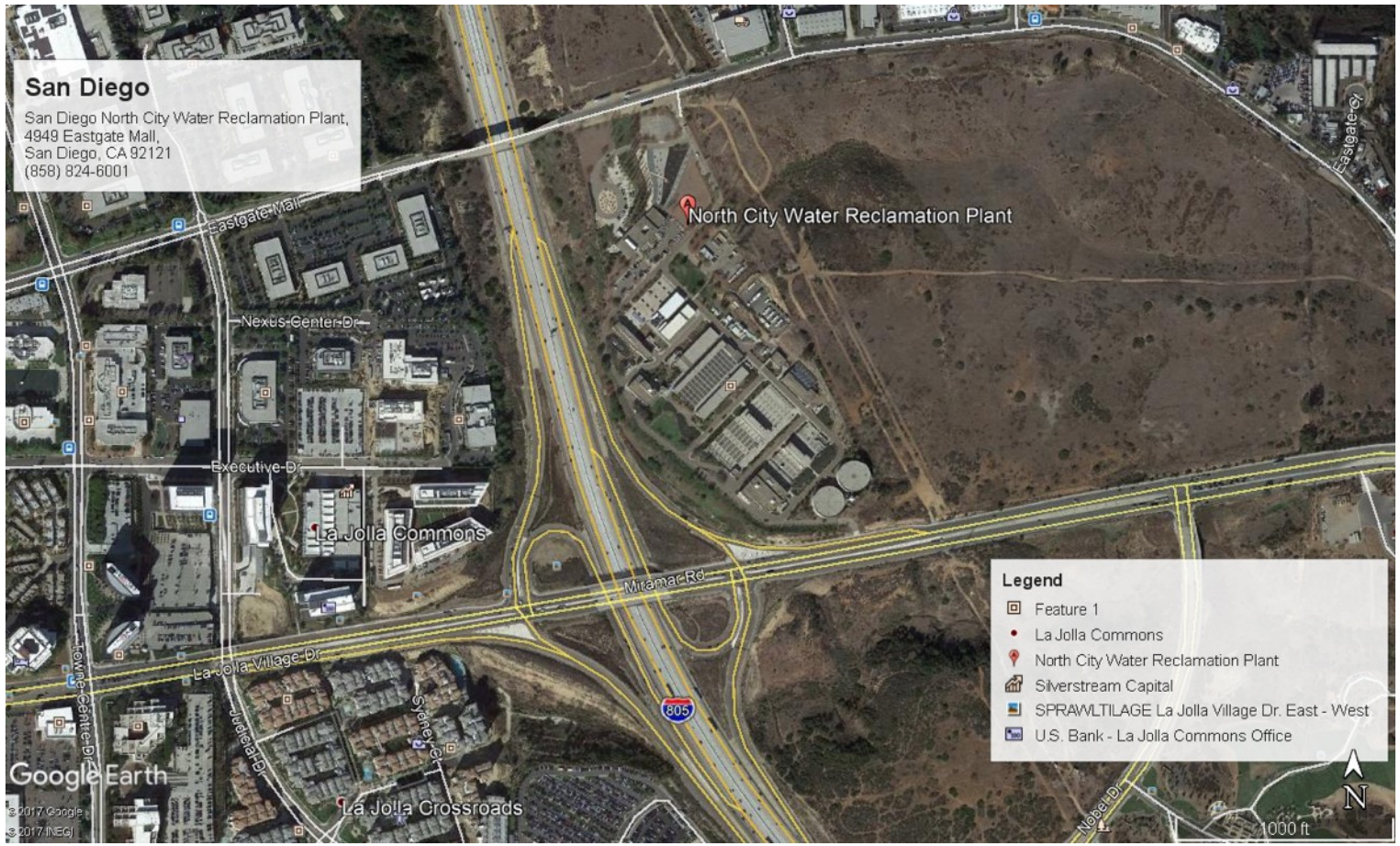
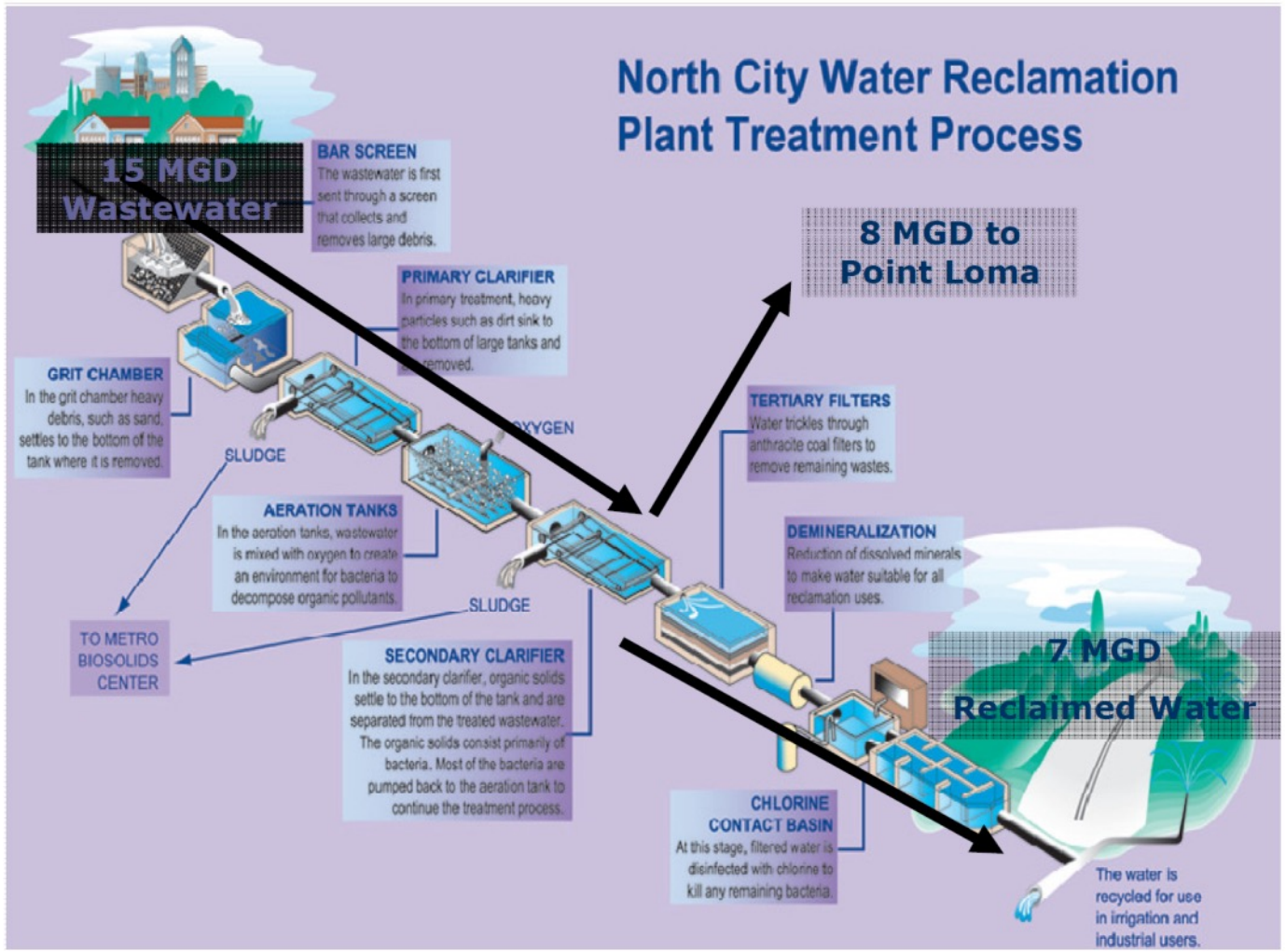
Modelling Ammonia Based Aeration Control in Real Time with Online Instrumentation

