Smart Water Fund

Final Report

Curlewis Recycled Water Project

Project: 72R-7043

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Smart Water Fund

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Final Evaluation Report

Background/Literature

Curlewis Golf Club relies on a strong membership base to support the ongoing operations of the business. Fundamental to securing this base is providing a golf course that presents well 365 days a year. Since opening in 1970, Curlewis Golf Club had relied on potable water for the majority of course irrigation, with harvested stormwater being used to supplement potable supplies when available. This water strategy served the Club reasonably well until 2006/2007 when Level 4 water restrictions were imposed and rainfall at Curlewis was 276mm vs. the long term average of 625mm. Lack of water had an immediate impact on course condition and membership levels. Modest amounts of water (20ML vs. required 70ML) over the past 5 years enabled turf survival; however, membership slowly declined from ~900 to 580. Unless the Club secured a long term, sustainable and cost effective source of irrigation water the ongoing viability of this important community asset would have been uncertain. If membership had dropped below 550, services at the Club would need to be cut, which would be likely to reduce membership further and ultimately lead to the closure of the business.

This report follows the successful implementation of the recycled water from sewer mining project at Curlewis Golf Club. Recycled water now constitutes the majority of water used for irrigation. During periods of peak demand stormwater is used to supplement the recycled water supply.

The excellent condition of the course resulted in it being ranked in the top 50 public courses in Australia in late 2011. A sustainable and cost effective source of irrigation water will strengthen and improve this ranking over time and result in a growing membership base.

Aims and objectives

Economic objective/s
Economic objectives of the project include:

- Increase membership levels from 580 to 880 over the next 4 years.
- Increase green fee revenue from $140,000/year to $170,000/year over the next 4 years.
- Deliver the project for a capital cost of $1.79M.
- Operate the project for a cost of $60K/year.

Social objective/s
Social objectives of the project include:

- Continued focus on the importance of Curlewis Golf Club as a community asset.
- Increase number of golf games at Curlewis from 35,000/year to 45,000/year over the next 4 years.
- Provide an opportunity for community and industry education on the value of water.
- Provide a template for recycled water from sewer mining that other similar facilities can adopt.

Environmental Objective/s
Environmental objectives of the project include:

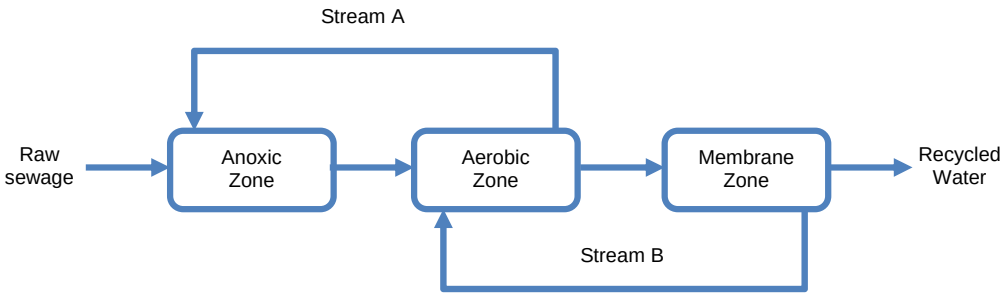
- Retain the golf course as community green space.
- Retain and enhance Flora and Fauna on the Golf Course.
- Secure a climate independent and sustainable source of high quality irrigation water.
- Eliminate reliance on potable water for irrigation.
- Beneficially reuse nutrients that would otherwise be discharged to the environment.
- Reduce the use of artificial fertilisers at Curlewis Golf Club.

Project overview

The Sewer Mining and Recycled Water Treatment Plant at Curlewis Golf Club is a Membrane Bio-Reactor (MBR) and Chlorination process that converts municipal sewage into recycled water for medium exposure risk end uses (Class B). The plant produces up to 250 kL/day of recycled water. The golf club uses the recycled water for controlled access irrigation.

MBRs remove dissolved organics that cause biological oxygen demand (BOD), and suspended materials in wastewater. MBRs replace sedimentation and tertiary filtration in conventional wastewater treatment systems. The MBR Plant feed is sewage collected from the Clifton Springs to Leopold DN375 rising main.

A unique design feature of the new plant is the ability to adjust the nitrogen levels in the recycled water to match the demands of the turf. Specifically the nitrogen demand is high in Spring / Autumn and low in Summer. The recycle ratio (Stream A below) from the aerobic to anoxic zone can be varied to adjust the level of nitrogen in the recycled water (high recycle ratio = low nitrogen and low recycle ratio = high nitrogen). Importantly the recycle ratio between the aerobic and anoxic zones can be adjusted independently of recycled water production (Stream B below).



The installation at Curlewis Golf Club includes:

- Connection into the Clifton Springs to Leopold rising main to extract raw sewage and discharge trade waste.
- Construction of a 250kL/day plant to produce Class B recycled water including:
  - Pumping system for raw sewage extraction.
  - Flow balance tank for balancing supply and demand of raw sewage.
  - Plant feed pump and macerator to reduce the solids to small pieces and prevent blocking of downstream equipment.
  - Inlet screening to 2mm to protect the membranes downstream. Screenings are dewatered and directed to a skip bin for off-site disposal to landfill.
  - Biological treatment using anoxic and aerobic zones for biodegradation of the wastewater matter (i.e. BOD) and nutrient (i.e. nitrogen) removal.
  - Membrane filtration to separate the treated water from the mixed liquor suspended solids producing a filtrate (referred to as permeate) and act as a disinfection barrier.
  - Separate internal recycle streams (aerobic to anoxic and aerobic to membranes) to enable nitrogen in recycled water to be adjusted independent of production.
  - Chlorination to act as an additional disinfection step.
  - Recycled water storage and transfer pumps to irrigation system.
  - Trade waste pumping station to return the Waste Activated Sludge (WAS) to the rising main.
  - Interconnecting pipework, valves and fittings.
  - Instrumentation, allowing for automation, monitoring and control of the complete plant.
  - Telemetry for communication with the Barwon Water Drysdale Pumping Station.
  - PLC and SCADA, which is also configured to allow remote access for process monitoring and trending.
- Equipment building.
- Construction of access roads to recycled water plant.
- Construction of pipelines to deliver recycled water to irrigation system.
- Provision of services (i.e. water / power / communications) to recycled water plant.

