



**AQUA-AEROBIC SYSTEMS, INC.**  
A Metawater Company

# SUCCESS STORIES

## PLANT NAME AND LOCATION

**SHENZHEN YANTIAN WWTP - SHENZHEN, CHINA**

## DESIGN DAILY FLOW / PEAK FLOW

**120,000 m<sup>3</sup>/day (31.7 MGD) / 145,360 m<sup>3</sup>/day (38.4 MGD)**

## AQUA-AEROBIC SOLUTION

**3 Aqua MSBR<sup>®</sup> SYSTEMS**

## Aqua MSBR<sup>®</sup> SYSTEM MEETS PHOSPHORUS REMOVAL REQUIREMENTS IN CHINA WITHOUT CHEMICALS

The Shenzhen Yantian WWTP is located in the Shenzhen Economic Development Zone near the Yantian port in China. The plant is partially surrounded by light industrial businesses and small jewelry factories. It occupies 11.5 hectares (28.4 acres) and serves a municipal population of about 125,000 along with the surrounding industrial and jewelry businesses.

Increasingly stringent permit limits on effluent BOD<sub>5</sub>, COD, TSS, Ammonia-Nitrogen and Total Phosphorus determined the need for a new wastewater treatment plant. Due to the limited land space and environmental sensitivity of the port area, Shenzhen had to design a new plant with technology that offered a small footprint and enhanced nutrient removal capabilities that addressed the particularly stringent Total Phosphorus discharge limits.



One Aqua MSBR<sup>®</sup> cell at Shenzhen Yantian WWTP. Shown is (1) AquaDDM<sup>®</sup> mixer with local control station and (2) Air Weirs.

Following their investigation of nutrient removal technologies, the city chose to install an Aqua MSBR modified sequencing batch reactor system. Plant construction was divided into two discrete phases. The first phase began in early 2000 and the second in December of 2001.



One of three Aqua MSBR<sup>®</sup> reactors at the Shenzhen Yantian WWTP.

The plant's treatment scheme includes a pump station, coarse and fine screening, grit removal, Aqua MSBR system, and sludge dewatering system. The entire plant's operation is controlled by a central control system.

Since the new plant began full operation in 2001, Shenzhen has consistently met its stringent effluent phosphorus limit through the enhanced nutrient removal capabilities of the Aqua MSBR system, and without chemicals.

## Aqua MSBR® SYSTEM PROCESS

The Aqua MSBR system features a combination of anoxic, anaerobic and aerobic cells with batch settling derived from sequencing batch reactor (SBR) technology. It eliminates the need for separate primary and secondary clarifiers while operating in a continuous flow/discharge mode with a full reactor volume at a constant liquid level. The system includes two sequencing cells and a variable number of specific function cells, depending on the effluent objectives of the plant. A 7-Cell configuration provides enhanced nutrient removal and functions as follows:

**Cells 1 & 7** - Sequencing Cells alternate four Phases:

1) Anoxic Mixing and Mixed Liquor Recycle, 2) Aeration, Mixing and Mixed Liquor Recycle, 3) Pre-settle, and 4) Clarification. As Cell 1 progresses through Phases 1-3, Cell 7 will remain in Phase 4 and vice versa.

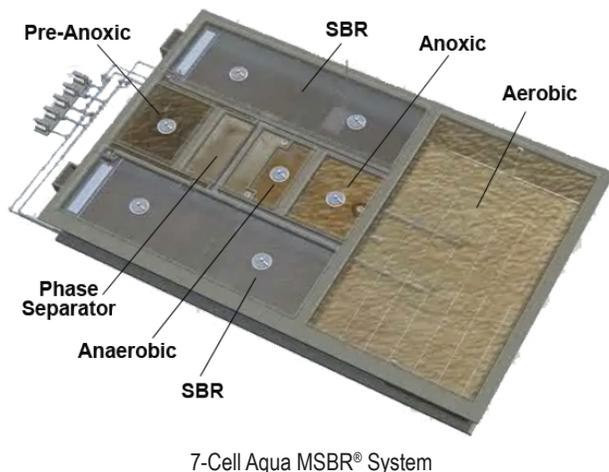
**Cell 2** - Phase Separator Cell designed to concentrate recycled mixed liquor or solids feed stream to the anaerobic cell and promote an optimal environment to enhance phosphorus release within the anaerobic cell.

**Cell 3** - First Stage Anoxic Cell designed to provide denitrification and promote an increased concentration of volatile fatty acids (VFAs) in the Anaerobic Cell.

**Cell 4** - Anaerobic Cell designed to promote phosphorus release under optimized conditions.

**Cell 5** - Second Stage Anoxic Mixing Cell designed to provide denitrification.

**Cell 6** - Aerobic Cell designed to provide oxidation of carbonaceous material, nitrification, and the biological uptake of phosphorus.



The two sequencing cells are ideally equipped to assume multiple functions ranging from anoxic mixing, aerobic mixing,

quiescent settling, sludge wasting and clarification and each features a patented Air Weir that effectively controls effluent flow. Each specific function cell may be designed for optimum conditions with respect to wastewater characteristics and specific effluent objectives.

## DESIGN CHARACTERISTICS

Shenzhen's Aqua MSBR system consists of a 7-Cell configuration. AquaDDM® mixers are used in Cells 1, 3, 4, 5, 6, and 7. Aqua retrievable fine-bubble diffusers are used in Cells 1, 6, and 7. The high quality effluent TSS produced is related to the design of each side cell. Currently the plant is running one of the three reactors and is processing 85% of its design flow\*.

## AVERAGE ANNUAL OPERATING DATA

LOADING	DESIGN INFLUENT	AVG INFLUENT	PERMIT EFFLUENT	AVG EFFLUENT
AVG Flow mgd	31.7	8.9*	----	----
Peak Flow mgd	38.4	10.9	----	----
BOD <sub>5</sub> mg/l	200	135	20	6.5
COD mg/l	300	255	60	35
TSS mg/l	200	148	20	9.2
NH <sub>3</sub> -N mg/l	----	23	15	7.6
Total P mg/l	4	3.8	0.5	0.33

## Aqua MSBR® SYSTEM ADVANTAGES

- Components can be designed to be accessible so operation is continuous during maintenance
- Small footprint; no separate clarifiers
- Ideal for large scale projects > 15,000 m3/day
- Better sludge flocculation; no sludge collection mechanisms
- Low TSS discharge; effective nitrification, denitrification and phosphorus removal
- Adaptability to phased construction
- Fully automated control system
- Low installation and operating cost
- Expandability