**Sewage treatment presents one of the most challenging environments for plant. Brian Tinham talks to Severn Trent's pumps services manager about problems and solutions**

# Waste water

Waste water treatment may not exactly sound glamorous but, from a plant perspective, it presents some interesting engineering and management challenges. For a start, the far-flung nature of pumping stations, sewage treatment works and the rest of the network seriously impacts the logistics of plant monitoring. Then again, those same distances also make achieving anything like consistency, in terms of plant and equipment choices – essential in today's cost-conscious world – difficult to set up and even harder to sustain.

Much the same apples to installation and commissioning, as well as plant maintenance. How do you establish policy-based best practice in such a dispersed environment? How do you police it when you have? For that matter, how can the distributed organisation learn from its experience, particularly when the utilities are still going through the nightmare of 'right-sizing'? Fewer engineers moving around greater numbers of sites, each with its own idiosyncrasies, isn't going to make any of this easy. And, to cap it all, there's the materials being treated – sewage in the UK is far more testing on plant equipment than many realise.

Rod Stanley, pump services manager for Severn Trent, puts it into perspective, making the point that his fiefdom extends all the way from the Bristol Channel to the Humber, and from mid-Wales to the East Midlands. We're talking about no fewer than 1,100 sewage works, 2,000 pumping stations, and thousands of miles of connecting pipework and associated infrastructure, treating some 2,700,000 litres of potentially quite variable sewage every day.

Given the industry's central dependence on what turns out to be a wide range of pumps, Stanley is right at the heart of Severn Trent's plant engineering challenges – so who better to provide some insight?

From a maintenance perspective, he indicates that Severn Trent manages its entire sewage treatment plant responsibilities – not just the pumps – through 17 area managers, each having a team of around 13 multi-skilled engineers and a work planner, responsible for scheduling breakdown and planned engineering work. Specifically on the pumps side, these distributed teams are then backed up by seven pump maintenance engineers and another workflow technician, together working out of two pump service centres – one in Nottingham, the other in Coventry – which are his responsibility.

That sounds pretty tight, so how does it work? "We've arrived at this formula over many years," explains Stanley. "The guys in the field have become fully-trained service engineers, so they can go on-site, identify the problem and, if it's a quick fix, do the work. If it's not, or if they are concerned about potential time or expense issues, they'll pass it back to my pump service centre teams and we'll make a decision about whether to repair or replace, based on what we find. We'll look at aspects like impeller clearance and condition, flow path condition, condition of the castings, mechanical seals, bearing condition and so on – and assess the comparative cost of spares and reconditioning versus replacement."

If that gets to 80% of the price of a new pump, the decision is usually to replace – although he makes the point that lifecycle costs are also important. So if the defective unit is in a well of, say, three older pumps, that might influence the outcome. "No one wants an oddball pump."

## Commercial choice

Meanwhile, if it is a repair job, either Stanley's team steps in or it's contracted out. "Who does the work depends on resource, workload, complexity and mechanical requirements," he says. "For example, we have a two-tonne maximum lifting capacity in our workshops and we're not equipped for major component refurbishment in-house." So, for bigger jobs, Severn Trent has purchasing agreements with three main suppliers – Flight, ABS and Wemco-Hidorstal – for repairing submersible and centrifugal pumps. Other suppliers then fill in the gaps: for example, EMS Industries looks after ramp pumps.

"In recent years, we've become much more commercially aware, so we now pick the work we can do most efficiently and contract out the rest, with an eye to getting best value for our stakeholders," says Stanley. That's still the lion's share, though: during the last 18 months, his pump service centres have repaired 1,600 pumps, while less than 100 have gone out to contract. "If we had sent all those pumps out, that would have cost us around £130,000 more," he boasts.

## Points

- Maintaining plant in distributed operations is best handled with multi-skilled service engineers and centres of excellence
- Repair or replace is a straightforward cost decision – unless there are existing equipment preferences
- Contracting out or repairing in-house has to depend on workload and overall efficiency
- Feedback of real world experience is critical to plant improvement
- There are occasions when investment in instrumentation saves on operating costs

Dean Smith, Camera Crew

# wars

He also observes that contractors don't just work for Severn Trent, and that Thames, United Utilities and others sometimes have priority projects, which could cause delays. "The trick for me is to keep track of the pump models we have, the work on the books and the jobs likely to be coming up – as well as building relationships with our suppliers."

