Sludge Treatment Reed Beds
Seven Common Questions and Answers

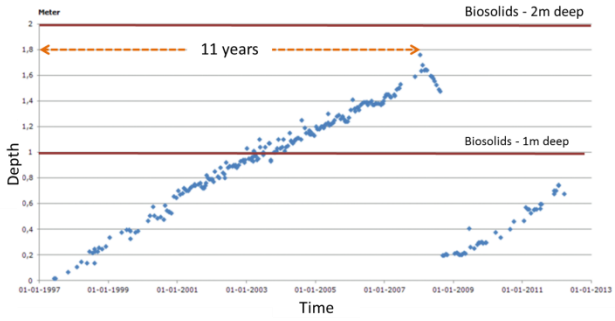
Q1: What is the difference between Sludge Drying Beds and Sludge Treatment Reed Beds?

Sludge Treatment Reed Beds have many advantages over traditional Sludge Drying Beds. The table below highlights some of the key differences between these technologies.

Traditional Sludge Drying Beds	Sludge Treatment Reed Beds (STRB)
Operates by adding sludge onto a filter material (e.g. sand/gravel). Dewatering occurs by: • Evaporation, and • Drainage	Operates with sludge periodically added onto filter material (e.g. sand/gravel). Wetland plants grow in the biosolids, which accumulate over 10-15 years within the basin before it is emptied. Dewatering occurs by: • Evaporation • Drainage **PLUS** • Evapotranspiration through plants and roots
Reduced water removal efficiencies occur with "crusting" on the surface and filter blockage at the base, preventing dewatering.	STRB are more efficient at removing water per area of bed. The presence of wetland plants increases the hydraulic conductivity throughout the biosolids (through mechanical movement of stems/roots). The plants also remove water deep from within the profile through evapotranspiration actions; "pumping" water up through the plant.
Shallow beds, typically less than <0.5m of sludge before dewatering is significantly compromised. Frequent replacement	Deep beds. Up to 1.5m deep sludge. Emptied every 10-15 years.
Anaerobic (only aerobic on surface).	Aerobic throughout profile.
Potential for odours, especially if crust forms on surface that prevents air from penetrating into the sludge profile.	Operates aerobically, so limited risk of odour. In Europe, many systems operate with residents living within 50-150m.
Slower stabilisation rates due to low oxygen conditions, and less microbial activity in biosolids.	Enhanced stabilisation with strong microbial interaction between rhizomes/wetland and sludge matrix

Examples of Sludge Drying Beds – empty and loaded

Examples of Sludge Treatment Reed Beds – emptying and graph of loading over 15 year at Helsinge WWTP (42,000EP)



Q2: Does the filter / drainage material become blocked over time?

No, several decades of experience have shown numerous sludge treatment reed beds successfully operating without any blockage to the filter/drainage material.

There are three main reasons for this:

1) The physiology of wetland plant is dominated by lateral growth of rhizomes rather than downward vertical growth, maintaining their rhizomes close to the surface. Plant stems (vegetation) grow upward to the atmosphere from these rhizomes. Vertical downward roots still exist, but they tend to be relatively minor feeder roots that do not pose a significant problem for clogging of pipes. The predominant lateral growth of wetland rhizomes, is a natural adaptation for survival in waterlogged soil conditions. If the rhizomes were to have a stronger downward movement (as is typical of larger tree species), then the ability for the "stems" to grow to the surface would be restricted. The lateral growth of the selected plants is one of the reasons why clogging is not seen in sludge reed beds.

2) The biosolid layer accumulated on the sludge reed bed surface is a much richer source of nutrients and water than what is found in the drainage layer. The primary function of roots in wetland plants is to seek out water and nutrients for the plant to grow. Given that there is plentiful water and nutrients in the surface sludge layers, there is no physiological reason for the plant roots to extend vertically into the drainage layers. For this reason, the vast majority (>80%) of wetland plant roots naturally occur in the upper 20cm of the soil profile in most situations.

3) As the biosolids accumulate (10-15cm per year), the active rhizomes gradually grow upward towards the surface to maintain their ability to send "vegetative shoots" to the atmosphere, with minimal energy. With time, the most active rhizomes therefore move further and further away from the filter/drainage material.

Q3: Do the reeds have to be harvested?

No. Reeds are cut only prior to harvesting after 10-15 years, predominantly to clear the area so that the basins can be easily accessed for emptying. Throughout the operational cycle, vegetation will die and grow on a seasonal basis. Dead vegetation is incorporated into the biosolids where it breaks down and adds structure to stabilised sludge material.

Q4: What is the quality of Sludge Produced?

Orbicon has been involved with the emptying and disposal of over 130,000 tonnes of biosolids from Sludge Treatment Reed Beds, which has met the high standards required to be spread onto nearly 10,000ha of agricultural land over the past 18 years.

Experience in northern Europe from over 50 large scale systems has shown that final dry solid concentration of the sludge is typically 25-40%, but this may be even higher in Australia with the substantially warmer climate.

Studies have also shown that the presence of key indicator pathogens (e.coli, Salmonella, Enterococci) are not present below 10cm, and are fully removed within 2 months from the last load. Sludge Reed Beds have also demonstrated to be more effective that stockpiling to treat Hazardous organic chemical, due to the active aerobic microbial environment that is created by the wetland pants and rhizomes.

There are numerous examples showing Sludge Reed Bed biosolids meet stringent heavy metal compliance, but that will be is feature of the sewerage catchment, and will vary from site to site more than the choice of equipment used to dewater and stabilise the sludge.

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Q5: Are Mosquitos an issue with Sludge Treatment Reed Beds?

No. Sludge Treatment Reed Beds are largely dry systems. The systems are operated in a load/rest cycle, typically 1-2 weeks of loading, followed by 4-8 weeks of resting before loading commences again.

During the 1-2 week loading cycle, sludge is transferred to the basins in batches of 200-300mm deep, 3-6 times per day. Drainage rates with the basins are generally >8m per day, therefore any sludge batch is fully drained within 1 hour of loading.

During the resting cycle, further drying occurs of the sludge through evaporation and evapotranspiration through the plants.

The dry nature of the Sludge Reed Bed operation, is not a conducive habitat for mosquito's to survive.

Q6: How do Sludge Treatment Reed Beds cope with wet weather?

Drainage rates with the basins are generally >8m per day, much larger than external extended wet weather periods anywhere in Australia. The individual batch rates of 200-300mm, which occur several times per day during loading are much larger than significant rainfall events. External rainfall therefore doesn't affect operation.

Some Sludge Reed Bed systems in Denmark have actually been designed as dual wet weather storage for combined systems during peak wet weather. At Kallerup Reseanlaeg WWTP, peak flows are stored across all the basins during large rain events and are then gradually released (after being filtered by the Reed beds) back into the activated sludge plant over several days/weeks when spare capacity exists. These events occur several times a year.

A similar dual benefit could be considered for all WWTP that integrate STRBs, potentially using the STRB basins as temporary storage basins of large peak wet weather flows, and reprocessing the filtered effluent back to the plant over an extended period.

Q7: Is Odour an issue?

Odour is not an issue in Sludge Treatment Reed Beds due to the loading /resting periods being carefully controlled to ensure it maintains aerobic conditions. There are numerous Sludge Treatment Reed Beds operating within 50-150m of residents without any deleterious olfactory impact.