

# **UK National Phosphorus Trials – A collaborative programme towards low phosphorus levels**

Pete Vale – Severn Trent Water

# Outline

1. The UK context - why do we need to remove (more) P from sewage effluents?
2. Background to National Phosphorus Trial Programme
3. High level summary of results

# Phosphorus and water quality

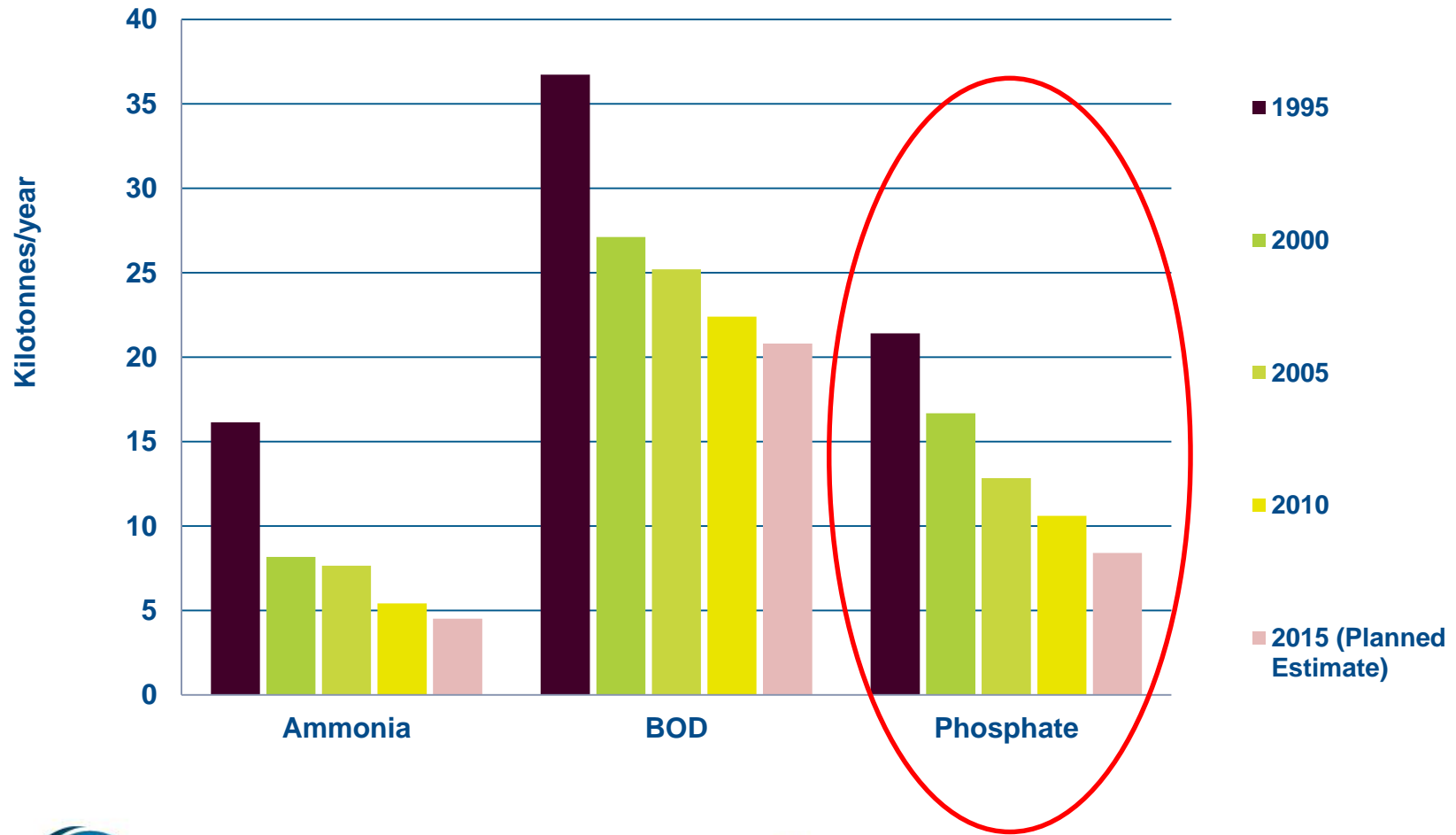
- Phosphorus is the most common cause of water quality failures in England (it is the main cause of eutrophication in freshwaters)



