How far can various control options take us in terms of increased hydraulic capacity under wet weather conditions?

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How far can various control options take us in terms of increased hydraulic capacity under wet weather conditions?

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Introduction

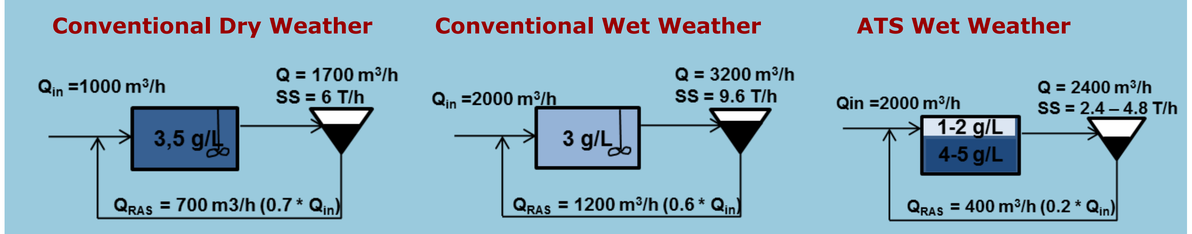
Many modelling studies have demonstrated that the hydraulic capacity of the WWTP can be improved by introducing various real time control options, however few studies have demonstrated how effective these controls are in the real world.

Based on 7 years full scale operation data this study investigates the performance of implemented controls strategies on hydraulic capacity and pollution treatment during wet weather conditions

- Location: Avedøre WWTP, Denmark
- Design Capacity: 345 000 PEB60
- Industrial and residential area
- Separate sewer
- Data: 7 years full scale operational data

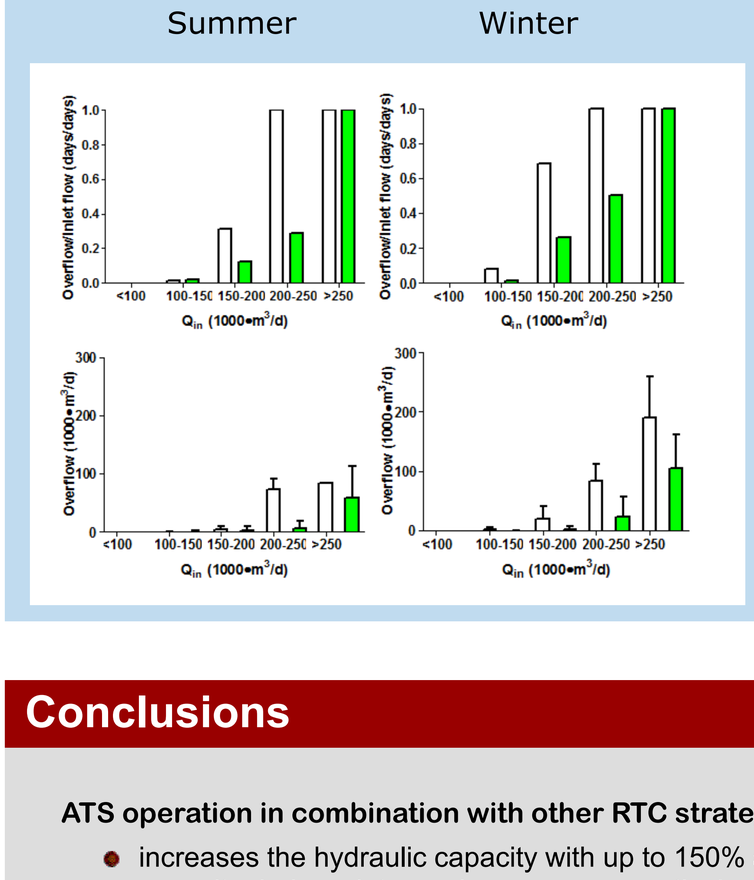
Implemented Wet Weather Control Strategies

- **Aeration Tank Settling:** Introducing settling phase in aeration tanks during wet weather (patented method).

