EBPR Retrofitting of a Legacy Wastewater System

A Passive Approach to Phosphorus Removal



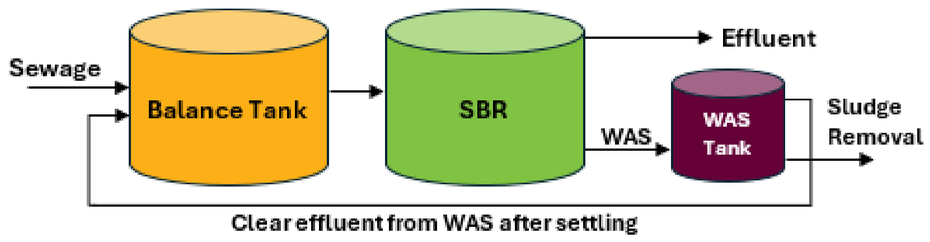
At the Mount Compass Wastewater Treatment Plant (WWTP), a series of operational modifications were trialled to introduce enhanced biological phosphorus removal (EBPR) within an existing sequencing batch reactor (SBR). The aim was to explore the potential for biological phosphorus removal as a cost effective and alternative approach to chemical dosing, aligning with broader sustainability and process optimisation goals.

How did we implement it?

We created an environment that encouraged growth of phosphate accumulating organisms (PAOs) within the SBR. This included the following changes:

- **Introduced an anaerobic feed:** Allow PAOs to feed on readily available carbon (rCOD)
- **Changed SBR from a top-fed to bottom-fed system:** rCOD is fed to the most dense biomass settled at the bottom of the SBR
- **Shifted WAS pump from bottom to top of the sludge bed:** Remove light, filamentous bacteria and select for dense PAOs
- **Slowly reduced settling time throughout trial:** Improved biomass settling

A)



B)

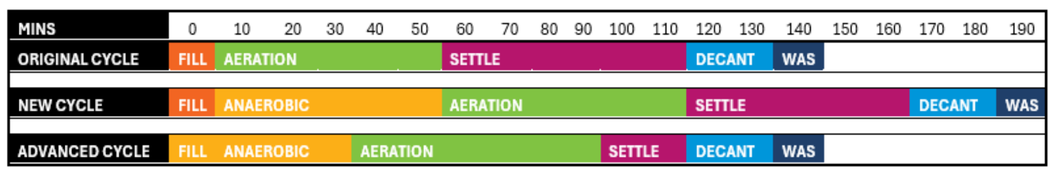


Figure 1: Mount Compass WWTP Schematic (A) and SBR cycle stages and times (B)

How is it going?

- Following introduction of the anaerobic feed, phosphorus removal improved from 0% to an average of 65% within 1 month (Fig 3).
- PO4 profiling during SBR cycles confirmed PAO activity, with anaerobic release during feeding followed by aerobic uptake (Fig 2).
- Laboratory batch testing of biomass under optimal conditions (higher loads: 30% vs 8% volumetric exchange ration (VER), and extended aeration) confirmed an increased capacity for phosphorus removal, with phosphate profiling showing hallmarks of strong EBPR activity (Fig 2).
- Introduction of shorter settling times improved biomass settling, with a steady decrease in sludge volume index (SVI), favouring denser PAO enriched biomass over filamentous bacteria (Fig 4).