Hach	City of San Diego
Dave Commons	Robert Relph
Bob Dabkowski	George Wendorf
Kevin Menning	
Melody White	

New England Water Environment Association 2018 Annual Conference
Boston, Massachusetts
Wednesday, January 24, 2018


San Diego
San Diego North City Water Reclamation Plant,
4949 Eastgate Mall,
San Diego, CA 92121
(858) 824-6001
Eastgate Mall
Nexus Center Dr
Executive Dr
La Jolla Commons
North City Water Reclamation Plant
Eastgate Cy
Miramar Rd
La Jolla Village Dr
Towne Centre Dr
Judicial Dr
Sydney Ct
805
La Jolla Crossroads
Nobel Dr
Google Earth
© 2017 Google
© 2017 INEGI
Legend
Feature 1
La Jolla Commons
North City Water Reclamation Plant
Silverstream Capital
SPRAWLTILAGE La Jolla Village Dr. East - West
U.S. Bank - La Jolla Commons Office
N
1000 ft


North City Water Reclamation Plant Treatment Process
15 MGD Wastewater
BAR SCREEN
The wastewater is first sent through a screen that collects and removes large debris.
PRIMARY CLARIFIER
In primary treatment, heavy particles such as dirt sink to the bottom of large tanks and removed.
GRIT CHAMBER
In the grit chamber heavy debris, such as sand, settles to the bottom of the tank where it is removed.
SLUDGE
OXYGEN
AERATION TANKS
In the aeration tanks, wastewater is mixed with oxygen to create an environment for bacteria to decompose organic pollutants.
SLUDGE
TO METRO BIOSOLIDS CENTER
SECONDARY CLARIFIER
In the secondary clarifier, organic solids settle to the bottom of the tank and are separated from the treated wastewater. The organic solids consist primarily of bacteria. Most of the bacteria are pumped back to the aeration tank to continue the treatment process.
8 MGD to Point Loma
TERTIARY FILTERS
Water trickles through anthracite coal filters to remove remaining wastes.
DEMINERALIZATION
Reduction of dissolved minerals to make water suitable for all reclamation uses.
CHLORINE CONTACT BASIN
At this stage, filtered water is disinfected with chlorine to kill any remaining bacteria.
7 MGD Reclaimed Water
The water is recycled for use in irrigation and industrial users.

