A NEW SOLUTION FOR UID'S
EQUIVALENT TREATMENT – TREAT IT, DON'T STORE IT

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Abstract

This paper will look briefly at the conventional solutions used to resolve UID's and highlight some of the potential problems that each of these solutions have.

It will also look at the cutting edge work being carried out by United Utilities (UU) to develop innovative and novel alternatives to storage. When these innovative solutions have been proved to work they are likely to be rolled out across UU's AMP3 UID programme.

General

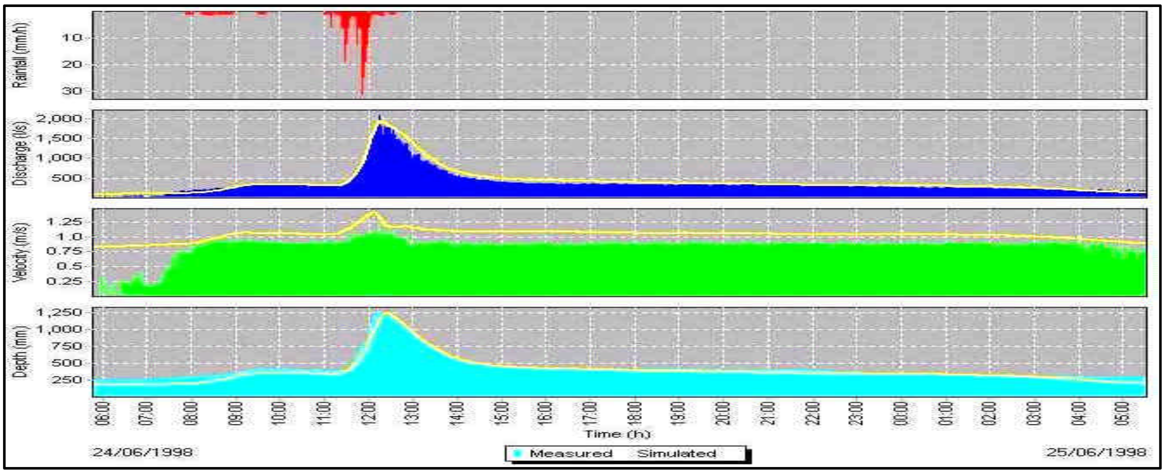
UU is a multi utility company and currently owns and operates electricity distribution and water networks in the north west of England. It manages and maintains more than 600 wastewater treatment works and over 100 water treatment works, together with 80,000 kilometres of pipes and sewers. It also maintains almost 60,000 kilometres of electricity cables and nearly 32,000 electricity sub-stations.

It is currently in the third year of its present 5 year asset management plan, AMP3. This involves spending over £1.7 billion on environmental improvements in the period 2000 to 2005.

Background/history

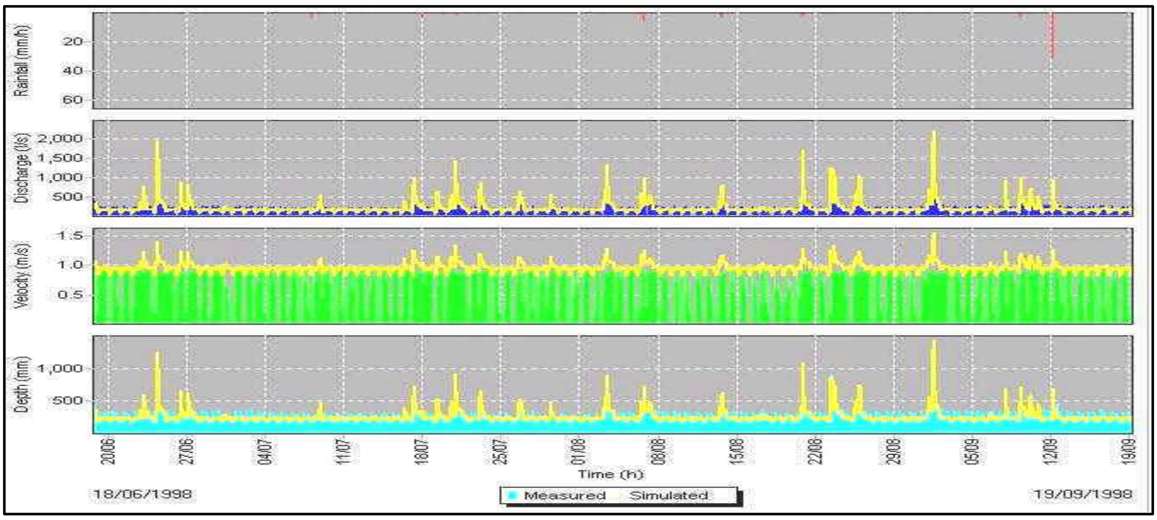
Detention tanks used to be sized using discrete events due to limitations of the available software, computing power and a lack of complete understanding of the full effects of follow-on storms.

