RPSC TAG – Minimum Technical Compliance of Options 1-6

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Goals and Minimum Technical Requirements

A suite of "Minimum Technical Requirements" for options as alternatives to the existing land treatment system were established for the TAG based on the Steering Committee goals.

Options

An initial long-list of options was inititally identified. It was narrowed down to a short-list of 5 options as having potential to meet the agreed goals and minimum technical requirements. Options 1-5 were developed with a view to integrating TERAX. The options aimed to meet the minimum technical requirements, including a maximum annual discharge of 30 t/yr N and 3 t/yr P (3.4 mg/l N and 0.34 mg/l P based on predicted 2051 flows). Option 6 was developed at a later date an alternative if TERAX is decoupled from the WWTP, ie the TERAX return liquor is not returned to the WWTP process, as a WWTP configuration that could meet the 30 and 3 t/yr N and P limit and maximise the use of carbon (reduce ethanol requirments without the TERAX return liquor).

Option 1 WWTP base upgrade: flow balancing, DRP-removal, UV treatment

Option 2 WWTP base upgrade + tertiary filtration (disc filters, sand filtration, in-line membranes)

Option 3 WWTP base upgrade + denitrifying tertiary filtration (sand filtration, carbon beds)

Option 4 Dual Discharge. No WWTP upgrade. MBR discharge to surface water. Bardenpho discharge to land at 5 mm/d or 20 mm/d.

Option 5 Land Treatment. No WWTP upgrade. Current flow discharged to land at 5mm/d or 20 mm/d.

Option 6 WWTP base upgrade (UV as a second pathogen removal barrier), primary bypass (decommission primary treatment), full MBR for the secondary process, sludge dewatering with centrifuges.

Minimum Technical Requirements

The options were assessed for compliance with each of the the previously agreed Minimum Technical Requirements (Table 1), where:

- ✓ achieves minimum technical requirement
- **P** could "Potentially" achieve minimum technical requirement
- **?** uncertainty around achieving the minimum technical requirement
- ✗ does not achieve the minimum technical requirement

Option 1 – does not achieve minimum technical requirement

A base-upgrade to the WWTP reduces DRP but the clarifiers do not reduce particulate-P sufficiently. Both TN and TP in the discharge exceed the minimum requirement. With a variable concentration of suspended solids in the discharge, the single barrier approach to pathogen kill is more risky.

Option 2 – does not achieve minimum technical requirement

A base-upgrade to the WWTP with tertiary filtration reduces DRP as well as particulate-P (depends on the filtration). TP levels below the minimum requirement of 0.34 mg/l (3 t/yr) can be achieved using sand filtration or in-line membane filters. While this option also removes particulate nitrogen, the requirement for a TN concentration of 3.4 mg/l (30 t/yr) can not be met. Suspended solids are low and UV treatment provides an effective single barrier approach to pathogen kill.

Option 3a – achieves minimum technical requirement

A base-upgrade to the WWTP with a denitrifying sandfilter to provide both filtration of the particulate fractions as well as an additional nitrate removal. This upgrade can achieve TP around the minimum requirement of 0.34 mg/l (3 t). This upgrade oiption provides the lowest risk of meeting the N limit of 3.4 mg/l (30 t) during normal operations as more nitrogen is removed (having two N-removal processes in series is more efficient than just one). Sandfiltration, as part of the filtration process, returns the back-wash to the treatment plant which can add to the variability in the plant. During storm flows or when other issues occur that impact settlability in the clarifiers, and the frequency of backwashing to clear the filters is high, the performance of the plant will reduce. Recovery time depends on the volume and mass of solids being received by the sand filter. There is a risk with this option that during extreme events bypass of filtration may be required. UV treatment provides an effective single barrier approach to pathogen kill, but there is some risk if the capacity of the sand filter is exceeded.

Option 3b – does not achieve minimum technical requirement

A base-upgrade to the WWTP with a carbon bed to provide both filtration of the particulate fractions as well additional nitrate removal. TP levels will be around the minimum requirement of 0.34 mg/l (3 t/yr) can be achieved and TN levels will be reduced to around the minimum requirement of 3.4 mg/l (30 t/yr). While potentially technically possible, carbon beds have not been proven on this scale, with these very low concentrations of nitrate or over a long timeframe. With a variable concentration of suspended solids in the discharge (either pre- or post- Ca-bed), the single barrier approach to pathogen kill is more risky.

Options 4 and 5 – currently parked

Option 6 – achieves minimum technical requirement

A base-upgrade to the WWTP with that bypasses the primary tanks to make full use of the carbon in a the secondary processes, and reduce sludge production, with some reconfiguration of the Bardenpho to optimise N-removal, with full MBR incorporated into the secondary process. This can achieve the lowest TP in the WWTP discharge, below the requirements of 0.34 mg/l (3 t), and aroudn the required 3.4 mg/l (30 t) N. Has the disdvantage of being hydraulically limited (can only pass a fixed amount through membranes) so careful selection of membranes and management of stormflows is essential Membranes and UV provide an effective double barrier approach to pathogen kill.