SHERWOOD ROAD ENVIRONMENTAL IMPROVEMENT PRECINCT

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4th Annual WIOA NSW Water Industry Engineers & Operators Conference
St Stanislaus' College, Bathurst
20 to 22 April, 2010

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ABSTRACT

Council previously determined that the Sherwood Road precinct was in need of a sewerage system. Extensive investigations revealed the suitability of a zero effluent scheme and the need to address a significant stormwater problem. Many of the properties in the precinct were discharging stormwater and greywater (failing septic systems) to the lower adjacent properties. These issues were accentuated by road drainage passing through the properties.

To resolve these problems the Sherwood Road Environmental Improvement Precinct Programme was proposed. The programme includes implementing a KELE Effluent and Wastewater Treatment system coupled with an Evapo-Cyle system, in conjunction with a storm water collection and bio-treatment swale. Together, these systems proposed to achieve zero effluent output from 30 homes and resolve the stormwater issues of the precinct. Effectively, this is the implementation of integrated water cycle management.

KEYWORDS

Environmental, Evapo-Cycle, Effluent, KEWT, Swale, Sustainable, evapotranspiration, Sewer

1.0 INTRODUCTION

The Sherwood Road Environmental Improvement Precinct is located 9 kilometres from Kempsey. It is comprised of twenty-six small residential allotments. These allotments have an average size of 750m^2 which gives the precinct an urban appearance, amongst adjacent rural residential properties. The area utilises septic tanks to treat household sewage. The combination of small lot size, clay soil and poor stormwater management within the precinct has proved less than ideal to maintain functional septic systems. Amenity of the properties was poor to mediocre, raising in particular health risks where failing septics began surfacing in the property backyards and 'over the back fence'. Many of the properties were on the brink of having to install very expensive pump out septic systems, as alternative renewals of the septic systems were impractical at this location.

To the south of the allotments (see Figure 1) is Warnes Creek which ultimately flows into the Macleay River up stream of Kempsey. Environmental issues from the Sherwood Road precinct had the potential to impact much more than a just a localised area.

The land between the residential allotments and Warnes Creek was approved for subdivision. Residential development of this land was difficult in the current context of pollution from the above properties. However, the location of the land would later present opportunity for Council's proposed solution to the combination of environmental issues.

Ownership and acknowledgment of the environmental issues was not readily accepted in the precinct. Council conducted a series of public meetings with the residents of the area whom had difficulty seeing the detrimental environmental, health and amenity issues.

Many emphasised 'it did not trouble the residents, as they had lived there for years without complaint'.
Others were angry at being halted on house extensions until their failed sewerage systems could be addressed. The general consensus of the residents was 'that it was not their problem (if it was over the fence)' and 'why should they have to pay for it?' After several meetings the residents acknowledged the problem and wanted a solution of low cost impact to them.

A number of conventional systems to treat wastewater were investigated, utilising standard and conventional reticulation layouts. Two major options for interconnecting with nearby (3.6km) existing private sewerage system (Mid-North Coast Correctional Centre) were discounted on the primarily basis of limited spare capacity. A number of the alternative systems investigated are listed below:

- Localised sewage treatment plant (eg at the nearby airport)
- Conventional Septic Tank and Drainfields
- Raised Bed and Septic Mound systems
- Advanced Material Media Filtration systems
- Aerobic Septic Systems
- Wetlands and Constructed Wetlands for sewage or effluent treatment with disinfection Systems
- Waterless and Low-Water and Greywater-Separation systems, including composting toilets, incinerating toilets, chemical toilets, and greywater systems

The main problem with most of the alternative systems was the large footprint, in a small precinct. Localised sewage treatment plants were not cost effective and there was limited opportunity for effluent reuse or effluent disposal.

Following negotiations, Council purchased the property between Warnes Creek and the allotments and determined a small footprint combination of treatment systems for the precinct. Two stand alone systems were placed in combination, to achieve a zero effluent output system. The KEWT system was chosen to take the bulk of the effluent and an Evapo-Cycle system offered further back up treatment capacity to cater for high load periods, such as wet weather events and allow establishment time for the KEWT system. A series of bio-treatment swales were chosen to address the stormwater issues.

Figure 1: ***The Sherwood Road environmental improvement precinct***

2.0 DISCUSSION

2.1 The Theory – the KEWT System

The Kele Effluent and Wastewater Treatment (KEWT) System was developed by Ben Kele with the assistance from the Plant Science Group of the Central Queensland University. It is unique insomuch it uses a mixture of biological treatment systems to treat the effluent and allow it to successfully supply water and feed nutrients into the growth of selected vegetation. The KEWT system concept is a system of underground filter beds, connected by pipes within evapotranspiration channels (channel pots).

The KEWT System recirculates through the channels pots and the evapotranspiration volumes are determined by plant and soil surface area. Trees can have a massive surface area, when compared to grass or bare ground, because of the relatively large leaf surface area. Therefore, a tree will have a much higher evapotranspiration volume per square metre of ground area than grass. This means that channel pots using the appropriate tree species can have a much smaller environmental footprint than systems that using grass only.

