➔ **The Power of Commitment**



Project name		CWMS Innovation – Onsite Solids Liquid Separation					
Document title		CWMS Innovation – On-site Solids Liquid Separation Investigation Report					
Project number		12684292					
File name		12684292-GHD-RPT-WA_CWMS Innovation - On-site Solids Liquid Separation.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S0	A	L. Whittaker	T Kent		M. Laginestra		13 Feb 2026
S01	0	L. Whittaker	M. Laginestra		M Butler ./ N Tooley	On - file	6 Mar 2026
[Status code]							
[Status code]							
[Status code]							

GHD Pty Ltd

Contact: Mitch Laginestra, Technical Director - Wastewater | GHD
Level 4, 211 Victoria Square
Adelaide, SA 5000, Australia
T +61 8 8111 6715 | **E** mitchell.laginestra@ghd.com | **ghd.com**

© GHD 2026

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Contents

1.	Introduction	1
1.1	Purpose of this report	1
1.2	Qualifications	1
1.3	Project scope	2
1.4	Objectives	2
1.5	Assumptions	2
2.	Description of existing operations	3
2.1	Current septage operation and clean-out	3
2.2	Willunga CWMS and WWTP	4
2.3	Sellicks Beach CWMS and WWTP	6
2.4	Summary of sludge generation	6
3.	Dewatering review	8
3.1	UniSA research review	8
3.1.1	Outline of Work undertaken	8
3.1.2	UniSA research commentary by GHD	9
3.2	Dewatering technology review	10
3.2.1	Mechanical dewatering systems	10
3.2.1.1	Belt Press	10
3.2.1.2	V-Press	10
3.2.1.3	Screw Press	11
3.2.1.4	Centrifuge Unit	12
3.2.1.5	Mechanical dewatering comparison	12
3.2.2	Passive and In-situ dewatering systems	13
3.2.2.1	Drying beds / drying pads	13
3.2.2.2	Geomembrane dewatering bag	14
3.3	Mobile vs Centralised systems	16
3.3.1	Mobile dewatering system	16
3.3.2	Centralised residuals management system	16
4.	Development and review of options	17
4.1	Base Scenario – Business as usual	17
4.2	Option 1 – Mobile screw press dewatering	17
4.3	Option 2 – Centralised Belt Press	18
4.4	Option 3 – Centralised drying bed	19
4.5	Options review	20
5.	Preferred option	24
6.	Summary, conclusions and recommendations	26
6.1	Summary	26
6.2	Conclusions	26
6.3	Recommendations	26

Table index

Table 1	Scoring matrix for dewatering technologies (Qualitative Scale: 1 = Low, 5 = High)	8
Table 2	Belt press, centrifuge and screw press comparison	13
Table 3	NPC: Base Scenario – ‘Business as usual’	17
Table 4	NPC: Option 1 – Mobile screw press	18
Table 5	NPC: Option 2 – Centralised belt press	19
Table 6	NPC: Option 3 – Centralised drying bed	19
Table 7	Summary of advantages and disadvantages of Options	20
Table 8	Revised MCDA for options	22
Table 9	Cost-benefit ratio assessment for options	22

Figure index

Figure 1	Typical CWMS system (adapted from LGA South Australia, 2025)	3
Figure 2	Septic tank pump-out – during and after	3
Figure 3	Willunga WWTP Gravity-thickened sludge tank	5
Figure 4	Willunga WWTP site layout	5
Figure 5	Monthly volume of water desludged across Council's septic tank pump out schemes	7
Figure 6	Monthly volumes of water desludged from Sellicks and Willunga WWTPs	7
Figure 7	Typical belt press diagram and belt material	10
Figure 8	Typical V-Press (Credit: Vand Solutions)	11
Figure 9	Mobile screw press (Source: IFS)	12
Figure 10	Centrifuge unit diagram	12
Figure 11	Drying bed schematic	13
Figure 12	Drying pad schematic	14
Figure 13	Geomembrane dewatering bag	15
Figure 14	Mobile screw press schematic flow diagram	18
Figure 15	Centralised belt press general layout	24
Figure 16	Centralised belt press process flow diagram	24
Figure 17	Possible site of sludge dewatering centralised facility at Willunga WWTP	25

Appendices

Appendix A Cost estimates

Appendix B Presentation of report summary

1. Introduction

The City of Onkaparinga's ('Council') community wastewater management systems (CWMS) involve operation and maintenance of septic tanks for individual households and businesses, which are periodically pumped out. Management of the residual material is regarded as a significant aspect of Council operations. Septic tank pump out is costly, especially when disposal sites are far from the pump out location. A significant proportion of the waste is liquid, rather than settled sludge material, which limits cost effective transport, and which could be processed by treatment plants. Current volumes of septic waste disposal comprise some 200 m³/month, although Council also operate 2 community sewage treatment plants at Sellicks Beach and Willunga, which also generate a significant volume of sludge (and could be included in any dewatering considerations). The sludge is currently spread on land at Milang.

This project proposes to investigate the possibility of separating solid and liquid waste during a septic tank pump out, allowing the thicker 'solids' component to be transported in the truck and liquids to be redirected back to sewer or septic management.

There are several dewatering technologies available, and Council is interested in reviewing adoption for mobile application as part of septic tank pump out operations. There are a number of challenges and opportunities including:

- Appropriate disposal of liquid underflow (quality and instantaneous volumetric flow)
- Determining the appropriate size of unit (for transport and achieving desired moisture content)
- Operability
- Finding a cost-effective balance between level of moisture removal and application (such as spreading or further treatment) and cost effectiveness of transport (associated with desirability for higher dryness of solids).

1.1 Purpose of this report

The purpose of this report is to document the review of the City of Onkaparinga's existing CWMS operations, including analysis of prior relevant work undertaken by students from the University of South Australia (UniSA), examine septage dewatering and management practices, and assess relevant innovation opportunities applicable to Council's CWMS. The report presents technical and feasibility assessments of potential options, and outlines a concept-strategy, providing recommendations to support informed decision-making by the Council.

1.2 Qualifications

This report: has been prepared by GHD for City of Onkaparinga and may only be used and relied on by the City of Onkaparinga for the purpose agreed between GHD and City of Onkaparinga as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than the City of Onkaparinga arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by the City of Onkaparinga and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.3 Project scope

The scope of work undertaken as part of this project consisted of the following activities:

1. Review of current septage and sludge volumes generated within the catchment (and currently disposed to Milang)
2. Review and analyse dewatering review work completed by students from UniSA
3. Research and assess relevant innovation opportunities (technological, operational, or management-based)
4. Prepare a report summarising findings, feasibility assessments, and recommendations; and
5. Develop concept of preferred strategy.

1.4 Objectives

The objectives of this project are to:

- Review and evaluate appropriate technologies, methods, or operational practices applicable to management of septage and sludge residuals from the Council's CWMS operations
- Assess feasibility, cost-benefit, and implementation pathways for potential residuals management
- Provide recommendations, next steps and supporting data for future funding applications or staged delivery.

1.5 Assumptions

The following assumptions have been used in developing the investigation for this report:

- The current volumes of septic waste disposal (spread near Milang) comprise approximately 200 m³/month (taken from Council-supplied Excel file of septage volumes)
- The Willunga WWTP produces approximately 195 m³/month of waste sludge requiring disposal (taken from Council-supplied Excel file of septage volumes)
- The Sellicks WWTP produces approximately 65 m³/month of waste sludge requiring disposal (taken from Council-supplied Excel file of septage volumes)
- It is assumed the existing arrangements for final disposal of septage residuals via land application at the Milang site will continue, with no change to disposal location, approval conditions, or end-use
- Stored WWTP sludge and septage pumped out from local septic tanks is approximately 2% total solids (TS) [and by inference includes 98% water]..
- The cost estimates (section 4) have been included for the purpose of the options evaluation, and do not necessarily accurately reflect the capital and annual costs.

2. Description of existing operations

2.1 Current septage operation and clean-out

The Council's current septage operation consists of a Septic Tank Effluent Drainage Scheme (STEDS). Under this arrangement, primary wastewater treatment is provided at individual properties via septic tanks. These septic tanks provide settling of solids, flotation of scum, and anaerobic digestion of settled residuals. Effluent exits the septic tank through an outlet and is conveyed to the local WWTP via a sewer network, refer to Figure 1.

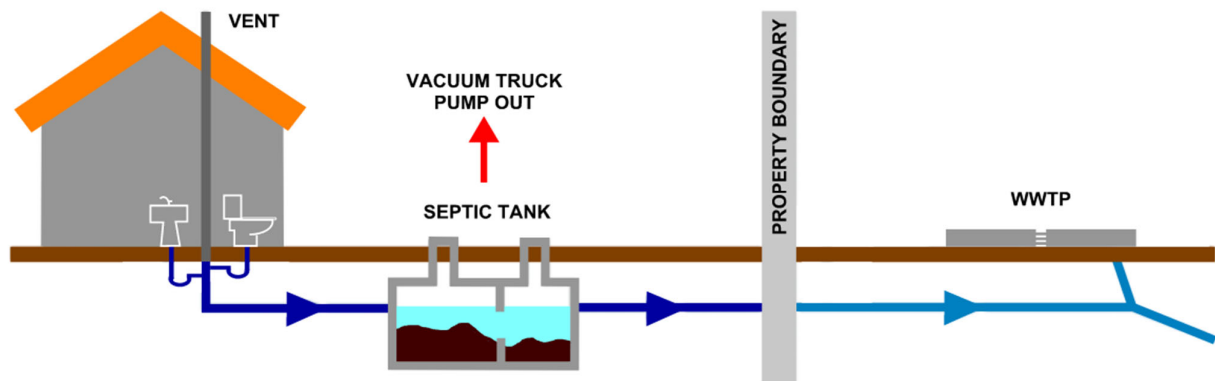


Figure 1 Typical CWMS system (adapted from LGA South Australia, 2025)

Solids accumulate in the individual septic tanks, and are periodically removed through Council-operated pump-out operations, where an operator pumps out each septic tank using a vacuum truck. The duration of each pump-out varies depending on the tank size, but takes approximately 20 minutes on average, with around 2 to 3 tanks emptied each day (inferred from Council-supplied Excel file of septage volumes). The septic tanks have a settled sludge layer down at the bottom, a mixed layer in the middle and a scum layer on the top (refer Figure 2 for image of a septic tank during vs. after pump-out). The operator uses a hose and a crowbar to disturb the liquid to enable adequate extraction during the pump out process. The removed septage is then transported and disposed via spreading over land near Milang, approximately 50 km away. Due to both the sizeable distance between Milang and the septic tank locations, combined with the significant volume of liquid included in the septage, this current system incurs a significant operational cost.