Fig 1 Typical plots of a discrete event



In the late 1990’s as computing power increased, more sophisticated software became available, the full implications of follow-on storms became better understood and the spill frequency targets got tighter UU moved to use Continuous Simulation modelling techniques for some spill frequency work. Continuous Simulation is where both wet and dry periods are modelled over a long duration anything between a 5 month Bathing Season to 20 calendar years.

Fig 2 Typical plots from a Continuous Simulation (CS) run of 3 months



The storage volumes coming out of these early CS models were significantly larger than had previously been experienced, up to 63,000m^3. As a result questions were raised if these volumes were correct and whether they could actually be built and operated. However, due to time constraints it was not possible to optioneer/build alternative solutions and the detention tanks were subsequently built.

It has since become clear that some of the early concerns were justified and that large detention tanks bring with them a number of potential problems and in some cases they were not the correct answer. The term “large” is actually relative, in that in some cases small volumes with have the same potential problems as the catchment/network/WwTW served is also small.

Further upgrades to the Continuous simulation software in the last few years has resulted in a another increase in the size of detention tanks.

Conventional solutions

Abandonment – close the overflow and hence stop all spills

Increase pass forward flow – retain the overflow, but increasing the pass forward flow reduces the spill that do occur to the required standard

Storage – retain the overflow but construct a detention tank that reduces the spills to the required standard

Problems with conventional solutions

Abandonment – Usually not possible unless recent re-sewerage work has altered the sewer network sufficiently to make the overflow superfluous.

Increase pass forward flow – Usually not cost effective because :-

- Network sites - long lengths of downstream sewer need upsized to ensure the additional flow causes no detriment to other overflows or existing levels of service (flooding /surcharge). Work causes major disruption to surrounding areas.
- WwTW Storm Tanks – the entire WwTW would need upsizing/rebuilding to the higher flow rates.

Fig 3 Typical disruption caused by PFF solutions

Storage – Normally the most cost effective solution. However, in certain circumstances this is not acceptable because of :-

- Very long drain down times
- WwTW running at max. FTFT for long periods
- Difficulties in operating the tanks themselves
- Locating land and getting permission to build the tanks themselves

Fig 4 Typical large detention tanks

Solution

An ideal solution would be to treat the effluent as it arises and discharge it to the receiving water. This type of solution had been considered in the past but has not been pursued due to various technical and/or financial difficulties, eg lack of technology, effluent standards, EA consent to discharge, timescales etc.

Having built and operated a large number of detention tanks over the last 10 years UU has considerable experience of both the positive and negative aspects of detention tanks.

In the late 1990's UU commenced an internal research project to look seriously at alternatives to detention tanks. This initially took the form of a desktop study/literature search for suitable treatment processes.

The first thing to determine is the standard that the treated effluent plant would have to meet. Depending on the location of the proposed discharge UU have assumed the following :-

- Bathing and Shellfish Waters – Meet the relevant bacteriological standards.
- Inland waters – BOD and/or Ammonia standards for relevant watercourses.