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# Significant Progress is being made:

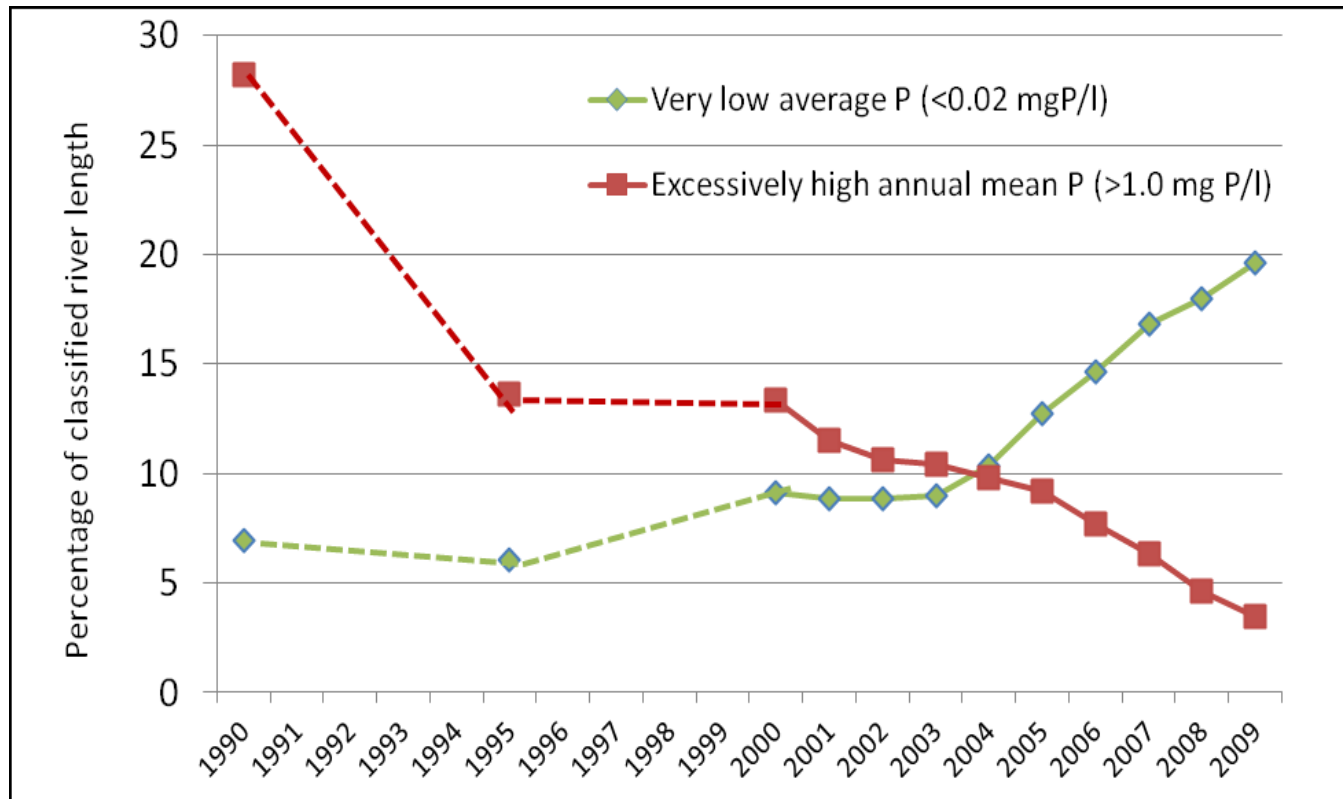
## Reduction in P load discharged by WwTWs over the last 20 years





