BIO Sewage Systems
The way nature does it.

20 Klipfontein
Cullinan
1001

PO Box 1931
Rayton
1001

t +27 (0)12 732 0013
f +27 (0)86 232 5938/2
m +27 (0)64 850 0568
e mark@biosewage.co.za

www.biosewagesystems.com

Method Statement of Bio Sewage Systems Waste Water Treatment Plant Operation

1) The primary treatment consists of a septic/collection tank with two chambers that receives the raw untreated sewage from source. Most of the settleable solids accumulate in the first compartment from where the settled sewage flows into the second compartment. The inorganic material (items that can't be processed) remains in the first chamber.
   The organic material in the sewage is reduced as a result of sedimentation and anaerobic digestion. The septic tank is designed to have sufficient storage capacity to act as a buffer and thereby smooth out fluctuations in flow and to store waste water in the event of a power interruption.

2) The septic/collection tank is fitted with a submersible pump which is used to transfer the settled and partially treated waste water into the sewage treatment plant.

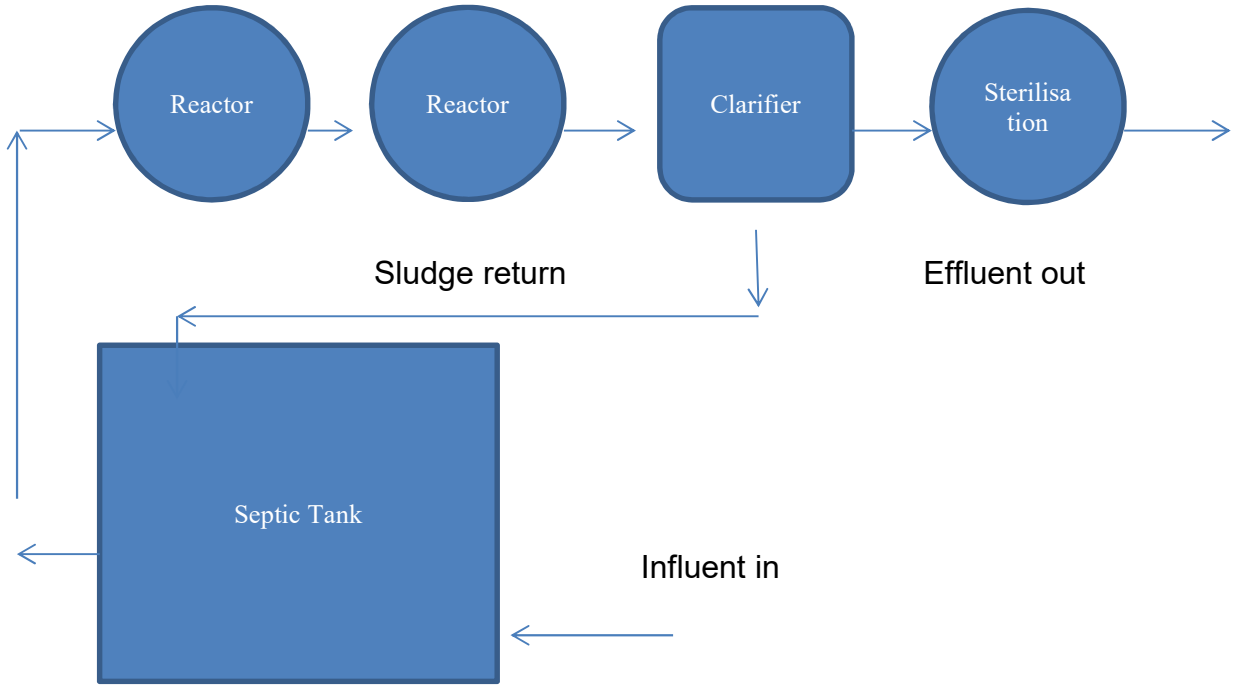
   The plant consists of various processing stages.

   a) Ammonia (NH_3) is a nitrogenous compound that is oxidized in a process called **nitrification**. The nitrification of wastewater is necessary to remove or reduce the amount of nitrogen compounds in wastewater. These compounds act as environmental pollutants. Nitrification occurs when nitrifying bacteria converts ammonia and other nitrogen compounds into **nitrite** (NO_2) and the conversion of nitrite into **nitrate** (NO_3). The nitrification process converts ammonia into nitrate. After nitrification, **denitrification** must occur to remove nitrate from wastewater. Denitrification is an anaerobic process that reduces nitrate into molecular nitrogen (N_2) gas that vents to atmosphere.
      This process occurs in the septic/collection tank and bioreactors. The number of bioreactors is dependant on inflow volume and are arranged in series. In each of the biological reactors, floating media is used to provide sufficient surface area to support the attached biomass required to facilitate the nitrification process of the sewage. The bioreactors are fitted with aeration devices. Aeration of the wastewater is necessary to remove ammonia before the effluent is discharged. Surface turbulence caused by aeration releases or strips the ammonia molecules from the wastewater solution into the atmosphere through bacterial process. Due to this aeration a high concentration of biomass (bacteria) is retained in the reactors improving efficiency.

The majority of the biomass is attached to the media while a small fraction remains in suspension. By reducing the suspended solids concentration in this manner, the settling rate of sludge will be higher and a low sludge volume will be ensured. The settling time is reduced while a high effluent quality will be ensured. Another advantage is that the time for nitrification, which contributes largely to the reaction time, is significantly reduced.

b) The flow from the final aerated bioreactor enters a clarification/settling tank. The suspended solids (sludge) is allowed to settle and collect in the hopper of the clarifier. The sludge is then returned to the septic/collection tank daily where the activated sludge begins the nitrification/denitrification of the raw sewage. With this process it ensures the system is a closed loop system with no sludge generation as it is reprocessed. This mitigates the necessity of sludge drying beds and sludge handling which is onerous and requires a large footprint and is labour intensive.

c) The clear effluent then flows into a sterilisation tank for disinfection. Ozone is used for disinfection. The ozone destroys any remaining coliforms, hormones and any other harmful by-products of sewage. The benign disinfected water is then either stored for irrigation, released into the environment or can be re-used as grey water for flushing.



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Advantages

GREEN

- Recycles Black and Grey water - Allows greatly reduced consumption of municipal water
- Environmentally friendly - No sewerage contamination of the environment, underground water or open water sources
- No chemicals used at all in the process
- Very small footprint

ECONOMICAL

- Very cost effective, the R/litre rate is a fraction of a commercial system
- Very quick to install with minimal civil works
- Simple and 100% natural process
- Very light on electrical consumption
- Can be run off solar power
- Fully designed and manufactured in South Africa

SOCIO-ECONOMIC BENEFITS

- Human dignity
- Better Sanitation for WASH program, especially in areas that have no water borne sewage systems.
- Job creation through micro-contractors
- Can be used in both rural and densely populated urban areas

LOW MAINTENANCE

- No sludge handling required
- Unskilled monitoring of plant
- No chemicals or additives
- Replacement of any failed pumps simple and economical

WATER USAGE

- Low fresh water consumption
- Processed water can be re-used for toilet flushing
- Processed water can be used for irrigation or gardens, lawns and crops
- One litre of sewage produces one litre of processed water