This study concluded that for :-

Bathing and Shellfish Waters - UV treatment would be used to meet the bacteriological standards together with an upfront process to improve the Suspended Solids and Transmissivity of the effluent. The upfront process would depend on flow rate and land availability but would probably be either a Chemically Assisted Lamella or Sand Ballasted Chemically Assisted Lamella.

Inland waters - BOD could be removed by one of the above settlement processes. However, ammonia would most likely require a biological process eg BAFF.

If any of these processes are to be implemented there is a need for pilot trials to be carried out to prove the suitability and reliability of the process to treat storm water.

In early 2002 a detailed project proposal for pilot trials of the 2 settlement processes listed above together with sand filters was submitted to and approved by UU senior management. These trials are only looking at a process for use on Bathing Water or Shellfish Water projects. A different type of solution is currently being pursued for Inland Waters.

The internal approval also allowed formal discussions to take place with the EA regarding treatment of storm flows using the following definition of what is now termed Equivalent Treatment :-

> *"Treatment of the volume of effluent that you would otherwise store, to an appropriate standard and discharge it as and when required"*

The pilot trials that UU are currently undertaking consist of :-

- Sand ballasted chemically assisted lamella (ACTIFLO®) with & without sand filter
- Chemically assisted lamellas (Vexamus lamellas) with & without sand filter

These trials are being run as a 2 stage process :-

Phase 1 – Pilot plant effluent is returned through the works to receive full treatment before being discharged to outfall. The pilot plant effluent is discharged to the 2nd storm tank, with the plants being shut down when this tank is full. This restricts the run time for the plants to approx. 3 hours

Phase 2 – If running with real storm water the effluent can be discharged direct to outfall thereby allowing the plants to be run for the duration of the individual storms. However, during the Bathing Season (May to September) if running the pilot plants with simulated storm water then effluent must be discharged to the 2nd storm tank and back through the WwTW.

The move from Phase 1 to 2 was carried out when it was possible to prove to the EA that the chemical carry over from the processes were within the anticipated limits.

