South West Water

Optimising Coagulation at SWW – “Eyeballing” Clarifiers to Electrophoretic Light Scattering

Nick Dade – Assistant Water Quality Scientist

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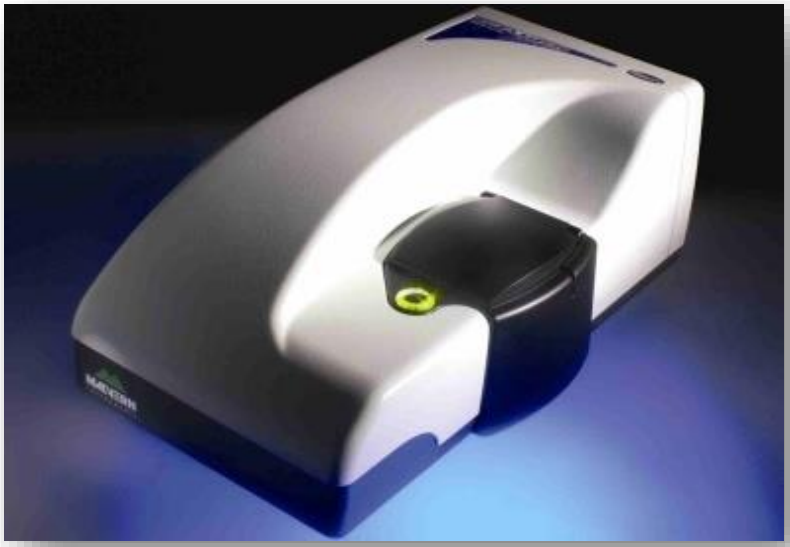

Conventional coagulant control

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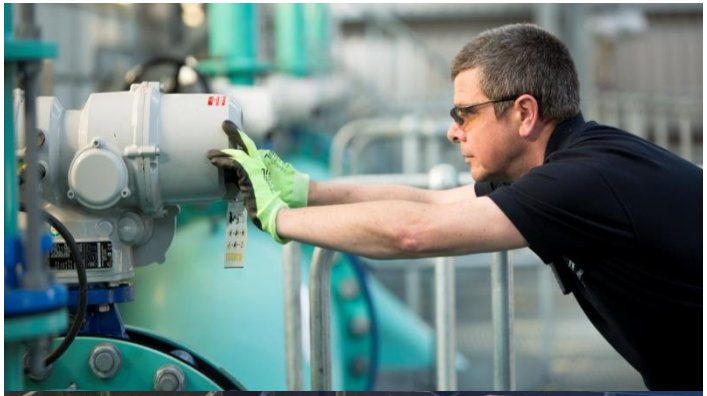
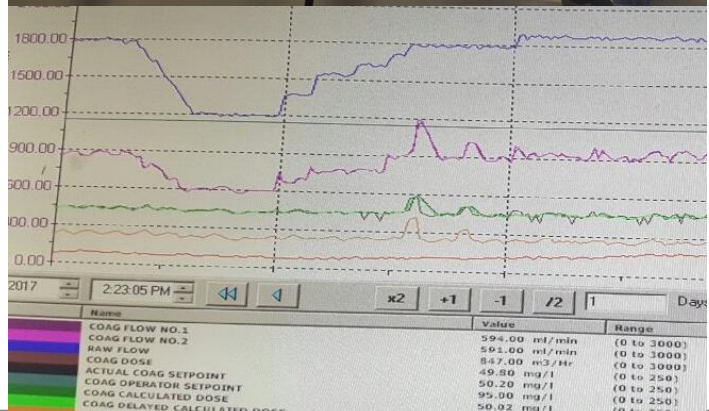
- Operator Experience
- Jar Testing
- Algorithms/feed forward based on colour, UVT and turbidity, Streaming Current Devices etc
- All the above do not accurately:
    - Reflect raw & plant conditions
    - Account for returns
    - Account for changes in pH – very important.....
- Healthy margin of safety / elevated coagulant dose
- Is there a better way/can we directly measure the desired outcome?