Problem: Oversized Blowers

- Expense of energy
- Waste of dissolved oxygen
- Floc shearing/settleability issues

- What size blowers do we really need?
- What is the most efficient operation?
- How quick is the payback?

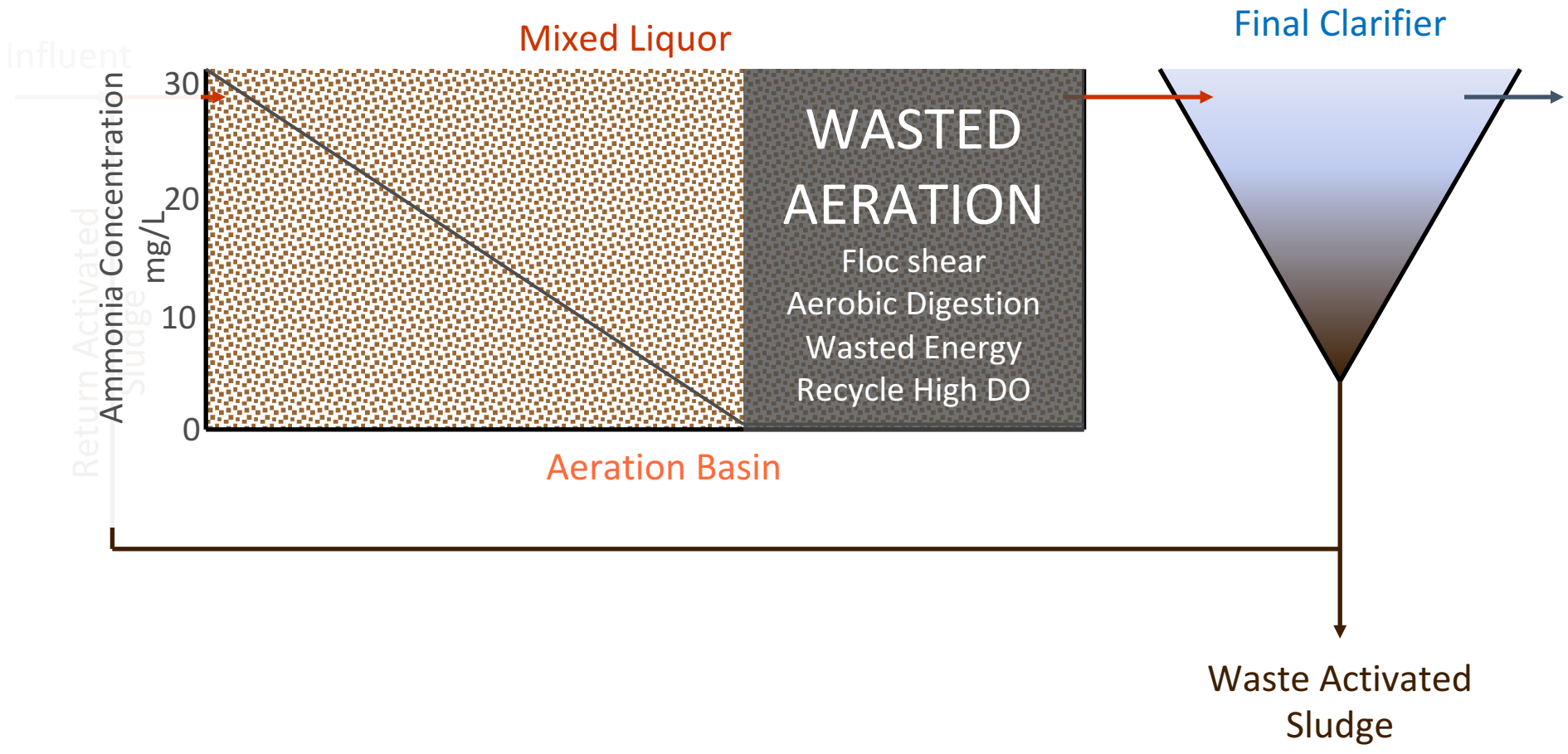
Solution: Model ABAC in Real Time

- Ammonia based aeration control (ABAC)
  - Use just enough dissolved oxygen to nitrify to desired setpoint
  - Assumes BOD is removed before nitrification is complete
- Hach Real Time Controller for Nitrification (RTC-N)
  - Calculates the optimal DO concentration for ABAC
  - Use for either modelling or controlling a process
  - Most utilities don’t have modelling software
- Actual DO – “Optimal” DO = $$ Savings $$

AMMONIA BASED AERATION CONTROL (ABAC)