- Construction of a high voltage electrical power supply system.

Key findings

Include findings from the nitrogen control unit.

- Successful control of nitrogen at high and low levels
- Significantly reduced N and P fertiliser since commissioning
- No fertiliser addition on fairway and greens
- Some used on tees for renovations only
- Currently monitor mow clippings volume, leaf growth and disease and all appears normal. Will take samples leading into winter to confirm soil composition is acceptable and whether additional nutrients need to be added, such as potassium, magnesium or gypsum.
- Financial savings from purchase of fertiliser will pay for the nitrogen control unit in approximately 24 months.

The Curlewis Recycled Water Project has demonstrated a number of Victorian firsts and proven the viability of a decentralised approach to addressing water issues:

- **First sewer mining project to access a sewer rising main**.

  Raw sewage is from a 375mm rising main owned / operated by Barwon Water on the Northern boundary of the golf course. The applicants believe this is the first sewer mining project in Victoria to extract raw sewage from, and dispose of trade waste to, a sewer rising main.

- **First sewer mining project to utilise Membrane Bioreactor (MBR) technology**.

  MBR technology is used to produce high quality recycled water as, on this scale, it provides a number of operational benefits (i.e. low operator involvement / high recycled water quality / high turndown) over conventional approaches. The applicants believe this is the first sewer mining project in Victoria to utilise MBR technology.

- **First recycled water project to incorporate variable nitrogen output**.

  The recycled water production process is configured to vary the nitrogen output based on the nitrogen demand of the turf. The applicants believe this is the first recycled water project in Victoria and Australia to be designed to incorporate variable nitrogen output to meet seasonal turf demand.

The plant has been successfully commissioned and to date has produced water that meets or exceeds the project objectives.

Return on Investment

The return on investment will be determined following four years of operation. Non-cost factors will be considered when determining the performance of the investment, in particular the security of supply

Recommendations

There are numerous facilities around Australia similar to Curlewis Golf Club such as:

- Golf courses
- Race courses
- Park and Gardens
- Sporting facilities
- Industrial water users

The majority of these facilities are all facing the issue of water sustainability. This plant provides a working answer to the question of how to secure a long term and cost effective water supply following a decentralised approach. Non-potable supplies such as stormwater and groundwater are not always available or do not deliver the required reliability. Subject to the availability of sewage, recycled water from sewer mining has the

potential to provide a cost effective, reliable and most importantly a climate independent source of non-potable water.

The design of the proposed recycled water plant at Curlewis Golf Club has been based on a "**cookie cutter**" approach. This will enable the highest degree of transferability from Curlewis to other sites detailed above. Key features that enable the project at Curlewis to be transferred to other projects include:

- **High quality recycled water**

  The proposed recycled water plant is based on MBR technology. This enables the consistent production of high quality recycled water which can be further treated if required by additional disinfection (i.e. UV) or salt removal (i.e. RO).

- **Modular construction**

  An innovative aspect of the proposed recycled water plant is the use of pre-cast concrete segments for the construction of the bioreactor. This construction approach reduces cost, time and is perfectly aligned with the "cookie cutter" philosophy. Various segments can be stacked to suit the design flow rate of the proposed plant. The proposed Geelong based supplier of the pre-cast concrete segments – VIC PITS – has operations all along the East Coast of Australia, thus enabling the design to be easily transferred to other sites without significant transport costs.

- **Space for options**

  The equipment building which sits adjacent to the bioreactor has been laid out to enable additional equipment, such as pumps, chemical dosing, etc, to be added without significant changes to the overall design. This flexibility further enhances the transferability of the proposed approach.

- **Cost effectiveness**

  Many of the facilities listed above will be in a similar position to Curlewis Golf Club in that they have limited ability to raise capital. The focus on reducing costs in the current project will lower the bar for the type of end users detailed above. Furthermore all stakeholders expect economies of scale in future projects as Curlewis has pioneered many of the project issues (i.e. design / agreements / project structure). We expect future proponents to benefit from the work undertaken at Curlewis.

Lessons learned

The major findings/recommendations from the design process were to receive clear and strong commitment from project stakeholders, particular local municipal authorities, because if this is not achieved the project timelines will start drifting out and delays will occur. In particular, the design of the connections by the authority should have commenced much earlier in the project.

Sharing the recommendations

To ensure the innovation approaches incorporated in the project provide State wide benefits the management of Curlewis Golf Club are committed to:

- **Using the project to advance the decentralized recycled water and sewer mining.**
  Learnings from the project will be willingly shared with stakeholders.
- **Educate the community on the sustainable use of water.**
  Encouraging site tours by local community groups and schools / universities to demonstrate the benefits of a working model on water re-use.

Conclusions

Curlewis Golf Club has fully realised the initial objectives of the project through leadership, innovation and persistence. Pioneering a new approach can be difficult especially if there are also time and cost pressures.

The project has eliminated Curlewis Golf Club's reliance on potable water and ensures sufficient water will always be available to maintain the golf course in accordance with the expectations of members and visitors.

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- Smart Water Fund
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