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Paul Thies: When it comes to wastewater management, utility managers are discovering that deploying a data-driven approach to their operations is helping them to realize cost and resource efficiencies and to avoid emerging problems like never before. This keeps things flowing, which is music to the ears of customers, plant operators, and people concerned about offsetting potentially damaging environmental incidents. Hello. I'm your host, Paul Thies. On this episode of *If/When* I discuss the concept of data-enabled utilities with Simon Gaskell, Jacobs' senior associate director, and Samantha Sloan, network business manager of United Utilities.

They shared their insights on how digital wastewater systems perform in comparison to analog systems, as well as some of the more common challenges of implementing a digital program to an existing wastewater system and more. Simon and Sam, thank you both so much for joining me today. We're going to talk about digital-enabled power utilities and water utilities and how the utility landscape is tapping into emerging technologies to really advance its efficiencies and performance.

I'm grateful to both of you for joining me today to share your expertise. Simon, to start us off. Let me ask you, can you compare and contrast for us how digital wastewater systems perform versus analog systems? What makes a digital approach truly better? Not just, well, it's digital and everybody assumes, "Oh, that's better," but what really goes into making it a better system?

Simon Gaskell: Thanks, Paul. Yes, I'd probably start by, first of all just framing wastewater systems and analog or conventional system viewpoint first. I think it's really important to ensure that we think about the wastewater systems or networks, not in isolation, but being part of a wider not just being just the sewer pipes under our feet or under the road, but all of the wider network interaction as well. Within Jacobs, we refer to Jacobs OneWater or OneWater landscape, which is the complex, integrated picture of the cyclical interactions between water sources and water users, and that includes wastewater and how it's managed.

Things to consider, all those inputs, be those customers, people are using discharging district water into the network, as well as your rain and stormwater that's coming into the system, but also users are consuming clean water and that's a separate network which is being managed. Then the wastewater network is feeding into treatment or processes, which is another set of assets that operational organizations are managing. In short, I think although the length of sewer is relatively simple physical asset, when you put it in the context of all the other multiple factors that play, then the picture becomes much more complex.

With that complexity comes challenges and opportunities. When we think about, on my mind anyway, analog or conventional systems, I'm thinking a bit of a spectrum depending on the operators or the geographies we're looking at, but it can be from one end where there's literally no technological systems in place where it's relying on human observation and control to manage the wastewater system through to another end of where you're seeing hardwired data logging units, telemetry systems which are communicating this data to a central point where it can be visualized and then form subsequent control activity.

Generation of alarms when conditions are passing certain thresholds, but particularly we're using dial-up technology where users are making requests to see the data. We've got relatively low sampling frequencies and although this is a complexity will vary in a system. I think the key takeaway really is that users are accessing stuff. They're not really getting a single real-time picture of the network in this conventional or analog approach. Control activity is typically manual and that awareness of issues happening is after the fact typically speaking.

The management of conventional systems can also be quite siloed. We've got different catch-up management or clean water or wastewater and other watercourse management systems. They're generally all on separate systems but there's no real integration between them. This transfer of data is pretty limited and even though they actually can be very similar in terms of their methodologies.

If we think now comparison or contract to a digital system title it, I widen that spectrum further now in terms of technology to start to be using more prolific use of wireless communications, IoT devices, edge control capability, and also less dependence on main power for all this technology. More battery-powered devices that we can achieve greater saturation in the network and in general, more challenging locations. A sewer is quite a harsh environment and interacts with quite complex other environments around it.

Generally, within a digital domain, we're seeing it easier to communicate and store and share data through cloud-based data storage architecture and allows us to really have improvements in how we can share data across systems within an organization, but with across departments, if you like, but also with other organizations outside that management organization to the wider industry or other interested parties, which is really important, I think, in the context of innovation and harnessing wider collaboration with the likes of supply chains and other organizations.

The other thing we consider is the increased use of data science techniques, including machine learning, able to provide a more timely generation of dynamic models which we can factor a range of data inputs which allows us to really understand what's normal behavior and when are we moving outside that normal behavior.

Paul: Let's unpack that a little bit because can you talk to us a little bit about how smart sensors, predictive analytics, machine learning, that sort of thing can aid wastewater networks in preventing flooding for instance, or blockages and pollution events?

Simon: Yes, sure. I think we just start with a thinking or start point of having the appropriate sensors or the right blend of sensors that really need to be positioned within the relevant locations in the network where we can build a sufficiently sort of a granular picture of how the system is operating at any one time, and then feed that data back into analytics engines to learn that behavior. Those analytics can inform logic, which as I said, detects it in the performance of the sewer network when it's moving outside what we'd accept sort of acceptable, sooner the relationship between one node point in the sewer network to another.