Imagine the Aeration Basin as a graph…

"Normal Operation": Add more air than necessary



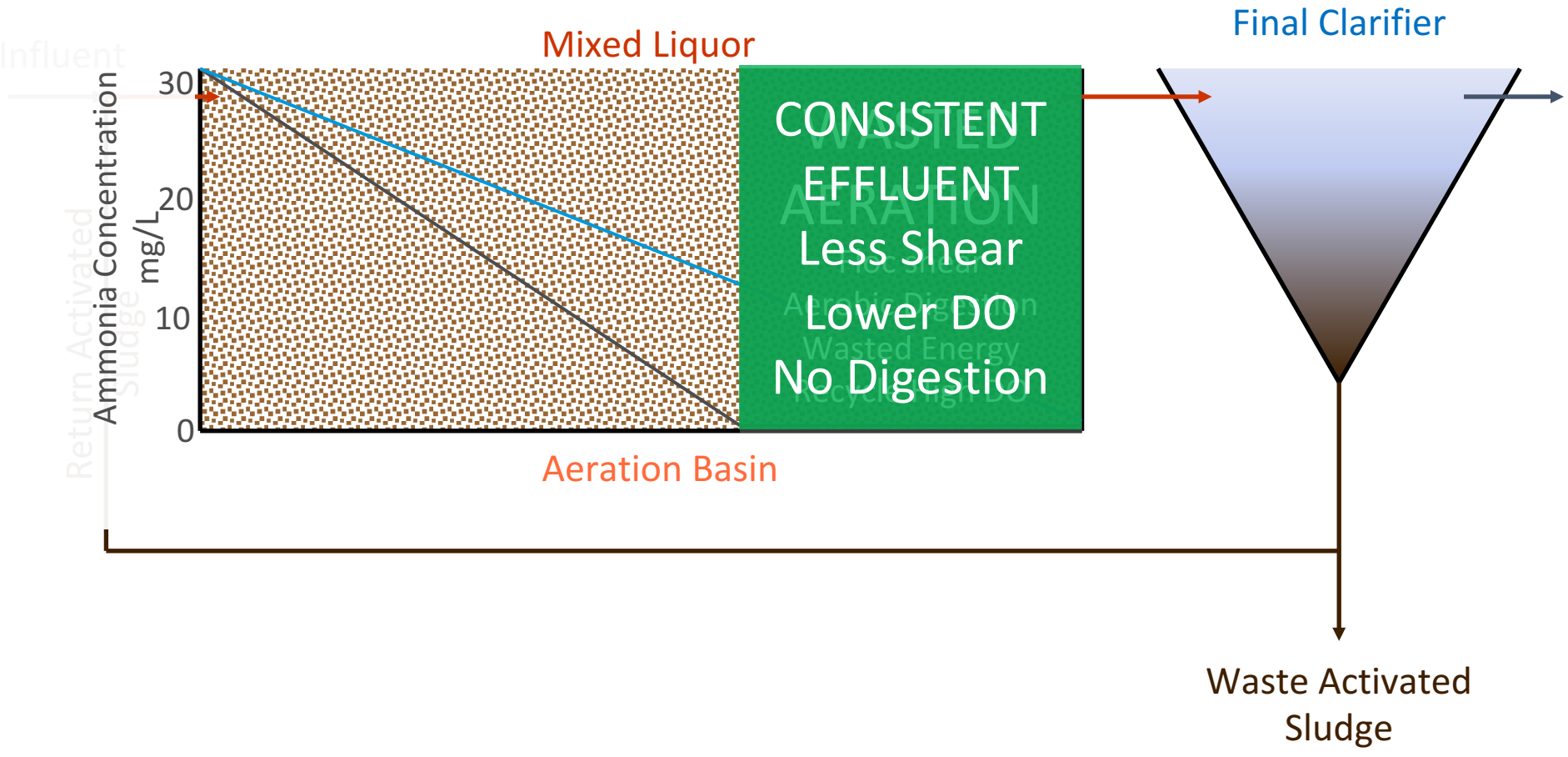
AMMONIA BASED AERATION CONTROL (ABAC)

Imagine the Aeration Basin as a graph…

"Normal Operation": Add more air than necessary

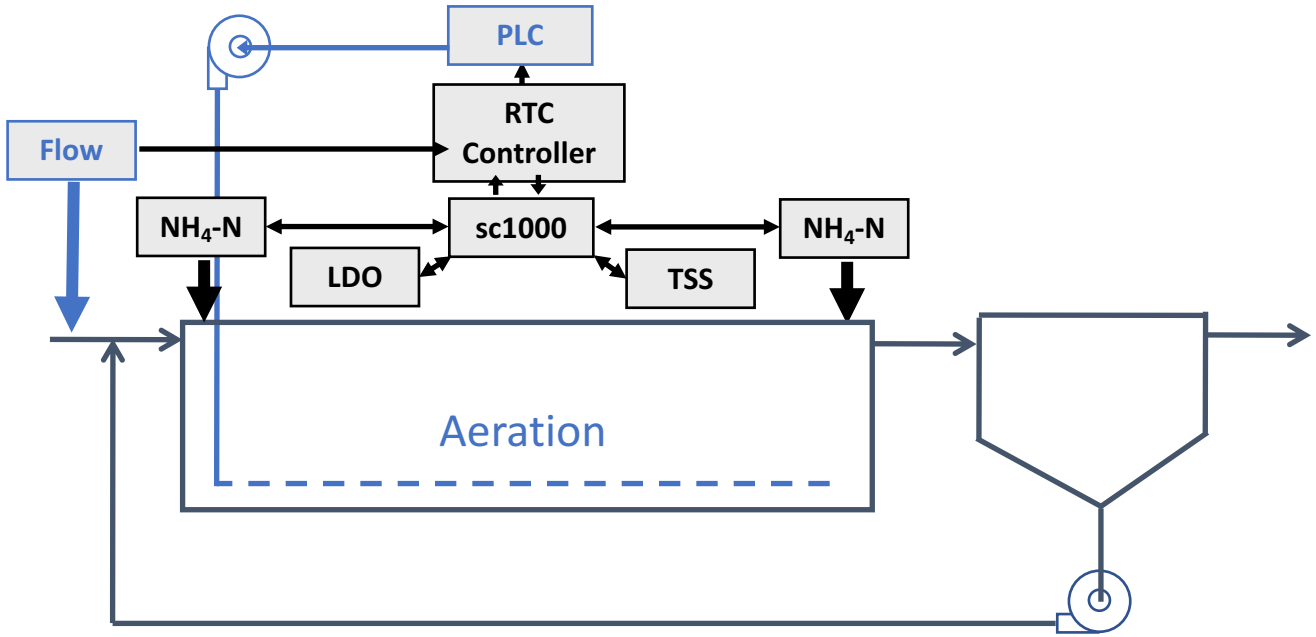
"ABAC Control": Add the perfect amount of air

