THE SOUTH AUSTRALIAN APPROACH TO RURAL TOWNSHIP COMMUNITY WASTEWATER MANAGEMENT

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ABSTRACT

In South Australia, wastewater treatment and safe disposal in towns of less than 10,000 persons falls to local councils rather than water authorities. Community Wastewater Management Systems (CWMS) serve to collect, treat and re-use wastewater generated within townships. This paper outlines the elements of a CWMS and the common types of collection, treatment and re-use systems employed in South Australia. The decision process used in the design and implementation of a CWMS based on the author's experience is outlined. This paper includes a brief discussion of funding models for construction and maintenance of a CWMS. The viability of inclusion of stormwater capture and re-use infrastructure as part of a CWMS is discussed in three examples.

KEYWORDS

Community wastewater management, South Australia, CWMS, STED, septic tank, treatment, collection, re-use, reclaimed, stormwater capture.

1 INTRODUCTION

The single South Australians Water Authority – SA Water is responsible for collection and treatment of wastewater in Adelaide and the larger towns only. Wastewater management in small townships outside of these few areas is the responsibility of the local council. Typically, all houses in these areas are fitted with a septic tank and soakage trench, with a few on-site treatment systems designed to produce reclaimed water for garden irrigation. Both methods of wastewater treatment rely on sufficient area for soakage or re-use. This restricts development in rural towns, as allotment sizes need to be large enough to satisfy local council conditions as well as the South Australian Department of Health (DH).

Since the 1960's Septic Tank Effluent Disposal Schemes (STEDS) have been implemented in many townships in SA. These systems consist of a pipe network laid in the road reserve which collect household septic tank outflow via on-site plumbing and a connection point. Pump stations at low points in the network are used to transfer wastewater to a treatment site, typically a facultative lagoon at some distance from the township. Several townships have historically re-used the lagoon-treated water, but increasing public health standards and ageing equipment have reduced this practice. Disposal is therefore generally by leakage through the inadequate clay lining, soakage from the overflow area and evaporation.

Over the last decade, ongoing drought conditions have raised community awareness of water as a resource, shifting the focus of wastewater treatment from disposal to re-use. Collection systems and treatment methods have also been evolving giving communities greater choice in the collection, treatment and re-use of wastewater generated within their towns. The STEDS approach was replaced in 2006 with Community Wastewater Management Systems (CWMS). This incorporates collection of both septic tank effluent and full sewer connections to households.

2 REASONS FOR INSTALLING A CWMS

2.1 PUBLIC HEALTH

Septic tanks treat household wastewater by an anaerobic process, which is both slower than aerated treatment and less effective at removal of nutrients and potential pathogens. Biological Oxygen Demand (BOD) remains high, typically two thirds of the original wastewater BOD. The effluent from a septic tank has only limited potential uses, and must be kept away from human contact. Typically a sub-surface trench is built to receive the septic tank outflow. This method provides the separation from human contact, and allows the biological processes in the soil and plants to further the treatment of the wastewater.

Septic tank systems can fail in terms of effectively removing wastewater from human contact either from the septic tank itself, or the soakage trenches. Should the tank itself deteriorate, wastewater and sludge could soak directly into the ground or run off the site. Insufficient sludge removal can result in very short retention time, leading to poorly treated effluent.

Over time, soakage trenches become clogged, preventing the treated water from penetrating into the ground. This pooling wastewater may run off the site particularly during rainfall and flow onto a neighbouring property or into a public space. Even well built soakages can be suspect when built in rocky or sandy ground as the sub-surface flow can be unpredictable and may direct undiluted water to the environment outside of the property boundary.

Soakage trench failure is reduced by specifying a soakage area of sufficient size, or by alternating between two soakage areas. Septic tank treatment effectiveness is managed by regular pump-outs of the accumulating sludge, typically every three to four years.

Reclaimed water produced in lagoon systems is not considered fit for re-use in areas where public access cannot be prevented, such as sports ovals and municipal garden areas. Lagoon treated wastewater needs further filtration and disinfection before being considered safe for such applications, however the consistency of treatment is questionable making the cost of engineering out the risk similar to the cost of a mechanical wastewater treatment plant.