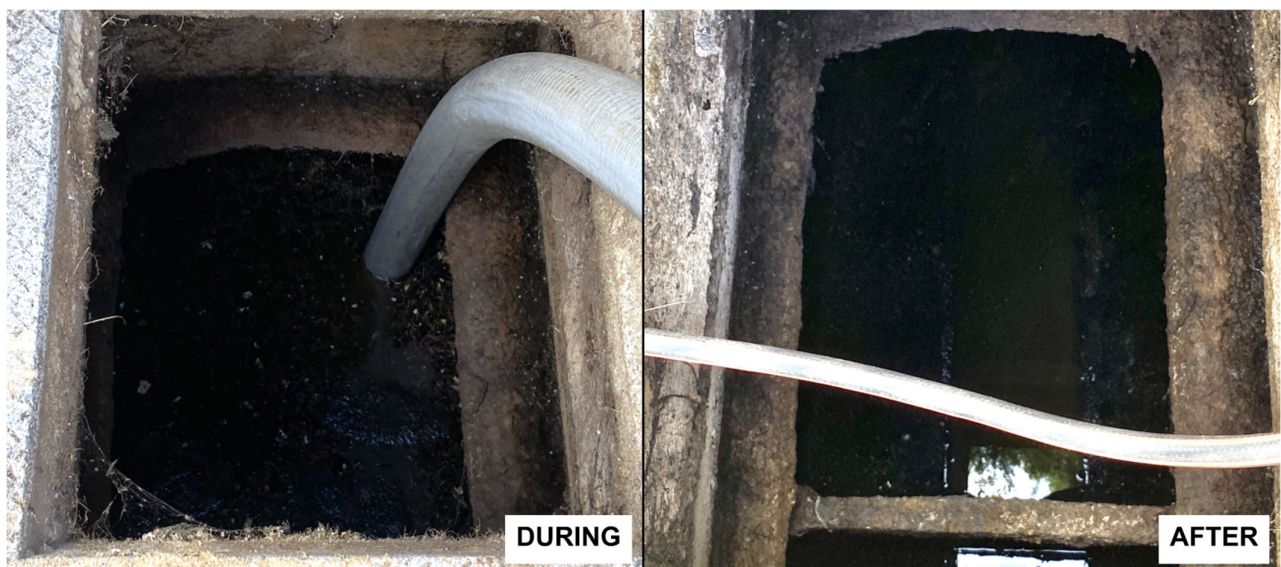


Figure 2 Septic tank pump-out – during and after

2.2 Willunga CWMS and WWTP

The Willunga CWMS is based on the STEDS arrangement described in Section 2.1 above. The Willunga WWTP, operated by TRILITY, currently serves the Willunga, McLaren Vale and McLaren Flat communities. The plant is designed to treat both septic effluent and raw sewage, with a peak wet weather capacity of 3 ML/day. The plant includes an intermittently decanted extended aeration (IDEA) system for biological treatment of the wastewater, and consists of the following process units:

- **Balancing Tank (lined storage dam):** For receiving inflow from the community sewerage system, this feeds the plant via an underground pipe leading to submersible pump, which feeds the IDEA reactor tanks at a controlled rate
- **IDEA Tanks:** There are two bioreactors, operating in parallel as an activated sludge system alternating between aerated and non-aerated conditions. Extended aeration promotes biological degradation of organic matter and nitrification (conversion of ammonia to nitrate via oxidation). Non-aeration periods create anoxic conditions, promoting denitrification (removal of nitrogen from water via conversion of nitrates to nitrogen gas). Dissolved oxygen (DO) is monitored in tank to control process conditions. The non-aeration phase leads into a settling phase to allow activated sludge to settle to the bottom of the tank. This phase is followed by the decanting phase, when clarified supernatant is withdrawn via a pipe located in the upper zone of the tank. When a low enough water level is reached, aeration resumes. The sequencing of phases alternates between the two reactors (i.e., while aeration is occurring in one reactor, non-aeration / decanting occurs in the other).
- **Gravity-Thickened Sludge Tank:** (Figure 3) Excess sludge is periodically removed from the bioreactors via a waste activated sludge pipe, to a sludge tank, where gravity-thickening occurs (overflow is returned to the inlet works). Settled sludge is then removed from this tank via a pipeline located near the bottom of the tank and pumped into the tanker for transport and spreading at the Milang site. The operators report the sludge volume transported is approximately 36 m³/week. There are also 3 sampling pipes located in the upper, mid and lower zones of the tank
- **Chlorine Dosing System:** Decanted secondary effluent from the bioreactors flows to a chlorine dosing system, where chlorine is added for disinfection.
- **Chlorine Contact Tank:** Following dosing treated effluent is piped to a chlorine contact tank, where the effluent is held to allow for sufficient disinfection.
- **Treated Water Storage Dam:** Disinfected effluent is discharged from the contact tank into a water storage dam, providing storage prior to reuse or discharge.



Figure 3 Willunga WWTP Gravity-thickened sludge tank

A site layout diagram with process units labelled is shown in Figure 4 below.



Figure 4 Willunga WWTP site layout

2.3 Sellicks Beach CWMS and WWTP

The Sellicks Beach community is served by the Sellicks Beach WWTP, installed in 2006. The treatment plant produces effluent for both re-use and disposal.

The WWTP is designed to treat a mix of septic effluent and raw sewage, with an average daily flow of 156 m³/day (peak flow of 246 m³/day, and maximum wet weather flow of 380 m³/day). Current flows are reportedly around 100 m³/day, although recent dry weather flows for December indicates flows closer to 120 m³/day (which are noted by Council/operational personnel as higher due to influx of holiday makers).

The plant consists of the following process units:

- Inflow automatic mechanical screen (2 mm aperture).
- Balance tank for receiving inflow from the community sewerage system.
- Overflow tank for emergency flow (which is returned to process later).
- Single SBR/intermittent activated sludge system which involves timer cycles to achieve biological degradation of organic matter, nitrification, denitrification and settling).
- Sodium hypochlorite (NaOCl) dosing system for disinfection of secondary effluent.
- Effluent holding tank.
- Waste sludge storage tank (used to settle and consolidate excess biological sludge which is periodically removed (weekly) off-site for disposal).
- In-line filtration system (proprietary Amiad system).
- Effluent pump delivery to the application areas (one at a time).

It is understood effluent is irrigated for only 2-3 hours per day on reserves/green space, during wet weather and soil saturation, with some effluent reused at a mine site.

2.4 Summary of sludge generation

On average, Council-managed septic tank pump-outs produce approximately 200 m³ of sludge per month (refer Figure 5). Of this volume, around 190 m³ per month represents septic tank contents, with an additional ~10 m³ per month attributed to water introduced by operators via local hose to disturb the liquid during pump-out. The average monthly cost to Council for this septic tank desludging and transport activities is approximately \$24.6k. In addition to septic systems, wastewater treatment plant desludging contributes further volumes. The Willunga WWTP produces approximately 195 m³ per month, while the Sellicks WWTP produces approximately 65 m³ per month, resulting in an additional monthly average cost of \$17.7k to Council.

All septage and wastewater sludge streams are currently transported and spread out at Milang, resulting in a combined sludge volume of approximately 460 m³ per month, and a total sludge disposal cost of approximately \$42.3k per month (which works out to be about \$ 92/m³).

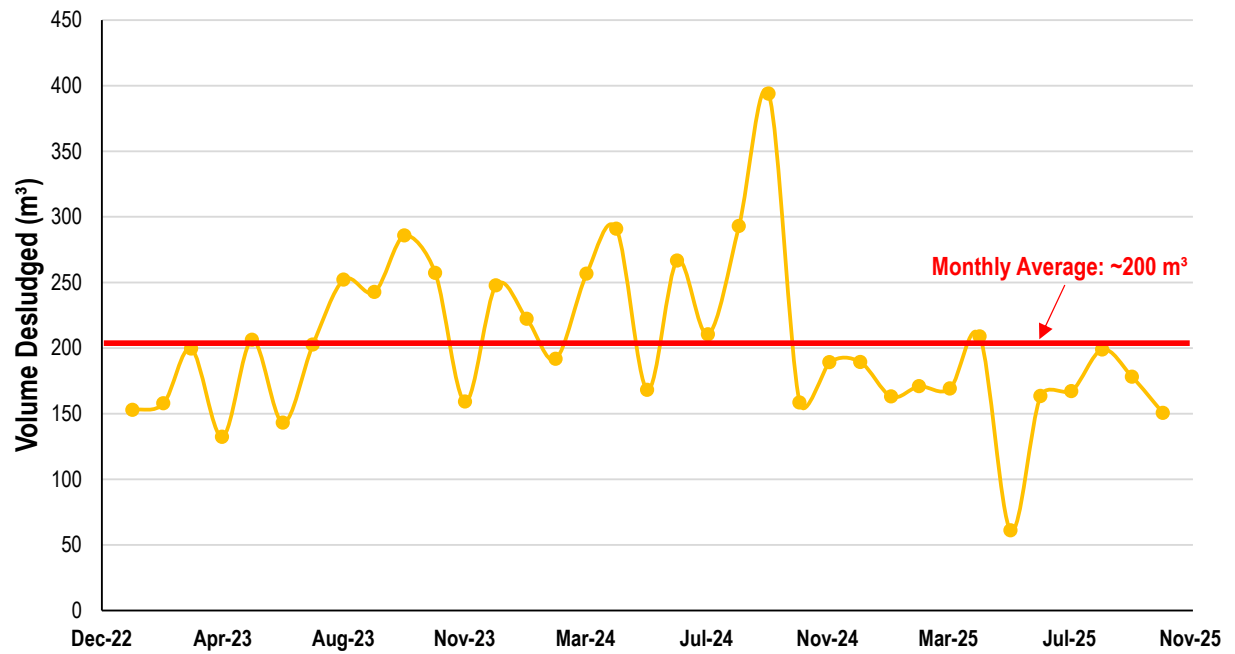


Figure 5 Monthly volume of water desludged across Council's septic tank pump out schemes

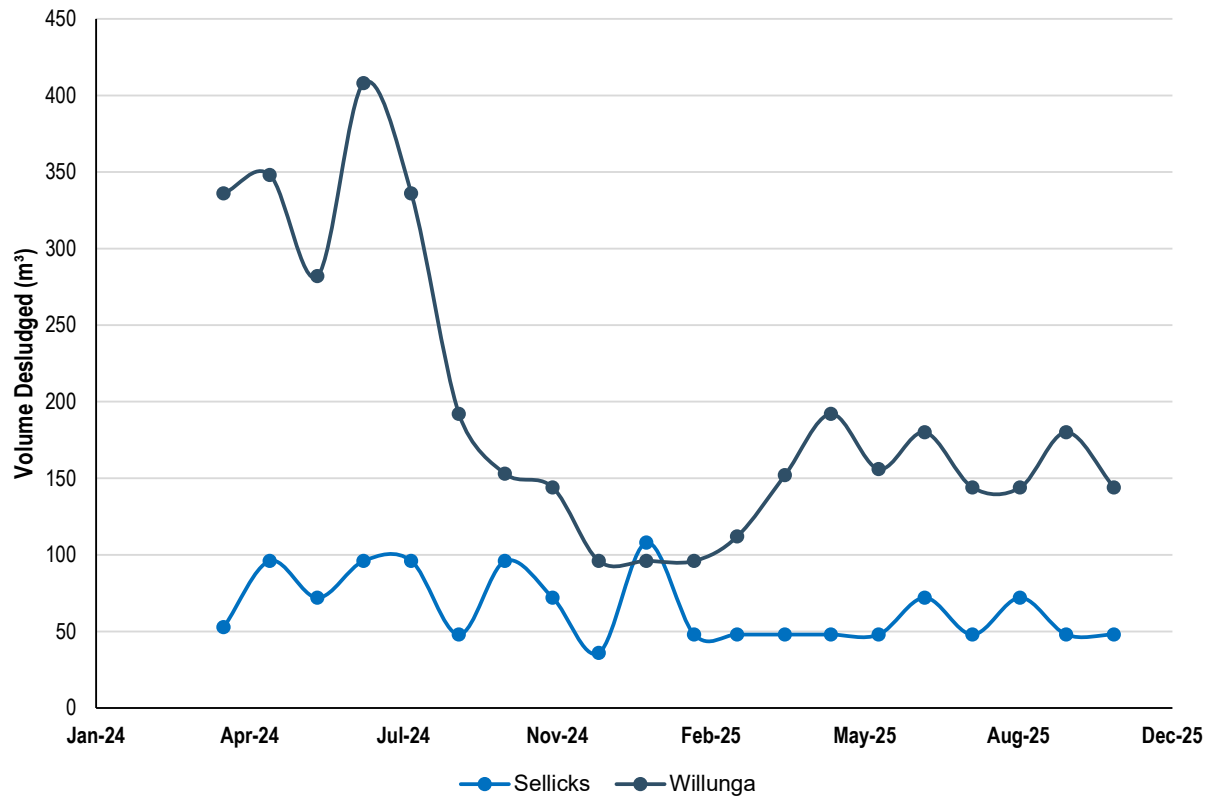


Figure 6 Monthly volumes of water desludged from Sellicks and Willunga WWTPs

3. Dewatering review

Dewatering has the potential to reduce the volume of sludge requiring transport and disposal by removing free water prior to haulage. This can result in reduced transport frequency, lower disposal costs, and improved operational efficiency.