Process Control | Energy $avings$ | Consistency

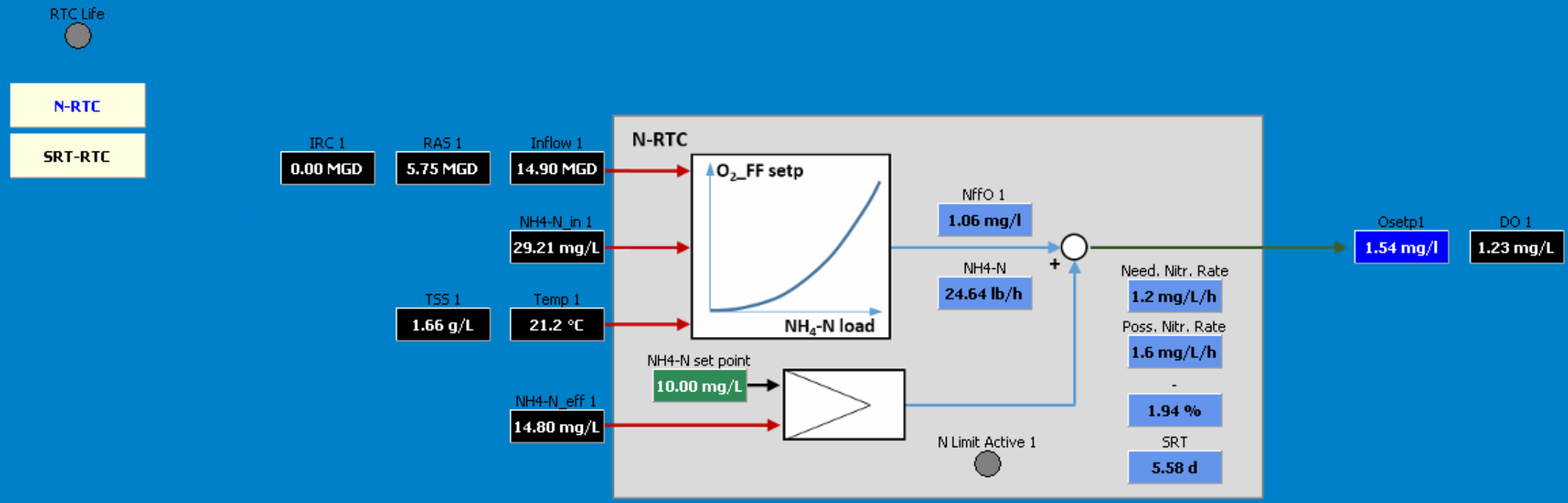


RTC-N nitrification controller

- Typical installation
  - Aeration Influent & Effluent Ammonia Concentration
  - TSS Concentration & LDO (temperature required)
  - Use existing DO Control system

