

Package Treatment Plant Operation and Management

System Selection and other Design Considerations



Joe Whitehead



System Selection

- There are a variety of techniques and tools available for selection of viable/suitable/acceptable treatment technologies for decentralised wastewater treatment systems, these range from:
 - Intensive/Complex – TBL, NPV, Life Cycle Analysis and Integrated Water Cycle Management etc.
 - Rational/Semi-Quantitative – Expected System Performance, Site/System Requirements and Cost-Benefit Analysis
 - Informed/Qualitative – Vendor Bidding/Selling, Past Experience or Regulatory Prescription



Rational System Selection

- The application of a Rational/Semi-Quantitative approach for system selection is a good “first pass” test for potential owners and managers of PTP technologies
 - Responds to regulatory limits (effluent quality) and conditions (system/environmental requirements)
 - Considers system/site limitations or constraints
 - Identifies range of appropriate alternatives
 - Matches system selection to an acceptable solution



Rational System Selection

- Not a fixed approach
- Framework may be adjusted to suit system/site peculiarities
- While targeted at new installations, framework may also be used to examine/assess suitability of existing systems
- **Typically, we would suggest the following five-step approach**



Rational System Selection Step 1 - Consultation

- Discuss system requirements with planning authority / environmental regulator
 - Planning Constraints (noise, odour, sensitive areas etc.)
 - System sizing (flow estimates, wastewater characteristics and variations)
 - Performance limits for both plant and re-use / effluent management systems (effluent quality)
 - Other requirements (water re-use, development staging)
 - Maintenance, Monitoring and Reporting



Rational System Selection Step 2 - Site Assessment

- Identify site characteristics and potential interactions with the built and natural environment
 - Site Constraints (available land area, site levels, landform and soils, sensitive receptors, access and construction issues, power supply, site drainage/stormwater)
 - Existing / Required building elements (integration with current development, other land uses)
 - Opportunities (onsite re-use, landscape irrigation, agriculture etc.)



Rational System Selection Step 3 - Development Assessment

- Identify development characteristics
 - Wastewater Generation (flow volumes, rates and variability, wastewater quality or characteristics)
 - Water Balance (water demand/supply, climate characteristics, irrigation potential and loading rates, storage requirements)
 - Opportunities (internal reuse, fire fighting water, ornamental)
 - Development (build-out, staging, future expansion?)
 - Resourcing (staff skill level, availability, external support)



Rational System Selection Step 4 - Options Assessment

- Identify suitable treatment technologies using:
 - Tables provided in this presentation, or
 - Other published sources
 - Sourced manufacturer/supplier information
- Confirm (general) option acceptability with regulatory staff
- Confirm with system manufacturers or suppliers that system options can meet performance limits
- Discuss potential problems/limitations with development staff and/or contractors



Rational System Selection Step 5 - Cost-Benefit

- Following short-listing of possible treatment options use a cost-benefit approach to optimise system selection for a given site
- Considerations may include:
 - Capital and ongoing operational costs
 - System robustness / complexity / flexibility
 - Performance reliability
 - Specific effluent quality criteria (e.g. lowest N possible)
 - Manufacturer/Supplier support or warranty
 - Compatibility with downstream effluent reuse option



System Performance Tables

- The following tables are prepared based on reported performance information for typical treatment technologies
- They should be used as a general guide to expected performance
- Many systems are designed for specific performance outcomes
- Where possible, manufacturers information should be used to confirm system loading and effluent quality data



Extended Aeration Plants

Extended Aeration AS		Expected Effluent Quality			
BOD ₅ (mg/L)	10	10	20	20	30
TSS (mg/L)	10	20	30	30	40
TN (mg/L)	<5	5	10	>10	--
FC (cfu/100mL)	<5	5-10	>10	--	--
Operational Scale					
1 - 50 EP					
51-200 EP					
200-1000 EP					
1000-2500 EP					



System Performance

- Critical to have performance data for any plant
- For existing plants – helps understand - performance, identify areas for improvement and rectification
- For proposed plants confirms, validates likely performance.
- Data required for similar plant in similar operating scenario
- Data often not available or limited, so have limited assurance that proposed system will perform as expected/required