All of which sounds fair enough, but it's still anything but trivial. "You have to remember that all engineers are individuals, potentially with different views on the best way of operating and maintaining plant. We've worked hard to manage that and we've made good progress, but there's still a way to go – for example, with building a cohesive pump strategy by size, when knowledge is so geographically dispersed.

## Familiarity and spares

"And the other thing is, like everybody else, we've got diversity of supply issues. We've got 40 or 50 manufacturers' pumps out there, as well as a whole range of types, and with that go, for example, all the problems of familiarity and spares holdings."

So what types? "About 80% of our pumps are centrifugal, single-stage, submersible units, although we also have dry well pumps equipped with cooling jackets. The smallest is 1.3kW and the largest 125kW. There are also some centrifugal multi-stage pumps – for example, driving wash-water for screens on sewage plant inlets. However, as a business, we also have progressive cavity pumps, ramp pumps, diaphragm pumps, screw pumps, peristaltic pumps, gear pumps, rotary lobe pumps… It's the full Monty."

Why so many? Stanley observes that pump choices, to some extent, go in cycles. "On sludge digestion, for example, ramp pumps fell out of favour years ago and the industry moved over to progressive cavity pumps, before recently coming back to ramp pumps again." And the reason: ramp pumps cost more and they're much larger, but the industry now understands that, assuming ramp pumps are sized and installed correctly, they will last the full 20 years expected of mechanical plant. "You might need three or four progressive cavity pumps in that time, which would mean more cost and downtime – as well as the health and safety implications of engineering interventions," he says.

"It's the same for rotary lobe pumps: they went out of fashion in desludging applications, because they were wearing too quickly. But technology and materials have moved on and manufacturers have also made maintenance much easier. Many units now have eccentric shaft fittings and subassemblies held in by fewer retaining fixtures. It all makes stripping down and rebuilding much quicker, so now there's more interest in them."

But making the right choice remains a challenge. "How do you know how much rag, grit or cotton buds you're going to get? How can you anticipate infrastructure changes? Also, storms that were supposed to be 40-year events are now becoming annual," observes Stanley.

There's also the fact that the way sewage is streamed, screened and treated in the UK is different to the rest of Europe, yet pump manufacturers design for the worldwide market. Stanley warns that means being circumspect about

**Rod Stanley, pump services manager, Severn Trent: "You have to remember that all engineers are individuals, potentially with different views on the best way of maintaining plant"**

specifications. “For a lot of our stations, screening is the biggest determining factor. Manufacturers quote all sorts of solids-handling capabilities, but those rely on critical clearances that may have little or no bearing on the real world on-site. Every situation is different and that makes a huge difference to performance.”

Inspection frequency is another problem. “We’re trying to standardise on maintenance, but for some installations twice yearly will be too soon, while for others it will be too late. Ideally, we need to move to condition-based maintenance and I’d like to see flow monitoring with automatic job generation, if a pump drops below, say, 50% efficiency.”

### Best intentions

But that means instrumentation for sewage pumping stations’ control panels. “The big debate is where to install flowmeters, because of the cost,” explains Stanley. “As a maintenance manager, I want to know what each pump is doing, so one per riser or delivery main, before the common, would be ideal, especially if two pumps are on duty/assist. The issue is that, over the years, our design colleagues have been looking for cost reductions, so they’ve even been taking out ammeters and hours-run meters, which we want to determine pump condition. Some of the best intentions can lead to problems.”

Stanley sees the pump service centres having a key role in solving this and making other improvements. “One of the benefits of our pump workshops is that we’ve now centralised a lot of data, so I’m trying to feed that into a maintenance strategy, based on RCM [reliability-centred maintenance] that shows us, for example, which pumps and pump types at which installations we need to inspect more frequently and those we can stretch. I’m also using the data to demonstrate the value that flowmeters, ammeters, level controllers and so on, linked into plant PLCs, can bring.

“And I’m providing feedback for the design teams, so that, for example, as they work on building pumping stations to a template – with standards for lifting equipment, non-return valves, pumps and so on – they take account of experience from guys at the sharp end. It’s a mistake to overlook opportunities during installation and commissioning to understand real plant performance, as against what the specifications and test certificates say. Maybe there are pipework configuration or sizing issues: we need to feed all that back.” PE