WATER WORKS

TECHNICAL PUBLICATION OF THE WATER INDUSTRY OPERATORS ASSOCIATION OF AUSTRALIA

MAY 2021

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WATERWORKS
OFFICIAL JOURNAL OF THE WATER INDUSTRY OPERATORS ASSOCIATION OF AUSTRALIA

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EXECUTIVE MEDIA
NEW YORK | SYDNEY | MELBOURNE | ADELAIDE
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Contributions Wanted

WaterWorks welcomes the submission of articles relating to any operations area associated with the water industry. Articles can include brief accounts of one-off experiences or longer articles describing detailed studies or events. Submissions may be emailed to peter.mosse@gmail.com or info@wioa.org.au

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DEDICATION RECOGNISED

WIOA is always keen to salute the operators in the Australian water industry for their commitment and the service they provide to their communities. Over the last 18 months, the skills and resilience of water industry operators in many areas of Australia were tested to the maximum, dealing with the disruptions caused by drought, bushfires and then COVID-19. There would not have been too many people unhappy to see the end of 2020.

Just when things seemed to be moving back towards normal, torrential rain brought massive floods to parts of Queensland and New South Wales, along with a new suite of challenges. At the time when Sydney's Warragamba Dam was spilling muddy water at a rate fast enough to fill Sydney Harbour each day, the desalination plant was able to be brought online to supplement drinking water supplies thereby avoiding severe restrictions.

Other communities however, just had to make do with the treated water stored in their reservoirs until the flood water subsided and the treatment plants could be brought back into operation. Continuing to deliver safe drinking water and wastewater services in these circumstances has really tested the mettle of many operators.

Once services are restored, the clean up after flood or storm events often takes many weeks and adds more strain to an already stretched workforce.

Water industry operators take their frontline responsibilities extremely seriously and sometimes without too much thought for their own personal wellbeing. During tough times like these, many operators move into crisis management mode, often wanting to see the job through from start to finish. They regularly go above and beyond the call of duty and it is not uncommon for operators to work long hours for many days, even weeks at a time. We have also heard that in some regional or more remote areas, operators have been on call for many months, and in some cases years, without taking a holiday or an extended break.

It is vitally important during times like these that we all look out for each other's physical and mental health. Operators need to be encouraged to maintain their normal exercise and recreational pursuits, even in the face of increased demands. Fatigue levels must be managed, and especially when driving is involved. Many operators travel long distances to get to and from their plants and tiredness, stress, inattention or distraction, and speeding can be a recipe for disaster. Remember, there is no job more important for anyone than making it home to their family after each day.

Many operators work alone or in very small teams and may bottle up the level of stress or anxiety they are feeling. The R U OK? concept is one way we can initiate a discussion with each other to try to keep ahead of and manage issues such as anxiety or depression. Opening up to colleagues can be difficult and confronting as there is no anonymity. Some operators may not necessarily want to talk with work mates even if they ask R U OK?

We need to encourage operators who are feeling stressed, lost or alone to talk to someone. There are a variety of other options including Beyond Blue (1300 224 636) and Lifeline (131 114) where issues can be talked through in an anonymous manner. Speak to your doctor if need be, and there is absolutely no shame in talking to a psychologist or counsellor.

We applaud you for your efforts and above all, please stay safe and well.

OUR COVER

Brian Woods from Veolia inspecting the membranes at the Gold Coast desalination plant.

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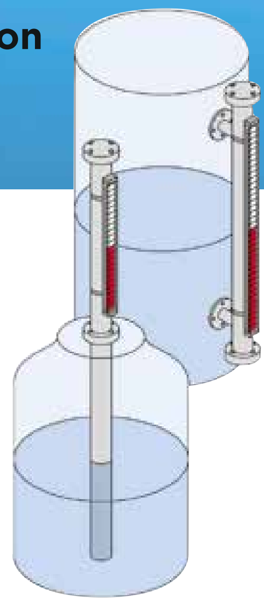

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GUEST EDITORIAL

David Sheehan

David Sheehan, Senior Water Quality and Regulatory Advisor at Coliban Water.

