



## PROCESS OPTIMISATION AT LÜLEBURGAZ PLANT

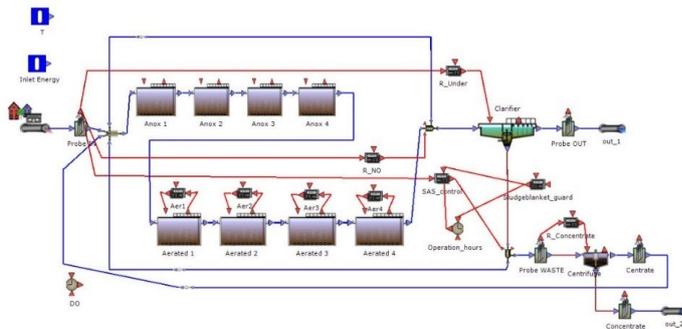
Model based design verification and optimisation of Lüleburgaz wastewater treatment plant by use of WEST for OPTIMISATION

As one of the beneficiaries of the Instrument for Pre-Accession Assistance (IPA) mechanism for European Union (EU) candidates, the Turkish Ministry of Environment and Urbanisation and the EU IPA department have invested in several environmental-concerns project. The construction of Lüleburgaz wastewater treatment plant (WWTP) is one of such projects. Due to the estimations provided by consultants in the design for the WWTP, a more reliable model based on verified data is required.

With MIKE Powered by DHI WEST for OPTIMISATION software, we were able to provide a dynamic model that was more reliable in simulating the WWTP, based on the design data provided by consultants and real data obtained from Supervisory Control and Data Acquisition (SCADA).

### LÜLEBURGAZ WASTEWATER TREATMENT PLANT

The design provided by the MASS Construction Company engaged by the municipality of Lüleburgaz was based on estimations that were not verified. This resulted in a design that could not capture the efficacies of the plant. A cost efficient solution was needed for the construction of the WWTP, which required a more reliable modeling tool. It also needed to be operated with optimised scenarios and had to have better capability in identifying future problems. Our WEST for OPTIMISATION software allowed the setting up of a dynamic model with process design data and update. In addition, using the software, a model with real data obtained from SCADA to produce a more reliable simulation that meets EU discharge standards, was developed.



Layout of Lüleburgaz WWTP on MIKE Powered by DHI WEST software © DHI

### CLIENT

- Municipality of Lüleburgaz, Kırklareli
- MASS Construction Co., Kocaeli

### CHALLENGE

- Need for verification of design with a modelling tool to increase design reliability
- Compliance with discharge criteria set by the Ministry Environment and Urbanisation of Turkey
- Cost ineffective treatment of municipal wastewater

### SOLUTION

- A process model based on Supervisory Control and Data Acquisition (SCADA) data has been created on WEST for OPTIMISATION software.

### VALUE

- Process design values verified by WEST for OPTIMISATION modelling tool
- A process model developed using existing data from SCADA
- Energy consumption calculations created for aeration, sludge handling and management of centrifuge parts

### LOCATION / COUNTRY

Kırklareli, Turkey

### SOFTWARE USED

WEST for OPTIMISATION

This project was carried out using MIKE Powered by DHI software.

The plant comprises of three stages

1. Pre-treatment stage; consisting of screening and grit and grease removal
2. Biological stage; consisting of an oxidation ditch followed by the secondary clarifier
3. Thickening stage; for excess sludge to be de-watered prior to disposal.

### MODEL-BASED DESIGN VERIFICATION

The aim of this modelling exercise was to conduct a model-based verification of the design by means of steady-state simulations, and to provide additional information regarding the variability of the effluent by means of dynamic simulations.

The influent data was provided by the client's measurements and process calculations. These daily values were interpolated using a dynamic pattern derived from the Benchmark Simulation Model no.1 (BSM1) and were used to generate a realistic dynamic data series.

#### Steady-state simulation

The main objective of the steady-state simulation of the plant using our WEST for OPTIMISATION model is to verify the process calculations. This was achieved by imposing the relevant design process parameters to the model to obtain the desired effluent quality.

#### Dynamic simulation

The purpose of the dynamic simulation is to verify that the average effluent leaving the plant corresponds to an amount of variable influent fed to the plant. This included daily patterns as well as rain and storm events over a period of 30 days.

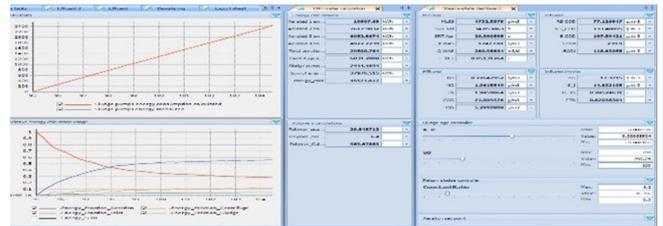
Results of the scenario analysis that was done according to varying internal recycle showed that the effluent discharge standards would be largely met.



Oxygen, nitrogen and Mixed Liquor Suspended Solids (MLSS) results © DHI

### DEVELOPMENT OF THE MODEL WITH SCADA DATA AND OPTIMISATION OF WWTP PROCESSES

The SCADA data allowed some dynamic characteristics of the WWTP to be described for the model. This included daily variations to the aeration pattern based on the logged data from the oxygen sensor as well as daily patterns for dispelling excess sludge based on existing data extracted from SCADA. These adaptations provide better insight to the behavior of the plant and were verified by dynamic simulations against effluent measurements from the laboratory. Calculating the energy consumption of various equipment under simulated conditions is an important goal as this tells about the capacity of the plant.



Dashboard showing energy consumption © DHI

Energy consumption and use of polymers over the simulation period are available on a dashboard so that the effect of various factors such as a change in control, influent load or rain can be identified immediately. The results also include the full information on effluent, MLSS, and detailed power consumption and are plotted along with SCADA and laboratory measurements for comparison.

### BENEFITS OF WEST

WEST is a powerful and user-friendly software application for dynamic modelling and simulation of WWTPs and other types of water quality related systems. Designed for operators, engineers, and researchers interested in studying processes in WWTPs, sewer systems, and rivers, applications of the software include:

- evaluation of design options
- process optimisation
- model calibration
- development of advanced control strategies
- monitoring of plant operation and troubleshooting
- research and development

### VALUE FOR THE FUTURE

The dynamic model that was created on MIKE Powered by DHI WEST for OPTIMISATION modelling software has helped to verify the process calculations that resulted in an easier evaluation of the plant's processes. With the combination of our software and the data gathered from SCADA, optimisation of the process parameters for the existing Lüleburgaz WWTP was possible.

Contact: [info@dhigroup.com](mailto:info@dhigroup.com)

For more information, visit: [www.dhigroup.com](http://www.dhigroup.com)