Preliminary research into some dewatering technologies has been undertaken by students from UniSA. This research is first reviewed. Following this, a more extensive review of suitable residuals management approaches is considered in the context of Council's current septic tank desludging operations.

3.1 UniSA research review

3.1.1 Outline of Work undertaken

Students from UniSA conducted two projects to research potential avenues to improve the Council's CWMS operational efficiencies related to septage residuals management. These projects were:

- Feasibility study into onsite solids separation to enhance community wastewater management system (Project 1)
- Onsite Solid separation of Septic tanks: A circular economy perspective (Project 2)

Based on the reported poor quality of output from Project 2, it was decided by Council that it would not be assessed by GHD.

Project 1 investigated the feasibility of implementing mobile dewatering technologies to separate solids during septic tank pump-outs. This was conducted via a literature review and comparative analysis of the following technologies:

- Centrifuge Unit
- Geotextile Bags
- Hybrid Containerised Units
- Belt Press
- Screw Press.

Each technology was assessed against 6 technical criteria to assess their suitability: solids reduction efficiency, energy requirements, operational simplicity, cost-effectiveness, regulatory compatibility, and potential for partial liquid return. The result was that, based on their scoring, the centrifuge unit and hybrid containerised units showed the greatest potential for use as mobile dewatering technologies (see Table 1 for the full results). It is noted that the ratings used by the students were adopted merely for qualitative comparison, as such, the scores across criteria were not summated to determine the most suitable option. Furthermore, no weightings were given for each criterion within the scoring matrix used.

Table 1 Scoring matrix for dewatering technologies (Qualitative Scale: 1 = Low, 5 = High)

	Centrifuge Unit	Geotextile Bags	Hybrid Containerised Units	Belt Press	Screw Press
Solids Reduction Efficiency	5	2	4	4	3
Energy Requirements	5	1	3	4	2
Operational Simplicity	2	5	4	3	4
Cost-Effectiveness	3	5	3	3	4

	Centrifuge Unit	Geotextile Bags	Hybrid Containerised Units	Belt Press	Screw Press
Regulatory Compatibility	3	5	5	4	4
Liquid Return Potential	5	2	4	3	3

Following the qualitative comparison, the report recommended some particular dewatering technologies used in industry that might be used within the Council's operations, these include:

- Flottweg C3E-4/454 Centrifuge (containerised, up to 20 m³/hour sludge processing rate)
- Flottweg X5E Centrifuge (centralised, 40-100 m³/hour sludge processing rate)
- Flottweg X4E Centrifuge (mobile, 15-50 m³/hour sludge processing rate)
- Mena Water RoS 3Q q440 Screw Press (fits into 20 ft container, 2-10 m³/hour sludge processing capacity)

3.1.2 UniSA research commentary by GHD

The UniSA honours research did not identify a single preferred dewatering technology. However, the key takeaway from the review was that mechanical dewatering has the potential to significantly reduce sludge volumes and associated transport and disposal costs, subject to each technology's suitability to the Council's current operational regime.

Chief concerns raised by UniSA involved requirements for skilled operation and energy use. In practice, septic tank pump-out operators already operate mechanical equipment and manage waste streams, and the additional operational skill required for certain dewatering technology options while initially being an issue, once they get used to the change may not be a significant increase. Furthermore, energy use (and associated costs) of these dewatering technologies are likely comparable to cost savings from sludge volume reduction. Capital costs and maintenance requirements of more complicated technologies are more relevant considerations over the long-term and should be assessed against potential transport cost savings from reduced sludge volumes.

Mobile dewatering units, including trailer-mounted centrifuges and screw presses, are available with processing capacities in the range of 15 to 50 m³ per hour (such as the Flottweg X4E). Centralised systems can process between 40 to 100 m³ of sludge per hour. Typical septic tank volumes range from 1.6 to 6 m³. Taking the 'low-rate case scenario' (15 m³/hour processing time for mobile dewatering plant, and 6 m³ septic tank), processing time amounts to approximately 24 minutes, which is similar to current tank pump out duration of 20 minutes. As such, dewatering might be completed within a similar timeframe to current pump-out operations. Smaller septic tanks may present a logistical issue. It should be noted that mixing of feed to a dewatering device is typically employed to achieve homogenisation of the feed and make conditioning (addition of flocculant) more effective.

Such a system for mobile might involve a containerised systems something along the lines of:

- Pump (self-priming) to remove contents of tank, with discharge three-way valve – to divert flow to the mobile dewatering system AND initially diverting flow back to the septic tank to facilitate mixing of contents
- Polymer dosing unit (liquid system) to condition mixed sludge prior to dewatering
- Mobile dewatering unit, with solids discharge to a skip
- Underflow discharge pipe to be placed to septic overflow (into sewer)

Overall, it is considered possible that a mobile system could be integrated into existing work practices without significantly increasing service time.

It should be noted that a mobile dewatering unit, could also be potentially utilised for management of sludge from the 2 WWTPs. This might be undertaken on a weekly basis, but would likely require an additional mixed, storage tank which would receive settled material from the existing gravity settling tank. This would allow appropriate mixing and conditioning for effective dewatering.

Alternatively, a non-mobile centralised dewatering system could be located at either of the WWTPs, with transported septage delivered to either site, and mixed in with the WWTP sludge for dewatering, prior to transport of residuals to Milang for spreading. This would potentially simplify operations since the WWTP operator would

look after this system, rather than relying on tanker drivers. Based on a sludge volume of some 460 m³/month, a capacity rating of 10-15 m³/hour would be suitable.

A non-mobile facility would also involve an opportunity to consider alternative systems for dewatering. A review of all dewatering systems is undertaken in the section below.

3.2 Dewatering technology review

Mobile dewatering requires mechanical dewatering systems.

Centralised dewatering systems can be extended to include passive dewatering systems.

The options are discussed below, based on the assumption that there is ongoing disposal of dewatered material to Milang. This in turn will involve a new transport and spreading system (to facilitate application of drier material).

3.2.1 Mechanical dewatering systems

3.2.1.1 Belt Press

Belt presses dewater sludge using two tensioned, porous belts. First, sludge is chemically conditioned via dosing with polymer. This conditioned sludge is then distributed onto a gravity-drained section of the belt, where free water drains under gravity through the belt pores. The sludge is then conveyed through a wedge zone between two recirculating belts over a series of rollers with decreasing diameters. These decreasing diameters progressively increase the compressive pressure and shear forces applied by the belts, which squeezes further water from the sludge through the belt pores. This creates a drier, dewatered sludge 'cake' that is discharged from the belt press.

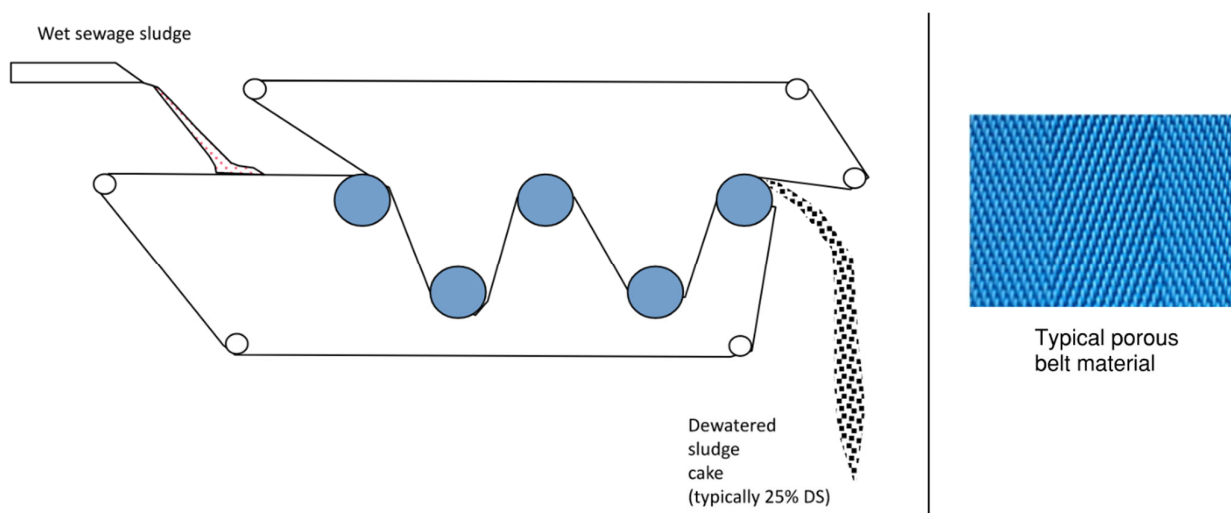


Figure 7 Typical belt press diagram and belt material

Belt presses for dewatering have low energy requirements, relatively low capital and operating costs, low mechanical complexity resulting in easier maintainability, with high pressure systems able to produce very dry cake, typically comprising of a Dry solids (DS) content of 25%. However, they are sensitive to sludge feed characteristics, and require prior mixing. Suitable sizes are available in both mobile and fixed plant.

3.2.1.2 V-Press

V-presses (also known as a V-fold press) are similar to belt presses, with the main difference being that a single belt, folded along a centreline is used, instead of a series of rollers with decreasing diameters. V-presses dewater sludge using a low-speed, low-shear compression process within a V-shaped press zone formed by two permeable belts. Prior to dewatering, sludge is chemically conditioned through polymer dosing. The conditioned sludge is then introduced at the open end of the V-shaped wedge between the belts. As the belts converge, the

sludge is progressively compressed as it travels through the press zone. This forces water out of the sludge through the belt pores. The dewatered sludge then forms a cake which is discharged from the press outlet.

V-presses are relatively simple mechanical systems. They have low energy requirements with moderate capital and operating costs. They rely heavily on effective polymer dosing, typically producing sludge cakes with a DS content in the range of 12-15%. V-presses operate quietly, are straightforward to control, and require minimal wash water compared to conventional belt filter presses. However, they generally have a lower maximum throughput than large belt presses (processing capacity of up to 3 m³ per hour). They are also sensitive to polymer selection and dosing, with belt wear being a key maintenance consideration. V-presses are well suited to organic sludges and are available in both mobile and fixed configurations.



Figure 8 Typical V-Press (Credit: Vand Solutions)

3.2.1.3 Screw Press

Screw presses dewater sludge using slow-rotating screws inside a cylindrical steel perforated screen. Sludge is first conditioned by mixing with a polymer, before it is fed through a gravity drainage inlet (typically a steel mesh). A rotating screw conveyor then conveys the sludge, where a reducing screw pitch or increased shaft diameter applies increasing compressive pressure, which squeezes out liquid through the screen apertures. The screw's slow rotational speed limits turbulence, improving liquid drainage. Screw presses are relatively simple dewatering devices with low energy use and washing requirements. However, they are generally less effective than the other mechanical dewatering systems discussed, typically achieving a DS content ranging between 16% and 20%.