As I have often mentioned in other forums, I started my career in the Australian water industry as a rather shy and naïve 18-year-old in Sydney Water's water microbiology laboratory, way back in April 1984. I have been extremely fortunate to have been able to turn that start into a close on 40-year career in the water industry.

Reflecting back on this time, much has changed in the water industry, mostly for the better, but much is still exactly the same as it was the day I poured my first agar plate.

The fundamental tasks of a water utility are still the collection and/or storage of raw water; its treatment to a drinking water standard; its distribution to people's homes; the collection of wastewater; and its appropriate treatment, disposal or reuse. This set of tasks is likely to remain the core business of a water utility for the foreseeable future, or potentially forever. Whilst there will be smarter ways to do each of these tasks, and new, fancier names for some of the processes, ultimately it will be about moving water around for the best benefit of the communities we serve.

Additionally, it will also remain the case that a litre of water will continue to weigh a kilogram, and water won't flow uphill unless it is pumped.

The other aspect that won't change over the foreseeable future is the underlying premise that water utilities are fundamentally linked with public health outcomes. The provision of safe drinking water and the appropriate disposal or reuse of wastewater are still the mainstays of healthy and prosperous communities. I am constantly amazed how quickly the loss of a centralised safe drinking water supply, or the loss of a centralised wastewater treatment system after an event like a flood or cyclone, can lead to outbreaks of waterborne disease. This strongly reinforces the requirement that vigilance and dedication to the provision of these services is needed to ensure that the health of communities is not compromised.

Australia, on the whole, has a very strong track record of providing safe drinking water, and avoiding waterborne disease outbreaks that have been seen elsewhere in equivalent developed countries. This is due, in large part, I suspect, to the almost universal use of chlorination to disinfect drinking water supplies across the country. However, it is equally a reflection of the dedication of staff across water utilities who deliver appropriate drinking water and wastewater services to Australia's cities and towns.

Whilst there is much to be proud of and celebrate with respect to our management of drinking water and wastewater services, to my mind, there are still three areas of unfinished business that need to be addressed in order to greatly enhance our management credentials.

Establishing Minimum National Competency Standards for Operational Staff

This has been an issue I have been pursuing for close on 13 years now, but I find it amazing that there are still no agreed and enforced minimum national competency standards for operational staff that are supported by a mandated certification process. In saying this, I am not suggesting that current operational staff are not capable, skilled and dedicated individuals. The issue is that under the current arrangements, there is nothing preventing an under-trained or under-skilled individual being left in charge of a water treatment plant that services several thousand people, and that being considered acceptable, until something goes wrong.

Figure 1. Operator Certification presentation

As stated above, the treatment of water to a drinking water standard is a public health measure, but it is currently treated like an unskilled job. No water utility would employ an unlicensed plumber or electrician to work on their assets, but we seem willing to accept unlicensed staff operating those assets. As a minimum, it seems like a no brainer to me that we should expect that all operational staff should undertake formal training on the unit processes, or tasks, that they are responsible for, and then be certified as competent at those unit processes or tasks.

In large part, the idea behind putting in place minimum national competency standards is primarily about giving due recognition and acknowledgement to operational staff that they perform a skilled and important role, which has a high level of community benefit. Anything less seems to me to devalue the contribution that operational staff make to the water industry.

Nationally Agreed Water Treatment Standards

We are slowly getting closer to having microbial health-based targets (HBTs) incorporated into the Australian Drinking Water Guidelines (ADWG), but all that having microbial HBTs in ADWG does is define how much treatment is necessary to ensure that drinking water is microbiologically safe, not how the individual water treatment processes that are used to make the water safe should be operated.

Some relevant operational information is contained in the Water Services Association of Australia's (WSAA's) *HBT Manual*, and Water Research Australia's (WaterRA's) *Good Practice Guide to the Operation of Drinking Water Supply Systems for the Management of Microbial Risk* and WIOA's Practical Guides are also great resources, but the water industry as whole would benefit from there being a single national water treatment standard.

