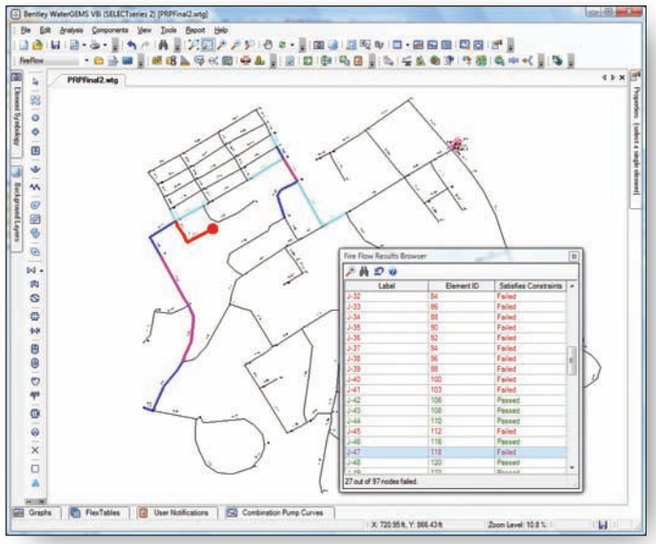
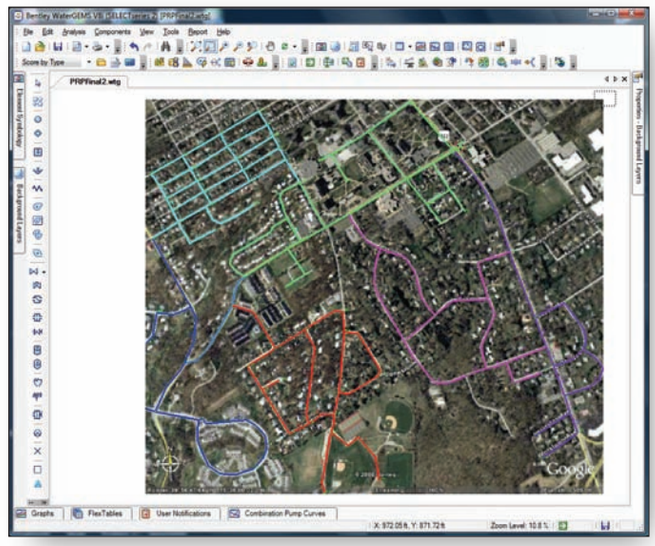
FireFlow showing bottlenecks



Overview of System by year laid



Plans in the pipeline

Bentley's new Pipe Renewal Planner gives hydraulic engineers a valuable asset management tool, enabling them to make more informed decisions about where next to wield the JCB

You may think it a little bit crazy to be looking at how we can hang on to the water we already have when the world continues to be subject to deluges of biblical proportions. Thanks to El Nino and La Nina we have witnessed some devastating floods in Queensland, Brazil and Sri Lanka, and the last couple of weeks have shown that the UK is no slouch when it comes to the heavens opening up either.

But you know as well as I do that, come spring, we will be looking at the usual round of water shortages, as the recent rains will have already found their way to the sea, meaning that we'll have to rely on stored water making a wasteful journey through the country's old water distribution systems before it reaches our demanding urban populations.

The utilities, or water supply companies, are well aware of the need to replace old piping with new - and the older the civilisation, the greater the ratio of ancient to modern piping. We have been working on substantial replacement projects in this country for many years. The problem, however, is the inadequacy of much of the information available about the older systems, and a suitable method of categorizing and quantifying what they do have so that they can make informed decisions about which parts of the piping system are inefficient, or at risk, and which must be tackled first. To date, project planning usually takes the form of roundtable discussions with streetwise hydraulic engineers, a mass of tables from previous repairs, and a good quantity of sharpened pencils.

PIPE RENEWAL PLANNER

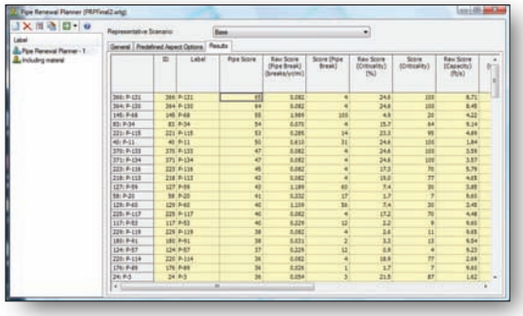
Planners now have an automated tool to help them, thanks to Bentley Systems. Bentley has introduced Bentley Pipe Renewal Planner, a new piece of software that's integrated within and supplied with the company's WaterGEMS hydraulic system modelling software, or as a module available with WaterCAD.

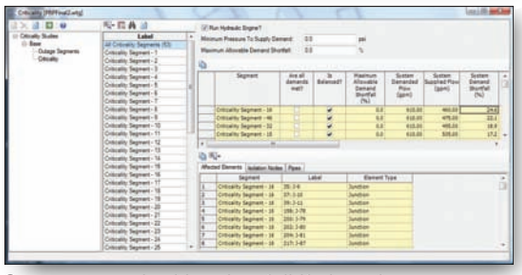
Pipe Renewal Planner is designed to be used in the asset management of a hydraulic system, as a tool for making decisions about where to spend money on new systems. It works out where the worst problems are - rather than flying by the seats of the old engineer's pants, which is more often the case, and its goal is to minimise costs, and to preserve or increase the efficiency of piping systems. It calculates the probable condition of sections of pipe, and ranks them according to several 'aspects'; pipe attributes that can be assigned scores in a number of areas that can then be combined, weighted and ultimately ranked.