# Improvements seen

-% of river length in England with v low and v high P concentrations



# How has this been achieved?

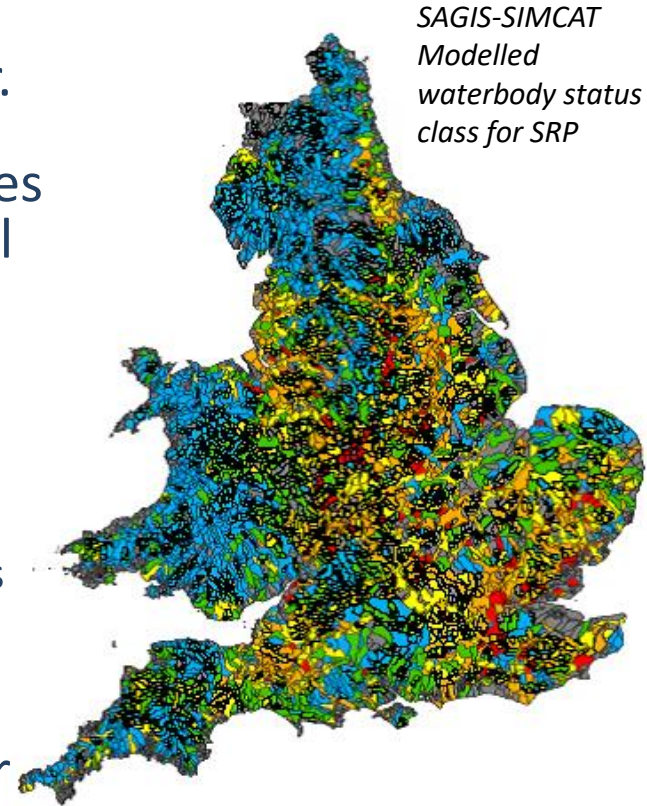


- Dramatic reductions in UK river P levels have been achieved in recent decades (from a peak in the 1980's & 90's).
- This has been brought about by:
  - reduction of P used in detergents
  - the introduction of P removal processes at WwTWs, and
  - falling fertiliser use and livestock numbers.
- There are now:
  - EU wide controls in place on P in laundry and dishwasher detergents and,
  - the UK Water Industry will have invested £2 billion up to 2020 to improve treatment specifically for P removal .
  - This has reduced P loads discharged to rivers from sewage treatment works by **60%**



# However...

- The Water Framework Directive (WFD) requires that all water bodies be at good status, or better.
- In 2015, 55% of rivers and 74% of monitored lakes exceeded the P standard for good environmental status\*
- How do we achieve the required in-river standards?
  - More WwTW's require P removal, plus
  - P permits will need to be tightened significantly – perhaps down to as low as 0.1mg/l TP
  - Diffuse sources need to be tackled too.
- Are these v. low limits achievable with current or new technologies (& at what cost)?
  - To answer this the National P Trial (PR14 P technology trial) was set up



\* EA (2015) Water Framework Directive 2015 classifications for river and lake water body phosphorus compliance.  
Environment Agency, Bristol.



# The National Phosphorus Trial - A National Collaboration



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Welsh Water



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Department  
for Environment  
Food & Rural Affairs



Cyfoeth  
Naturiol  
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# National Low P Trial Programme

- Trial programme configured to evaluate whether optimisation of current technologies or adoption of new technologies could achieve very tight P limits (circa 0.1mg/l TP).
- There are 3 strands to the trial programme:
  - ‘P1a’ – Assess, using pilot plant trials, whether novel technologies can meet very tight P limits
    - These techs typically new to the UK but with reference sites internationally.
  - ‘P1b’ – Assess whether the optimisation of existing processes can achieve very tight P limits
  - ‘P1c’ – Investigate whether innovative technologies can achieve very tight P limits
    - Techs generally not proven anywhere at full scale (for this application).
    - Trials generally at smaller scale – lab or pilot

