METITO

Commitment to a Cleaner Environment

A Case Study

Al Khor Sewage Treatment Works - Qatar

Introduction

With the economic boom and subsequent increase in population, Qatar embarked on a programme to construct new waste water treatment facilities and upgrade existing ones. The new Al Khor Sewage Treatment Works (STW) is designed and constructed to replace the existing STW in Al Khor area. The ultimate plant layout has been proposed for a population of 36,000 designed in two phases: Phase 1 designed to serve flows from a population of 18,000 and is sufficient until the year 2014, whilst Phase 2 will be designed and constructed at a later stage to cater for the ultimate plant capacity of 36,000 PE. The treatment process is based on the Sequencing Batch Reactor system (SBR).

Scope of Work

The scope of the first phase includes the supply, installation, start up operation and commissioning of the plant.

Plant General Information:

Process Overview

The system is divided into four main processes:

A. Preliminary Treatment which consists of:

- Septage reception facilities
- Inlet Works comprising flow measurement, mechanical screens, launder channels, compactors, actuated and manual penstocks, vortex grit separators and grit classifiers. The inlet works is constructed to handle ultimate phase 2 design flows.
- Flow collection and distribution chambers constructed to handle ultimate phase 2 design.

B. Secondary Treatment which includes:

- Sequencing Batch Reactor system
- Post-SBR balancing tanks
- Tertiary pumping station

C. Tertiary Treatment & Disinfection consisting of:

- Continuous sand filters and air compressors
- Ultra-violet equipment and hypochlorite based disinfection system
- Effluent storage tanks, two final effluent storage lagoons and lagoon pumping station

D. Sludge Handling System which includes:

- Sludge reception, sludge thickening, sludge aerobic digesters and sludge dewatering

SBR Process Steps

The SBR process is based on a sequential arrangement of sub-processes which take place in the same tank. The selected process is unique in the sense that the incoming flow to the system is continuous. Raw sewage enters the SBR system at the same rate as the incoming flow at all times, thus eliminating the need for a buffer tank between the inlet works and the SBR units to absorb the variations in flow.

Three process streams are designed to cater for Phase 1 flows, and a provision is made for two streams to be installed in the future for Phase 2. The decanted water from the SBR units gravitates into flow balancing tanks sized to have sufficient buffering volume to cater for the variable decanted flows and the selected filtration plant capacity.

Continuous Sand Filtration

The plant utilizes continuously working filters, i.e. the filter is not taken out of operation during backwashing or cleaning. Simultaneously with the filtration process, fouled sand is cleaned and suspended solids are discharged with the wash water.

Water is distributed into the filter through the inlet pipe. It then rises through the downward moving sand bed and is discharged via an overflow weir at the top of the vessel. Fouled sand is lifted by the air lift pump from the bottom of the filter to the sand washer where it is rinsed in counter-current flow with clean filtrate. Cleaned sand falls back over the surface of the filter bed to be utilised in the filtration process again.

UV Disinfection & Hypochlorite Dosing

The filtered water is taken to a distribution chamber from where it is introduced into the effluent storage tank via a channel provided with an Ultraviolet light

disinfection unit (UV). As wastewater flows past the UV lamps, the microorganisms are exposed to a lethal dose of UV energy. The UV dose is measured as the product of UV light intensity times the exposure time within the UV lamp array. After UV treatment and before the final effluent pumps, dosing of hypochlorite is applied to achieve the required level of residual chlorine in the treated water. Hypochlorite is dosed in the channel downstream of the UV units allowing the effluent storage tanks to provide the required chlorine contact time.

Sludge Handling Units

Excess sludge from the biological plant is frequently pumped by sludge transfer pumps to the Surplus Activated Sludge (SAS) Tanks. The tanks are provided with an aeration system to prevent the settling of suspended solids. SAS sludge is then transferred by progressive gravity pumps to gravity belt thickeners which remove excess water from the sludge up to 5% concentration dry solids. A polymer dosing system is provided to improve the thickening process as well as capture of solids. Thickened sludge is scraped off the belt and conveyed to the aerobic digestion tanks by progressive cavity pumps.

Two aerobic digester tanks are provided with a diffused bubble aeration system. The supplied air ensures that a sufficient amount of oxygen is available to achieve the extent of sludge digestion. All digested sludge is then pumped to the sludge dewatering unit for further treatment.

Sludge Dewatering system

Digested sludge is pumped to the sludge dewatering centrifuges which dewater sludge up to 18% concentration dry solids. This is achieved through high centrifugal forces and polymer dosing which improves the solids cake concentration.