2.2 PROPERTY DEVELOPMENT

Large soakage trenches reduce the options an individual property owner has on what he can do on his property. For new multi-lot developments, specifications demanding several hundred square metres for soakage reduce the number of allotments that can be derived from the area being subdivided. Many people moving to small towns outside of the metropolitan area are doing so to retire, and smaller properties with lower maintenance are preferred. Transfer of wastewater off site enables the developer to offer smaller lot sizes, and gives greater choice of land use to the property owner.

A STED system relies on septic tanks being in place, which is somewhat restrictive in new areas. Sewer collection systems vary only slightly from STEDS systems, but provide the benefit of removing wastewater directly from the house in sealed pipework without requiring a septic tank. This is particularly of benefit in new developments. New schemes are now trending towards full sewer collection systems, as the price difference is relatively minor (see Section 4.2 below for details on the physical difference between a STED and a full sewer system).

In the case of any township with an existing STED system, new developments with wastewater flowing to an existing part of the network that is not designed for full sewer must specify septic tanks for new homes. Developers can construct a full sewer system within their development only if the wastewater flows to an upgraded pump station. Developers can connect either using a pump station within their own development or by extending their gravity drain to an existing pump station provided the pumps are sewer capable. The treatment system must also be able to handle an increased sludge load. If this is a facultative lagoon, full sewer pipework may be ruled out unless there are plans to upgrade to a mechanical wastewater treatment plant.

2.3 RE-USE OF WATER

Increasing prices for potable water along with periods of restricted access to this potable water make the availability of an alternative water source attractive to councils for municipal and sporting ground irrigation. Property developers can make use of the reclaimed water for street-scaping, or if of sufficient quality, returning it to homes for garden watering and toilet flushing.

The steady volume of wastewater generated within townships can become a valuable resource once it is collected and treated to a sufficient standard for the intended re-use. Costs for irrigating with reclaimed water are currently around 60% of potable water supply, with the reliability of having no supply restrictions imposed. As potable supply prices increase, the relative cost of reclaimed water will become even more attractive.

3 FUNDING A CWMS

The capital cost and running cost of each system is different depending on a broad range of factors. The method of funding the installation, maintenance and upkeep of a CWMS in SA is to collect annual fees based on the whole-of-life cost and the number of connections. Each element of the system is priced and an expected operational lifetime is assigned. Annual running and administration costs are added to the total, and the resulting net present value is divided by the number of connections to the system. This forms the basis for the CWMS annual fee.

In SA the fee is subsidised by the state government in order to keep payments in rural towns on a par with the annual sewer connection charged to residents of Adelaide or the four other cities with an SA Water sewer system (Port Lincoln, Port Augusta, Whyalla and Mount Gambier).

Financial analysis of the whole-of-life cost is done as part of the design process, both for new schemes and upgrades. It is often found that Councils have been under-charging, which would therefore require lending or other funding to perform major upgrades or maintenance to the system in the future. Following this financial audit process, Councils can choose to increase the CWMS levy to ensure that funds are available for the scheduled replacements and maintenance required.

4 ELEMENTS OF A COMMUNITY WASTEWATER MANAGEMENT SYSTEM

A CWMS comprises several elements each of which may take a variety of forms. These are the household wastewater transfer system, the community collection network, the treatment system, a storage structure, tertiary treatment, irrigation pipework and re-use applications.

4.1 HOUSEHOLD TRANSFER OF WASTEWATER

The householder needs to transfer the wastewater from either the septic tank or a direct sewer connection to the property boundary. Generally, this is achieved with a 100mm PVC pipe connected to the tank outlet or the household plumbing and extending to the property boundary where it connects to the community collection system at an inspection point (IP). For very long properties, or those separated by some distance from the community collection system, a household pressure system may need to be installed. Several companies supply systems that are capable of full sewer pumping, are fitted with an alarm system and have sufficient pressure to inject into a pressurised community pipe system if need be. They are generally fitted with pressure sensors and a control system so that pumps are shut down at high pressure. This might occur in a community where several household pressure systems are installed following a community wide power outage during which the sumps have filled past the pump trigger point. This control system eliminates the need for telemetry or other connection between multiple household pressure systems.