We understand how it's being designed and the relationship with the likes of water courses and river systems. We can really understand under what conditions we could expect pollution events to occur. I think what's neat is you don't necessarily need sensors in absolutely every single location, so you don't need the whole thing monitored to be able to be effective. To do that, especially in the UK, would be really cost-prohibitive.

How we can infer this impact against using GIS data and wastewater models combined with all this data together really helps us have the potential to detect these problems proactively. In tools such as Jacobs equity and platform, we can boil down a lot of this data, which can be quite overwhelming for individuals or operators. We can give a simplified situation awareness picture and we can blend it with analytics and that business logic rules that the business can set. Then we can give teams prioritized recommendation of where they could be intervening in the network to prevent a blockage.

When we're seeing behavior in a sewer going above the level expected, when nothing's changed, it's not raining, why is it going up? There's a potential blockage. We could go in and intervene ahead of time and avoid that blockage, potentially causing a pollution into a watercourse in that example.

Paul: Okay, great. Then, Sam, let's talk a little bit about how you would weave in a data-driven approach to an existing wastewater system. Tell us, what are some of the common challenges for implementing a data-driven approach and how are those challenges overcome when you have an existing wastewater system that you're trying to apply that to?

Samantha Sloan: Yes, certainly. I'd say the one challenge would be the adoption of technology. I think something that hardly we fall over one too many times is certainly going after the technology first and thinking about the people and the organizational model second. One thing that I would say is really to flip that on its head. For me, it boils down to two real things. First one is the actual operating model that you have in place. We're not set up and certainly in the water industry. A lot of our operating models are not centered around data-driven technology-driven approaches to managing these assets. We're very much driven around delivering a service to customers and reacting to issues as they arise.

The first thing that I would say, really, in terms of dealing with that as a challenge is set up your operating model first. How you organize yourself first, create the roles, create the ownership, the accountability of performance, and ultimately the end users of that solution first. By doing that, what you do is you create the need essentially for the solution. If I give an example, having teams set up processes as Simon discussed there a bit about **[unintelligible 00:10:38]** looking at things manually. It takes a lot of time, but if you do that, you create a need for then a digital solution to come along and make that quicker, make it more effective, and therefore there's a want there within the teams to utilize it.

I'd say my first big recommendation would be, create your organizational model first. That makes it digitally ready to adopt the solution. The second thing I would say then is, and something that people forget too often is, have the people that are going to be using that solution at the end actually be the ones that helped drive it from the

start. One thing we done within United Utilities was really looked at starting off the teams using the solution before it was necessarily ready to be used. We had our teams in the driving seat whilst we were still in the deployment phase of the project.

Utilizing the technology, whilst we were still developing the technology, having them involved in development of the processes of where we place the sensors, where we capture the data, even down to how we want that solution to, I guess, look and feel on a very aesthetics point of view. Because ultimately, doing it in that way, it means once you get to the actual transition or implementation into the organization, the people that are going to be the important users, they've already had a chance to influence it. They've already had a chance to help shape it. There's no surprises. There's no fear, there's no shock. They already know what it is, and they already know how it's going to help them deliver in their roles.

Certainly, I'd say that's the biggest challenge is that adoption. The two things I would say is, really think about setting the operating model up first, and having your people help drive the solution throughout the project phase.

Paul: Oh, that's wonderful. I could see that the temptation to be enamored of the shiny new toy, so to speak, could get the better of business managers who aren't necessarily or may not necessarily have thought about the process implications and the staffing to that, and just making sure that there's that adoption mindset.

Simon: I add just onto that a little bit, just in terms of those challenges as well. In terms of for the business and adopting those digital systems. We've got a higher degree of complexity and overall, the value chain and all the points included in it are a bit more challenging to manage. There's increasing choice in technology as well in the market, and you can end up having a blend of mosaic of different components of solution. There's a risk of users having to grapple lots of different interfaces, technology, and other pieces.

Wherever possible, simply you can make that journey for individuals in the business to engage with all that, the more, the better. **[unintelligible 00:13:32]** really bear in mind when bringing that change.

Paul: Absolutely. Now, Sam, can you tell us a little bit about some of the benefits that a data-driven approach can bring to wastewater management? Are we talking about cost savings, improved performance, advanced notice of impending equipment failures? What can you tell us?