Figure 9 Mobile screw press (Source: IFS)

3.2.1.4 Centrifuge Unit

Centrifugal units use high rotational forces to separate liquids from sludge. Sludge is first dosed with a polymer. The centrifuge bowl spins high speeds, creating centrifugal forces 3,000 times greater than gravity. As the bowl spins, the heavier matter is thrown outward, while the lighter liquid separates inward and is retained closer to the centre of rotation. A screw conveyor then transports the dewatered solids in the outer layer to the discharge point, while the centrate water overflows over a weir.

Centrifuges have a clean appearance, minimal odour problems, low capital cost to capacity ratio (as they have a high throughput) and have fast start up and shutdown capacities. However, they have a high energy demand and are harder to maintain than the other dewatering devices, with some components potentially requiring high maintenance by skilled maintenance personnel. They typically achieve a DS content between 22% to 28%.

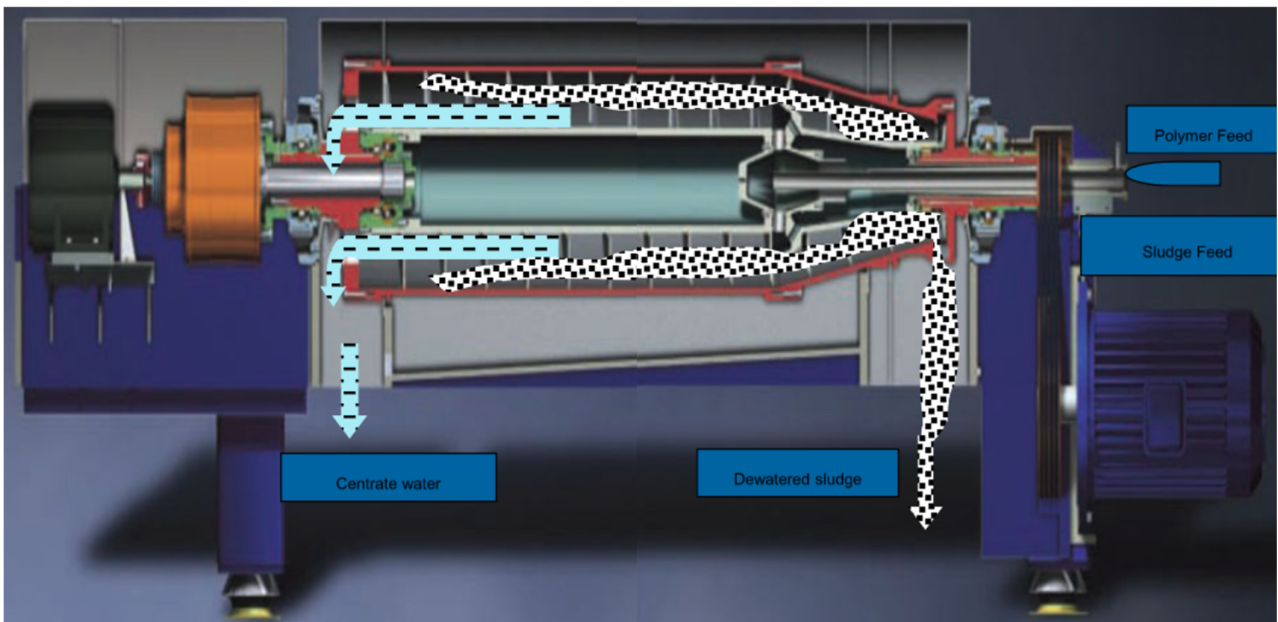


Figure 10 Centrifuge unit diagram

3.2.1.5 Mechanical dewatering comparison

A summary comparison table between the different mechanical dewatering systems is shown in Table 2.

Table 2 Belt press, centrifuge and screw press comparison

Characteristics	Belt Press	V-Press	Centrifuge	Screw Press
Energy usage	Low – lower than centrifuge (especially for <2% solids content in sludge)	Low	High power consumption	Medium
Capital cost	Low running costs, slightly higher labour costs	Low	High initial, operating and polymer costs / low labour costs	Medium
Polymer dosage	Low – 50% lower compared to centrifuge	Medium	Medium	High
Water requirements for washing	High – needs to be washed continuously	Low to medium	Minimal	Minimal
Dryness of sludge cake	Can be high solids (18 – 25% DS)	Low (12 – 15% DS)	Can be high solids (22 – 28% DS)	Medium cake solids (16 – 20% DS)
Noise	Medium	Low noise	High	Low
Complexity of O&M	Medium	Simple	High	Medium
Type of sludge	Suitable for thin sludges (<1.5% solids)	Organic, requires good polymer conditioning	Excellent for well screened and greasy sludges. May be an issue with septage (unscreened)	Specifically for biosolids dewatering purposes

3.2.2 Passive and In-situ dewatering systems

3.2.2.1 Drying beds / drying pads

Drying beds are simple, passive systems. Sludge is applied in layers onto sand / gravel beds for drainage. Water drains by gravity while any remaining moisture is removed by evaporation over time (see Figure 11). Drying beds have low energy consumption, no chemical dosage requirements, have low sensitivity to sludge variability, and can achieve higher solids content than mechanical methods (can exceed 35-40% under favourable climatic conditions). However, they require large areas of land, require stabilised sludge (to minimise odour effects) and their design must consider climatic effects (may be an issue over winter in Adelaide). Sludge removal after drying is labour-intensive and there are potential visual and odour issues.

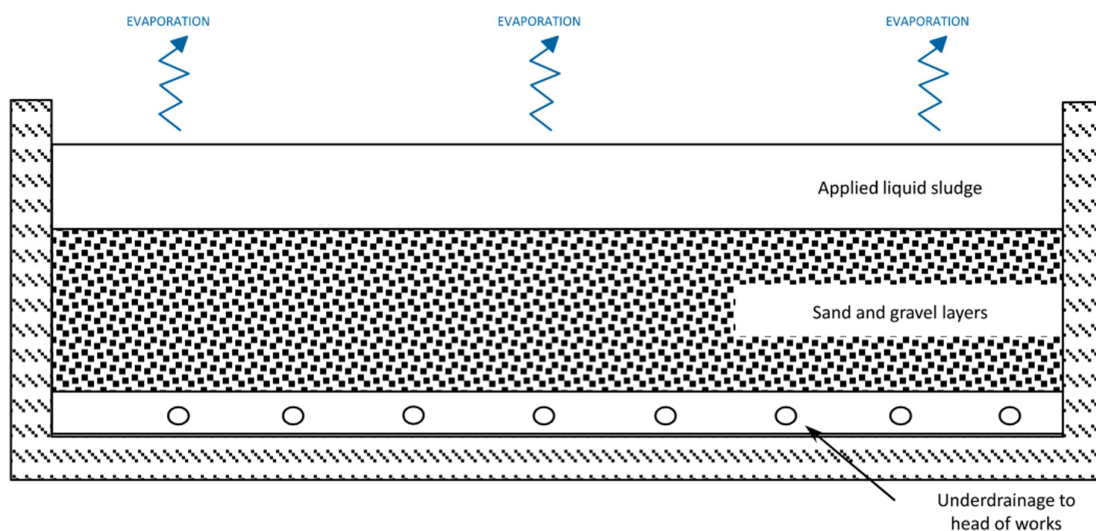


Figure 11 Drying bed schematic

Drying beds are typically sized to contain 1-2 weeks of sludge material (allowing for drainage). The base of the drying beds should be level, well compacted, trafficable for removal of biosolids and must be able to cope with loading from the catchment. The base must be lined with a low permeability layer (such as a 0.3 m thick layer of clay with a permeability not greater than 10^{-9} m/s, or high density polyethylene plastic sheeting, bitumen or concrete or some other layer that has been approved by the EPA) to prevent seepage into groundwater.

In differentiating between drying beds and drying pads; the former relies on free drainage of moisture as well as evaporation, whereas the pads involve an impervious surface to contain run-off and permeation into the ground, relying solely on evaporation (see Figure 12). As a result, the surface area required for drying beds is significantly less than the area required for drying pans (typically $\frac{1}{3}$ of the size).

Although free drainage of liquid material from septage application can be of some concern (due to potential for groundwater contamination due to seepage), there is a possibility of locating the drying bed at the WWTP, with underdrainage directed to WWTP for treatment. Due to this fact, and their smaller footprint compared to drying pads, only drying beds will be considered for this application.

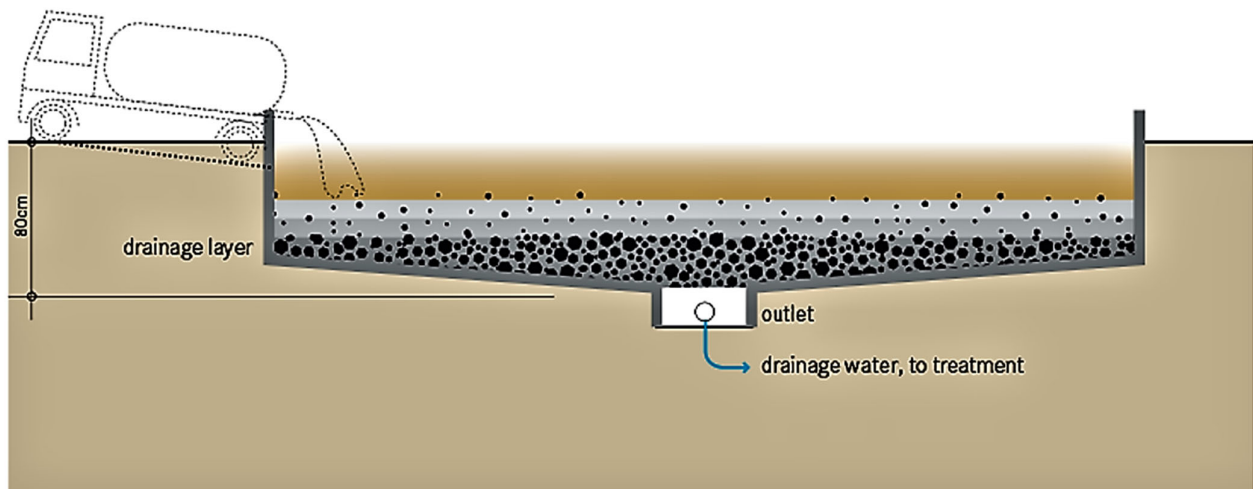


Figure 12 Drying pad schematic

3.2.2.2 Geomembrane dewatering bag

Geomembrane dewatering bags achieve dewatering through gravity filtration and solids consolidation. Sludge is pumped into the permeable geotextile bag, creating internal hydrostatic pressure. Chemical conditioning is required. Water seeps out of the bag through fabric pores into lined areas for collection. The solids are retained, and as drainage progresses, the sludge is consolidated under its own weight, expelling additional water. This process continues over time, with evaporation further reducing moisture content. See Figure 13 for a typical geomembrane dewatering bag.



Figure 13 *Geomembrane dewatering bag*

3.3 Mobile vs Centralised systems

Based on review of operations and work undertaken to date, there are two potential approaches in which the reviewed mechanical or passive dewatering systems can be deployed:

- Mobile dewatering (based around travel with the septage collection truck)
- Centralised residual management system (based on single facility for dewatering of septage and sludge collected)

3.3.1 Mobile dewatering system

A mobile dewatering system would consist of a mobile, mechanical dewatering device that travels around with the septage collection truck. Dewatering would, therefore, occur at or near the point of pump out. Septage would be pumped out from the tank, through the dewatering device, with the dried cake then discharged into a collection skip, which would reduce transport from some 20 m³ to around 3-4 m³.

Note that our review considers transport based on 20 kL tanker.

Given the scale of requirements and simplicity of operation, only a mobile screw or belt press has been considered.