Most aspects are property based; unremarkable information that includes the year of installation, the pipe material (clay, cast-iron, plastic, etc.), the neighbourhood in which it is based, and its characteristics, and can include user defined properties to include any further information the hydraulic engineer deems relevant. Bentley has added to these with a couple of more specific aspects, which are more performance based, such as the pipe's actual capacities established using FireFlow analysis, or using criticality analysis, and of course its pipe break history. Like property based aspects, these can also be specially defined and set up to cater for local requirements.

Pipe break histories can be imported from other systems, but often these lack common reference points, and the least

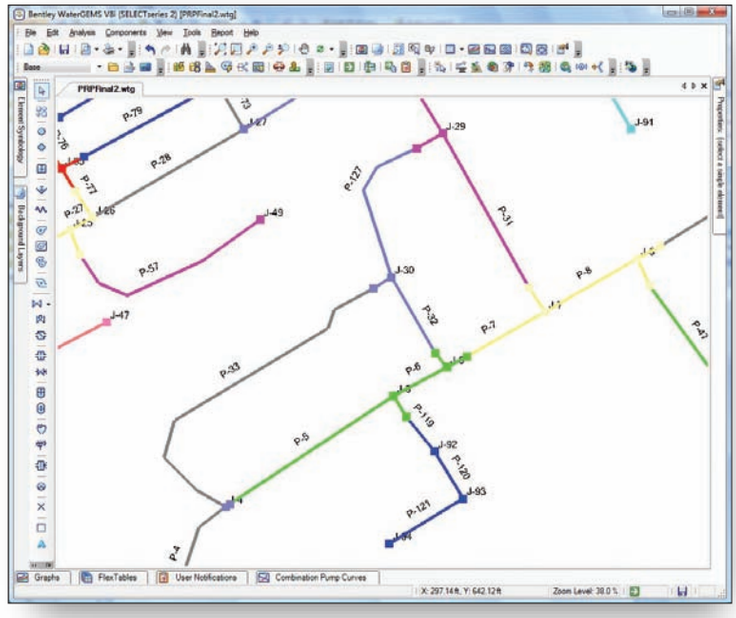
PipeBreak analysis results





Segments ranked by shortfall if closed

Segments Isolated by Valving



that has to be done to enable them to be used is to geo-reference the pipe locations, so that they can be used in the WaterGEMS model. Pipe break raw data can come from one source categorised with a pipe ID, and from others that list breakages but merely recall the definition of the break. Whichever history you have, preparing the data for the Pipe Renewal Planner can prove to be a time consuming, manual task.

A further aspect that can be included relates to costs, enabling pipe renewal planning to take account of the cost of renewing piping systems, and to keep within budgets, using WaterGEMS' Darwin Analysis to provide the necessary information.

Criticality and capacity are easily defined. Criticality can be established during an analysis by taking sections of pipe out of service to define the resulting shortfall in the system, deduced from running the model in static or EPS mode. The pipes that usually need to be looked at first are those closely connected to pumps, or at the beginning of branched systems. Capacity studies likewise use analysis to ascertain which pipes are creating bottlenecks.

Pipe Break Analysis looks at the pipe history and its break rate - how many breakages have occurred over a year and a defined distance - to produce a projected number of breaks over the period in question. Add in Darwin Analysis and you can ask the question "how many breaks do we expect in this section of pipe over the next thirty years, and how much will it cost to replace them?"

NORMAL WORKFLOWS

Workflows are pretty straightforward and, as the software is based on WaterGEMS, familiar to users of that system. They involve the creation of a System Inventory of each section of piping under scrutiny, from which users can perform pipe break analyses and other property-based analyses directly on imported or created data, to provide a normalised score for each. The WaterGEMs model of the pipe network is used to perform fireflow and criticality analyses, producing similar normalised fire and criticality scores. All of these are then charted, and a weighting for each aspect is applied to provide an overall score. The pipe section with the highest score is deemed to be most in need of renewal.

Actually, it's a bit more hands-on than that. The scores provide vital clues about the pipe network, and should be used as a valuable tool so that informed questions can be asked what the results show and why, and how the score could be improved; what aspect of the pipe needs to be addressed, up to complete replacement.

PRODUCING ASPECT SCORES

How do you convert the property of an aspect into a 'score'? There are basically two ways - stepwise and continuous. Stepwise looks at the make-up of materials, a series of discrete properties, based on knowing how long it takes for the property to break down, or lose its efficiency, and such things as its year of installation, and its pipe break history. Continuous relies on velocity or capacity simulations, using fireflow analysis.

VIEWING RESULTS

As with WaterGEMS all graphic reporting features are brought into play, such as colour coding results, graphs, charts and easy-to-read tables, but the main focus is on providing an accumulation of pipe data automatically, in a digestible format, and producing a full report once all data is in place 'at the click of a button'. It's time to put away those pencils and notepads and let the computer do the work.

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