Fig. 5 Photograph of Pilot Plants at Millom WwTW

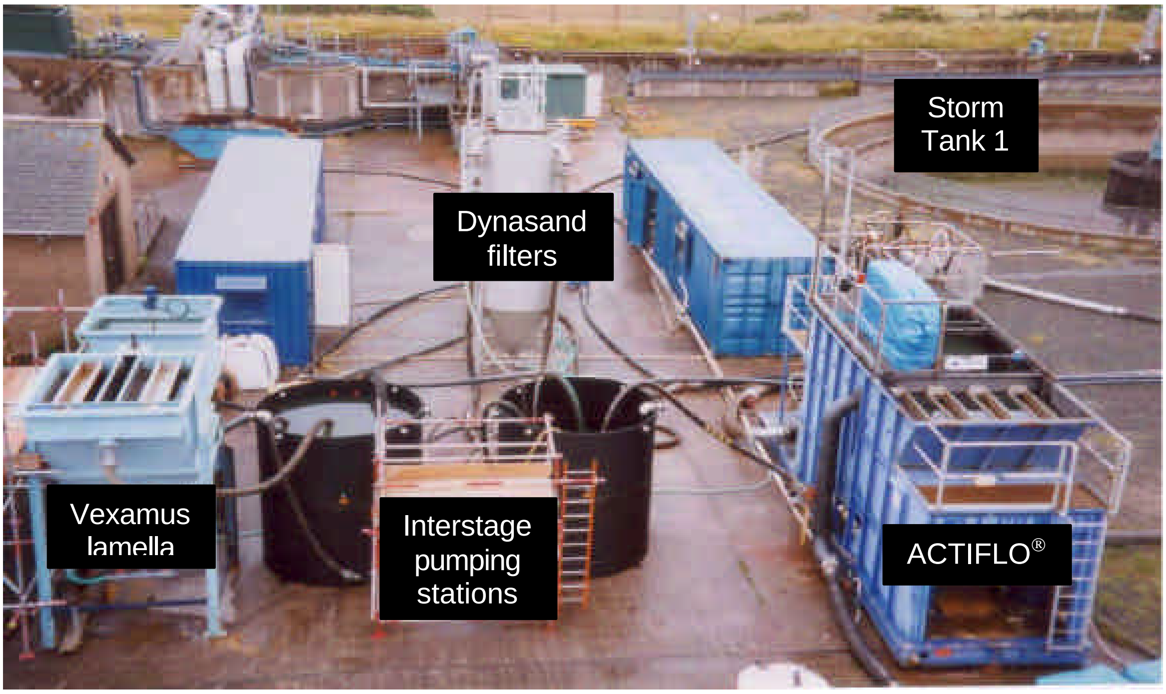
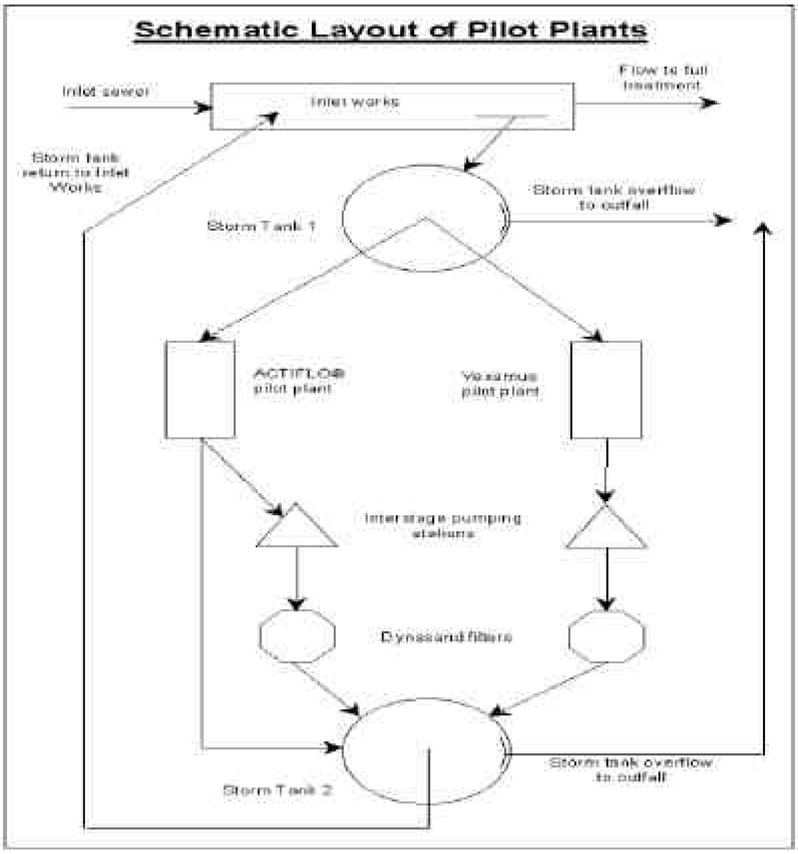


Fig. 6 Schematic layout of pilot plants



The trials have been ongoing since July 2002 at Millom WwTW utilising either real storm events or simulated storms but due to confidentially issues the full details of the trials cannot be made public at this point in time.