Capital cost of a mobile unit would be expected to be of the order of \$300,000 – \$400,000.

3.3.2 Centralised residuals management system

A centralised residuals management system would require a designated site for transport of septage to undertake dewatering operations. Under this approach, septage would be pumped out using the collection truck and transported to a local site. The most suitable sites would include:

- Either WWTP site (with potential odour issues at the community-based sites with proximity to adjacent receptors, the building may require odour control) and
- Council-operated site (separate).

Given the odour potential and the requirements for dewatering WWTP sludge, we have assumed the central point would be either Sellicks beach or more likely Willunga as there would appear to be more space there.

If mechanical dewatering is undertaken, septage would first be stored in a dewatering storage tank with fixed mechanical dewatering plant attached, with additional storage required for the dried cake. The key disadvantage of the centralised system is land availability.

We have not considered geobags – these require storage for some 12 months and are not considered suitable for regular delivery / transport for spreading. For the same reasons of complexity as mobile units, we have not considered centrifuges.

Consequently, we have only considered two options for comparison:

- Screw press or belt press (contained within a building which is controlled for odour). Footprint of this would be of the order of 40-50 m².
- Gravity drying beds, if it is considered that odours might not be a nuisance, but these would require a footprint of some 350-375 m² (nominally 10 x 37 m).

4. Development and review of options

Based on our review of Council's current septage operations, as well as the relevant technologies, the following options have been compared for Council's septage management:

- **Base Scenario – 'Business as usual':** No changes to Council's current septage management operations
- **Option 1 – Mobile screw press:** Containerised mobile screw press dewatering unit, associated with collection truck, providing dewatering at the septage collection point
- **Option 2 – Centralised belt press unit:** Installation of a belt press dewatering unit, housed within a building, which also contains polymer dosing unit, mixing tank, storage of residuals and controls, odour control. Located at Willunga WWTP.
- **Option 3 – Centralised drying bed:** Implementation of a centralised drying bed for sludge dewatering, located at Willunga

4.1 Base Scenario – Business as usual

The base scenario is developed to quantify the costs of 'business as usual'. This option involves no changes to Council's current septage operations. Values of transport were taken from data sheets supplied by Council. It should be noted that these values rely heavily on assumptions, and it is recommended that Council perform their own analysis based on more extensive data surrounding operation costs. Our analysis indicates an annual cost over \$ 0.5 M. A Net Present Cost (NPC) was developed for this scenario, shown in Table 3.

Table 3 NPC: Base Scenario – 'Business as usual'

Base Scenario – 'Business as usual'			
Item	Value	Unit	Notes
Septic sludge volume requiring transport	460	m ³ per month	Septage + sludge. Taken from Council supplied Excel sheet
Sludge volume transport cost rate	92	per m ³	Assumed
Cost of sludge volume transport	\$42,320	per month	Taken from Council-supplied Excel sheet, combined cost from septage pump out and WWTP sludge disposal
Total annual cost, AC	\$507,840	year	
Discount Rate, <i>r</i>	5	%	
Project / Plant Lifespan, <i>n</i>	20	years	
Annuity Factor, <i>AF</i>	12.46		$\frac{1 - (1 + r)^{-n}}{r}$
NPC	\$6,325 k		(AC ₀ * AF)

4.2 Option 1 – Mobile screw press dewatering

Option 1 involves the purchase of a mobile screw press. A screw press was selected due to its simple mechanical design, reliability, low noise and enclosed design, making it particularly suitable for mobile use within residential environments. A V-press was not deemed as suitable due to its lower capacity and corresponding longer processing times.

Septage would be pumped from the septic tank directly through the screw press during pump-out (after mixing) and conditioning (polymer dosing). The dewatered sludge cake would be discharged into the collection truck at a reduced volume, with separated liquid returned to the sewer. Dewatering would occur concurrently with pump-out, minimising any increase in overall service time per property. Note that the separated liquid returned to the sewer would incur an additional cost arising from treatment at the WWTP.

The option involves a trailer-mounted / containerised system with polymer dosing, pumps, screw press, controls and collection truck / skip.

Development of operating and maintenance procedures, including operator training would be required.

Capital costs for options 1-3 are based on unit values and generic estimates of items (preliminary rough order of costs only). Annual costs adopted had different bases (polymer was based on estimates of 10 kg / dry tonne usage and use of powder polymer, transport costs were based on Council supplied value, and O&M was based on a percentage of the estimated capital). An NPC was developed for Option 1 and compared against the Base Scenario, showing savings of approximately \$2.95 M across a 20-year period, shown in Table 4.

Table 4 NPC: Option 1 – Mobile screw press

Option 1 – Mobile Dewatering System (Screw Press)			
Item	Value	Unit	Notes
Upfront capital cost, C_0	\$500,000		Approximate, includes storage shed at WWTP
Sludge volume transported to Milang	80	m ³ per month	Assume septage 2% solids, 18% DS content from dewatering
Monthly cost	\$8,832	per month	20% increase applied to factor in potential incomplete collection truck before transport
Yearly polymer dosing cost	\$40,000	per year	
Yearly O&M costs	\$25,000	per year	Assumed 5% of capital cost
Total annual cost, AC_1	\$231 k	per year	
NPC ₁	\$3,380 k		$C_0 + (AC_1 * AF)$
Δ NPC	-\$2,947,247		Dewatering reduces whole-of-life cost by approximately \$2.95 M in present-value terms.

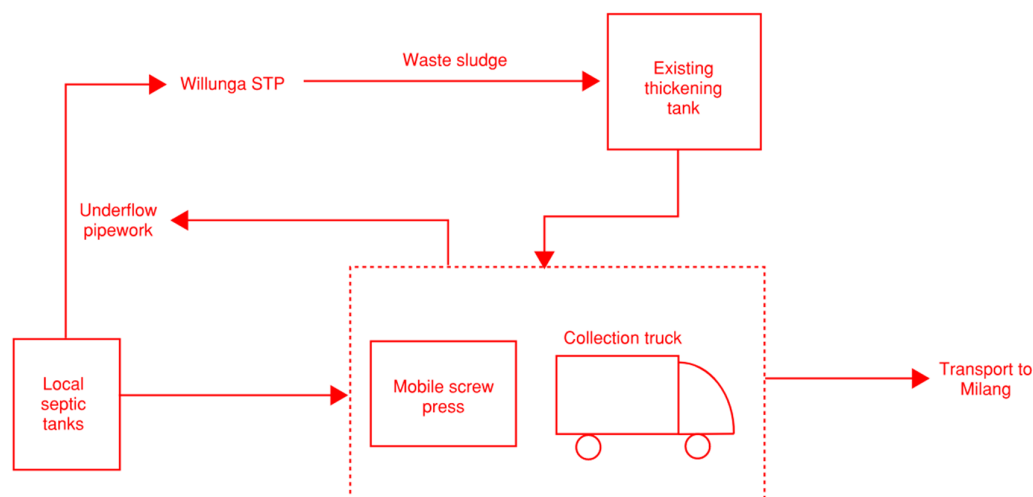


Figure 14 Mobile screw press schematic flow diagram

4.3 Option 2 – Centralised Belt Press

Option 2 involves the establishment of a centralised dewatering system located at Willunga WWTP. A belt press is simple to operate and was selected for this option due to its high sludge volume reduction capability, high throughput capacity and medium complexity.

Under this option, septage collected from individual septic tanks would be transported to a centralised location for dewatering using the existing collection trucks. It would be deposited into a holding tank from where it would be

processed after mixing (with WWTP sludge) and condition (polymer dosing) through the belt press. Dewatered cake would then be transported for land application at Milang.

While this approach still requires transport of raw septage (with a high water content), the transport distances would be significantly shorter than the current haulage to Milang. The key advantages offered by this option include both the ability to deposit the sludge into a centralised tank, and have dewatering occur while the collection truck is elsewhere pumping out additional tanks. Additionally, there is an opportunity to dewater sludge streams generated from the WWTPs enabling added operational efficiencies.

An NPC was developed for Option 2 and compared against the Base Scenario, showing savings of approximately \$2.6 M across a 20-year period, shown in Table 5.

Table 5 NPC: Option 2 – Centralised belt press

Option 2 – Centralised Dewatering System (Belt Press)			
Item	Value	Unit	Notes
Upfront capital cost, C_0	\$640,000		With building and odour control, assumed to fit on site
Sludge volume transported to Milang	65	m ³ per month	Assume septage 2% solids, 22% DS content from dewatering
Monthly cost	\$5,980	per month	
Monthly sludge transport cost to centralised facility	\$8,464	per month	20% of existing sludge transport costs
Year polymer dosing cost	\$40,000	per year	
Yearly O&M costs	\$32,000	per year	
Total annual cost, AC_2	\$245 k	per year	
NPC ₂	\$3,700 k		$C_0 + (AC_2 * AF)$
Δ NPC	-\$2,625,040		Dewatering reduces whole-of-life cost by approximately \$2.6 M in present-value terms

4.4 Option 3 – Centralised drying bed

Sludge drying beds are used for the dewatering and drying of sludge, where a residuals slurry is applied to a drainage bed, with evaporation allowed to take place over 5-7 days. Over time, the sludge reaches a dewatered, spadeable condition, typically achieving around 30-40% total solids (TS). The dried solids are then removed using mechanical equipment such as a front-end loader or shovel and spade.

Modern practice typically involves multiple drying bed cells, sized so that one or two beds can be loaded during a normal operating cycle while the remaining beds continue to drain and dry. Beds are generally bounded by earthen embankments or vertical walls constructed from concrete blocks or reinforced concrete to contain the sludge during the early high-moisture phase.

Secure fencing would be required around the area.

Sizing is governed by the volume required to contain the sludge and allow sufficient evaporation to achieve the target dryness, and an area of some 375 m² will be required. An NPC was developed for Option 3 and compared against the Base Scenario, showing savings of approximately \$3.45 M across a 20-year period, shown in Table 6.

Table 6 NPC: Option 3 – Centralised drying bed

Option 3 – Centralised Passive Dewatering (Drying Pad)			
Item	Value	Unit	Notes
Upfront capital cost, C_0	\$487,500		Approximate, see Appendix A for breakdown, excluding any need for purchase of land
Sludge volume transported to Milang	35	m ³ per month	Assume septage 2% solids, 40% DS content from dewatering

Monthly cost	\$3,220	per month	
Monthly sludge transport cost to centralised facility	\$8,464	per month	20% of existing sludge transport costs
Yearly O&M costs	\$50,525	per year	No polymer dosing, but operators need to clear drying beds
Total annual cost, AC_3	\$190 k	per year	
NPC_3	\$2,865 k		$C_0 + (AC_3 * AF)$
ΔNPC	-\$3,461,303		Dewatering reduces whole-of-life cost by approximately \$3.45 in present-value terms

4.5 Options review

Table 7 summarises the key advantages and disadvantages of the base scenario and each shortlisted dewatering option, drawing on operational, technical, cost and implementation considerations discussed in the preceding sections. This comparison provides context for the relative performance of each option prior to quantitative scoring

Table 7 Summary of advantages and disadvantages of Options

Option	Advantages	Disadvantages
Base Scenario – Business as Usual	– No capital expenditure required – No change to current operations or training requirements – Known and well understood operational risks	– High transport frequency and costs due to high liquid content – Operational inefficiencies retained – Increasing exposure to future cost escalation – Environmental risks
Option 1 – Mobile Screw Press	– Dewatering occurs at point of collection, maximising volume reduction prior to transport – Minimal increase in pump-out duration due to concurrent operation – Low energy use and relatively simple mechanical design – Enclosed, low noise system suitable for residential environments – Lowest NPC of all options assessed	– Requires polymer addition – Lower achievable DS content (typically 18–20%) compared to centrifuge unit – Additional mechanical equipment introduces maintenance and reliability risks – Reduced likelihood of fully loading collection truck prior to disposal – Odour likely during dewatering operation
Option 2 – Centralised Belt press Unit	– High throughput and higher achievable DS content (typically 22–28%) – Ability to dewater septage and WWTP sludge using shared infrastructure – Dewatering can occur while collection truck continues pump-out operations – Clean appearance with minimal odour issues – Significantly reduced environmental risks associated with transport and odour	– Continued transport of raw septage prior to dewatering (albeit for smaller distance) – Higher energy demand and more complex maintenance requirements – Requires suitable centralised site and additional infrastructure – Increased traffic movements to centralised location
Option 3 – Centralised Drying Beds	– Passive process with very low energy and chemical requirements – Highest achievable solids content (typically 30–40% TS) – Low sensitivity to sludge variability – Simple and well-established technology – Reduced transport environmental risk	– Large land requirement and high upfront capital cost – Long drying times and strong dependence on climatic conditions – Labour-intensive solids removal and ongoing site management – Requires EPA approvals – Significant odour risk associated with WWTP adjacent community

It should be noted that any of the above new alternatives will introduce a new unit operations (dewatering) to the existing regime. While mobile dewatering will require special training for septage operators, the introduction of dewatering at a centralised site will require training / new operational step for the WWTP operators. The latter is considered significantly simpler, since these operators have a good understating of residuals management and general unit operations. This has been taken into account in the comparison rating of options.