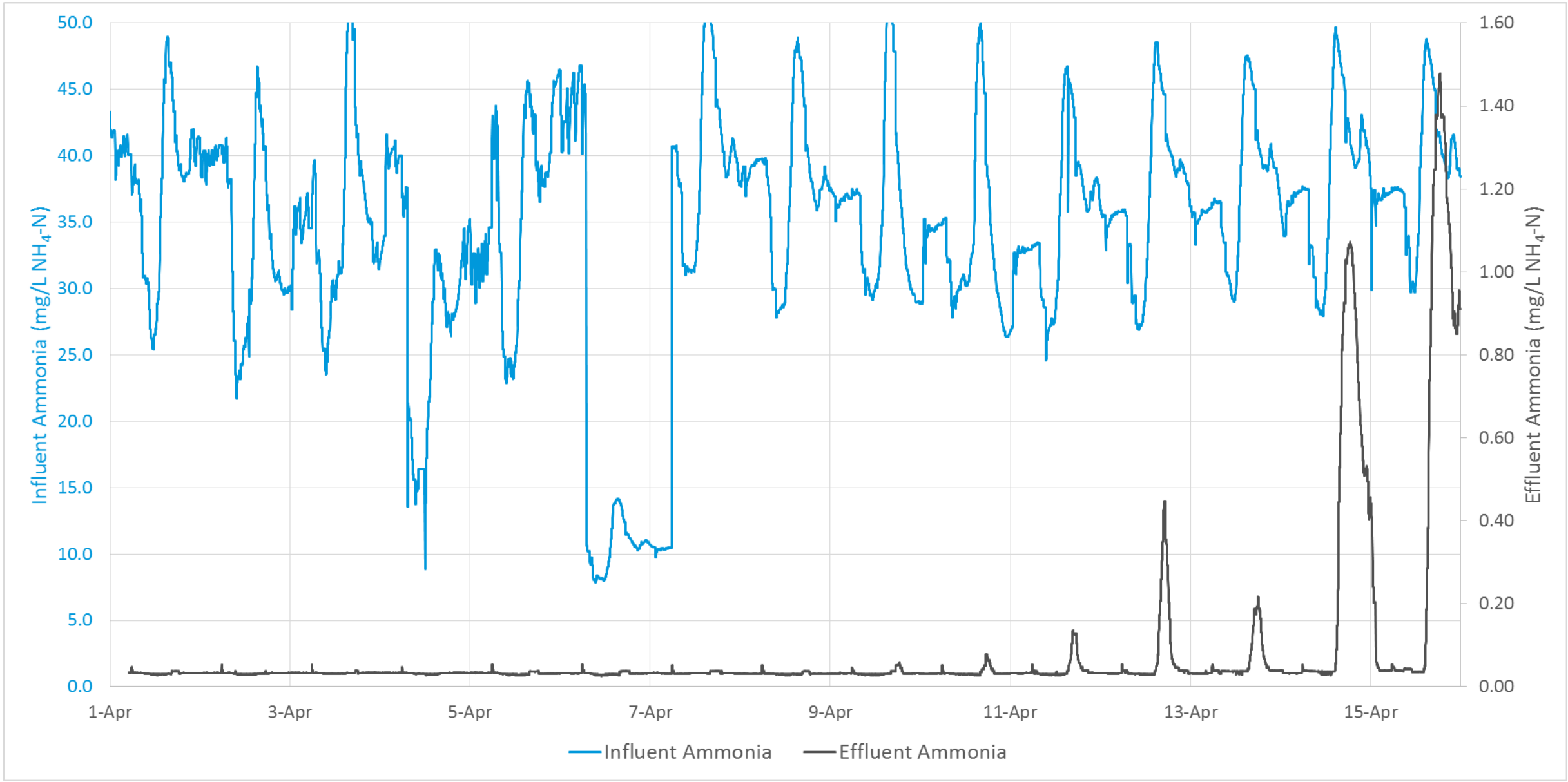


Hach RTC-N

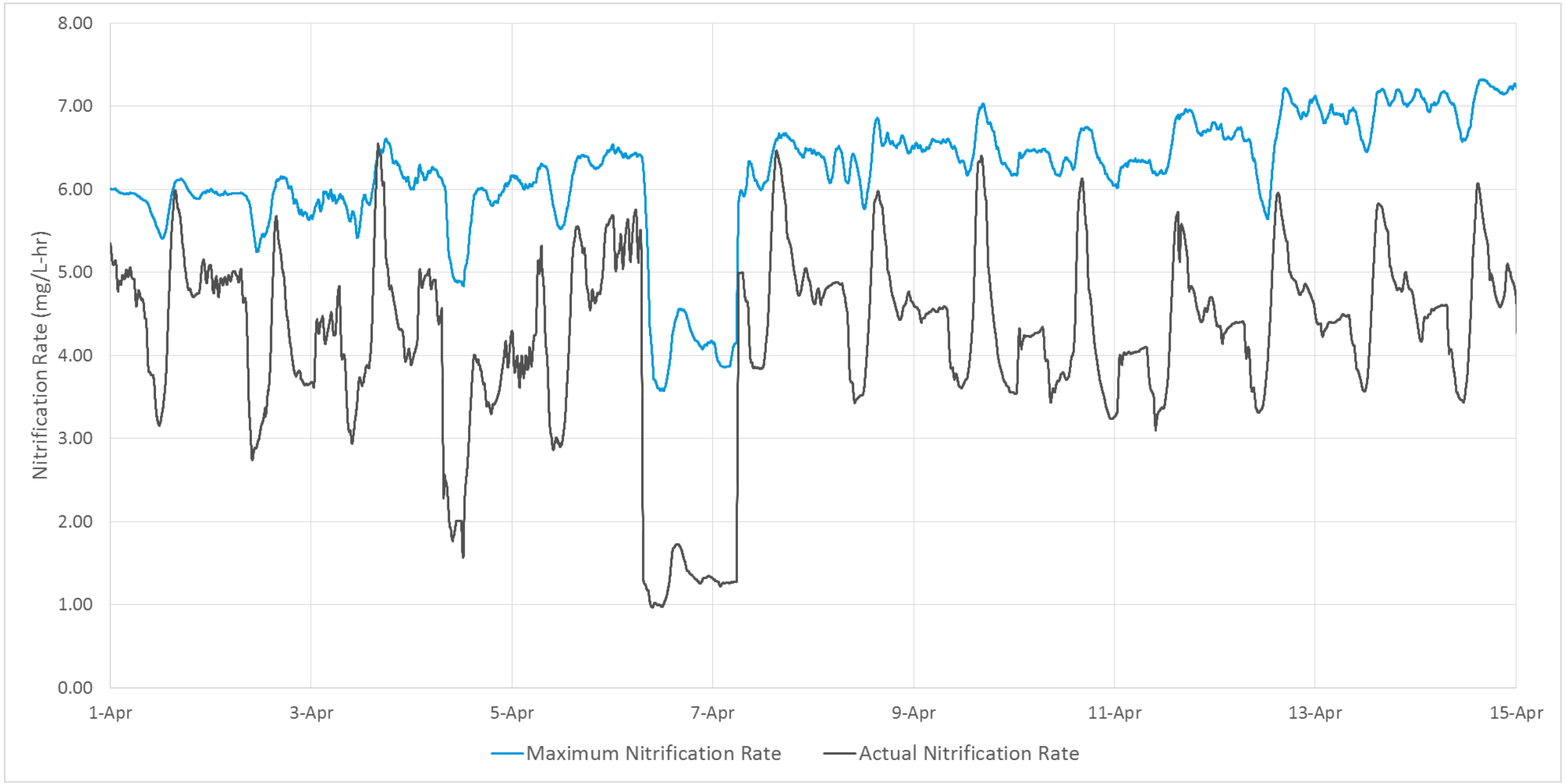


Plant View | Transition View | RTC Settings | Minimize | Exit | Language

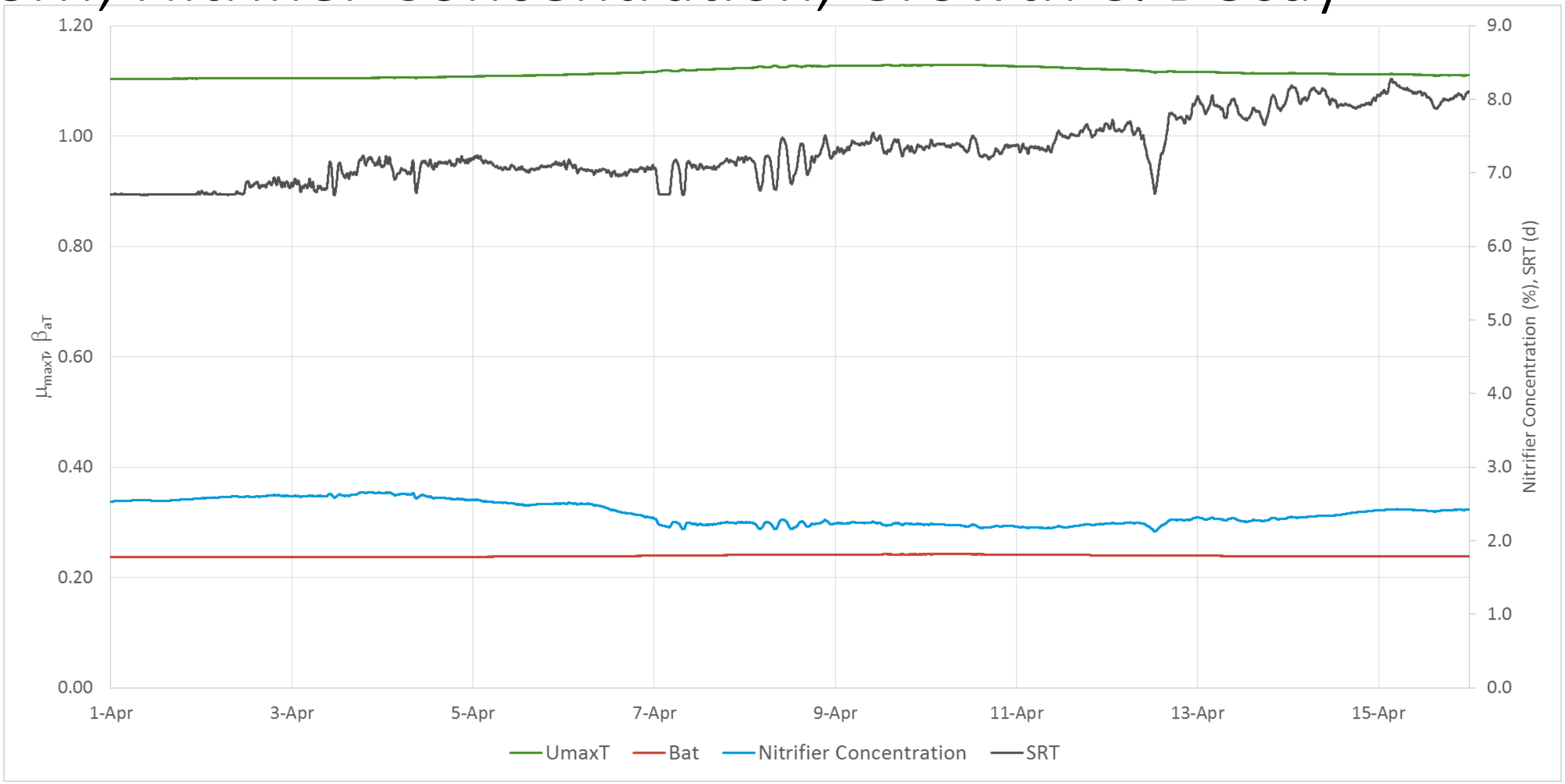
Influent & effluent ammonia



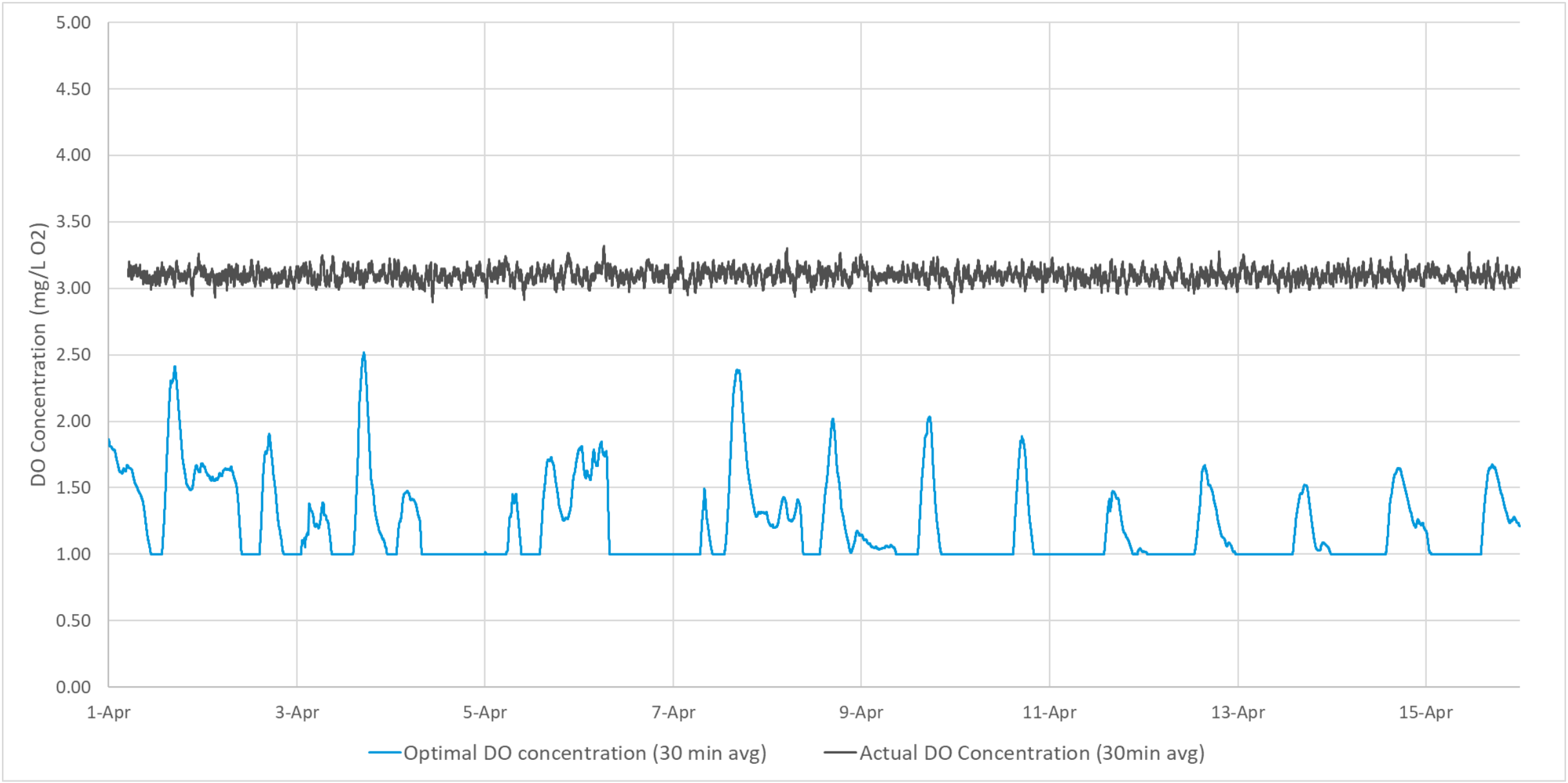
Needed vs Maximum Nitrification Rate



SRT, Nitrifier Concentration, Growth & Decay



ABAC DO vs Actual DO



Results from real time modelling

Average Actual Dissolved Oxygen Concentration (mg/L)	3.10
Average Optimal Dissolved Oxygen Concentration (mg/L)	1.22
Average Potential Energy Savings (%)	24.2%

Conclusions

- Significant energy savings possible with ABAC (65.8%) along with enhanced denitrification
- Needed vs Maximum nitrification rate allows operators to manage sidestreams
- Nitrification rate, Nitrifier concentration, Optimal DO data will help engineering design appropriately sized system
- Hach RTC-N system suitable for modelling or control of unit processes