Inspection and Troubleshooting of Onsite Wastewater Management Systems

Secondary Treatment Systems, Irrigation, Passive Polishing Systems

Secondary Treatment Systems

- Variety of secondary treatment options:
  - Aerated Wastewater Treatment Systems (AWTS / STS)
  - Sand Filters
  - Mounds
  - Wetlands / Reed Beds

AWTS

- Commonly one or two tanks
- Four stages of treatment:
  - Anaerobic digestion (primary treatment)
  - Aerobic digestion (secondary treatment)
  - Clarification (settling)
  - Disinfection
- Most commonly surface or subsurface irrigation follows

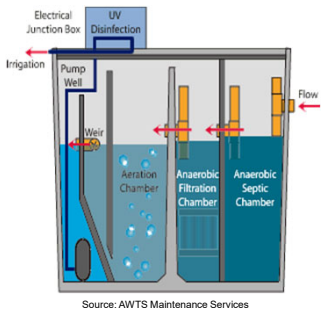
AWTS Configurations

Modular design

Integral design

Primary Chamber

- As for septic tanks
- Sludge return should be directed to inlet and not result in disturbance of the crust



Source: AWTS Maintenance Services

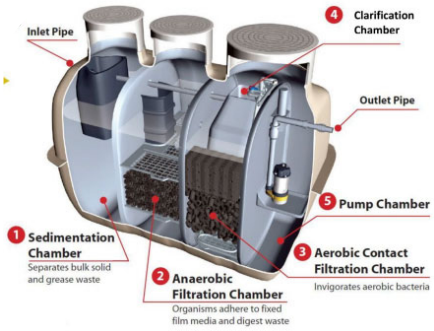
Aerobic Treatment

- The addition of air to the aerobic chamber promotes oxidation and microbial consumption of the organic matter and bacteria
- Two types of process designs:
  - Attached Growth Processes
  - Suspended Growth Processes

- Air is commonly supplied by blower (80-120 L/min) with air diffusers in the aeration chamber

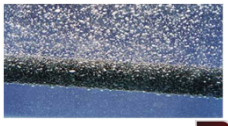
Fuji Clean ACE1200

(source: www.fujiclean.com.au)



Aeration Chamber

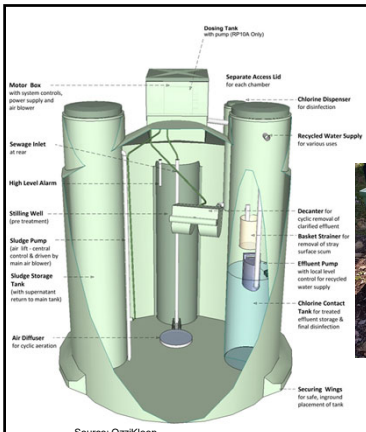
- Biofilm on media and liquid – chocolate brown
- pH 6.5 – 8.5 (mid-range)
- Fine bubbles rising throughout
- Dissolved oxygen 2-4mg/L
- No odour
- Air supply and sludge return systems require regular monitoring and adjustment



Suspended Growth 'Activated Sludge'

- Activated sludge / Sequencing Batch Reactor
- Microorganisms retained in suspension within the wastewater via mechanical mixing or aeration (blowers)
- Sludge must be wasted (removed) otherwise final effluent quality may be compromised and lead to blockages in irrigation systems
- Assess Sludge Volume Index with Imhoff Cone

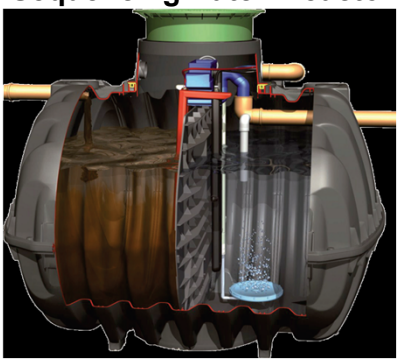
Activated Sludge System



Source: OzziKleen

Settleability / Sludge Volume Index Test

Sequencing Batch Reactor



Source: Klaro/Graf Australia

Clarification

- Facilitates solids settling in quiescent conditions
- Many utilise a funnel (Imhoff) design to concentrate settled sludge and minimise re-suspension
- Sludge return may be recirculated to the aeration chamber to assist with denitrification, or may be returned to the inlet of the primary chamber