Following the above high-level qualitative review, a Multi-Criteria Decision Analysis (MCDA) was undertaken. This was broadly based on preliminary considerations in UniSA's review of dewatering technologies, but expanded to reflect other aspects considered to be important to Council. At the presentation workshop with Council (25 Feb 2026), Council's representative Cassandra O'Connor, agreed with the objectives and the weighting. The MCDA assessed each option against the following criteria:

- **Operational / maintenance simplicity (weighting 0.3):** Considers the mechanical complexity of each option, expected maintenance requirements, and need for specialist operation or servicing.
- **Ease of integration (weighting 0.15):** Considers how well each option fits within Council's existing pump-out and sludge management operations. This includes noise and odour considerations in residential areas, compatibility with current operations, and whether additional land acquisition or fixed infrastructure would be required.
- **Environmental risk [transport] (weighting 0.2):** Considers noise and spillage risk aspects .
- **Environmental risk [odour] (weighting 0.25):** Considers odour aspects in residential areas – either form mobile dewatering or at new centralised site.
- **Capacity and scalability (weighting 0.1):** Includes the option's ability to process Council's current septage volumes efficiently, and potential to also treat WWTP sludge streams.

The cost analysis is kept separate to the non-economic (factors) and this is used in a cost to benefit ratio further below.

Note that an additional consideration across all options is the application of dewatered sludge at Milang. This might involve spreading of dewatered material (slinging and ploughing). However, if rehydration is required for land application (to enable spreading as per existing operation), some of the volume reduction benefits may be partially reduced, or additional handling steps may need to be introduced.

Each option was scored against each criterion, with a score range of 4 (best) to 1 (worst). The MCDA is shown in Table 8.

Table 8 Revised MCDA for options

Criteria	Weighting	Base Scenario – ‘Business as usual’		Option 1 – Mobile Screw Press		Option 2 – Centralised belt press Unit		Option 3 – Centralised Drying Bed	
		Score (Raw)	Score (Weighted)	Score (Raw)	Score (Weighted)	Score (Raw)	Score (Weighted)	Score (Raw)	Score (Weighted)
Operational / maintenance simplicity	0.3	4	1.2	1	0.3	2	0.6	2	0.6
Ease of integration	0.15	4	0.6	3	0.45	2	0.3	1	0.15
Env. Risk [transport]	0.2	1	0.2	3	0.6	2	0.4	2	0.4
Env. Risk [odour]	0.25	2	0.5	1	0.25	3	0.75	1	0.25
Capacity and scalability	0.1	1	0.1	3	0.3	4	0.4	2	0.2
Total Score	1	12	2.6	11	1.9	13	2.45	8	1.6

As can be seen above, the business as usual scenario (option 0) scored highest overall – which is largely helped by no change to operations / maintenance regime. It can also be seen that the centralised system scores a close second (around a 6% difference, which is considered insignificant based on the qualitative review). It should be noted that if higher ratings were apportioned to the environmental risks, then the centralised system would come out in front.

Following completion of the MCDA, a cost-benefit assessment was undertaken to integrate the economic and non-economic outcomes. The NPC for each option was combined with the corresponding MCDA score to derive a cost–benefit ratio (nett present costs, divided by MCDA score, which provides a cost per benefit, so the lower value, the better). This is shown in Table 9.

Table 9 Cost-benefit ratio assessment for options

Item	Base Scenario – ‘Business as usual’	Option 1 – Mobile Screw Press	Option 2 – Centralised belt press Unit	Option 3 – Centralised Drying Bed
NPC	\$6,325 k	\$3,380 k	\$3,700 k	\$2,865 k
MCDA score (weighted)	2.6	1.9	2.45	1.6
Cost-benefit ratio	\$ 2,433	\$ 1,779	\$1,510	\$1,791

Based on this analysis, Option 2, the centralised dewatering press, is considered the most favourable option, and indicates that despite the high capital investment required, provides a range of benefits for Council (annual costs over time as well as environmental benefits).

The existing business as usual arrangement comes out last (least preferred), and indicates the benefits of change to the existing system.

While a mobile press, may be suitable, changes to pump out arrangements and logistics of storing unit, and operating system at each septic tank, indicate a few disadvantages.

It is noted that both the MCDA and NPC assessments rely heavily on a range of assumptions and simplifications relating to capital costs, achievable dry solids content, maintenance requirements, and operational practices. As such, the cost-benefit results should be viewed as a tool to support option selection and high-level budget planning, rather than as a final cost assessment. GHD strongly recommends further Council-led analysis using detailed operational cost data and possible site-specific trials to inform final investment decisions.

5. Preferred option

The preferred option involves the design and installation of a centralised dewatering press to enable on-site sludge dewatering as well as septage management. The system is designed to operate during WWTP operational hours and would involve a new sump to collect and mix septage and WWTP sludge.

A preliminary general arrangement and flow schematic diagram are depicted in the figures below.

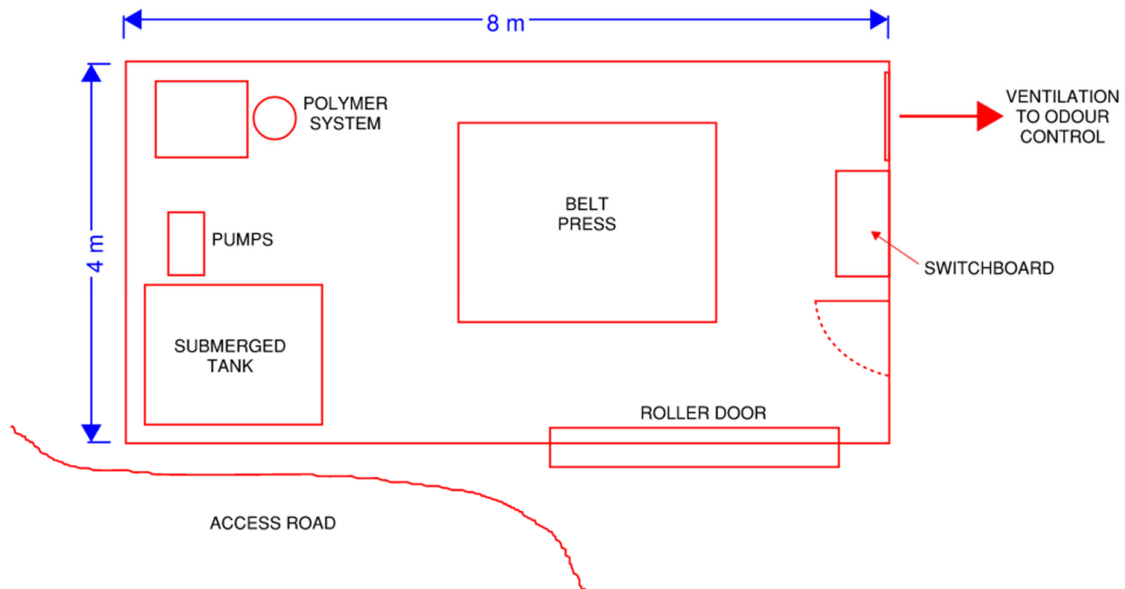


Figure 15 Centralised belt press general layout

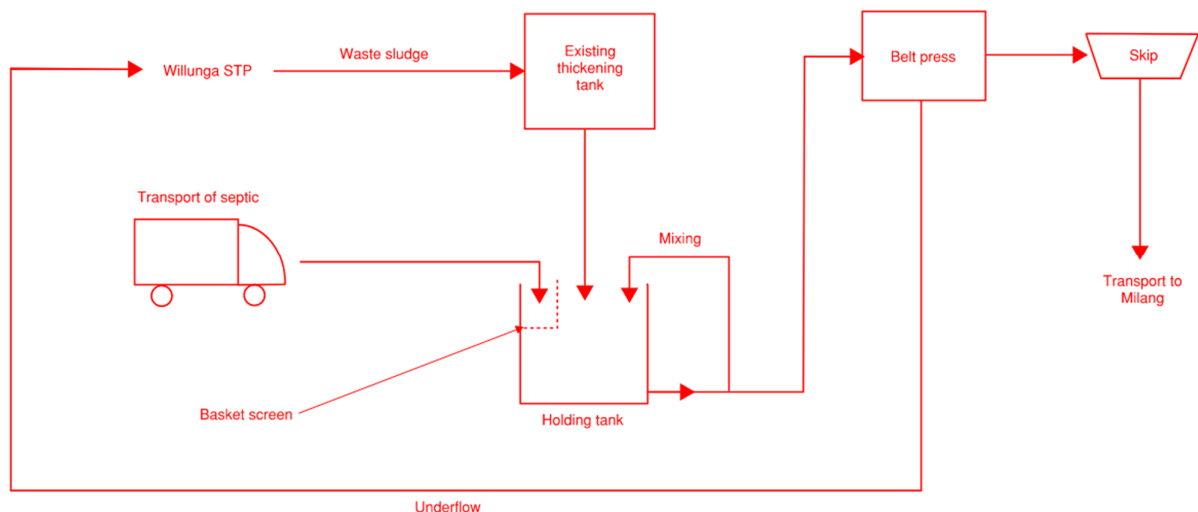


Figure 16 Centralised belt press process flow diagram

A potential location at the WWTP site is indicated in the figure below



Figure 17 *Possible site of sludge dewatering centralised facility at Willunga WWTP*

6. Summary, conclusions and recommendations

6.1 Summary

The City of Onkaparinga is reviewing options to improve management of septage generated from its Community Wastewater Management System, with the objective of reducing sludge volumes, transport requirements, and associated operational costs. Council currently undertakes septic tank pump-out operations across its CWMS, with collected septage and wastewater treatment plant sludge transported to Milang for land application.

GHD was engaged to review the feasibility of adopting dewatering technologies as part of its existing septic tank pump-out operations. After an assessment of a range of both mechanical and passive dewatering technologies, as well as the suitability of either mobile or centralised deployments, GHD shortlisted the following options for comparison:

- **Option 1 – Mobile screw press:** Implementation of a mobile screw press dewatering unit, containerised, for dewatering at the septage collection point
- **Option 2 – Centralised belt press unit:** Implementation of a belt press unit at a centralised location (nominally Willunga WWTP)
- **Option 3 – Centralised drying bed:** Implementation of a centralised drying bed for sludge dewatering, located in either STP site or separate Council-owned site.

