

SLUDGE TREATMENT REED BED – RESEARCH AND DESIGN

Pilot System: Wacol WWTP



CLIENT

Queensland Urban Utilities (QUU), is the principal distributor-retailer of water and wastewater service provider for customers in Brisbane, Ipswich, Lockyer Valley, Scenic Rim and Somerset local authority areas. QUU operates 27 Sewage Treatment Plants (STP), removing and treating approximately 124, 600 ML of sewage per annum.

PROJECT SUMMARY

The Water and Carbon Group's Sludge Treatment Reed Bed (STRB) pilot system situated at Queensland Urban Utilities (QUU) Wacol STP is the first of its kind in Australia. Building on the extensive knowledge base of Danish partner Orbicon who are world leaders in STRB technology, this system is assisting in determining the specific sizing and operational parameters for a full-scale sludge treatment system for this site.

BACKGROUND

STRB technology is an alternative low energy, lower cost solution to traditional mechanical dewatering processes. It involves selectively loading a series of vegetated gravel reed beds with sludge over a set period, to passively dewater and mineralise sludge on-site. The dewatering and mineralisation ability of sludge is variable and dependent on several key factors, including characteristics of sludge, local

climatic conditions, vigor of reed growth, loading rates and resting periods. Understanding these key factors is critical for determining full-scale dimensions and maximizing the operational efficiency of a STRB system.

OBJECTIVES

In line with understanding key factors, the specific objectives for the pilot system include:

- Ascertain dewaterability and treatment performance of the site specific sludge
- Determine how loading events influence the capacity of the STRB system to refine loading plans
- Refine STRB operational parameters in Australian conditions
- Prepare an economic model for a full scale STRB system

ACTIVITIES

To achieve the stated objectives, the pilot system was operated over twelve months. This involved undertaking a series of loadings on four small basins, accompanied by a loading and monitoring plan. Loading the STRB pilot consisted of pumping sludge into each basin allowing it to filter through the media. Sludge filtrate was returned to the STP. Throughout the process, key data including filtrate flow rate, visual and chemical inspection samples of the filtrate, soil moisture and climate observations were taken. The loading process was varied over time following a detailed loading program to help identify sludge and filtrate behaviour at different loading rates.

OUTCOMES

Dewatering and mineralisation observations have shown the activated sludge from Wacol WWTP to be applicable to STRB technology, even during intensive loading periods (Figure 1). Chemical analysis of the sludge residue has shown efficient dewatering during the project, with up to 58% dry solids achieved from influent sludge with average 0.8% dry solids.

Filtrate samples taken during loading events have shown a high capacity for particulate removal, simply via drainage through the filter media (Figure 2).

Chemical analysis of the sludge filtrate showed low quantities of BOD, COD and Ammonia as N important for reducing aeration demand on the STP when re-circulated, consequently improving the efficiency of the treatment plant.

Filtrate capacity of the pilot system and soil moisture were actively monitored to optimise operating loading parameters and pre-empt reed stress to inform and adapt the loading plan on a continual basis.

Table 1 below shows the influent chemical analysis of the RAW sludge and the resulting effluent filtrate to be returned to the treatment facility.



Figure 1: Representative sludge residue from pilot STRB



Figure 2: Sludge filtrate (sampled every 15min after loading). Sludge sample (0) included as reference

Table 3: Raw sludge and sludge filtrate chemical analysis

| Parameter | Raw Sludge | Filtrate (average across 4 beds) |
|---------------------------------------|------------|----------------------------------|
| Total Residue (dry solids) (%) | 0.8 | 0.1 |
| Total Nitrogen as N | 330 | 30 |
| Total Phosphorus as P | 240 | 20 |
| BOD (5 days at 20°C) | NR | <5 |
| COD as O₂ | NR | 133 |
| Ammonia N | NR | 0.07 |