Zeta potential for coagulant optimisation

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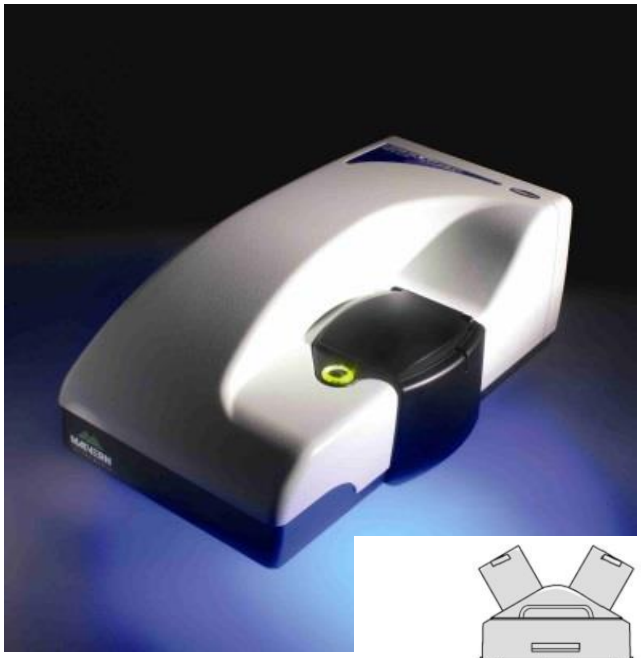
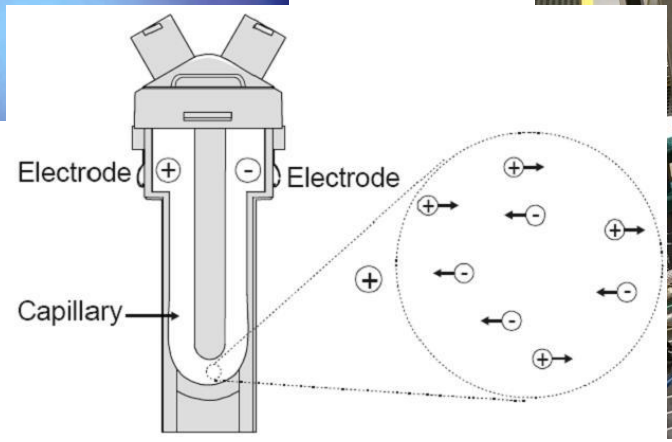
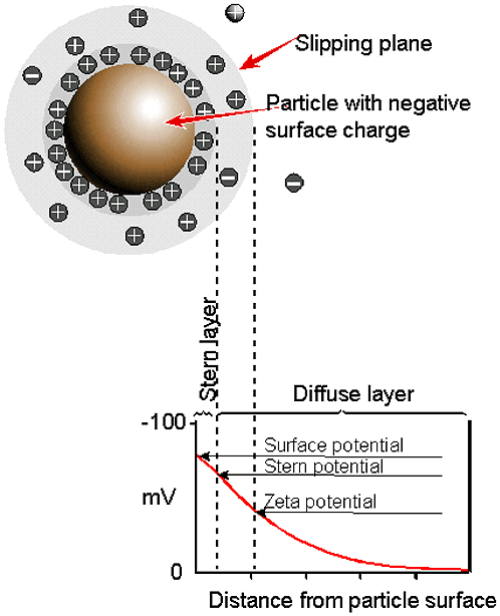
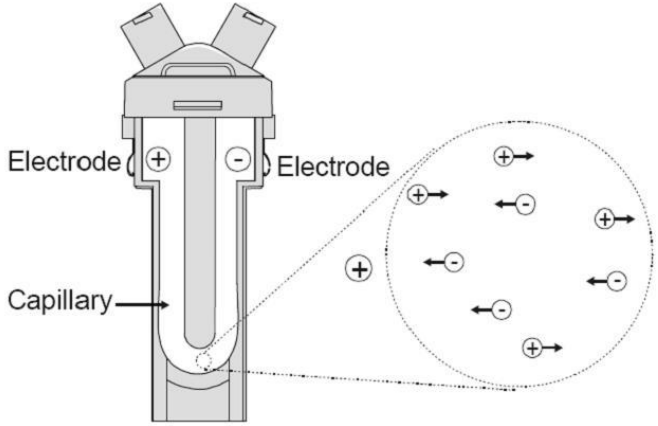