Each of these options were assessed against Council's current CWMS operational regime (Base Scenario). All options assessed have the potential to achieve sludge volume reduction prior to disposal, however each presents different operational, cost benefit, and logistical aspects for consideration.

In progressing any alternative option, Council will need to consider alternative spreading of dewatered material, since current liquid spreading is practised. Adoption of a mobile or centralised system will require a more extensive analysis of cost savings, and operational considerations based on Council's full knowledge of current operational costs and maintenance regime and validation of the final preferred method.

6.2 Conclusions

Based on GHD's review, there is significant cost advantage in changing from the existing tankering of raw septage and sludge. While spreading of dewatered sludge will need to be considered, utilisation of centralised mechanical dewatering technologies presents a viable option for Council to reduce costs and operational inefficiencies associated with the current CWMS operation. The assessment indicates that a centralised press represents the most appropriate option under current conditions, providing a favourable balance between cost effectiveness, ease of integration, environmental aspects and operational simplicity.

6.3 Recommendations

It is recommended that Council consider this analysis and undertake steps to review and confirm benefits and logistics, with the following steps suggested:

Planning:

- Confirm achievable sludge volume reductions and dry solids content
- Review application of dry solids at Milang (or another site) – Council may need to negotiate a suitable alternative transport method with their transporter for spreading. If this is difficult, Council could negotiate with a composter (such as Peat Soils) to take the dewatered material
- Evaluate potential additional operational complexity, including operator requirements
- Determine suitable equipment size and supplier for purchase of a belt press for dewatering of septage and WWTP sludge
- Confirm polymer requirements and impacts on operating costs

- Assess maintenance needs and reliability of dewatering equipment
- Confirm constructability and costs associated with establishment of the centralised system

Review and implementation:

- Adopt preferred dewatering system as part of the existing septic tank pump-out strategy and WWTP sludge management
- Develop design of proposed system for design and construct contract
- Develop operating and maintenance procedures, including operator training requirements (with Trility)
- Establish routine inspection, monitoring and maintenance arrangements to confirm ongoing performance (with Trility)
- Undertake a refined cost benefit analysis using data obtained from testing and Council-specific operational data for further improvements (if desired).

Appendix A

Cost Estimates

CENTRALISED DEWATERING FACILITY

Volume to be treated	460 m3/month	
Say	15 h / week	operation
Throughput	7.7 m3/h	

Capital Costs				
DESCRIPTION	Qty	Units	Unit cost	Total
Install fencing		0 m	100	0 say part of WWTP
Site preparation, excavation, foundations		50 m2	50	2,500
Excavation, cut and fill (embankments)		62.5 m3	50	3,125
Hardstands and additional civil works		200 m2	500	100,000
Building		32 m2	2,000	64,000
Dewatering unit		1 no.	65,000	65,000
Polymer dosing system		1 no.	35,000	35,000
Sump / pump station		1 no.	60,000	60,000
Controls / E&C		1 no.	50,000	50,000
Odour Control		1 no.	75,000	75,000
General Miscellaneous		1 item	25,000	25,000
TOTAL - base construction				479,625
Design, project supervision			20%	65,000
Contingency			30%	97,500
TOTAL COST				642,125

DRYING BEDS

Parameter	Volume (septage + sludge)
Volume to be treated	460 m3/month
Depth	0.5 m
Number of pads	4 say 10 days drying
Area of each bed	76.6666667 therefore ~75 m2
Dimensions	10 x 7.5 m

Capital Costs				
DESCRIPTION	Qty	Units	Unit cost	Total
Install fencing		0 m	100	0 say part of WWTP
Site preparation, excavation, foundations		400 m2	50	20,000
Excavation, cut and fill (embankments)		500 m2	50	25,000
Hardstands and additional civil works		250 m2	500	125,000
Access ramps to pads		4 no.	15,000	60,000
Front end loader		1 no.	75,000	75,000
General Miscellaneous		1 no.	20,000	20,000
TOTAL - base construction				325,000
Design, project supervision			20%	65,000
Contingency			30%	97,500
TOTAL COST				487,500

Annual costs

Maintenance		2.50%	8,125
Operators	400 h per annum	80	32,000
Front end loader operation	4 h per week	\$50.00	10,400
Electricity (kWh)	0	\$0.35	0
Maintenance sub total			50,525
Residuals disposal	420 m3 per annum	50	21000
Baseline operator fee for pump out	1600 per month		19200
Septage transport to central facility	8464 per month		101568
Total Annual Cost			192,293

Net Present Cost	5 % discount factor, 20 years	2,883,471
Delta NPC		-3,442,347

Note - all unit rates based broadly on GHD estimates from previous projects, other notes / allowances identified on next page

Base Scenario Business as usual		
Capital cost	\$0	
Monthly cost	\$42,300	month
Sludge Volumes requiring transport	460	m ³ per month
Sludge Volume Transport Cost Rate	92	\$ / m ³
Cost of Sludge Volume Transport	\$42,320	per month
Annual cost	\$507,600	year
Discount Rate (r)	5	%
Project / Plant Lifespan (n)	20	years
Annuity Factor (AF)	12.46	
NPC(A)	\$6,325,818	
Option 1 - Mobile Dewatering System (Screw Press)		
Upfront capital cost - dewatering system	\$400,000	
Shed and hardstand at WWTP for storage of unit	\$100,000	
Sludge volume transported to Milang	80	m ³ per month
Nominal septage servicing (nominal only)	\$5,000	per month
Monthly sludge transport cost to Milang	\$8,832	per month
Year polymer dosing cost	\$40,000	per year
Yearly O&M costs	\$25,000	per year
Total annual operating cost	\$230,984	
NPC(B)	\$3,378,571	
Delta NPC	-\$2,947,247	
Option 2 - Centralised Dewatering System (Belt Press)		
Upfront capital cost, building / facility at Willunga WWTP	\$642,125	
Sludge volume transported to Milang	65	m ³ per month
Monthly cost	\$5,980	per month
Monthly sludge transport cost to centralised facility	\$8,464	per month
Year polymer dosing cost	\$40,000	per year
Yearly O&M costs	\$32,106	per year
Total annual operating cost	\$245,434	per year
NPC(B)	\$3,700,778	
Delta NPC	-\$2,625,040	
Option 3 - Centralised Passive Dewatering (Drying Bed)		
Upfront capital cost, C0	\$487,500	
Sludge volume transported to Milang	35	m ³ per month
Monthly cost	\$3,220	
Monthly sludge transport cost to centralised facility	\$8,464	per month
Yearly O&M costs	\$50,525	per year
Total annual operating cost	\$190,733	
NPC(B)	\$2,864,455	
Delta NPC	-\$3,461,363	

Appendix B

Report summary presentation



→ **Mitch Laginestra**
Technical Director – Wastewater

CoO CWMS Innovation – On-site solids liquid separation

Welcome

1



Background

→ City of Onkapringa CWMS



2

Problem & Objectives

Council operates CWMS/STEDS: septic tanks at properties, solids periodically pumped out and disposed via land application at Milang.

Problem: a large proportion of collected material is liquid → high haulage frequency and cost.

Objectives:

- Review and evaluate suitable technologies/operational practices for septage and residuals management
- Assess feasibility, cost-benefit, and implementation pathways
- Provide recommendations, next steps, and supporting data for future funding/staging



3

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

3

Current sludge streams



4

Septic tanks pumped out by vacuum truck; septage transported ~50 km to Milang for land application

Willunga WWTP: IDEA process; gravity-thickened sludge tank; sludge tankered to Milang

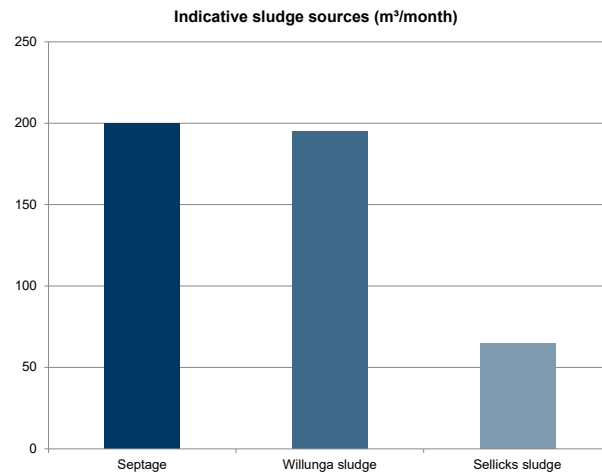
Sellicks Beach WWTP: SBR-based plant; waste sludge removed for disposal

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

4

'Business as usual' (BAU)

- Combined septage + WWTP sludge transported: ~460 m³/month
- Total current disposal cost: ~\$42.3k/month (~\$92/m³)
- Indicative annual cost: ~\$0.51M/year
- 20-year NPC (5%): ~\$6.33M



5

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

5

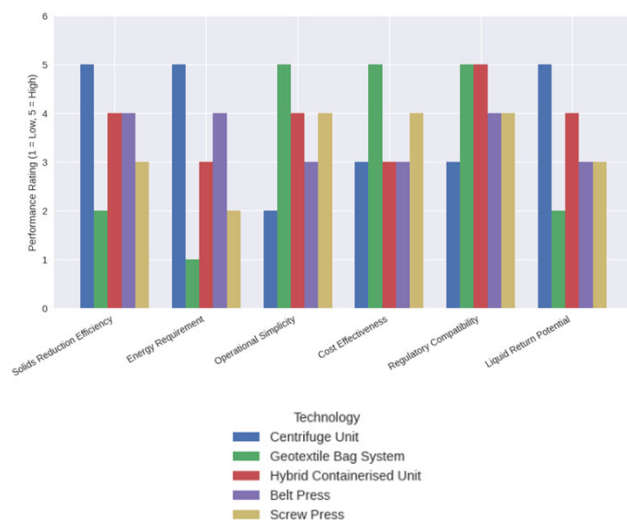
Review of Uni SA work undertaken

UniSA completed two student projects on improving CWMS septage management

- Project 1: Feasibility of onsite solids separation during septic tank pump-outs
- Project 2: Circular economy assessment (*excluded from review*)

Project 1 reviewed mobile dewatering technologies, including centrifuge units, geotextile bags, hybrid containerised units, belt presses, screw presses

Technologies assessed qualitatively against: Solids reduction, energy use, operability, cost, regulatory fit, liquid return



6

6

Key findings / GHD commentary

UniSA did not identify a single preferred technology

- Assessment was qualitative only (no weighting or combined scores)
- Several technologies mentioned, including:
 - Flottweg C3E-4/454 – containerised centrifuge (~20 m³/h)
 - Flottweg X4E – mobile centrifuge (15–50 m³/h)
 - Flottweg X5E – centralised centrifuge (40–100 m³/h)
 - Mena Water RoS 3Q q440 – containerised screw press (2–10 m³/h)

Key takeaway: mechanical dewatering can significantly reduce sludge volumes and transport costs