Samantha: I'd say, all of the above really. I can't speak anymore favorably about adopting a data-driven or technology-driven approach, but if I bring it back to my experiences within United Utilities and within the water industry here in the UK, I guess we kick off the project or launched our operating model with a solution around 18 months ago. Like I said, we're still in project phase wrapping up in about a month's time.

In those 18 months we've already delivered significant benefit in, I guess, all of those categories that you listed there, really, but the one that I would call out, which was the real driving **[unintelligible 00:14:34]** behind actually taking on this approach was delivering a better service for our customers. Ultimately, we are responsible for

serving over seven million customers when it comes to wastewater collection and management. A real driver for us was, how do we stop the requirement for our customers having to call us to tell us what's gone wrong? Because obviously at that point it's too late, isn't it? They've already had that negative impact.

They've already suffered the consequences. They're already going to have to deal with the clean-up, and we've had that reputational impact, the financial impact, the regulatory impact. Ultimately, it all comes down to the customer experience for us, and how do we change that and that incident from being a reactive one to being a proactive one. That's the key thing for us. Actually, in the 12 months after we put the operating model in place, we see the 10% reduction in customer-driven jobs from the population that we serve. That's over 3,000 jobs that were prevented from us having this technology approach in place.

Like I said, we are still in that project phase and we've still to complete, but we've made a significant dent in the requirement for our customers to call us and tell us that they've had that unwanted incident at their property, or they've witnessed a pollution in watercourse in a nearby environment. For me, firstly, customer experience, that is what we're driving for. We don't want our customers to have that need to contact us reactively, but that of course, has an indirect benefit financially. That could be through our improved regulatory performance. If we pick up those things proactively, we don't suffer the consequences from a regulatory performance point of view.

Also, there's the element of getting out there proactively. It means we can resolve things quicker. There's less clean up, there's less time on site, which means increased productivity. All of these things in the round really wrap up to, I guess, better financial performance, better customer performance, and also better engagement from our teams because it's a much more improved environment to operate in if we're actually clearing things proactively rather than reactively. That's what I would say really is what we've witnessed really strongly since we started this.

Another element I would say is, less from a customer angle and more from, I guess, a **[unintelligible 00:17:01]** assets or how we would refer to our mechanical and electrical assets across the drainage areas that we've managed. We've seen through the adoption of the sensors on sites, and the use of the data and the trending capabilities that we've got, that we've actually been able to reduce the number of reactive-driven jobs. On the back of alarms, and further work being raised by around 25% across the sites that we've actually implemented this approach.

Again, another really significant percentage reduction when we look at having a data-driven approach in comparison with a more traditional approach that we've seen before. Ultimately again, that comes down to less prior usage, less reactive failures, which means more asset outage, less **[unintelligible 00:17:49]**, which again, is a real negative from our team morale and engagement perspective, and also customer engagement as well, because nobody wants somebody turning up on the street outside at 2:00 AM in the morning when you're trying to get some sleep.

Ultimately, across our asset base and across the customers that we serve, we've seen real impact on both the customer-driven jobs and then those reactive figures from the assets that deliver the service.

Simon: Sam, what I really like when the related benefits to the teams more is when you've got more of a predictable plan work without that pressure to try and resolve things in a reactive way, you're working in a much more measured, calm approach and could be in daylight hours and ultimately the impact on just having that safer working environment as a result.

Samantha: Definitely, Simon, and certainly being able to go out there proactively, take your time, carry out thorough investigations rather than reacting to initiatives arise and trying to mitigate it. What we're seeing is being able to spend more time on site, do proper root cause analysis on site, and whether that's CCTV camera footage, upstream, downstream, really understanding the asset condition rather than it being focused on resolving that customer-driven issue and making sure the customer service is there.

We're really being able to focus more on the assets and take our time and understand in that root cause, which will only help improve performance in the future, and help us plan better and more effectively in the future as well. I'd certainly say that kind of a more calm environment, yes, you're spot on with that because it really allows us to take our time and understanding what these issues are that we're resolving.

Paul: Then, Simon, can you tell us how can improved wastewater network performance contribute to a positive environmental impact? I know we talked about trying to prevent pollution events, but can you expand on that a little bit? How's this digital approach contribute to more of a positive effort for the environment?

Simon: It was a great question, Paul, and I suppose really relevant just in the increasing expectations placed on responsible network management organizations to have that net positive impact on the environment. It's becoming a real focus in the UK especially currently.