Zeta - How it Works





Zeta potential trial – bench scale tests

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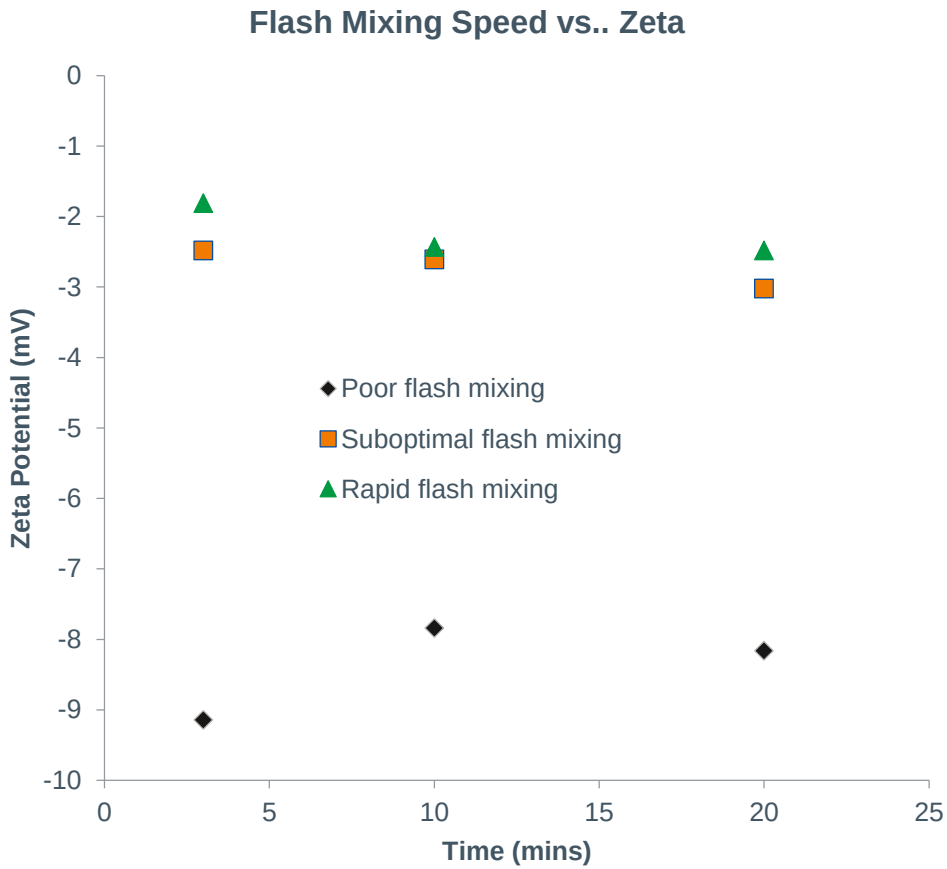
- Nano Z (Malvern) purchased
- Validate the findings of previous research in our situation?
- Numerous bench scale tests performed:
  - Coagulant dose
  - Coagulation pH influence
  - Mixing effects
  - Poly dosing
  - Powdered carbon additions
  - Supernatant returns
  - Ion exchange
  - Ion exchange and coagulation



Influence of coagulant dose (and pH)

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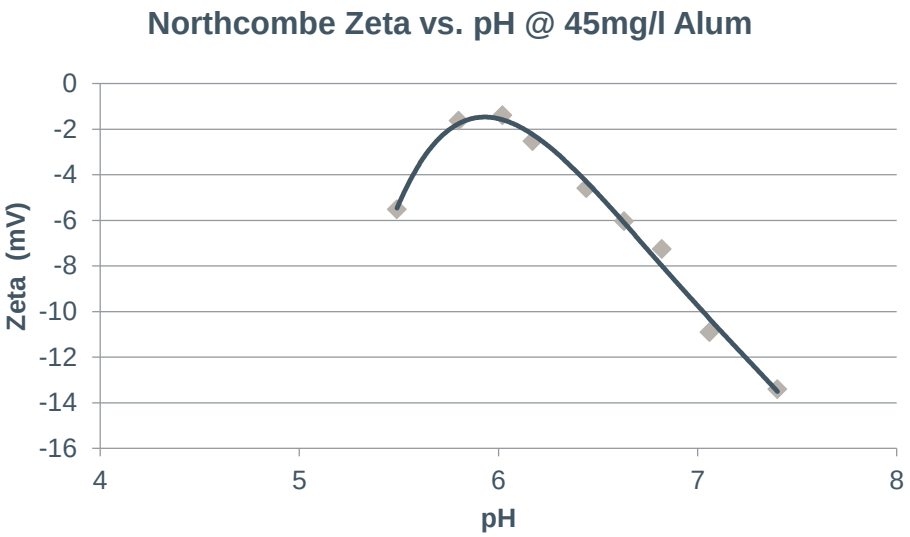