# Low P - Novel Technologies

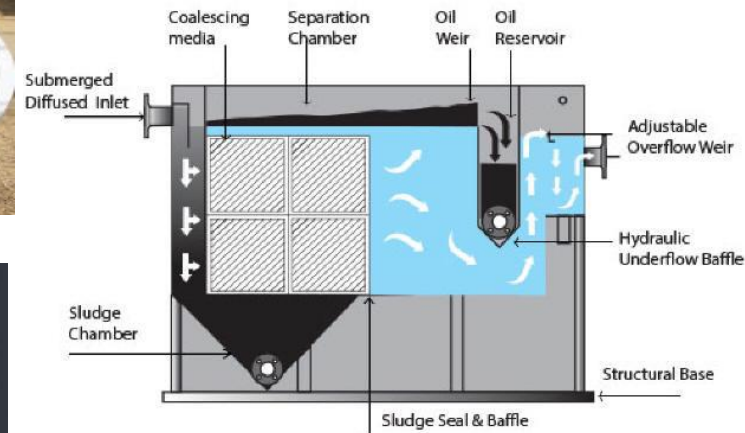
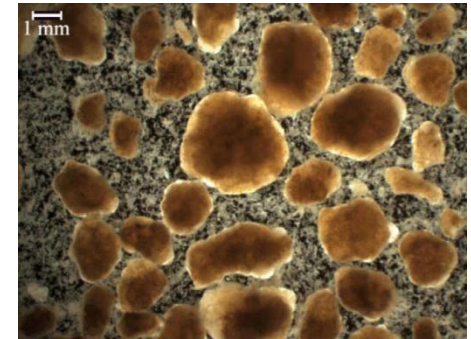
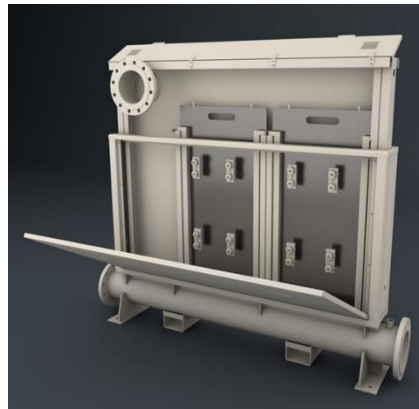
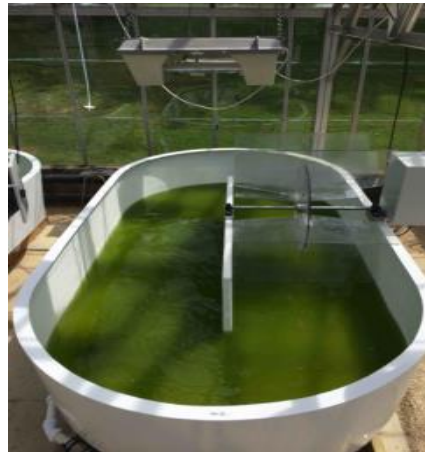
| P1a Novel                           | Number of trials |
|-------------------------------------|------------------|
| Blue PRO (or similar modified COUF) | 5                |
| Mecana                              | 4                |
| Fuzzy Filter                        | 2                |
| Co-Mag/Bio-Mag                      | 3                |
| Adsorption Media                    | 2                |
| Filterclear                         | 1                |
| Dynasand Oxy                        | 1                |
| <b>Total</b>                        | <b>18</b>        |