Final Effluent Quality

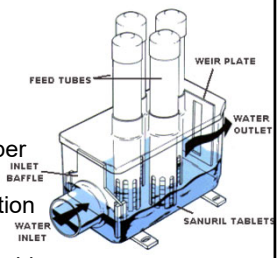
- pH 6.5 - 8.5
- Check turbidity with turbidity tube
- Highly clarified; turbidity <5 NTU for chlorine disinfection, <1 NTU for UV disinfection
- Low turbidity indicates good treatment and effective removal of BOD and TSS
- Build up of sludge indicates sludge return is not removing sufficient sludge – may require pumping out

Disinfection

- In most States a disinfection system is mandatory for AWTS and STS, particularly for surface irrigation
- In AWTS disinfection is by either:
  - Chlorination (most common)
  - Ultraviolet (UV) radiation
- All AS 1546.3:2017 STS currently use chlorination

Disinfection - Chlorination

- Usually chlorine tablets in an erosional feeder
- Poor quality chlorine tablets swell and cause blockages
- Retention in a contact chamber should be for more than 30 minutes for effective disinfection
- Free residual chlorine in the contact chamber effluent should be 0.5-2.0mg/L



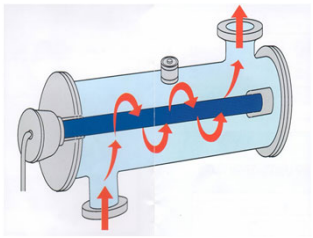
Disinfection - Chlorination

- Moderate BOD_5 and TSS in effluent will consume chlorine
- Microbial clumping may limit effectiveness
- High organic loads may lead to the production of harmful organochlorine compounds and will result in excessive chlorine consumption
- Excess chlorine (>2mg/L) will kill the good microbes in the soil in the irrigation area

Disinfection - UV Irradiation

- Highly clarified effluent is required for effective UV disinfection (turbidity <1 NTU)
- Effluent passed through a clear pipe with adjacent UV tubes irradiating the effluent
- Carryover of biological flocs may reduce the effectiveness by shielding pathogens
- Effectiveness is related to contact time
- High maintenance requirements, as pipe must be kept clean for optimum performance
- A redundant UV tube system is necessary in case of failure

Disinfection - UV Irradiation



Centre for Environmental Training

cet

AWTS

AWTS

Issues with AWTS

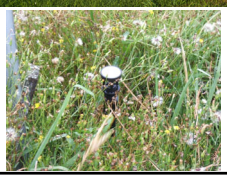
- Shock or constant high hydraulic loads
- Intermittent or low hydraulic loads (particularly older AWTS pre-AS1546:2017)
- Sensitive to biocides (disinfectants, antibiotics)
- Poor treatment in one stage generally adversely impacts later stages of treatment
- Poor air balance for treatment and sludge return adversely impacts treatment
- Insufficient sludge wasting
- Extended shut off (holidays, power outage)

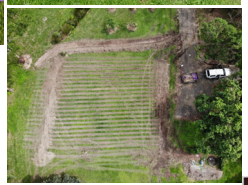
Centre for Environmental Training

cet

Irrigation Systems

- Surface irrigation
- Subsurface irrigation





Centre for Environmental Training

cet

Issues with Irrigation Systems

- Undersized for soil and climate
- Only irrigating part of required area
- Undersized pumps, uneven distribution
- Blocked or removed filters
- Spraying into inappropriate areas
- Damage to surface irrigation components
- Blockages or breakages in subsurface systems
- Lack of flushing mechanism
- Lack of servicing and maintenance
- Sequencing valves not operating properly

Centre for Environmental Training

cet

Sand Filters

- Passive secondary polishing

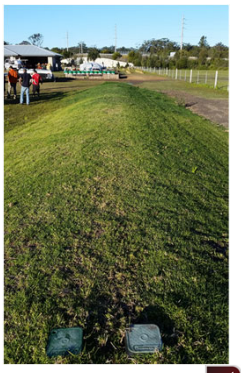
Issues:

- Undersized for hydraulic and organic loads
- Incorrect media
- Media clogged with FOG or organic build-up
- Uneven distribution
- Creeping failure due to gravity feeding

Centre for Environmental Training cet

Mounds

- Passive secondary polishing
- Undersized, poorly designed
- High linear loading rate (LLR)
- Poorly constructed
- Insufficient evapotranspiration
- Uneven distribution (pump)
- Toe seepage



Centre for Environmental Training cet

Wetlands / Reed Beds

- Passive secondary polishing
- Undersized (hydraulic)
- Stormwater ingress
- Blockages / sludge
- Plant selection
- Insufficient number of plants
- Inappropriate discharge
- Structural failure (cracks, sag, puncture)

Centre for Environmental Training cet

Mound System

Reed Bed

Centre for Environmental Training cet