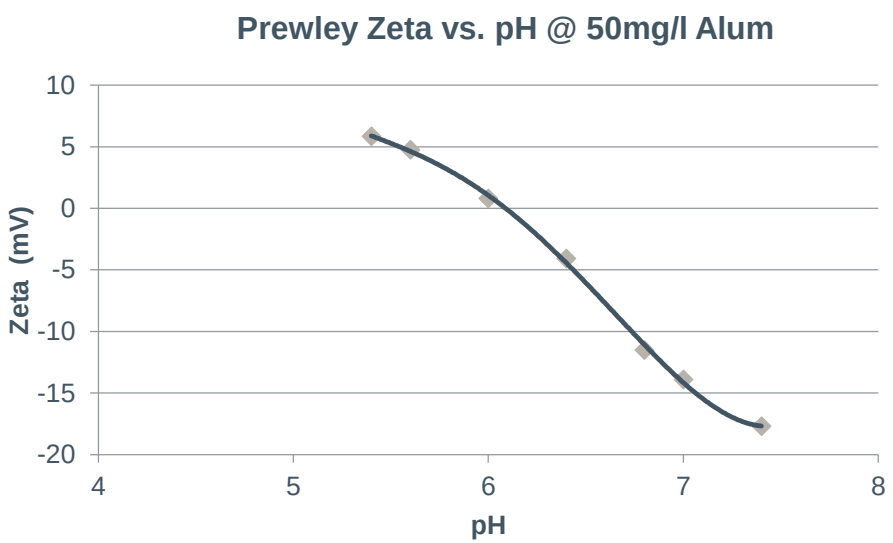

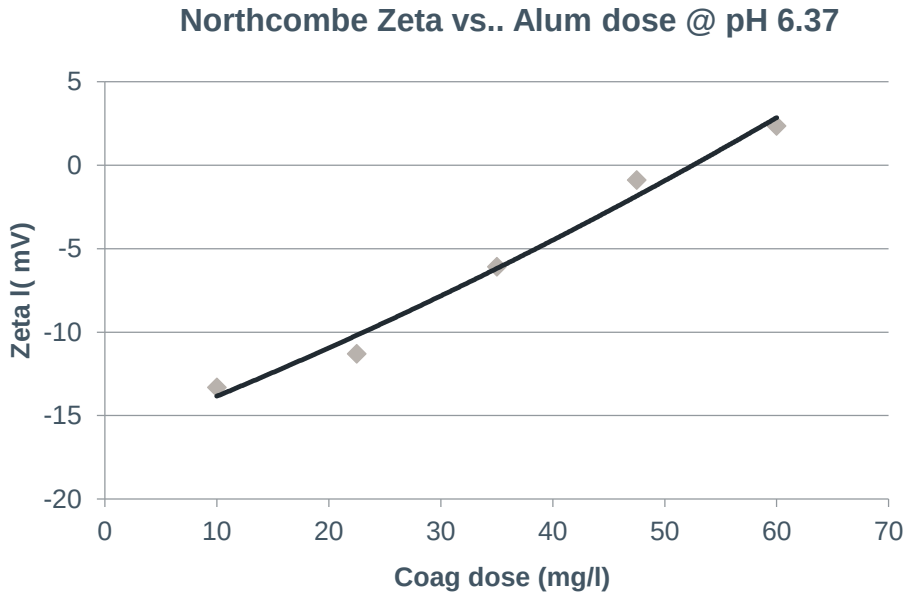

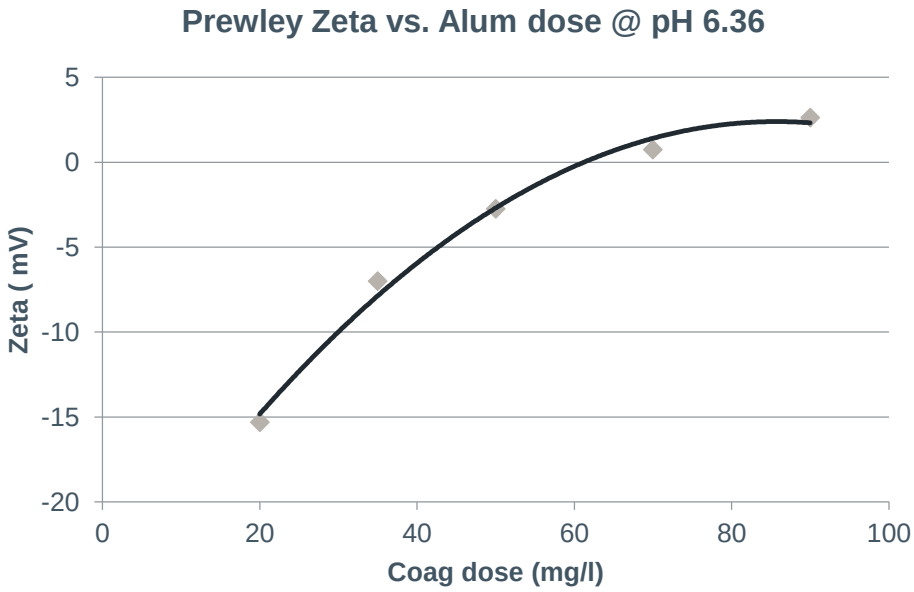

Improved Water Quality with removal of many precursors to THM/DBP formation