I'll pick out a couple opportunities. I mean, first, there's kind of what we talked about already about we have a maximizing the potential of the network and more resilience in it, but allowing it to reach its full potential of holding as much volume of wastewater as it's designed to, particularly where we've got combined sewer flows, which we have got wastewater from customers and rainwater together. We're really have the opportunity to reduce the risk around pollution. If we have a network which is fewer obstructions, we've got more effective flow than at risk of spilling is being reduced.

I think the fact that we got a degree of observation and real-time monitoring means that there are instances where there's unavoidable spill events, but if in fact that we know exactly what's happening at a certain point where the ability for these organizations to respond in a far more timely way and mitigate the impact the environment is much more readily available rather than just relying on the human observations after the fact.

I think another key opportunity is really, and leveraging that sort of one water mindset is or maybe in United Utilities term as a systems thinking mindset is achieve a high performance. We can control the operation of the wastewater network more effectively because we know exactly what's going on, we can improve efficiencies downstream into the treatment processes as well. If we've got more predictable flows

of water wastewater into those treatments we've got the opportunity to have greater efficiencies and how they actually operate.

Sam has touched on there, so almost like the running costs of all the powered assets in the network, these could be pretty, these processes are fairly high consumers of energy and therefore carbon as well as chemicals and others. We can really sort of an opportunity to drive efficiencies in the consumption there and therefore overall from reduce the impact on the environment as a result of what we consume.

Paul: Sam, let me come back to you and we touched on this just a little bit, when we talked about starting first with the process and with the people and then folding in the technology, but what do you say to someone in wastewater management who says, I'm not a data scientist, or I don't have time to keep up with the latest advances in cutting edge computer technology or something to that effect. How do you put their minds at ease about deploying this kind of technology into their systems?

Samantha: They are common concerns or feelings really, and you can feel that way of barking on any change. I don't think people that come off that with those kind of queries or concerns are alone. What I would say is definitely to focus on the why, why do you need to tick on this change. What is that your burning platform? Because ultimately if as a business you're deciding to take this sort of transformation on, you need to understand the why, and ultimately doing that helps you then really focus on the prioritization of efforts within your own day-to-day within your teams and various stakeholders across the business.

Because bringing it back to the why, and for us, like I said, it was the customer. It might feel I don't have enough time to focus on cutting-edge technology or I'm not a data scientist, but why are we doing it? We're doing it because we need a step change in the service we provide to our customers. What other way can you do that? Really for me, it's always bringing it back to the why, what is your burden platform for change? Because ultimately for me, that puts everything into perspective. I guess the last bit there around watch your, I'm not a data scientist I don't want anything about that.

It doesn't take a team of 100 data scientists to implement a digital transformation, it takes data scientists, but it also takes engineers, it takes operators, it takes people, managers, it really takes a big collaboration across different skill sets to be able to deliver a transformation within a wastewater management system within any organization really. I would never say, "Oh, you need to have a certain skill set to be able to contribute." Definitely not. I think going back to what I said at the start, if you've got that platform for change and you know what you need to do, then that should make everything else clear and really fall back into perspective.

Paul: Then, Simon, let me ask you my last question for today. What's next on the horizon for a data-driven approach to wastewater management? Where do you see developments and emerging technology taking us next?

Simon: Thanks, Paul. I think one word would be optimization. The costs associated with optimizing what you already have in terms of infrastructure working for you, they're dwarfed compared to those where you have to invest in building new infrastructure to deliver the same level of capacity so more capability in the network.

Really making the most of what you would have is really cool, I think, to how water or wastewater network operators will be tackling their challenges facing today, and indeed the forecast challenges they know they're going to have in the future.

I think we'll see more widespread utilization of automated control technologies and the network which will able to maximize your storage of wastewater in this scenario in the network without bidding customers or environment at risk. There's always a bit a risk when you've got that sort of a control being and done by a sort of system, rather by human intervention. I think anything where we've got repeatable or routine activity or maintenance in the asset base, I think there's opportunities to optimize that further with a data-driven approach. More condition-based maintenance on those assets that are really informed by a measured health and state of it, rather than just by just routine activity, prioritize where you're investing and balancing that cost financially as well as the expected performance improvements you're going to have as well as what's the environmental or social value impact going to be when we take this activity. I really think that's next on the horizon is really where we're optimizing what we've already got and leveraging the full potential of the infrastructure assets that these organizations have.

Paul: Simon and Sam, I want to thank you both so much for talking with us today about a data-enabled approach to utility and wastewater management. Thank you so much for your time and insights.

Simon: Thanks, Paul. Thanks, **[unintelligible 00:26:32]**.

Samantha: Brilliant. Thanks for having us.

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[00:26:52] [END OF AUDIO]