

### Description

The **Aqua Hybrid BNR** (Biological Nutrient Removal) process was developed to capture the features of conventional IDEA (Intermittently Decanted Extended Aeration) processes, but at an affordable cost.

The Aqua Hybrid BNR process offers operational advantages and significant cost savings over other BNR technologies from the construction phase through to the long term maintenance and operational life of the plant.

Aqua Hybrid BNR uses a twin circular tank construction which offers savings in construction time and cost. Design criteria are generally flexible, sometimes allowing locally available forms to be utilised or in some cases existing tanks may also be used.

Aqua Hybrid BNR plants are highly reliable, easy to operate, cost effective over their extended life and require very little operator intervention. Most of these plants can be easily modified to accommodate growth. In many cases, only with the addition of extra aeration capacity and minor modifications to the control systems.

With over 400 installations across Australia, Malaysia, Thailand, China, Indonesia, PNG and Africa, the Aqua Hybrid BNR Process offers proven economical and reliable treatment of wastewater, particularly where low Nitrogen and Phosphorus limits are required.



### Advantages

- Low footprint
- Robust process characteristics
- High effluent quality
- Simple robust decanting system with no moving parts
- Fully Automated - minimal operator attention needed.

### Design

The single tank IDEA process has been used in Australia since 1967. The Aqua Hybrid BNR process has been developed by the addition of an Anoxic-Aerobic Tank upstream of the IDEA tank.

The first tank called Aerobic Anoxic Tank (AAT) has an anaerobic selector (when configured for bio-P removal), followed by a sequencing aerobic/anoxic zone.

Raw wastewater continuously flows into the anaerobic selector. The flow then passes into the sequencing aerobic/anoxic zone. Cycles consisting of periods of aeration followed by non-aerated mixing periods occur in this tank. The cycle times are varied depending on the time of day and according to DO levels in the tank.

The second tank, which is called Intermittently Operated Clarifier (IOC), operates as a sequencing aerobic and anoxic reactor as well as a clarifier. Flow enters the IOC from the AAT through an energy dissipating baffled section. As per the AAT, the aerobic and anoxic phases of operation are cycled. Sludge is recycled from the IOC to the AAT during the Aerobic/Anoxic phase.

Aeration is supplied by either mechanical surface aerators or fine bubble diffusers.

Fluid in the IOC tank builds to a pre-set level and then the aeration, mixing and sludge return are stopped and the sludge is allowed to settle for a pre-set time.

Following this settling time, the clear supernatant from the top of the tank is decanted.

A simple but clever patented decanting system called a **Gas Locked Siphon Decanter (GLSD\*)** is utilised. It has no moving parts and is designed to allow decanting of the fluid at much lower effective weir loading rates than conventional mechanical floating weirs. This minimises the risks of mechanical problems and solids loss in the effluent.

The whole process is controlled by a PLC and SCADA system designed to maximise process performance and minimise operator requirements.

**\*Air Lock Decanters (ALD), Siphon lock decanters (SLD) are also referred to as Gas Lock Siphon Decanters (GLSD) - as they all use a common engineering principle of introducing air or a gas into the siphon to 'freeze' or 'stop' the siphon action. Once the source air is removed in the case of the decanter, a valve closed restricting the available air the siphon can restart again without the use of any pumps or motors.**

## Technical

The design of the Aqua Hybrid BNR system has many features that give this process quite significant advantages over alternate processes.

### De-nitrification

All Aqua Hybrid BNR plants are designed to achieve high levels of de-nitrification, even if regulations don't require this. This is because de-nitrification:

- Allows for the recovery of alkalinity - avoids pH reduction in low alkalinity waters, which eliminates alkalinity addition and ensures an optimal pH for nitrification
- Recovers oxygen - this reduces aeration costs.

- Provides additional process stability - helps prevent nitrogen de-gassing and resultant sludge flotation during the clarification period.
- Is essential for efficient biological P removal.

### **Shallow tank design**

The Aqua Hybrid BNR utilises a shallow tank design rather than deep tanks. This gives improved solids capture due to:

- Lower rise rates - improved settling of solids during the settling and decanting phases.
- Lower supernatant velocities over the surface - eliminates the scouring of solids during decanting.
- Lower rise rates under peak flow conditions - allows higher peak wet weather flows without degrading the performance.

### **Gas-Locked Siphon Decanter**

The utilisation of the Gas Locked Siphon Decanter offers several advantages over other decanter designs including:

- No possibility of mechanical failures due to no moving parts or mechanically complex design - lower operational costs.
- Much cheaper construction and installation costs.

### **High Effluent Quality**

The key feature of the design is the attention paid to minimising solids in the effluent and maximising process stability. Because de-nitrification is an important step, even where regulatory consents on effluent quality are not high, the process will still achieve very high removals, particularly of Nitrogen.

## **Applications**

### **Process applicability**

Aqua Hybrid BNR plants offer robust process performance under adverse conditions due to long sludge residence times, fewer process units, compact layout and less mechanical equipment.

### **Applicable Flow Range**

Plants can be designed for almost all flow ranges.

Aquatec Maxcon has designed Aqua Hybrid BNR plants ranging from 10 kL/d to 100 ML/d.

The Aqua Hybrid BNR process has the ability to handle peak flows up to seven times average dry weather flow (ADWF). This is mainly attributed to the cyclical operation of the intermittent aeration tank (IAT), decanting effluent only after a preceding settling period. This arrangement prevents the washout of solids from the IAT during peak flow conditions.

The IDEA plants have a high turn down ratio allowing sound operation of the plant even with low flow/load conditions for extended periods. This feature makes the IDEA plant suitable for caravan parks, recreation areas and holiday villages, which only experience full load conditions for about 4 months per year.

### **Influent Wastewater Characteristics**

The Aqua Hybrid BNR process is suitable for treating typical domestic and industrial wastewater ranging in composition from weak to strong concentrations. Typically, the plants are designed to treat sewage with BOD5 of 100 mg/l to 450 mg/l and TN of 30 mg/l to 120 mg/l.

### **Climatic Constraints**

Aqua Hybrid BNR plants can be designed for any climate. Our plants are operating in tropical Malaysia/ Northern NSW to snow bound Perisher valley / Cynthia Bay.

The process equipment and reactors are sized after careful consideration of the climatic conditions.

### **Services**

Aquatec Maxcon project manages, designs, fabricates, supplies, installs, commissions, operates and maintains a complete range of water and wastewater treatment plants and equipment for water, municipal and industrial applications based on world's best practice.

Aquatec Maxcon has process and engineering staff facilitating complete in-house capability and commitment to OH&S, Q.A. and Environmental requirements and ongoing Research and Development in Australia for the Australian Water market.

Aquatec Maxcon has been in the Australian water business for 50 years, employing over 300 staff throughout the Aquatec Maxcon Group, with offices in QLD, NSW, VIC and SA.

The Aquatec Maxcon group offers complete vertically integrated solutions in the delivery of water infrastructure with in-house process design capability, designers, drafters, procurement, fabrication facilities, protective coating application, electrical switchboard manufacture, PLC and SCADA controls, project managers, field installation crews, commissioning engineers, operators, service and maintenance people.

The Aquatec Maxcon group of companies allows us to be a "one-stop-shop" for water,

industrial and municipal clients, reducing the number of interfaces as well as offering practical and cost effective overall solutions.

Aquatec Maxcon is widely recognised as a trusted project manager and water technology partner.

It's delivery of, and contribution to projects has been recognised with International, National and State Awards for Excellence in project management, engineering excellence and community relations.