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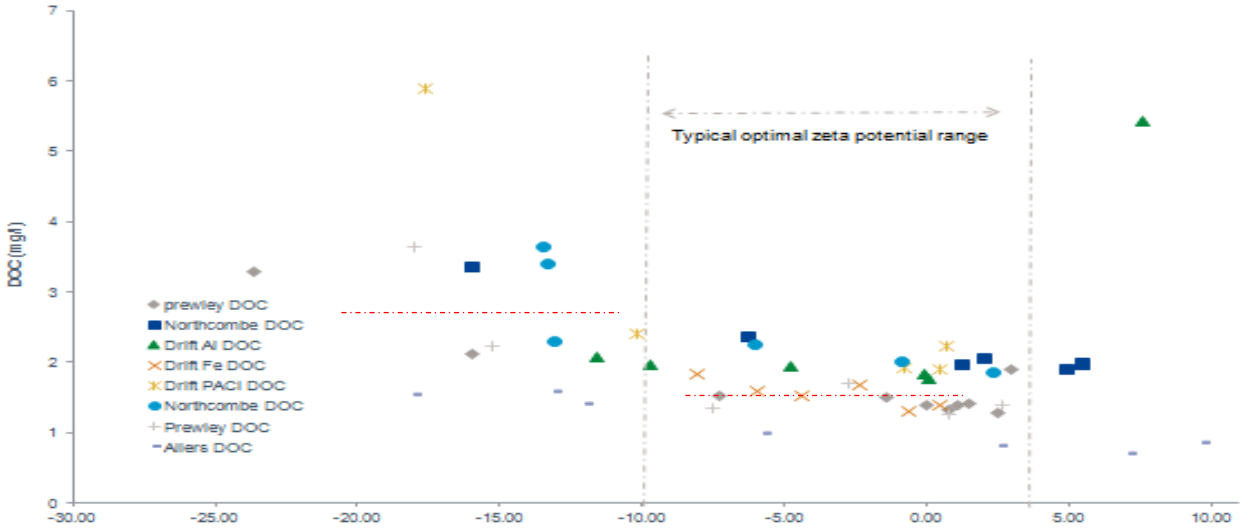
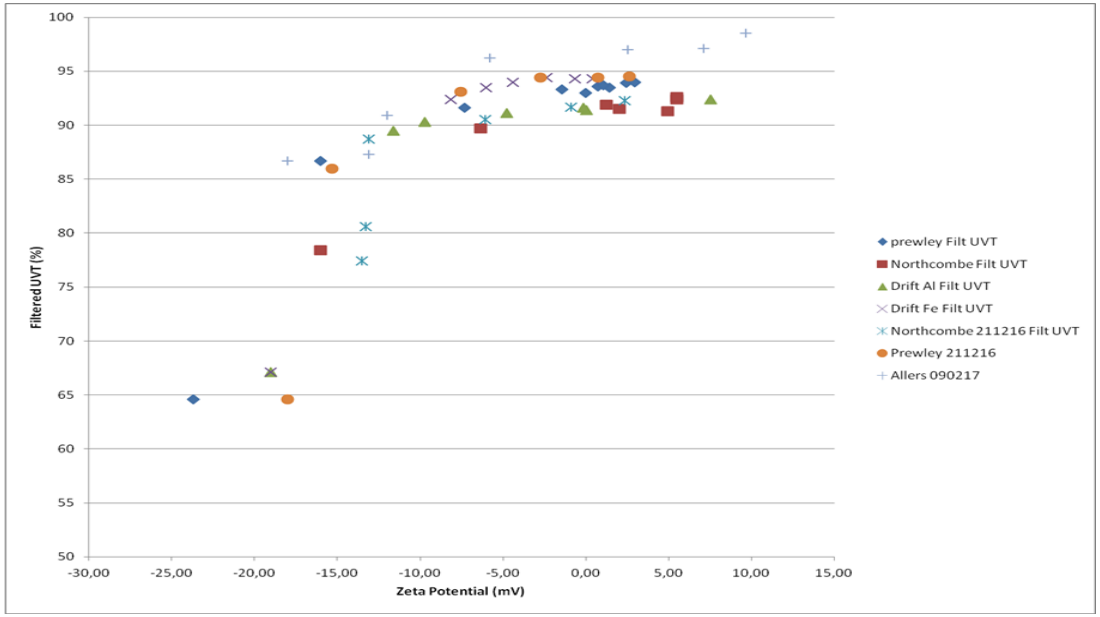
DOC reduction within the ‘Goldilocks range’