The overall design of the community system is done to maximise the number of households that can connect with a gravity pipe due to the ease of installation and the low maintenance associated with gravity flow systems. Responsibility for pipe maintenance or repair transfers from the householder to the network operator at the inspection point. This is also applied to installation, where the local council will install the community pipe network and the householder is given a period of time to engage a plumber to install on-site pipe work.

4.2 THE COMMUNITY COLLECTION NETWORK

The community collection pipe network serves to accumulate and deliver the wastewater to the treatment site. The first consideration is given to a gravity drain system. Pipe grades follow land slope but must have a minimum grade of 0.4% for STEDS or 0.5% for sewer. In flat terrain at this grade, trenches can exceed economical excavation depths for long pipe runs. Installation of pump stations at low points in the network collect the wastewater from the surrounding catchment and pump via rising mains to the treatment location. Community pump stations consist of a receiving chamber, (typically the maintenance hole associated with the pipe network), and a pumping chamber. The combined storage should accommodate 20% of predicted daily wastewater flow to meet DH emergency storage criteria. Extra storage is required if predicted peak inflow exceeds the pump's capacity. Dual pumps are fitted in the pump chamber and are programmed to run singly on alternating duty. Should one fail to start, or the high level alarm switch is reached due to compromised flow, the pump is turned off and duty is transferred to the other pump. An alarm signal is sent to the operator via telemetry or the mobile phone network. Pump stations are usually installed when pipe trench depth exceeds 3m, although the pump chamber may be deeper to achieve the requisite storage capacity.

Under some conditions, gravity drains and pump stations may not be the optimal solution for the collection of wastewater. Geotechnical conditions restricting deeper gravity drain systems may be hard rock, soft sand, high groundwater or other subsurface conditions that inhibit trenching to reasonable depths to allow long pipe runs at constant downward grade. Undulating terrain conditions may require too many pump stations to be economical as a whole. Widespread properties may also make the cost of gravity drains prohibitive on a per property basis. Alternative collection systems exist that may be more economical for the particular conditions prevailing in any given township. On-site or household pressure systems can be used in any of the above conditions by extending the pressure pipe beyond the property boundary as a common main network. These pipes do not require constant grade, but follow the terrain. They are therefore shallower than gravity pipe, and can be installed where hard rock or high groundwater prevent deeper trenching. They are also useful to collect wastewater from properties that are at some distance from the majority, as the cost of the combination of pressure systems and common main may be less than gravity drain over the same distance.

When a collection system design requires more than about five pump stations, a vacuum system may be more economical. These systems consist of a single pump station located within the community, at the treatment site or some other location. A system of pipes laid at a shallower grade with periodic "sawtooth" risers collects wastewater from collection pits serving up to four houses. When wastewater reaches a trigger level in the pit, a vacuum valve opens and the wastewater rushes into the vacuum pipe system. These systems suit townships that are long and flat such as those on foreshores or river fronts. They are commonly used in marina developments, as the pipes need to be shallow and collection lengths are often long. They can also be installed in undulating terrain by decreasing the length of the shallow grade pipe and increasing the number of short risers. As wastewater accumulates at the vacuum pump station it is pumped via conventional rising mains to the treatment site.

The optimum collection system for a community may be a combination of the systems described. These are known as hybrid systems, and generally occur as a combination of pressure systems and gravity drains and pump stations. The depth of a gravity drain can often be reduced by the addition of one or several household pressure systems at the upstream end. By reducing the length and hence the depth of an individual drain, the overall trenching cost as well the number of community pump stations can be minimised. A community pump station costs about 20 times a household pressure system, so providing several of these to householders to prevent the need for an extra community pump station reduces the community wide cost.