The KEWT System channel pots are planted out with a series of native/exotic plants and bamboos of ranging heights. The plants use the treated effluent as their primary water source and the plant variety furthers the effluent absorption and nutrient uptake.

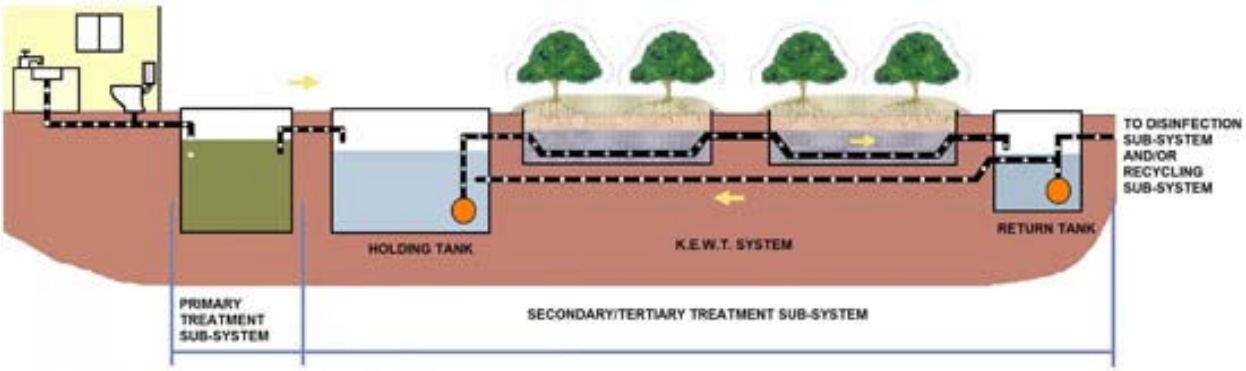

Figure 2: ***The KEWT system at Sherwood***

The Sherwood Road System accepts effluent from the property septic tanks, via a conventional gravity sewer system (see Figure 1). The effluent collects in the holding tank and is pumped to the channel pots. The effluent flows through the channel pots to the return tank, and is pumped back to the holding tank, unless a high level switch has been tripped to invoke flow to the Evapo-Cycle system.

2.2 The Theory - Evapo-Cycle System

The Evapo-Cycle TM system is a pressure dosed evapotranspiration-absorption/mound hybrid system designed to evaporate the applied wastewater to atmosphere following biological treatment. It is a contained system that basically eliminates the possibility of pollutants being transported off site to contaminate the environment. Given the proximity

of Warne's Creek at Sherwood, this safeguard was environmentally important.

When used with primary wastewater treatment systems (septic tanks) the small footprint Evapo-Cycle is proven to significantly reduce pathogens while applying zero, or very little, hydraulic loading on the land. Evapo-Cycle was originally development at the Centre for Environmental Studies at the University of Tasmania; it complies with AS/NZS 1547:2000 as an alternative system. Since 1996 Evapo-Cycle has operated on a number of commercial and domestic sites throughout Tasmania and Adelaide.

Effluent is introduced to the Evapo-Cycle system under pressure and evenly along the central distribution line of the core treatment zone (see Figure 2). The Core Treatment zone is filled with a specially graded aggregate which promotes the formation of a zoogleal film. Zoogleal film forms on the surfaces of the core material, immediately adjacent to the central distribution line. This film creates a zone of restricted flow, maintaining an unsaturated flow in the restricted flow zone. Unsaturated flow is necessary to attain the required treatment for pollutants, of critical concern, are the bacterial and viral pathogens.

The Evapo-Cycle pressure distribution system utilises a short term "dose/rest" loading cycle. The float switch activates the pump and runs a "dose" of effluent to the core treatment zone. This process limits the volume of effluent loaded at any one time, preventing continual saturation.

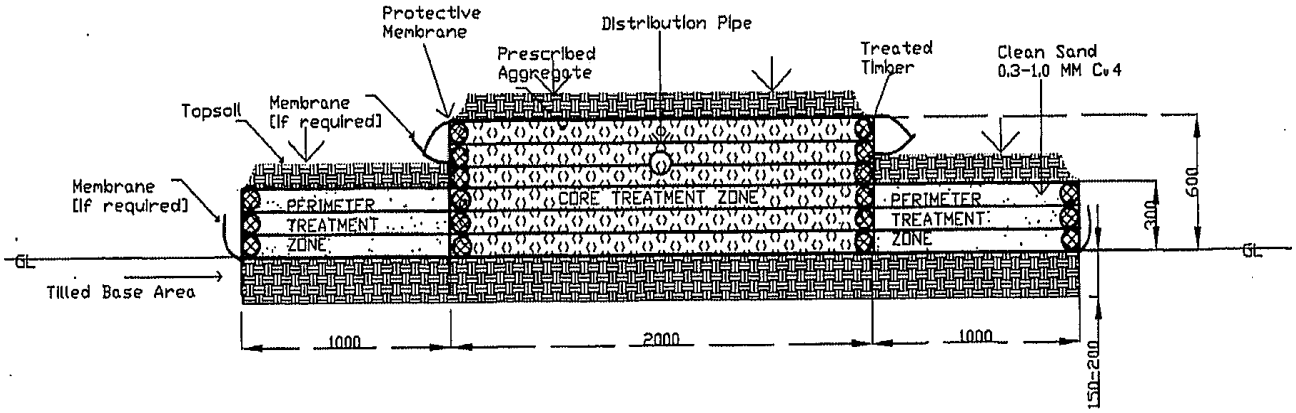

Figure 3: ***Cross sectional view of the Evapo-Cycle***

2.3 The Theory - Biotreatment Swales

Biotreatment swales were proposed to address the stormwater issues. Stormwater drainage from the homes would be directed to biotreatment swales and swales would also accept drainage from the wider precinct's catchment, including the roadways.