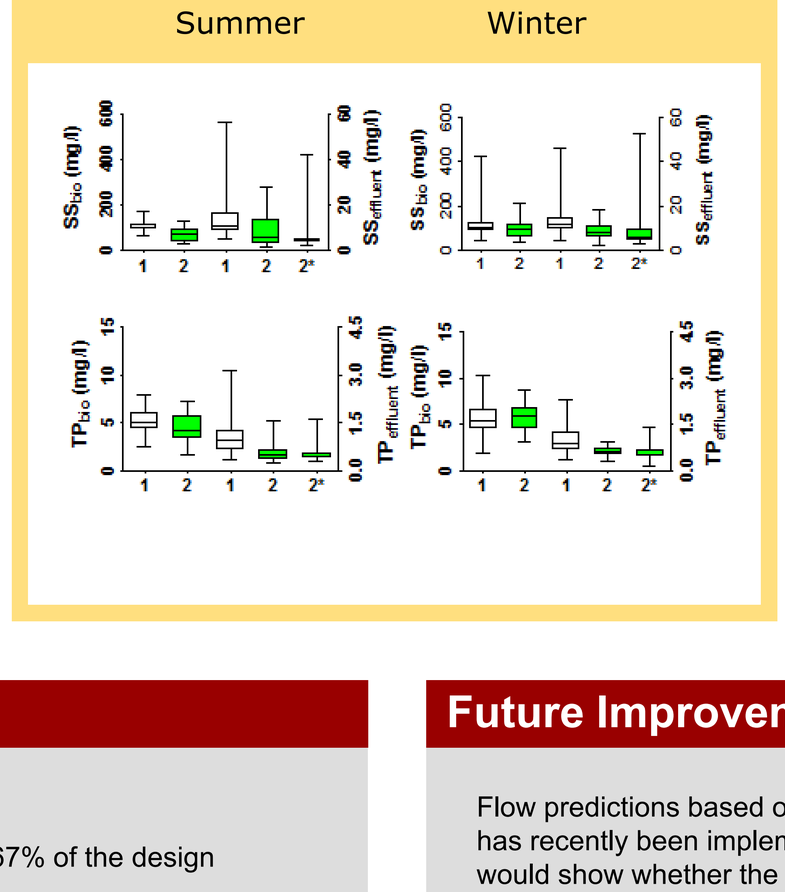


- **Sludge Age Control**: Dynamic control of mixed liquor suspended solids in aeration tanks based on temperature, NH_4-N and NO_3-N concentrations.
- **Switch to wet weather mode based on flow predictions:** Flow data from a pumping station with approximately 1 hour flow prediction time were used
- **Return Sludge and inlet flow Control based on sludge blanket level**: Controlling the return sludge flow and inlet flow based on sludge blanket level and suspended solids in return sludge.
- **Flow equalization tank**: Storm water storage tank at the WWTP is used as flow equalization tank
- **Platform used for implementation:** STAR control ™

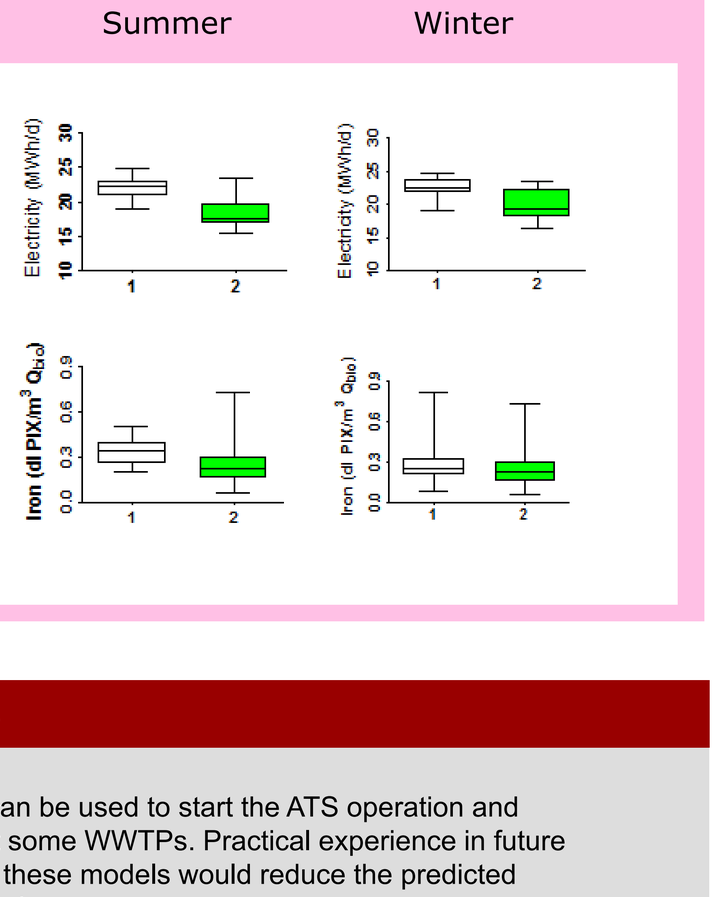
Results - Overflows



Results – Treatment Efficiency



Results – Electricity and Chemicals



Conclusions

ATS operation in combination with other RTC strategies

- increases the hydraulic capacity with up to 150% and 67% of the design capacity during winter and summer, respectively
- reduces the effluent concentrations compared to the conventional wet weather operation by
  - 50-60% for chemical oxygen demand (COD)
  - 30-60% for Suspended solids
  - 40-50% for total phosphorous (TP)
  - No change in total nitrogen (TN) removal efficiency
- reduces the electricity consumption by 7-12 %.

However, in very few cases the ATS operation in combination with RTC was unable to avoid overflows below the design capacity.

Future Improvements

Flow predictions based on radar can be used to start the ATS operation and has recently been implemented at some WWTPs. Practical experience in future would show whether the usage of these models would reduce the predicted overflow frequency due to climate changes

Further Information

- Sharma A.K., Guildal, T., Thomsen, H.A.R., Mikkelsen, P.S., and Jacobsen, B.N. (2013). Aeration tank settling and real time control as a tool to improve the hydraulic capacity and treatment efficiency during wet weather: Results from 7 years full scale operational data. Water Science and Technology, 67 (10), Pages 2169-2176
- WEFTEC 2013, Session 417: Wet Weather Operation and Control of Integrated Sewer and Wastewater Treatment Plant Systems, 8th October, 2013, 13:30 – 17:00, Room S406b.

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Anitha Kumari Sharma