4.3 THE TREATMENT SYSTEM

Wastewater is treated by the action of bacteria which remove the nutrients via biological processes. This process commences in a septic tank, but occurs much faster when oxygen is supplied. Shallow lagoons up to 1.2m deep known as facultative lagoons is a passive method of providing sufficient surface area that with some mixing by wind and thermal currents provides oxygen for the biological treatment of wastewater. Lagoons are sized to retain wastewater for 66 days, and are usually compartmentalised to prevent mixing of incoming wastewater with the older more treated water. Older STED schemes generally employ a facultative lagoon for treatment of collected wastewater. These were easy to build in remote locations, required no mains power to run and space was generally available. Some schemes re-used the water treated in lagoons by pumping the outflow to the local town oval or other irrigation area. Some townships still re-use lagoon treated water, but modern public health standards require filtration and disinfection. Mains power is not always available at lagoon sites for this purpose, but solar pumps can be used to transfer water to a storage tank associated with the irrigation system. Some trials are underway in South Australia to augment the lagoon treatment process by addition of mechanical mixers to prevent stratification and encourage algal growth and hence increase oxygen levels. Some trials using enzymes to accelerate the biological processes are also being considered.

The alternative to facultative lagoons is mechanical wastewater treatment plants. These generally are a series of tanks that are differentiated into balance or receiving tanks, aeration or treatment tanks, decant tanks and storage tanks. Smaller plants may combine several functions in the one tank. Plants are fitted with programmable logic controllers (PLC) that monitor and control the performance of the plant. Levels of sophistication vary from level switches triggering various motors and valves, to flow sensors, oxygen probes and turbidity meters. More recent plants have communication facilities so that the plant owner and operator can access the various control settings and make alterations remotely. All plants must have a monitoring and contingency plan including auto-dialling alarms and sufficient hydraulic capacity to store 24 hours of wastewater flow above normal operating levels in the case of power loss or system breakdown.

The basic function of mechanical treatment plants is the provision of oxygen by aeration interspersed with anoxic periods which accelerates the denitrifying cycle. Lower nitrogen levels in reclaimed water are important for maintaining continuous re-use at an irrigation site. Most plants separate clarified treated water from the solids within the system by a period of settlement. The clarified water is drawn off to a decant tank before being pumped through filters and disinfected, either with chlorine or UV sterilisation. This reclaimed water is now ready for re-use appropriate to the level of treatment.

4.4 STORAGE OF RECLAIMED WATER

Storage structures used for reclaimed water from wastewater treatment plants are either tanks or ponds, which can hold much greater volumes of water. There are two main reasons for providing a storage structure; buffer storage to hold the outflow of a plant while re-use cannot take place and winter storage to hold reclaimed water for summer months to maximise the area of irrigation. Buffer storage enables the plant to continue operating and converting wastewater to reclaimed water during periods of high rainfall where disposal by irrigation could not take place, or during irrigation system breakdown and maintenance. Irrigation of public areas with reclaimed water generally takes place at night time to provide an extra degree of public safety. A buffer storage allows for the accumulation of daytime reclaimed water production for night time irrigation.

4.5 RE-USE OF RECLAIMED WATER

Filtration and sterilisation is required for both lagoon and mechanical plant reclaimed water. This generally takes place after storage, as some quality parameters may reduce during the storage period. Solids need to be removed so that sprinkler or dripper nozzles do not clog. A pump draws the water from storage and pumps it through an appropriate filter, depending on the level of human contact at the re-use site. Disinfection chemicals such as sodium hypochlorite are added in line, generally before the filtration process to prevent fouling of the filter media.

The purpose of the re-use site is to receive all of the water treated by the plant. Uses of reclaimed water range from woodlots, ovals, golf courses and road construction or dust suppression water. Commercial opportunities such as crop or pasture irrigation or fodder production as well as orchard irrigation are also possible with reclaimed water. Often a range of re-use sites is required to utilise the annual production of reclaimed water.

