

Wastewater Treatment Plant for Ruwais Housing Complex Abu Dhabi - UAE

A Case Study



Introduction

The town of Ruwais lies 250km west of Abu Dhabi, capital of UAE where the largest oil well fields and petrochemical industrial complex are located.

The successful operation of this entire complex is managed by Abu Dhabi National Oil Company's (ADNOC) professional and dedicated workforce. ADNOC has constructed a township providing the most modern amenities for all its employees and other associated companies. The township is named Ruwais Housing Complex.

ADNOC plans for continued growth necessitated the expansion of the present township. While conforming to its commitment to maintain the highest standards of environmental protection, and its augmentation of the township's infrastructure was part of this planned work. This included expansion of the drinking water supply and a modern wastewater treatment plant.

Metito was awarded the multi-million US Dollar utilities expansion project against tough competitive bidding. Project execution involved complying with the international standards, as well as the specifications drawn by ADNOC and its consultants CRSS International. Metito successfully completed this most challenging task to the entire satisfaction of the project owners.

Scope of Work

This included the detailed engineering, manufacture, inspection, supply, installation, testing and commissioning, start-up, performance test and training of personnel at site.

Plant General Information

The drinking water and wastewater treatment facilities are extensive and mainly comprise the following units:

- Drinking water treatment, storage and pumping

- Sewage pumping stations
- Sewage treatment plant
- Sludge digestion & handling facilities
- Irrigation pump station
- Electrical and control equipment
- SCADA System
- Miscellaneous site works

Plant Technical Characteristics

Drinking Water Treatment, Storage and Pumping

Drinking water from the main water supply line is stored in two 20,000 US gallons capacity storage tanks. A fully automatic chlorination system renders water suitable for drinking purposes. The disinfected water is delivered to the housing complex through a set of transfer pumps. The minimum water supply pressure is maintained through the use of two 129m³ hydro-pneumatic tanks. The tanks are in carbon steel construction and designed as ASME (U) STAMPED pressure vessels. All associated compressors, controls and monitoring devices are designed for fully automatic operation.

Sewage Pumping Stations

Raw sewage from the housing complex is transferred to a main sewage lift station through two intermediate pumping stations from the plant located at distances of about three and five kilometers. Each intermediate pumping station is provided with two sewage lifting



pumps, each having a capacity of up to 100 m³/h. From the main sewage lift station, sewage is pumped to the wastewater treatment plant. Four pumps transfer the sewage to the treatment site. The pump capacities vary from 260 m³/h to 560 m³/h. The lift station equipment is installed about 11 m below ground, and the dry well is furnished with advanced ventilation and odour control equipment.

Wastewater Treatment Plant

This includes the following units:

- Raw sewage metering station
- Inlet headworks
- Aeration tanks
- Clarifiers
- Secondary coagulation, flocculation and settlement
- Travelling bridge gravity filters
- Sludge digestion and handling
- Gas chlorinating equipment
- Effluent pumping station
- Irrigation pumping station

Inlet Headworks

The inlet headworks comprise grit removal and disposal facilities to remove the heavy grit particles, followed by

automatic and manual screens that remove large floating and suspended objects from raw sewage.

Aeration Tanks

Partially treated raw sewage enters two circular aeration tanks 44 m in diameter. To achieve economy, the tanks are constructed as earthen basins with waterproof liners. The integrity of the liners is continuously monitored through a uniquely designed leak detection grid installed under each liner. Each aeration tank is combined with an anoxic zone for effective de-nitrification. Two 75kW Brush Rotors are installed in each basin to meet the aeration requirements.

Clarifiers

The aerated sewage passes through two circular clarifiers 13.5 m in diameter. The effluent flows through a peripheral inlet and central collection system, and the clarifiers are equipped with gear driven central cage and rake mechanism. Sludge is raked into a central cone at the bottom of the clarifier. The pipework is arranged to provide continuous sludge re-circulation and excess sludge discharge.

Secondary Coagulation, Flocculation and Settlement

Biologically stabilised treated waste is further treated by a coagulation and flocculation process, and fine suspended solids are again removed by the sedimentation process with the help of two 50m x 50m x 4.5m deep settlement tanks. Like the aeration tanks,



these tanks are also designed as earthen basins with waterproof liners and continuous monitoring leak detection.

Travelling Bridge Gravity Filters

Clarified water is treated in the gravity filters to further improve the quality of water. The filters are provided with travelling bridge backwash equipment mounted on a frame structure that moves along the filter via a mechanism powered by a reversing motor. The backwash equipment, comprising a moving stainless steel hood and submersible pump, is mounted on this bridge. Hydraulically sized orifices are provided to collect the backwash water in a uniform manner.

Sludge Digestion and Handling

Sludge from the biological and clarifier stages is pumped to two 1,150 m³ digester tanks, where it is digested and stabilised under aerobic conditions. Two centrifugal air blowers, each having a capacity of 3,300 m³/h, supply the required air. Digested sludge is pumped to a circular sludge thickener 15 m in diameter, from which thickened sludge is pumped to the sludge drying beds. Underflow from the sludge drying beds and supernatant water from the sludge thickener is returned to the inlet headworks for recovery.

Gas Chlorinating Equipment

The complete chlorination equipment is housed in a separate building. Two wallmounted vacuum operated, solution feed, sonic flow type gas chlorinators are supplied to provide chlorine solution to the chlorine contact tank and filters. An automatic switchover facility



ensures the continuous supply of chlorine, and the gas feed flow is controlled automatically. Ancillary equipment installed include an on-line chlorine analyser, chlorine leak detection and gas monitoring and chlorine emergency kit.

Irrigation Pumping Station

The irrigation reservoir receives treated water from the wastewater treatment plant for storage and distribution. The reservoir is provided with inlet control valves and four sets of pumps to supply water to the irrigation system. The water passes through online automatic self-cleaning filters and a hydro-pneumatic tank to maintain minimum pressure in the system.

Electrical and Control Equipment

These include state of the art SCADA, process control panels, MCC's, cabling, wiring, earthing, plant and street lighting and lightning protection. An ATS/MTS with bypass facility is provided to avoid parallel operation of

main and generator incomers to the MCC in line with the latest Water and Electricity Department (WED) requirements. PLC based control panels are located near the individual plant facilities. These are water supply system and other facilities. All control stations are connected to the SCADA system over a multi drop communication link. The SCADA system operates on a dedicated digital leased line to provide continuous information. Drinking water is received from Ruwais refinery located 25 km away, and the SCADA system transmits the necessary information to the refinery for an assured supply of drinking water to the housing complex. The link between the two locations is maintained by a fiber optic communication network.

The entire water treatment package was successfully commissioned and put into operation to the full satisfaction of ADNOC. The project is a clear demonstration of Metito's commitment to provide its clients with the most advanced treatment technologies whilst meeting the most stringent international and local standards.

Schematic Flow Diagram