Improvement in UVT



Companywide evaluation

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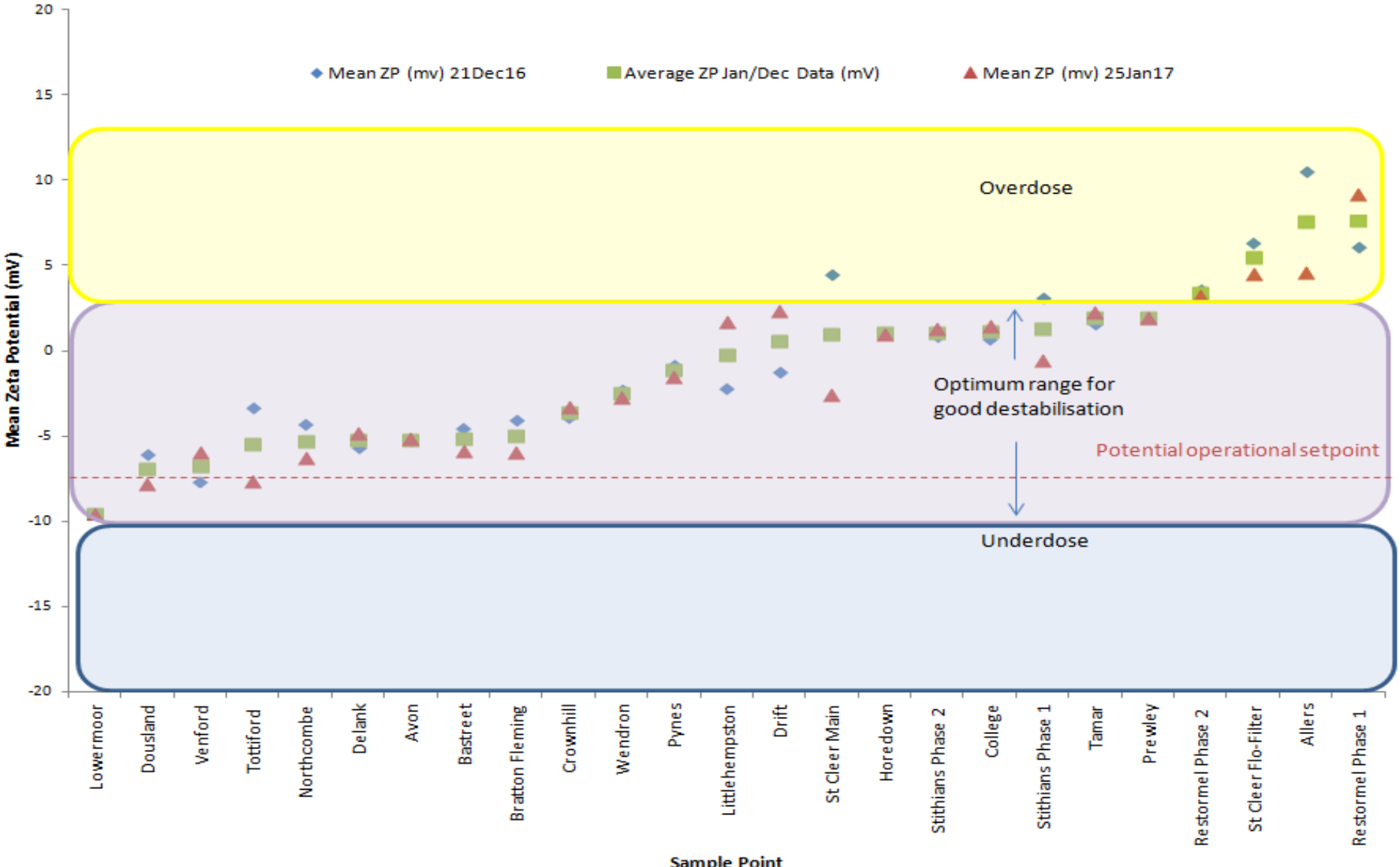
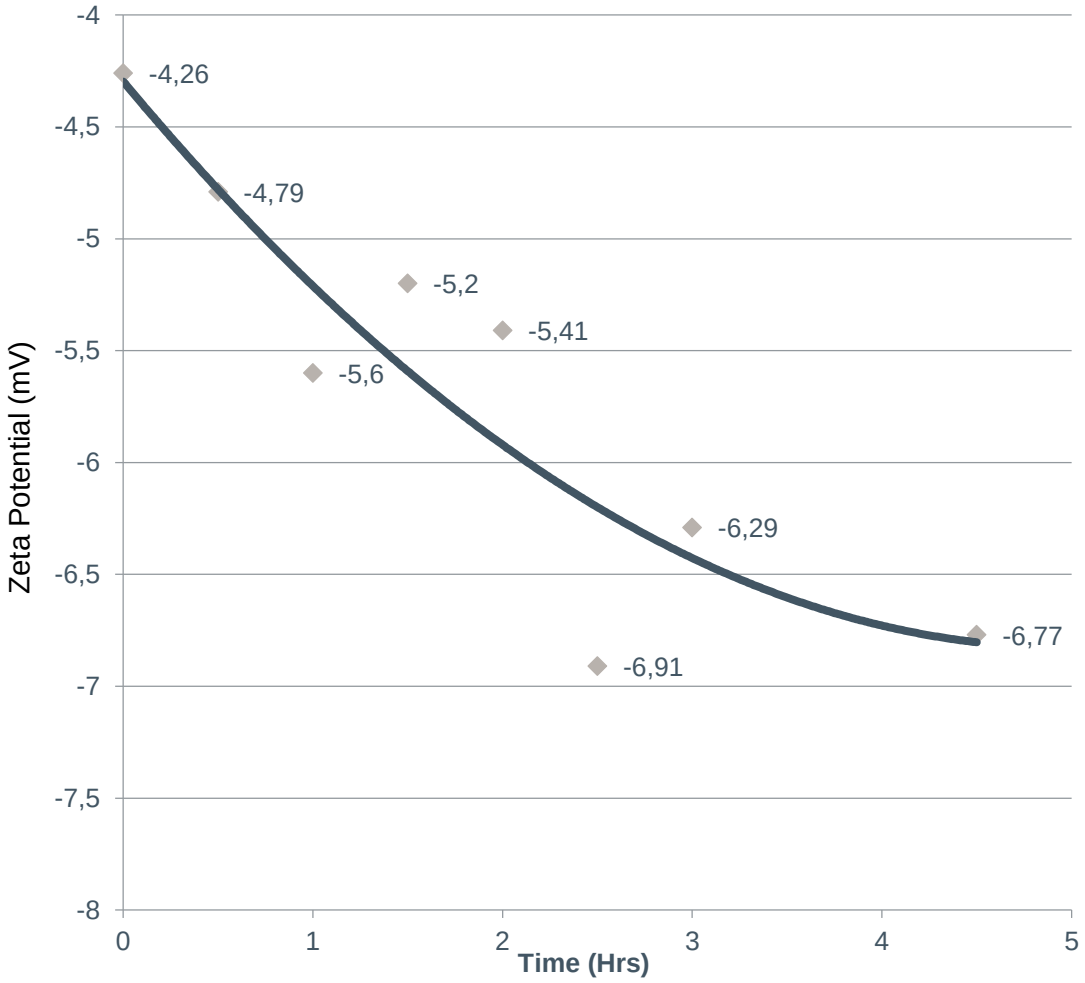