5 DESIGN CONSIDERATIONS FOR A CWMS

The main information required during the initial assessment of CWMS design options consists of a geotechnical investigation to determine the typical sub-surface characteristics and a basic survey to show the lay of the land. This information guides the selection of the type of collection system that can be constructed and enables engineers to determine the catchment layouts to a reasonable degree of accuracy. Following the considerations of all of the elements of the CWMS, a concept design report with recommendations is presented for the client's consideration. The various options will include a cost estimation to aid in the client's decision process.

Following acceptance of one of the design options plus any additional features determined in follow-up discussions, the design proceeds to preliminary and final stages aided by further geotechnical investigation and a full-feature survey.

In designing a new Community Wastewater Management System or an upgrade to an existing system, the approach used by consulting engineers at HDS Australia is to work backwards through the elements of the system and to consider the client's requirements and the engineering and environmental constraints at each stage. An assessment of the viability of adding stormwater capture to the CWMS is also made, as there may be cost savings associated with construction of the wastewater and stormwater infrastructure at the same time.

5.1 RE-USE

The first consideration in CWMS design is the available and potential re-use opportunities in and near the township as the Department of Health has guidelines as to the quality of treatment required for various re-use types. Household re-use such as toilet flushing and garden watering via a "third pipe" system requires such high standards of treatment and continuous monitoring that such treatment systems are generally not economically viable for rural councils. Areas of public access require lesser levels of treatment but with restrictions to watering times and controls to prevent irrigation during high wind or recent rain in order to prevent the reclaimed water leaving the re-use site by spray drift or runoff.

Priority is given by the designers to those sites used by the most residents, or those that are the most visible to visitors resulting in a broader community benefit. The most likely of these is usually the town oval, as this forms the focus of weekend sporting events, particularly in those country towns where a CWMS is required. Secondary to these are municipal gardens, which tend to take a smaller fraction of reclaimed water compared to the oval. Golf courses are often too distant from the township to consider as re-use sites, with relatively few users in country areas. They are also generally too large to fully irrigate, particularly when the town oval is already receiving a large fraction of daily reclaimed water production. When irrigation of the local golf course is viable, it is able to receive all of the reclaimed water generated within any country township.

If the area of existing re-use sites near the community is insufficient for the predicted reclaimed water production, then a new re-use area needs to be assigned and incorporated in the layout design and the water balance calculations. This new site may be a commercial irrigation opportunity, and we advise councils to approach local landowners for expressions of interest.

5.2 STORAGE

Once predictions of daily and annual production of wastewater and reclaimed water have been made, and the potential re-use sites and other uses identified, a water balance model is produced. If the re-use needs are less than daily production, then there is no point in storing reclaimed water over winter, and extra re-use sites need to be found. Alternatively, if the daily irrigation need is greater than the daily production of reclaimed water, then winter storage should be considered. The benefit of fully irrigating the sites in summer should be weighed against the cost of constructing a storage structure. Alternatively, in wetter areas there may be no opportunity to re-use water during winter and a storage pond will need to form part of the design.

Storage structures are sized by considering the daily production of wastewater taking into account seasonal population fluctuations, local rainfall patterns and volumes and the monthly output of reclaimed water to the various re-use sites. Annual input needs to balance annual output with buffer storage for wet years or some other contingency for excess water. The winter storage pond is the maximum monthly storage volume calculated in the water balance model.

Buffer storage is required if there is no warrant for winter storage and there is no other overflow irrigation area that can receive reclaimed water at any time. A buffer storage volume of two weeks is generally sufficient, with one week in dryer areas.

5.3 TREATMENT

The nature of the re-use determines the level of treatment required for the CWMS. Very small communities such as shack villages may not have any local sporting grounds or municipal areas and very low but variable daily wastewater flow. The only practical re-use may be a woodlot that can be fenced to restrict public access.

The treatment system for such an area may be a facultative lagoon or basic mechanical treatment plant without sophisticated controls or disinfection equipment. Where re-use is in a public space, treatment quality and consistency must be of a higher level than a lagoon. There may be two levels of treatment quality needs; one for general public space and municipal irrigation, and another for a more sensitive foreshore area or bowling green or location where access may occur at night such as a tourist area. Reclaimed water can be diverted from the treatment train at different stages, so that only the water requiring higher treatment undergoes that treatment.