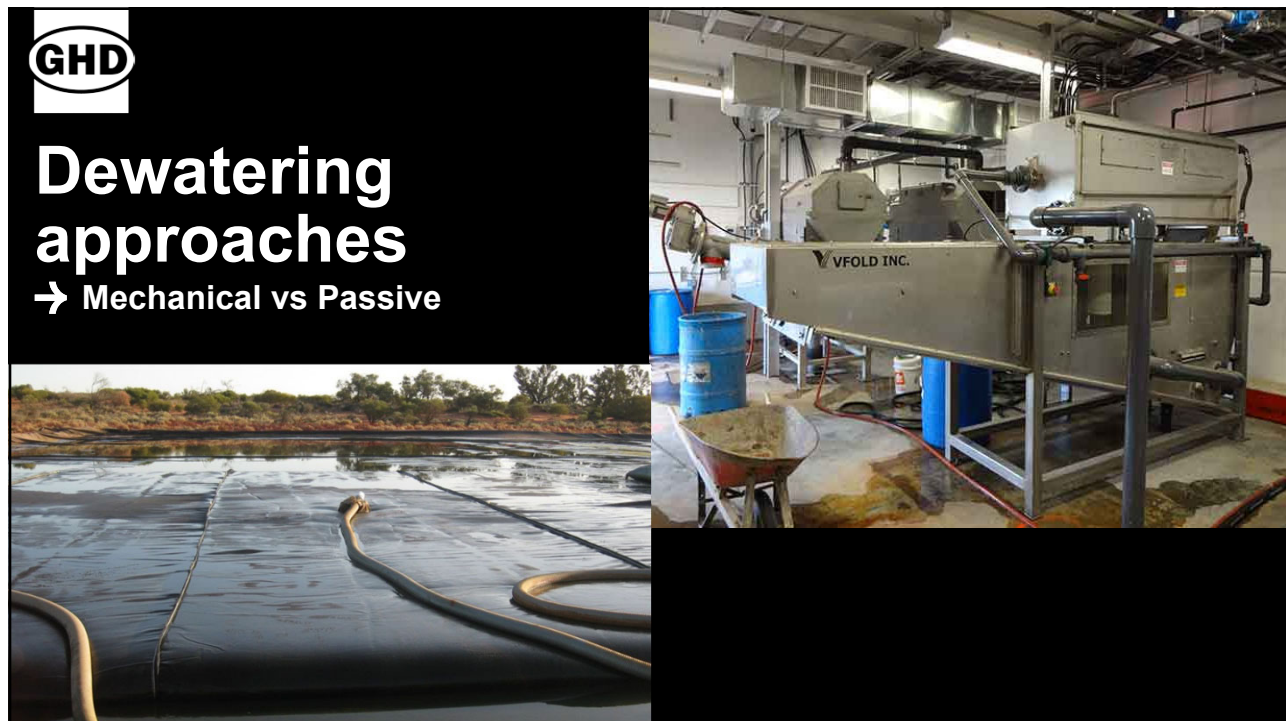
GHD notes:

- Operator skill and energy use are manageable in practice
- Mobile systems (15–50 m³/h) could operate within current pump-out timeframes
- Both mobile and centralised dewatering approaches appear feasible for Council

7

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

7



8

Mechanical dewatering approaches

Belt press

- 18–25% DS (polymer; continuous belt washing).



9

V-fold

- 12–15% DS (lower throughput; smaller, quieter).



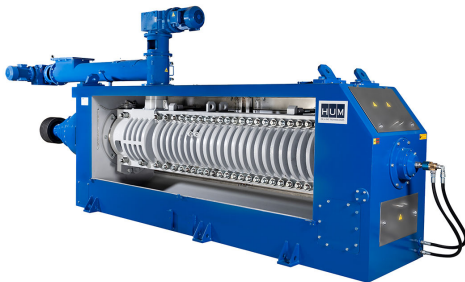
CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

9

Mechanical dewatering approaches (cont.)

Screw press

- 16–20% DS (simple; low noise; good for mobile).



10

Centrifuge

- 22–28% DS (high throughput; higher energy/maintenance).



CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

10

Passive dewatering approaches

Drying bed

- typically 30–40% TS under favourable conditions; larger land area and odour/climate sensitivity.



11

Geomembrane / geotextile bags

- gravity filtration + evaporation; needs polymer (like mech presses), drainage management and storage time.



CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

11



Options

→ Review and assessment

Considered 4 options (including do nothing)

WWTP sludge was a major contributor to cost so included

The three chosen alternatives are based on review of passive and mechanical and were considered to provide a range of options (1x mobile and 2x centralised)

12

Options

Base scenario

Continue existing arrangement

Continue existing pump-out and septage haulage to Milang

Pros

- No capital investment
- No change to operations or training
- Known and well-understood risks

Cons

- High transport frequency and cost
- Ongoing operational inefficiencies
- Increasing cost and environmental risk

Option 1

Mobile Screw Press

Dewater at point of collection, separated liquid returned to sewer, sludge cake hauled to Milang

Pros

- Dewatering at source reduces transport volume
- Minimal impact on pump-out time
- Low energy use, simple and enclosed system
- Lowest net present cost

Cons

- Polymer required
- Lower cake solids (~18–20%)
- Added maintenance and reliability risk
- Potential odour during operation

Option 2

Centralised Belt Press

Deliver septage to Willunga WWTP, mix/condition, dewater using belt press, sludge cake hauled to Milang

Pros

- Higher throughput and solids
- Shared use for septage and WWTP sludge
- Reduced odour and transport environmental risk
- Dewatering occurs while collection truck continues pump out operations

Cons

- Raw septage still transported to site
- Higher energy and maintenance demand
- Requires centralised site and infrastructure
- Increased traffic movements

Option 3

Centralised Drying Bed

Passive drying cells (~350-375 m² footprint), spadeable solids, haul to Milang

Pros

- Very low energy and chemical use
- Highest solids content (~30-40%)
- Simple, proven technology
- Reduced transport risk

Cons

- Large land area and high capital cost
- Long, climate-dependent drying times
- Labour-intensive operation
- Odour risk and EPA approvals required

13

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

13

MCDA

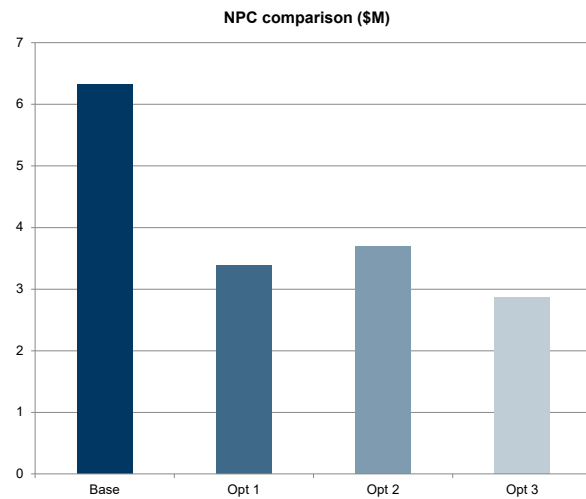
Criteria	Weighting	Base Scenario – 'Business as usual'		Option 1 – Mobile Screw Press		Option 2 – Centralised belt press Unit		Option 3 – Centralised Drying Bed	
		Score (Raw)	Score (Weighted)	Score (Raw)	Score (Weighted)	Score (Raw)	Score (Weighted)	Score (Raw)	Score (Weighted)
Operational / maintenance simplicity	0.3	4	1.2	1	0.3	2	0.6	2	0.6
Ease of integration	0.15	4	0.6	3	0.45	2	0.3	1	0.15
Env. Risk [transport]	0.2	1	0.2	3	0.6	2	0.4	2	0.4
Env. Risk [odour]	0.25	2	0.5	1	0.25	3	0.75	1	0.25
Capacity and scalability	0.1	1	0.1	3	0.3	4	0.4	2	0.2
Total Score	1	12	2.6	11	1.9	13	2.45	8	1.6

14

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

14

Net Present Cost review (20 years, 5% discount)



Compared with Base (~\$6.33M):

- Option 1: savings of ~\$2.95M
- Option 2: savings of ~\$2.65M
- Option 3: savings of ~\$3.46M

(High level estimates - sensitive to DS%, polymer, O&M and transport assumptions)

15

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

15

Cost-benefit ratio

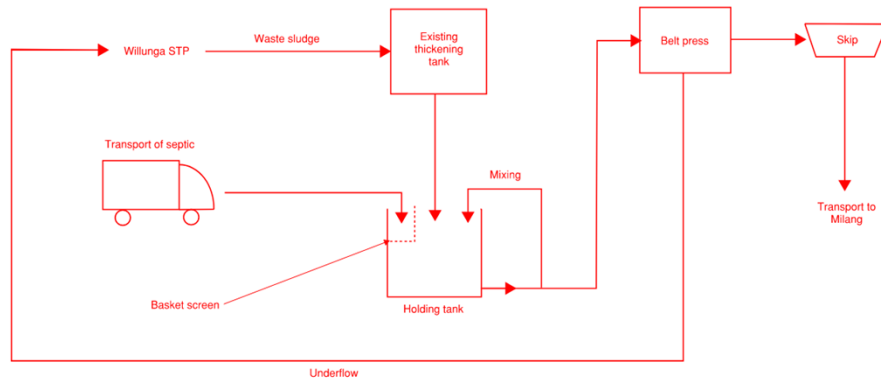
Item	Base Scenario – 'Business as usual'	Option 1 – Mobile Screw Press	Option 2 – Centralised belt press Unit	Option 3 – Centralised Drying Bed
NPC	\$6,325 k	\$3,380 k	\$3,700 k	\$2,865 k
MCDA score (weighted)	2.6	1.9	2.45	1.6
Cost-benefit ratio	\$2,433	\$1,779	\$1,510	\$1,791

16

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

16

Preferred option

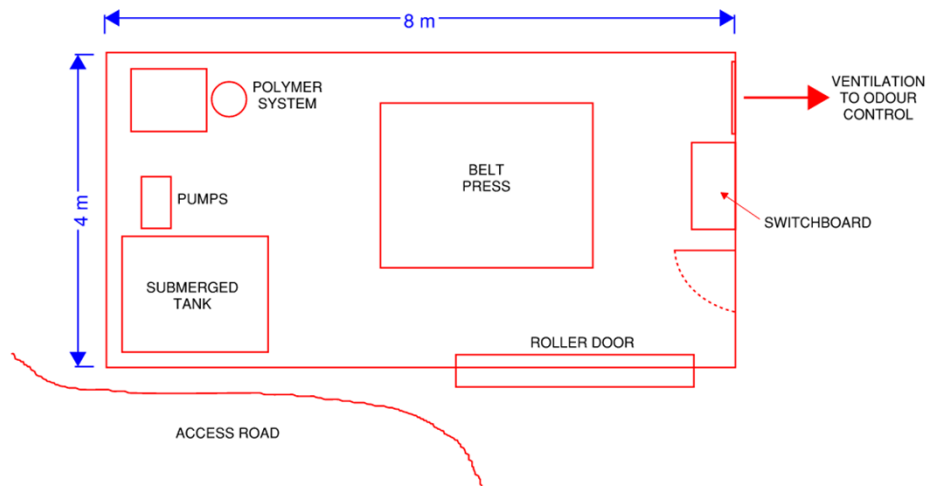


17

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

17

Preferred option



18

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

18

Conclusions

WWTP sludge is considered to be a major contributor to cost so has been incorporated into the review

Current sludge management involves a high annual cost (\$ 0.5 M p.a)

Alternative options offer significant savings over time

For each of the 3 alternatives there is a significant capital cost required up front \$ 0.4 – 0.65 M).

However, playback is within 3-4 years.

Some logistics need to be confirmed prior to adoption.

19

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

19

Recommendations

Pilot trial (mobile or at a centralised site) to validate achievable %DS and polymer demand.

Confirm pathway for separated liquid (return-to-sewer and WWTP loading/energy impacts).

Confirm Milang land-application requirements for higher-DS material (handling/rehydration needs).

Refine whole-of-life cost model using Council's detailed operational costs and trial data.

20

CoO CWMS Innovation – On-site solids liquid separation | © 2026 GHD. All rights reserved.

20



ghd.com

→ **The Power of Commitment**