Besides basic operational information, things that this standard should contain include agreed polling intervals for online instruments, potentially standard rules around the set-up of SCADA or HMI screens, an agreed methodology for the calculation of Ct values for chlorine and ozone, and other relevant matters to improve the standardisation of treatment processes and treatment outcomes.

This may not be easy to achieve, and there will always be localised exceptions to the standards proposed, but there are also likely to be significant benefits. The first benefit would be that no matter where you are in the country, the processes used for treating water to a drinking water standard, and the measures used to verify that a drinking water standard had been achieved, would be standardised. The second benefit is that this would help enable a situation where a certified operator could go to any water treatment plant in the country, and they would have a reasonable chance of being able to operate the plant. Thirdly, this would have flow on effect during emergency situations, where operational staff could be rapidly deployed.

Having all Water Supply Options "On the Table"

This last piece of unfinished business probably appears to be somewhat in conflict with the preceding discussion about how the water industry is primarily in the public health business, as wastewater, and particularly poorly treated wastewater, is a source of health risk. The challenge though, is that faced with an uncertain climate future, which is likely to be drier, and with Australia being the driest permanently inhabited continent on Earth, the idea that you use treated drinking water once prior to disposal to the environment, in the absence of a sustainable reuse option, is starting to feel a bit short-sighted.

Of course, the main additional option that is not currently on the table is the addition of purified recycled water to drinking water supplies. I feel the important concept here is that it is one possible option, not the only option, that is available to diversify sources for drinking water supplies.

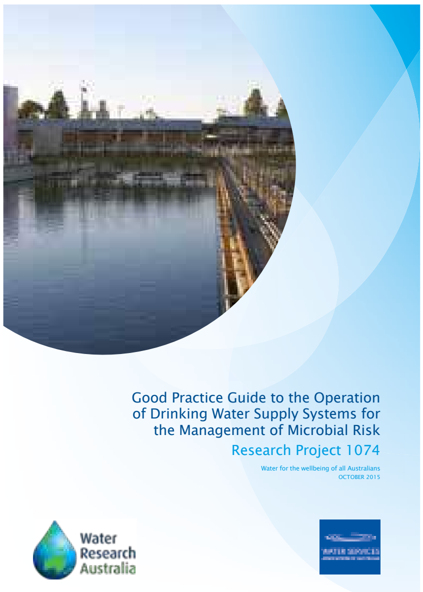

Figure 3. Good practice guide.

Figure 2. Operators doing filter operations training.

Figure 4. Practical Guides for operators.

In many circumstances, it may not be the best option, but in some it might be, and if we wish to have a future where there is enhanced urban water security, purified recycled water is an option that should be considered.

It is also worth noting that purified recycled water is a long way from untreated wastewater, and the level of treatment applied makes purified recycled water a much cleaner source water for a water treatment plant than many current waterways that are used as sources of drinking water.

But, ultimately, this last piece of unfinished business can only succeed if the first two are addressed. To achieve the safe use of purified recycled water requires highly competent individuals working to agreed treatment standards, in order to build some of the trust that will be needed to satisfy communities that using purified recycled water is indeed safe. This needs to be supported by appropriate regulation and extensive community engagement.

In closing, it is a privilege to be a long-time member of the Australian water industry, but by working our way through the three bits of unfinished business discussed above, we can take the industry from good to great.

The Author

David Sheehan (David.Sheehan@coliban.com.au) has over 35 years' experience in the Australian water industry, in a range of roles, both regulatory and within water utilities, but always with a strong water quality and human health focus.

David is currently employed by Coliban Water in the role of Senior Water Quality and Regulatory Advisor providing strategic advice to ensure Coliban Water supplies fit-for-purpose drinking water, recycled water and wastewater, as well as ensuring that Coliban Water meets all its regulatory obligations with respect to the various types of water that it supplies to its customers and discharges to the environment.