Biotreatment swales are vegetated, moist channels with rock inclusions to drain and retain water run-off, providing treatment prior to entering the waterway. Vegetated roadside swales are also known as "bioswales" or "biofilters" and have become an accepted alternative to pipes and concrete-lined trenches, are cost-effective and an efficient solution for stormwater quality management. The bio-treatment swales reduce flow velocities and assist in protecting waterways from frequent storm events, as they utilise overland flow and mild slopes to convey the water slowly downstream. After planting out the swale, additional rocks, 'rip-rap', is placed to preventing erosion and

disperse the water.

The biotreatment swales use three main water treatment processes listed below.

- Physical - settlement of silt and other particles within temporary ponds and filtration of particles by the vegetation and permeable rock walls
- Biological - uptake of nutrients and pollutants by the vegetation
- Chemical - sunlight and aeration provides some benefit

At Sherwood, two biotreatment swales were identified as necessary to resolve the stormwater issues.

2.4 The implantation - Construction Phase And Beyond

Construction commenced early December 2008 following lengthy planning and investigative processes. The two biotreatment swales were the first of the treatment systems constructed. Early successful construction with community involvement and property amenity improvement, improved community support for the programme, began to instil ownership of the programme and improved the construction site for the effluent treatment systems. Part funding for the biotreatment swales was provided under the Federal Government's Community Water Grants (Water Quality Improvements) Programme.

The local school, Aldavilla Primary, has been involved in the programme, assisting in the planting of the principal biotreatment swale. The school has a high environment focus being recently awarded Waterwise status. The biotreatment swale construction project enabled the children's understanding of water quality improvement techniques to be expanded through effective, hands-on activity in a real local situation. Council's Waterwise educator was in attendance to help facilitate the links between in-class theory and on-location practicalities and experience.

Construction of the K.E.W.T. and Evapo-Cycle systems commenced mid 2009. A pilot plant is currently in its commissioning phase. The pilot plant serves 6 homes and the capacities of the KEWT & Evapo-Cycle systems will be confirmed, prior to duplication of the systems to serve all 30 properties. At Sherwood, the pilot plant has 8 channel pots containing 210 plants of 10 different species. The plants for KEWT system have been carefully selected for their good adaptation to the local climate, to limit weed infestation and preference has been given to native species where practical.

Figure 4: ***Post construction and pre-commissioning***

Management of communication with the residents has been crucial. A key element has been community involvement and education. This has extended to a series of information pamphlets describing progress and the technology, a picture site sign and volunteer involvement during the planting phases. Plumbing surveys in February 2009, to detail the property connections for the pilot plant and update the pilot plant's environmental assessment were met with enthusiastic co-operation of participating residents. Open communication has enabled residents to move forward from the initial lack of ownership/acknowledgment of their local environmental issues.

3.0 CONCLUSION

The Sherwood Road Environmental Improvement Precinct now has construction of the biotreatment swales and pilot plant for effluent treatment is complete. However it was not all plain sailing. The construction experienced setbacks with prolonged wet weather with four natural disaster declared floods occurring in 2009 and unexpected power connection delays. The biotreatment swales survived severe inundation during the floods and recovered well. The Precinct's properties were also thankful for the reduction in stormwater inundation achieved during a very wet year, as the stormwater solutions had been completed before the first 2009 flood.

The Sherwood Road Environmental Improvement Precinct will be a sustainability demonstration site for Kempsey Shire Council. The combined environmental issues in this precinct are being resolved for today and into the future within the limited financial means of a financially challenged Council. Considerable interest in the performance of these treatment systems has been generated, as it is a sustainable low cost sewerage solution that is replicable and requires only a small footprint. The Council staff have worked hard to pull together this innovative, yet practical solution and have benefited from the assistance of the contractors and consultants involved in the project.

A major outcome of the Sherwood Road project will be the improved community relations established in Sherwood because of the community involvement through the development of solutions and then the implementation of those solutions. And, in essence, that is what local government is about; sustainably delivering the infrastructure to serve the needs of your community.

4.0 ACKNOWLEDGEMENTS

KEWT system - Brendan & Matt McKennariey & Graham Bryan from GBG

Enviro-Cycle system - R M C Patterson (Environmental Consultant) and Raymond Gouck

Gary Smith, Anne-Maree Burke and Cath Anthony for assistance in this paper development

Special thanks to Aldavilla Primary School, Kempsey Shire Council staff and the local community who helped whom have supported and helped bring this project to fruition