Zeta potential – coagulated sample stability



- **Zeta values reduce over time**
- Multiple tests carried out to improve stability:
  - Settled vs.. mixed samples
  - Temperature control
  - Glass vs. Plastic containers
  - Soaking containers in coag'd water prior to use
  - Air gaps vs.. no air gap
- **No clear solution found except to perform the analysis onsite**

Full scale demonstration, Northcombe WTWs (50 MLD)

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- Initially stabilised water quality/improved treatment performance but increased coagulant dose
- Over time optimised coagulation dose & pH balance, 30% coagulant reduction, instrument payback <12months)
- Increased dose required at times, not necessarily any correlation with raw water traditionally used to predict coagulant demand
- Extended operation at maximum works flow achieved during dry weather
- Operator confidence

As a troubleshooting tool

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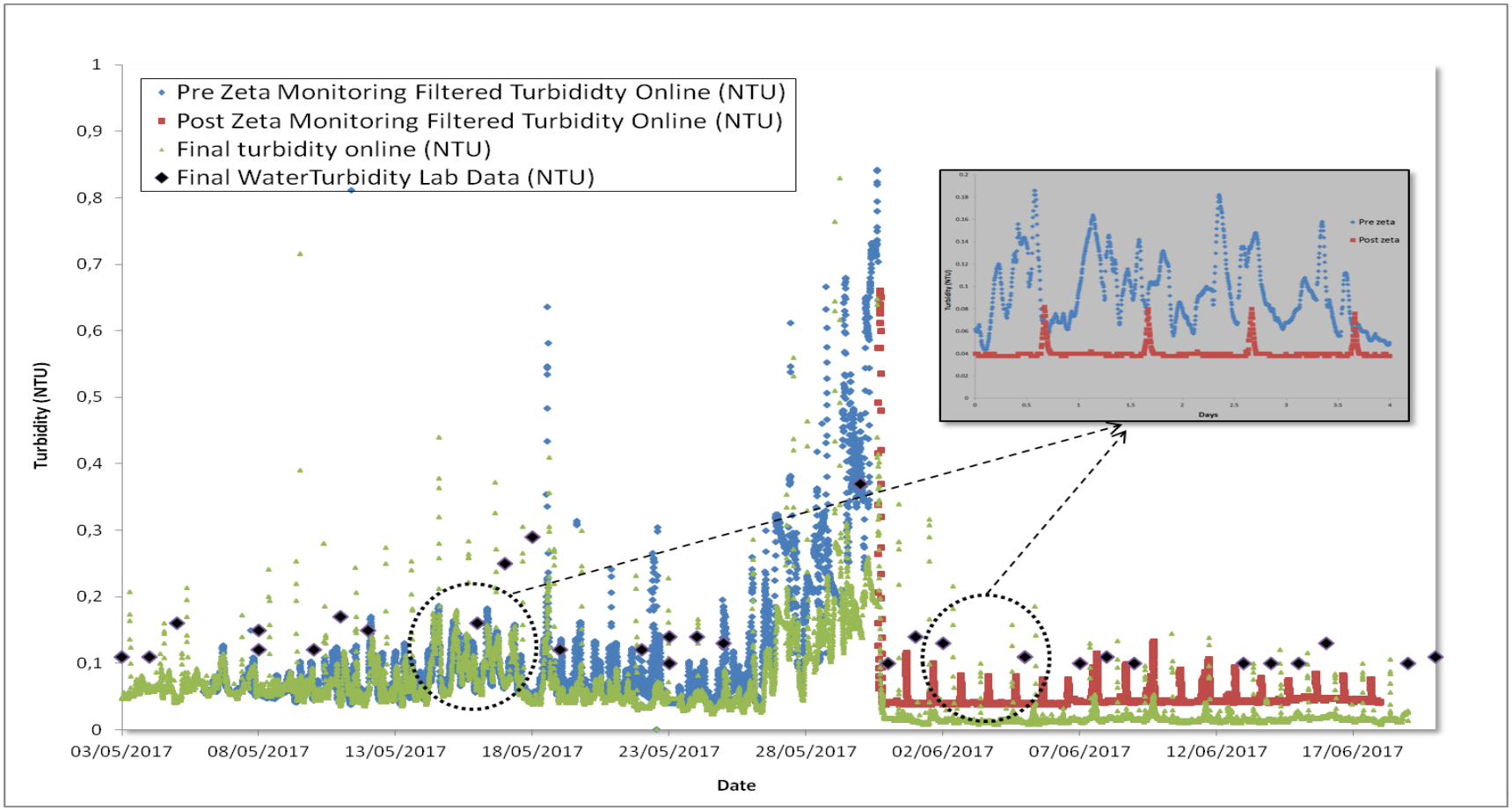
- Used at several sites to rapidly optimise processes
- Below - optimised process and recover from issues associated with an algal bloom/short filter run times
- Operators now asking for the Zeta machine to visit their sites