Fig. 7 Example of the results obtained to date

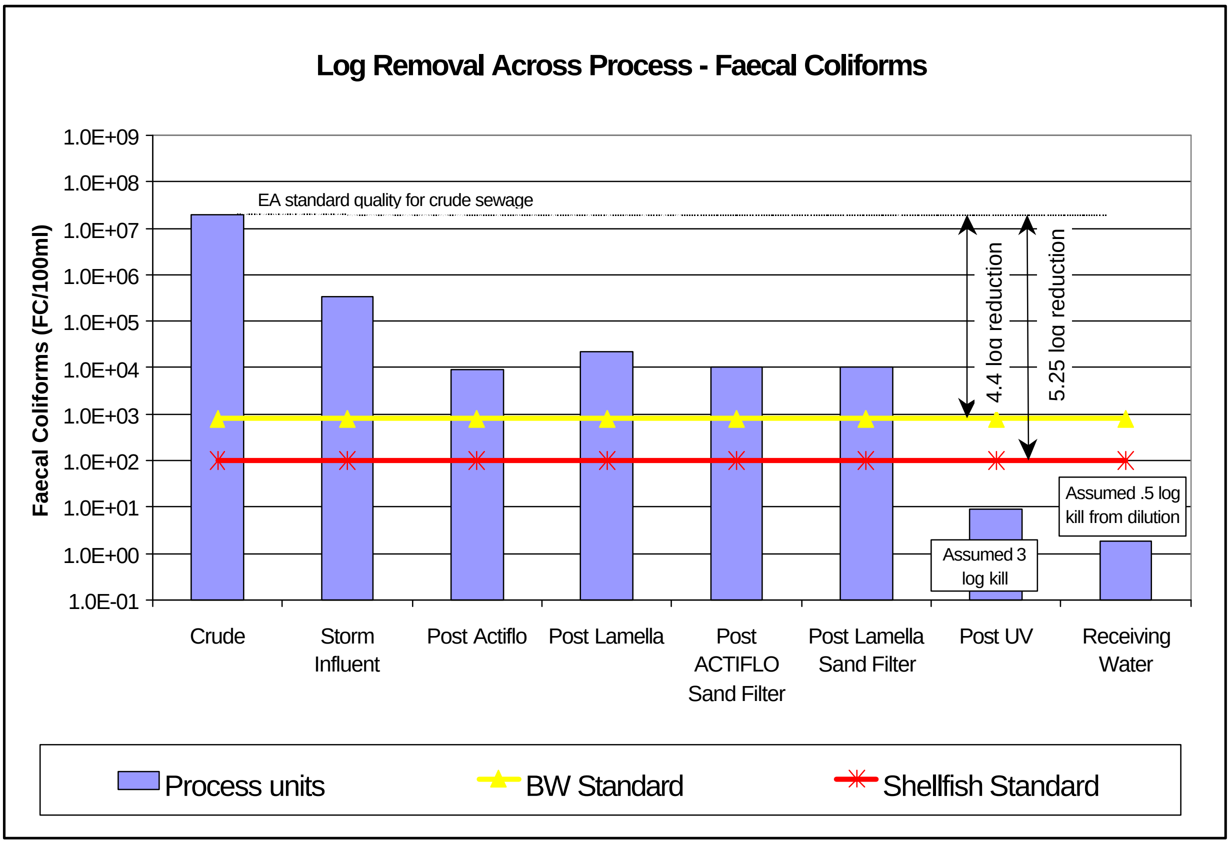


Fig.7 above shows that the entire process appears to give us the required log kills.

The results from both plants are very promising and we have moved to a stage of proving the plants ability to consistently deliver the required quality of effluent and finalise operational procedures.

This type of solution has not been applied in the UK to resolve a UID problem. Therefore whilst the EA have been very supportive throughout the trials they have no policy/guidelines on how to consent a full-scale plant.

UU are in detailed discussions with EA, CEFAS and other interested bodies on how to ensure that this new use of existing technology can be applied to AMP3 projects.

Future

UU are currently looking at installing this process to resolve a number of Bathing Water and Shellfish Water UID's during the AMP3 period.

As even tighter regulatory standards are likely in the near future the need for cost effective and operable solutions becomes even greater. The drawback of the tighter standards is that they may impact on the ability to use chemicals as part of the treatment process.