Odour Control Units

Parts of the plant that have a significant potential for generating odour are suitably covered and enclosed air is treated for reduction of H_2S and other noxious sewage-related gases. An activated carbon system is used with a design efficiency to remove at least 99% of the H_2S present in the foul air extracted from the wet well or chamber. H_2S monitoring ports are installed in the body of the bulk carbon type deodorizer system to facilitate detection of the progress of H_2S saturation in the carbon bed.

Structures that are expected to generate odours are vented to the atmosphere via an odour control system. These are:

- Septage reception tanks & sludge screen channels
- Inlet works (channels & chambers)
- SBR distribution chamber
- Return pump station works
- Imported sludge screening station
- Centrifuge channels

Mechanical equipment that are expected to have an odour potential are provided with covers and are vented through odour control systems. These are:

- Mechanical screens
- Screenings conveyors
- Screenings compactor
- Grit classifier
- Gravity belt thickener machines
- Sludge dewatering system

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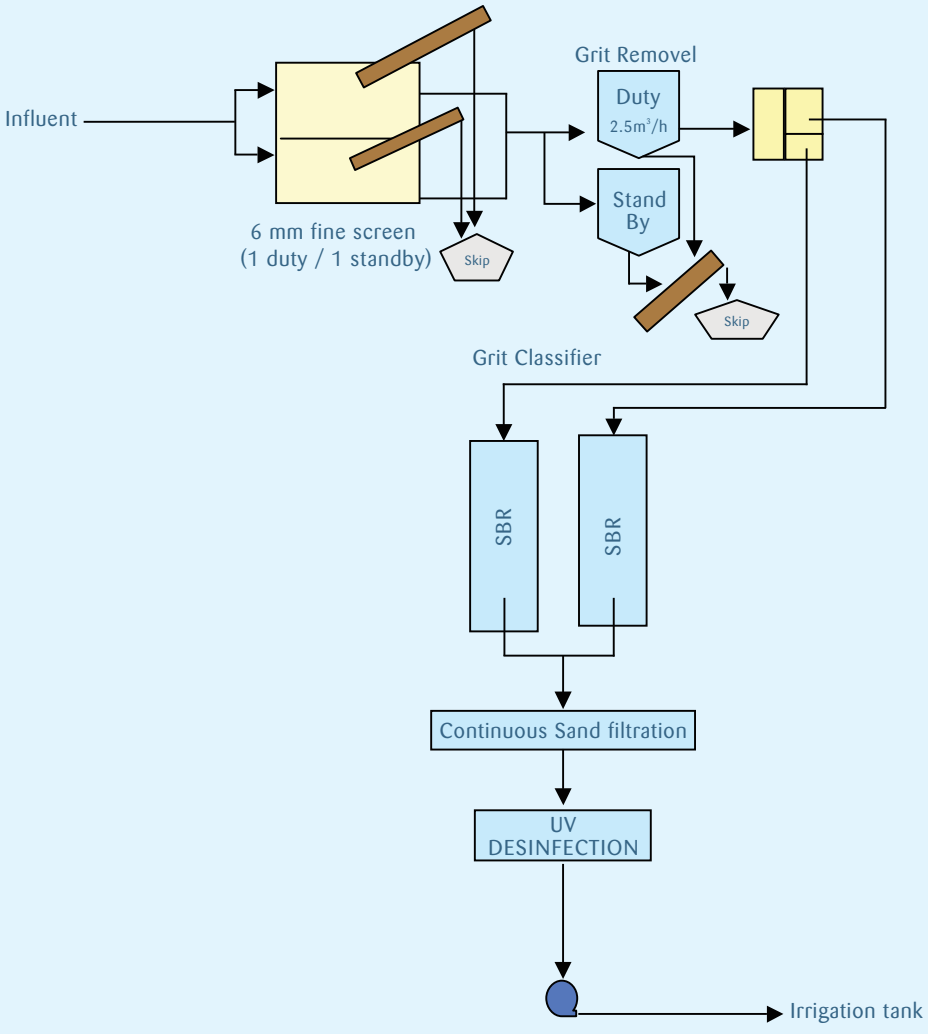
Main Benefits to the End User

The provided plant offers the advantage of a very limited space requirement and comparatively low energy consumption, thanks to the SBR biological treatment system and tertiary treatment using continuous filtration. The quality of the treated effluent is in accordance with the local authorities regulations for re-use in landscape irrigation and other green projects, thus having a major contribution to the government's reuse and recycling initiatives.



SBR Process Flow Diagram

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