WT – Online Zeta Trending!

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WT Installation – Not all plain sailing, but success now in the pipeline!

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- Bubbles
- Low quality factor
- Fouling of inlet, outlet and header
- Blockages - loss of flow / shutdowns
- Drained / overflowing header tank

Install Take 3..... Back to Basics?

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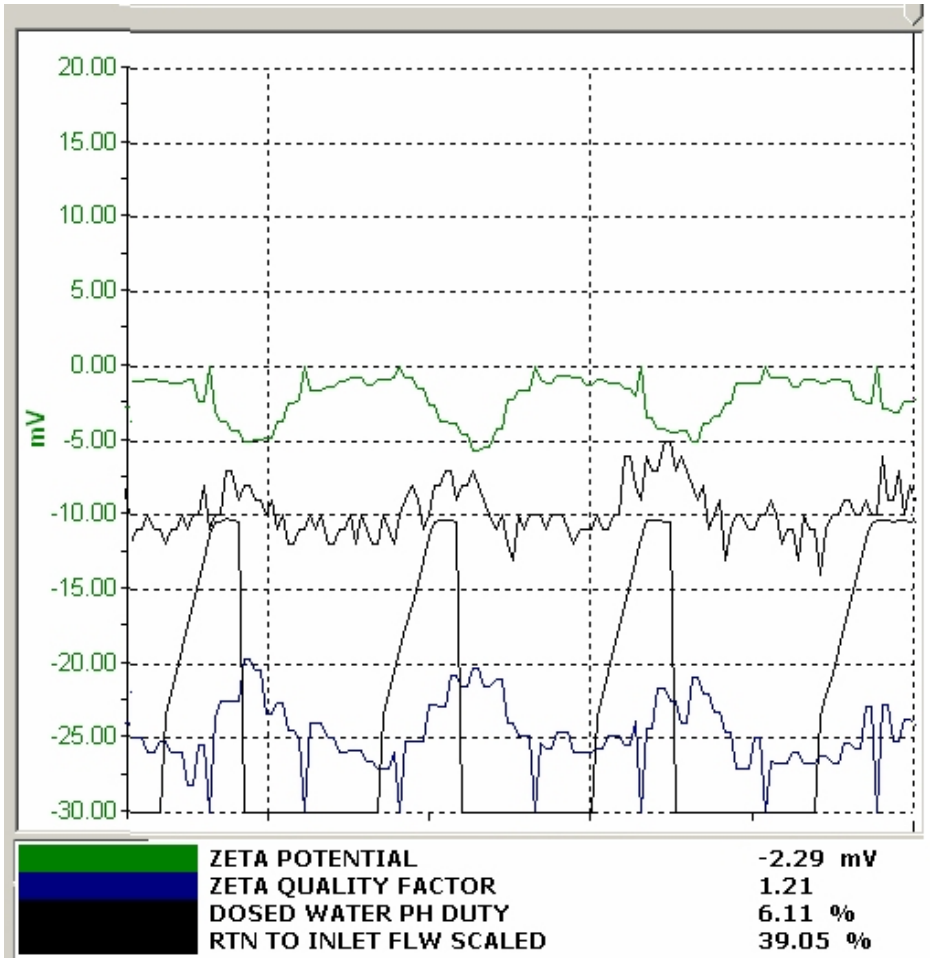
- Temporary trial using submersible pump to a header tank
- Vertical pipe work into the instrument fast loop
- No flow control per se apart from constant head and valves
- Still some blockage issues requiring frequent maintenance – working with Malvern to resolve
- **Few shutdowns, good zeta results so far..... ~ 2months of running!**

Recent automated ZP and QF data

Recent Trend highlighting impact of return flows

- pH
- Zeta Potential
- Quality Factor



Future aspirations, Zeta road map

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- **Manual instrument:**
  - ❖Troubleshooting process issues
  - ❖Validating works performance
  - ❖IEX/Coag research and optimisation
  - ❖Zeta for use with Membrane Filtration
- **Automated Zeta instrument:**
  - ❖Improve/Develop universal sample system
  - ❖Assess and Improve algorithms
  - ❖Automated Zeta trim with algorithms
  - ❖Dose control

Thank you. Questions?