A functional specification of the treatment plant is then prepared that takes into account the reclaimed water quality requirements and the redistribution to various irrigation areas. The plant design may incorporate irrigation pump and control systems, although transfer pumps moving reclaimed water to the storage tanks of existing irrigation systems is more common.

Design of facultative lagoons is increasingly rare in CWMS design. Technology improvements and commercial competition have resulted in falling supply costs for mechanical treatment plants, and the cost of constructing and lining a lagoon is increasing as is the level of environmental controls imposed by government departments. Evaporative loss from lagoons is significant, resulting not only in reduced re-use area but in saltier water. Long term maintenance such as de-sludging and reed removal are often not performed reducing the hydraulic retention time and decreasing the quality of the treated water.

5.4 COLLECTION NETWORK

Water quality needs and re-use locations do not play a major role in the layout and choice of collection system compared to the topography and sub-surface conditions. However the design location of treatment plant and re-use areas interact with pipe route design which needs to be considered when optimising the overall CWMS design. In the few cases where a facultative lagoon treatment system is either existing or the design solution, then the collection system may be restricted to STEDS only rather than full sewer due to the solids load.

Having considered the water balance for the re-use sites and available reclaimed water, it may be viable to incorporate a stormwater capture system into the CWMS to increase the annual irrigation water available. Captured stormwater is transferred in a separate pipe network to the wastewater, as large volumes of rainwater should not enter the treatment system due to the diluting of the biological processes. Stormwater can be stored with treated reclaimed water in the winter storage pond, so the pipes follow the same route and can be in the same trench provided codes for separation and pipe labelling are adhered to. There are significant cost savings to installing a stormwater capture system at the same time as a CWMS and should be considered at this time as separate installation after construction of wastewater infrastructure could make stormwater capture un-viable.

6 STORMWATER CAPTURE – THREE EXAMPLES: TUMBY BAY, COWELL AND EUDUNDA

When consulting engineers are engaged to provide an assessment of a township's wastewater collection, treatment and re-use options, the public often come forward with ideas for capturing stormwater for re-use. An engineering assessment can then be made of the merits of stormwater capture. Three examples given below illustrate the range of outcomes from such an assessment.

6.1 TUMBY BAY

Tumby Bay is situated on the Eyre Peninsula 700km by road from Adelaide. It is only 40km from Port Lincoln, a major regional centre, and supports its population of 1,200 on tourism, fishing and farming. At the time that the assessment of Tumby Bay's wastewater treatment system upgrade was being undertaken there was an existing STED system with 16 pump stations transferring wastewater to a facultative treatment lagoon that was known to be leaking all of its water not lost to evaporation through its clay liner, as re-use was no longer taking place. The eventual design decision was to replace the failing facultative lagoon with a mechanical wastewater treatment plant. An assessment of the predicted volume of daily wastewater flow was made, based on population figures and LGA and DH guidelines and verified with pump run times from the main pump station. The resulting volume of reclaimed water was shown to be sufficient for the town oval, foreshore grassed areas, a bowling green and several other applications.

Residents of Tumby Bay on Eyre Peninsula had observed large volumes of stormwater following natural run-off channels to low lying areas near the marina. They were keen to capture this water source and add it to the treated reclaimed water. There was warrant for assessing the viability of this, as sufficient irrigation sites could be found within Tumby Bay. Using rainfall statistics and an assessment of the catchment area, it was found that the predicted annual stormwater that could be captured was only 1% of the wastewater flow. Clearly the additional cost of capturing, temporarily storing and pumping the stormwater was not viable. This conclusion was communicated via Council to the residents who had raised the idea, and stormwater capture is not being pursued further in Tumby Bay at this time.

6.2 COWELL

The community of Cowell is 200km further north of Tumby Bay, with a population of 1,300 based on farming, fishing and the aquaculture industry, particularly oysters. There is no existing community wastewater management scheme (CWMS) in Cowell, with most residences using septic tanks and soakage trenches and about fifty on-site aerobic systems.

