

Small Flow Orbal® Wastewater Treatment Systems

Applications

Small Flow Orbal systems are created specifically for small wastewater flows in the range of 0.035 to 0.5 MGD. Siemens has used a “complete solution” approach in developing the designs in recognition of the need to provide cost-effective wastewater treatment solutions for smaller communities that have limited financial resources.

Design Package

The design package of the Small Flow Orbal System consists of: a standard Orbal® multi stage aeration system, two (2) scraper clarifiers, an aerobic digester, SmartBNR controls, and associated pumps, blowers, and control valves.

Design Process

At the heart of each system is the Orbal® multi-stage aeration system. This process has a series of concentric oxidation ditch channels surrounding a center island. Wastewater flows through the reactors in series from the outer-most channel to an outfall structure located in the center island. Small Flow Orbal systems are designed with two channels designed to treat from 35,000 to 500,000 gallons per day. Six basic design layouts provide complete treatment options for this range of flow (See Table 1). Each Small Flow system can be modified for enhanced biological nutrient removal.

In a Small Flow Orbal System, influent wastewater enters the outer channel of the basin where it is mixed with (return activated sludge) RAS from matched clarifiers to form the system’s mixed liquor. Each RAS pumps provided for each Small Flow System are sized with a variable capacity range of 50 to 150% of the maximum design flow for each model. The combined mixed liquor passes progressively through the Orbal channels before passing through the center island outfall structure and on to the final clarifiers.

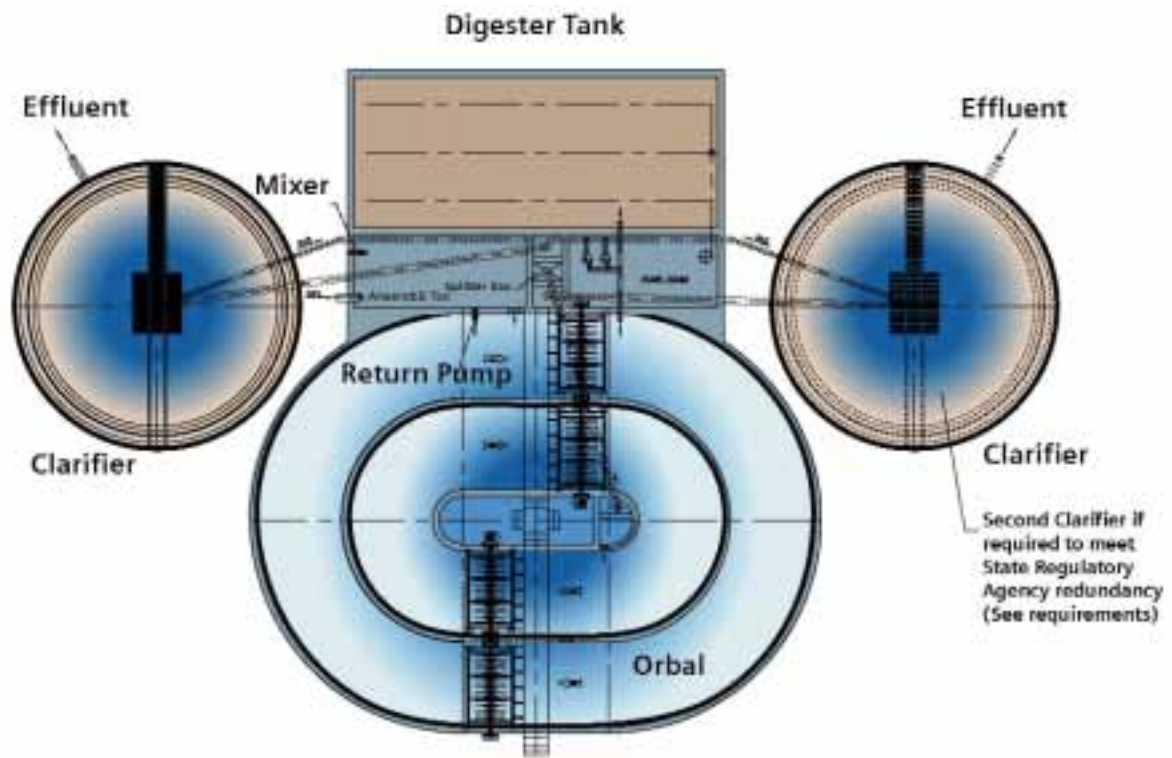
Flow through the Small Flow Orbal basin passes from the outer channel to the inner channel. The flow from one Orbal channel to another is by displacement of the mixed liquor circulating in each channel through submerged ports interconnecting the adjacent channels. The displaced flow is equal to the volume of raw waste and RAS.

The outer channel of a two channel Small Flow Orbal basin normally operates as an aerated anoxic reactor. This channel will typically show dissolved oxygen (DO) concentrations at or near 0.0 mg/l. The inner channel is maintained in an aerobic state with a design DO concentration of 2 mg/l. Therefore, denitrification will occur in the outer channel. This provides energy efficiency by lowering the oxygen demand on the entire system. Physical separation of the channels allows the environment within each channel to be precisely controlled to produce efficient treatment. The PLC – based SmartBNR control system provides precise control. The SmartBNR system controls the oxygen delivery of the disc aerators by changing the speed of each aerator in operation or shutting down / starting up additional aerators.



Small Flow Orbal System with Concrete Walls

A wastewater treatment option for smaller flows.



The outer channel of a two-channel Orbal basin contains a larger volume than the inner channel of the basin. It is roughly a 67% / 33 % split. To meet State regulatory design redundancy requirements, flow control systems can be arranged so that any channel of the Orbal system can be dewatered, with the other channel remaining in service, continuing to provide adequate treatment at design load. If any aerator is out of service, enough reserve oxygen transfer capacity is designed into the system so that the remaining aerators provide enough oxygen at maximum output to meet design load.

Energy Efficiency

The Orbal Small Flow process, using completely mixed reactors in series, provides economical, flexible, and reliable treatment performance. The “reactors in series” arrangement minimizes cost by using common wall construction. Because of the mixing efficiency of the disc

aerators, there is no need for mixers in the aerated-anoxic outer channel. The Orbal BNR process offers superior nitrification-denitrification performance, so greater removal of NH₃-N and TN removal is achieved than in non-aerated anoxic reactors. When considering all of these advantages, the energy savings of the Orbal Small Flow system is considerable.

- Complete secondary treatment packaged system from single source
- Advanced nutrient removal capability
- Aerated anoxic technology with tanks in series design
- Ready for immediate design
- Ideal for small engineering budgets
- Coordinated process design for low construction costs
- SmartBNR control system for maximum energy efficiency

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