## Suppliers:



# Low P - Innovative Technologies

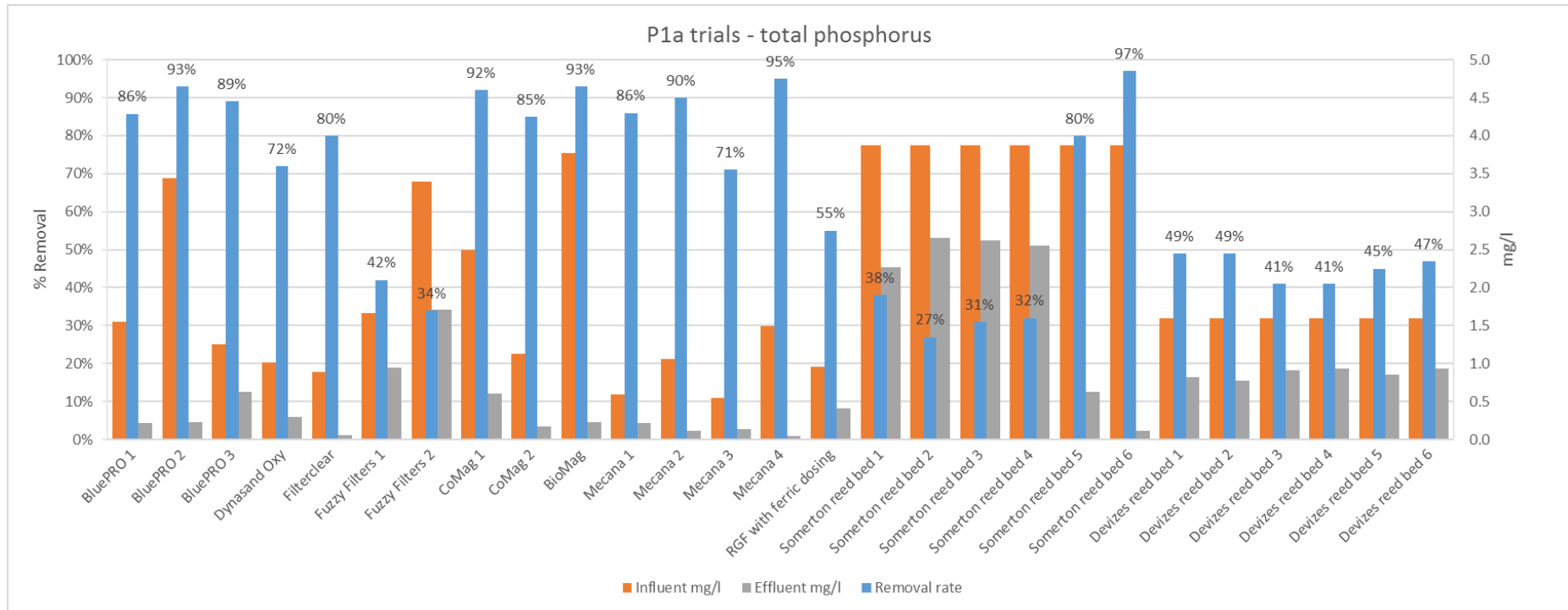
|                  |   |
|------------------|---|
| Wessex Water     | High-Rate Algal Ponds, (with University of Bath)  |
| United Utilities | Granular Aerobic Sludge (Nereda)                  |
|                  | T-DAF   |
| Anglian Water    | Granular Aerobic Sludge (Nereda)                  |
| Southern Water   | BNR SBR with primary sludge fermentation (Nutrem) |
|                  | Electro-coagulation (Soneco)                      |