Members of Council were keen to capture stormwater as part of the CWMS design and installation. This was a viable approach, as the two main runoff routes through town could be fitted with stormwater capture sumps and pumps, and the stormwater mains could be laid in the same trenches as the wastewater pipework. The stormwater could then be directed to a storage pond adjacent to the proposed wastewater treatment plant rather than diluting the treatment process. The mixed stormwater and reclaimed water could then be filtered, disinfected and pumped to irrigation sites on demand.

When the population figures were assessed and predictions of likely reclaimed water production were made, it was seen that the large town oval was still too small for receiving the predicted reclaimed water flow. Council was actually asked to consider potential new commercial uses for the reclaimed water in order to dispose of the predicted annual flow. It seemed that the only warrant for stormwater capture was if this potential commercial use were of sufficient value to warrant the increased spending required to augment reclaimed water supplies with stormwater capture.

This conclusion was reported to Council, whereupon they clarified the basis for their interest in stormwater capture. They were concerned that contaminants from street runoff could affect the water in the bay in which their oyster industry is based. This industry is a major source of employment and revenue for Cowell, and it is considered that reducing the risk of producing poor product following rainfall runoff was worth the expenditure of designing and constructing a stormwater capture system. This requirement by Council changed the design approach taken to stormwater capture. It was now considered as a first flush diversion system similar to that fitted to a household downpipe but on a community scale. Furthermore, the first flush was not to be disposed of with the cleaner water being kept, but the other way around. The resulting updated design captures the potentially contaminated water by holding it in below ground storage tanks for a programmable period then pumping it into the wastewater system. This relatively low volume added to the treatment plant at a slow rate will not upset the biological processes in the plant, nor will it significantly change the irrigation area requirements.

6.3 EUDUNDA

Eudunda is a farming community located 100km north of Adelaide. Upgrades to the Eudunda CWMS commenced in 2003 with a report into the treatment upgrade and re-use options available to the community. The town oval had previously been irrigated with overflow water from the evaporation pond adjacent to the facultative lagoon, but this practice had ceased some years before. The local golf course is situated next to the oval and is visible from the township, making it a viable re-use site also. A treatment plant was constructed at the lagoon site and the lagoon was converted to a 20 ML plastic lined winter storage pond.

Eudunda is next to the Tothill Ranges, and rainfall runoff caused frequent high flows that overtopped the drainage channels and flooded the streets several times per year. A detention dam was constructed to reduce flow rates of stormwater through the town. The runoff route lies next to the main wastewater pump station which had recently been fitted with two new storage chambers, pumps and telemetry to the treatment plant as part of the CWMS upgrade. The existing rising main was inadequate for the flow received at the pump station and a future stage of upgrade works was to install a new rising main along a route lying outside the township 3km to the treatment plant.

The above factors combined to make stormwater capture viable for Eudunda; a high volume of stormwater was flowing past a point from which future pipework would be placed to direct flow to the treatment plant past the new storage pond, the runoff rate was reduced so duration of flow was increased enabling greater pumping time following a rain event, a telemetry signal from the plant could prevent pumping if the pond was too full and the golf course irrigation system had been installed so that the extra captured stormwater had a viable re-use site. When annual stormwater flows are measured, more water can be captured if required by the increasing of the storage pond size from 20 to 40 ML and by further reducing flow rate from the detention dam by holding and delaying the lowest portion of the dam without compromising its flood prevention function.

7 CONCLUSIONS

The implementation of Community Wastewater Management Systems since 1962 in South Australia has provided safe removal of wastewater from residences in 143 townships and settlements. Many of these schemes treat the wastewater to re-usable standard. Since 2007, 61 schemes in 32 local government areas have been upgraded resulting in 8.4 GL of wastewater being treated and re-used annually in South Australia. The approach by design engineers, the Department of Health, the Environment Protection Agency and the Local Government Association has resulted in efficient, sustainable and affordable wastewater treatment and re-use for communities isolated from municipal wastewater systems. These schemes provide significant water savings in the driest state in the driest inhabited continent.

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