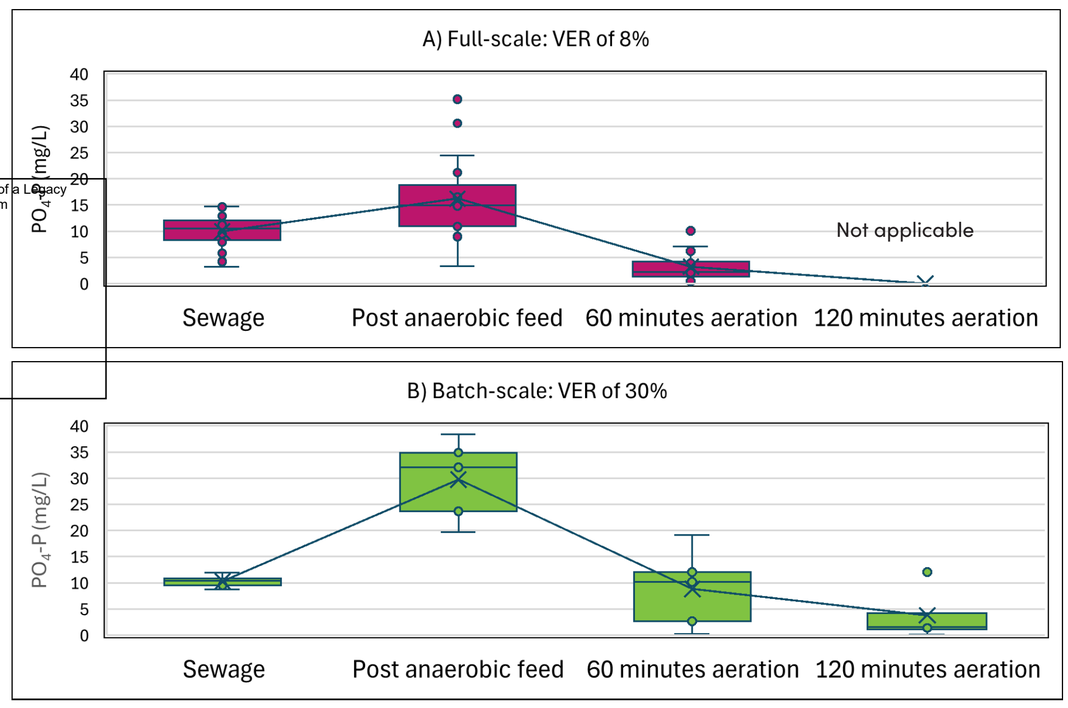


Figure 2: Full-scale (A) vs Batch- Scale (B) testing for phosphorus removal

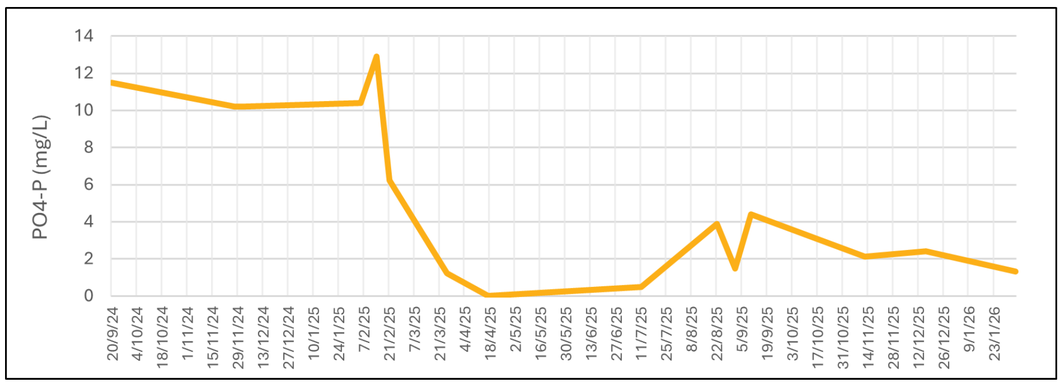


Figure 3: Phosphate effluent results from SBR grab sample during decant phase

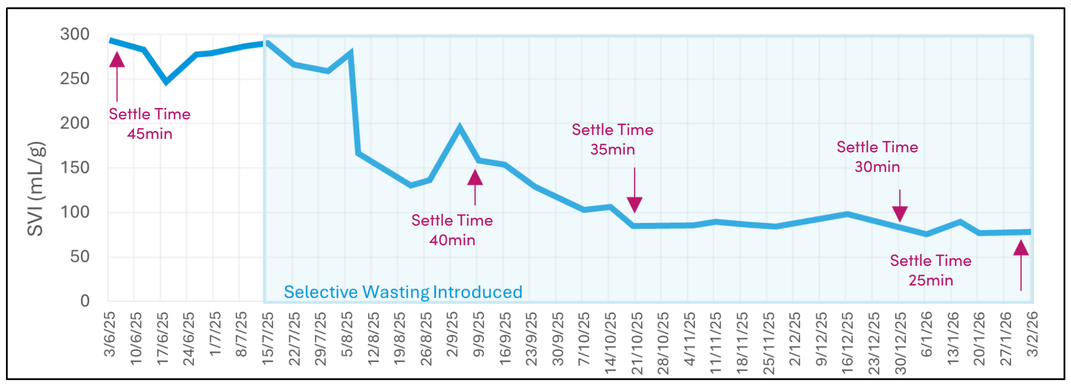


Figure 4: SVI at Mount Compass WWTP SBR

Conclusions and next steps

- Minor operational adjustments (anaerobic feed, selective sludge wasting, and reduced settling time), proved to be a cost-effective means of enhancing biological phosphorous removal at full-scale.
- Significant improvements in biomass settling were also observed, suggesting a viable strategy to limit filamentous bulking which plague these systems.
- Phosphorus was re-released during WAS storage, which returned a concentrated phosphorus stream to the balance tank. Next steps could include targeting phosphate removal from WAS tank effluent only (5kL/day instead of 170kL/day) to reduce plant-wide phosphorous.

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