# High level summary of results



# Novel Technology Trials –TP removal

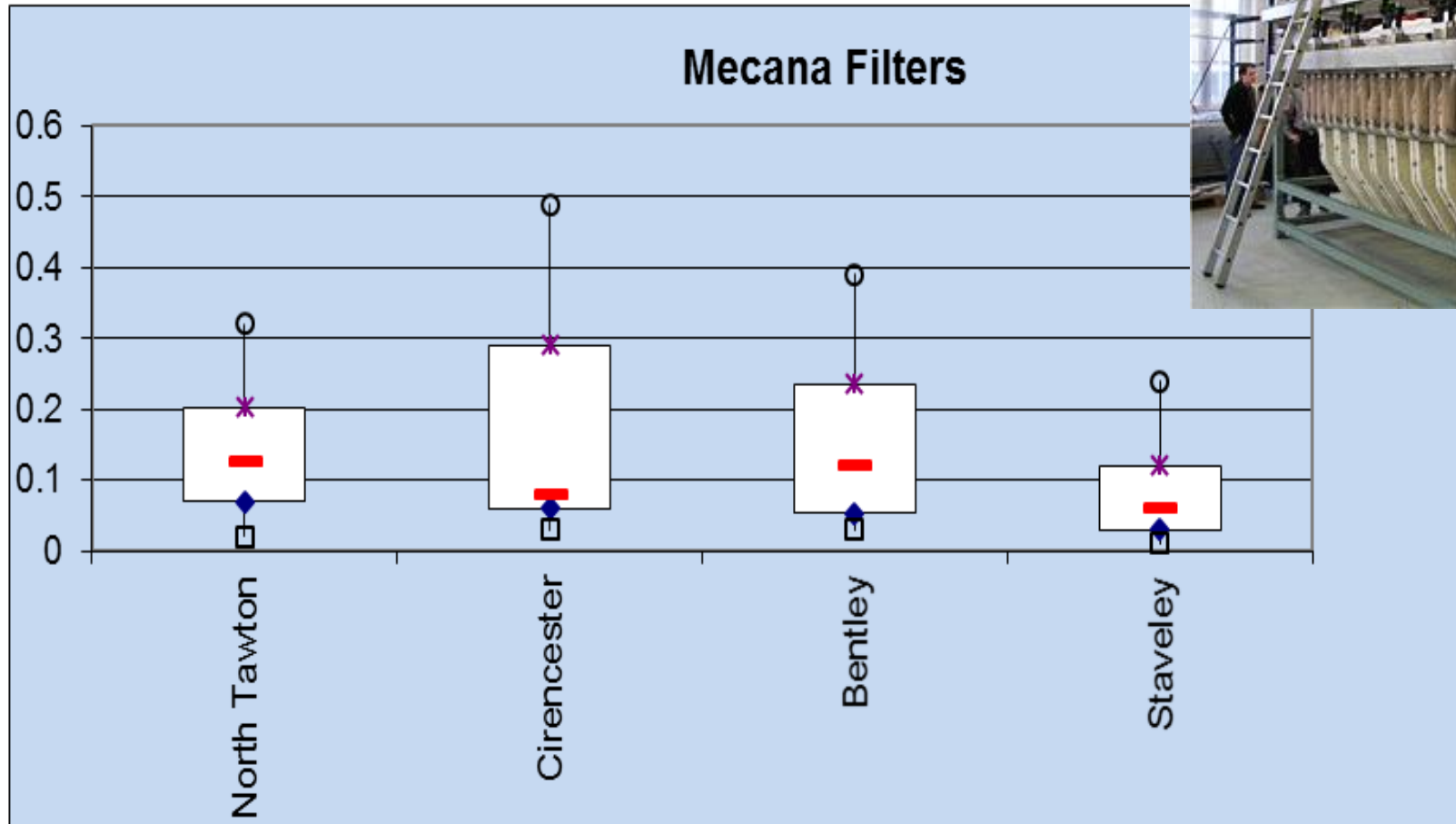


Graph courtesy of

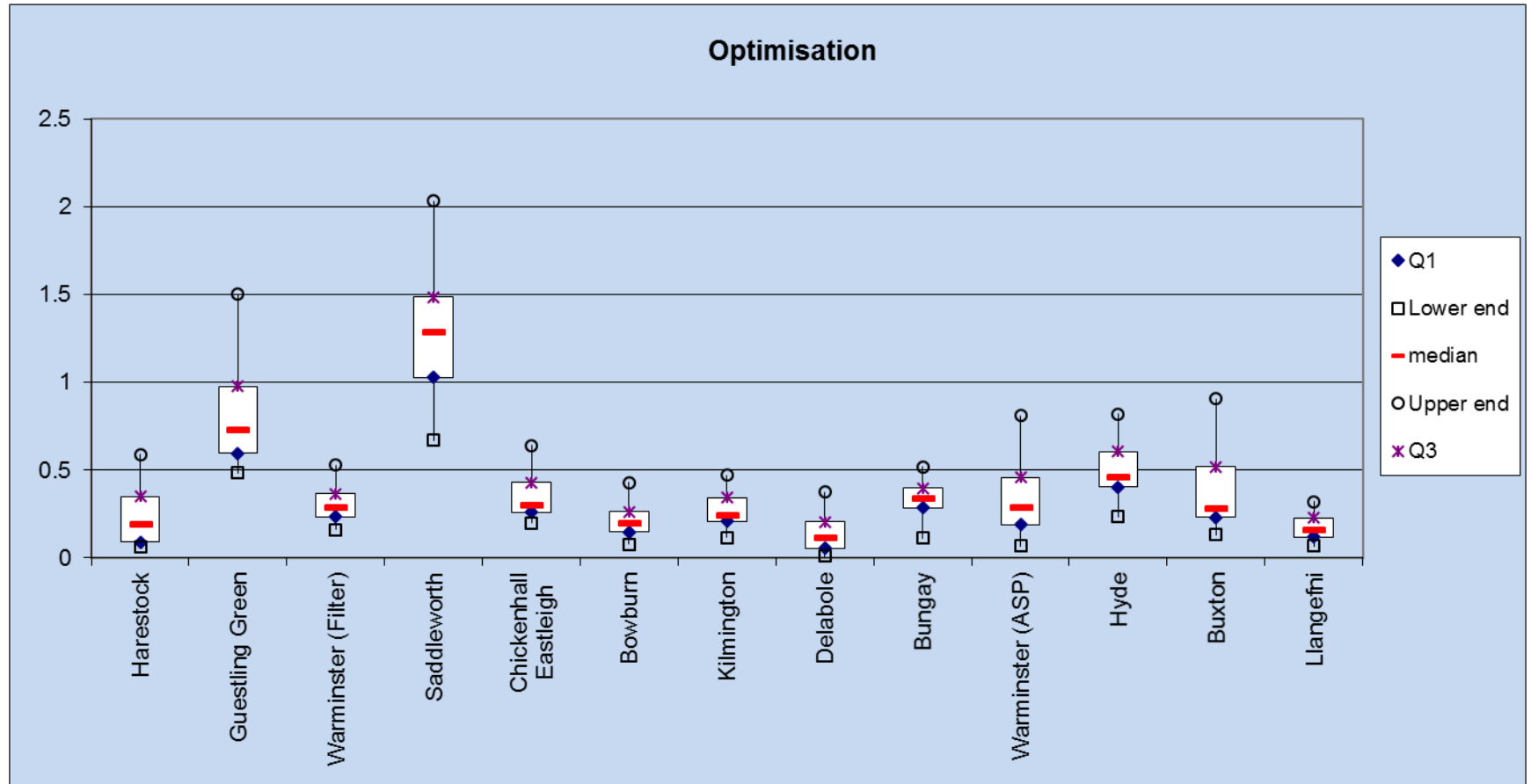
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# Pilot Trials of new technologies – Effluent TP mg/l

## Mecana Pile Cloth Media Filters



# Optimisation Trials (P1b) – Effluent TP mg/l



# How are we going to use the outputs from the programme?

- Atkins are currently compiling all the individual water company reports into a synthesis report.
  - A draft has been issued and the report will be published soon, this will contain the comparative data on:
    - Performance
    - Totex, and
    - Carbon costs
- The Water companies will use the output in their business planning for AMP7 (PR19)
- The Environment Agency will use the output to help refine and define the permitting regime for PR19/AMP7



# Final thoughts.....

- The focus of the National low P trials has been on facilitating water quality improvement (to achieve GES in UK receiving waters).
- Let's not forget, though, that P is also a finite irreplaceable resource essential for all life - and so the key to sustainable P management in the future must lie not only in removing P from sewage but recovering it so it can be reused.



# National Collaborative Project

## Any Questions?



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