DYNAMIC MODELLING OF THE COLESHILL SEWAGE WORKS

CLIENT: **Severn Trent Water Ltd.**

LOCATION: **Birmingham, U.K.**

PROJECT DESCRIPTION

Severn Trent Water Ltd. (STW) operates about 70 activated sludge plants. In the future, some will have to meet COD, total N, and total P consent limits as well as existing BOD, SS, and NH_4–N limits. STW recognizes that **computer simulation can play an important role in understanding the operation of large-scale sewage works, allowing them to meet consent limits more effectively**.

The Coleshill sewage works is a 55 MLD conventional diffused-air nitrifying activated sludge plant. The plant meets an effluent requirement of 25/45/20 (BOD/SS/NH_4-N) based on the 95th percentile and 3 samples per week. Coleshill has over 150 analogue inputs to the site monitoring the system, including:

- 8 ultrasonic flow level sensors
- 16 dissolved oxygen probes
- 8 sludge blanket probes
- 4 MSL respirometers
- 3 effluent suspended solids probes
- 3 ion-selective NH_4-N probes
- 3 pH sensors
- 3 temperature probes

➢ Site instrumentation

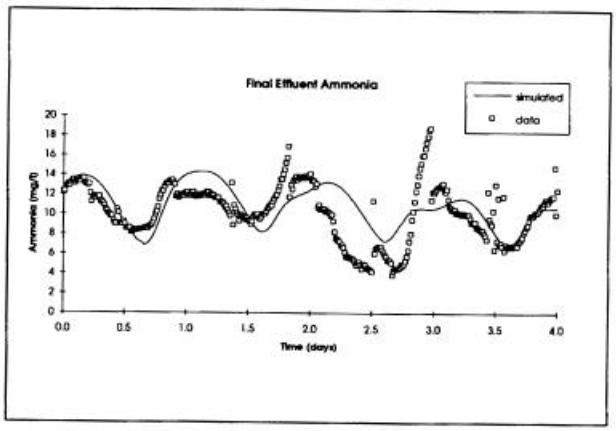
The purpose of this investigation was to develop a calibrated model of the Coleshill sewage works and to link the model to the site monitoring the system for operational control purposes.

➢ Development of calibrated model

RESULTS

A process flow diagram derived from the physical layout of the plant was developed using GPS-X. Following a review of historical plant performance, the model was calibrated to a number of flow conditions to assess the stability and sensitivity of model parameters.

Operational parameters such as waste and return flow rates, DO set-points, etc. were identified and specified as inputs to the model. A steady-state solution of the model, calibrated to average historical plant data, allowed for the identification of a set of long term model parameters.



- Comparison of final effluent ammonia data and simulation results

A number of **simulations under dynamic conditions were performed**. The results of a four day simulation on the effluent ammonia concentration are shown in the figure above. The first two days were used for model calibration, while the next two days were used for model verification. The discontinuities shown in the observed data (every 12 hours) are associated with the self-calibrating feature of the instrument. It is interesting to note that following a calibration, the measured value returns to the simulated value.

The results of this investigation have shown that simulation can serve as a tool for:

- Optimizing plant performance
- Detecting monitoring instrument failures
- Enhancing process performance understanding
- Design assistance for the upgrade of existing facilities