Prior to starting at Coliban Water, David spent 9 years working at the Victorian Department of Health in the role of Team Leader – Water Regulation. Prior to joining the Victorian Department of Health, David spent 3 years working for a private water testing laboratory (SGS) in rural Victoria, and prior to that he spent 17 years working for Sydney Water, and its trading company Australian Water Technologies (AWT), in various water-related roles.

Additionally, David is a current member of Standards Australia's FT-020 Water Microbiology Committee, a current member of National Association of Testing Authorities (NATA's) Life Sciences Accreditation Advisory Committee and has been on the Board of Water Research Australia since October 2014.

David also undertakes ad hoc work for the World Health Organization with respect to water safety plans and drinking water quality risk management.

Editor's Comment

This is the first in a series of Guest Editorials we are introducing to WaterWorks where we ask senior Australian water industry practitioners to comment on something relevant and important to them relating to the Australian water industry.

Trenchless rehabilitation and CO_2 reduction are a perfect match

The reduction of greenhouse gas emissions is becoming increasingly important. Trenchless construction with Primus Line® significantly reduces ecological footprint, compared to conventional open-trench construction methods.

In the calculation, a lot of factors play an important role, such as:

- the amount of material to be removed
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Primus Line's installation partner, Sinzatec, from Spain, determined the savings on a project near Madrid.

During the rehabilitation of a DN400 drinking water pipeline, the use of Primus Line reduced carbon emissions by 86 per cent

Due to the geology of the terrain, an open-construction method to renew the DN400 drinking water pipeline would have been difficult, costly and time-consuming. Thus, the 3.4-kilometre-long asbestos cement pipeline was finally rehabilitated with Primus Line® in only four days.

The analysis showed a significant reduction of approximately 86 per cent in carbon emissions and an intensive saving of fuel consumption (minus 87 per cent). This is mainly due to the lower number of truck loads required (minus 99 per cent), and the reduced use of construction machinery and necessary equipment.

SEWER MINING FOR COVID

Dr Dan Deere and Dr Kelly Hill

Most people in the water industry are probably familiar with the term "sewer mining" referring to tapping into the sewerage system to extract sewage for recycling. But sewage can also be "mined" for information. A few examples of how sewage is being used as a source of information include:

- Testing for pathogenic microorganisms, such as viruses and bacteria, to allow early detection and follow their spread through the community. One of the earliest examples of this was poliovirus, and to this day poliovirus is tested in sewage in many countries around the world, including Australia, to help provide early warning of the re-emergence of the virus. Another early example was the testing of sewage for the bacterial pathogen causing typhoid which is also still tested in this way in countries where typhoid is endemic.

  Other common viruses, such as the one that is the most common cause of gastroenteritis in Australia, "norovirus", causing what is often termed "winter vomiting disease", has also been tested for in this way.
- Testing for narcotics as part of the National Wastewater Drug Monitoring Program run by the Australian Criminal Intelligence Commission since 2016, with funding until 2024. The program tests for both legal and illegal drugs to keep track on levels of use.
- Testing for antimicrobial/antibiotic resistant microorganisms and the genes that confer resistant properties on those microorganisms as part of research projects.

Most recently, sewage samples have been collected to test for SARS-CoV-2, the virus that causes COVID-19, or COVID. Gradually building up over the past year there are now approximately 1,000 samples per week being collected from around Australia and New Zealand that are being tested for SARS-CoV-2. The results are being publicly reported in the states of VIC, NSW, QLD and SA that have the biggest testing programs. More recently set up programs are in place in WA. The overall program is being coordinated nationally by Water Research Australia as a collaboration between water utilities, health agencies, laboratories and researchers under the "ColoSSoS" project. There are similar projects underway in many other countries.

Sewage surveillance for SARS-CoV-2 is just one part of the various forms of testing for the virus, with testing in turn being just one aspect of how the pandemic of COVID is being controlled.

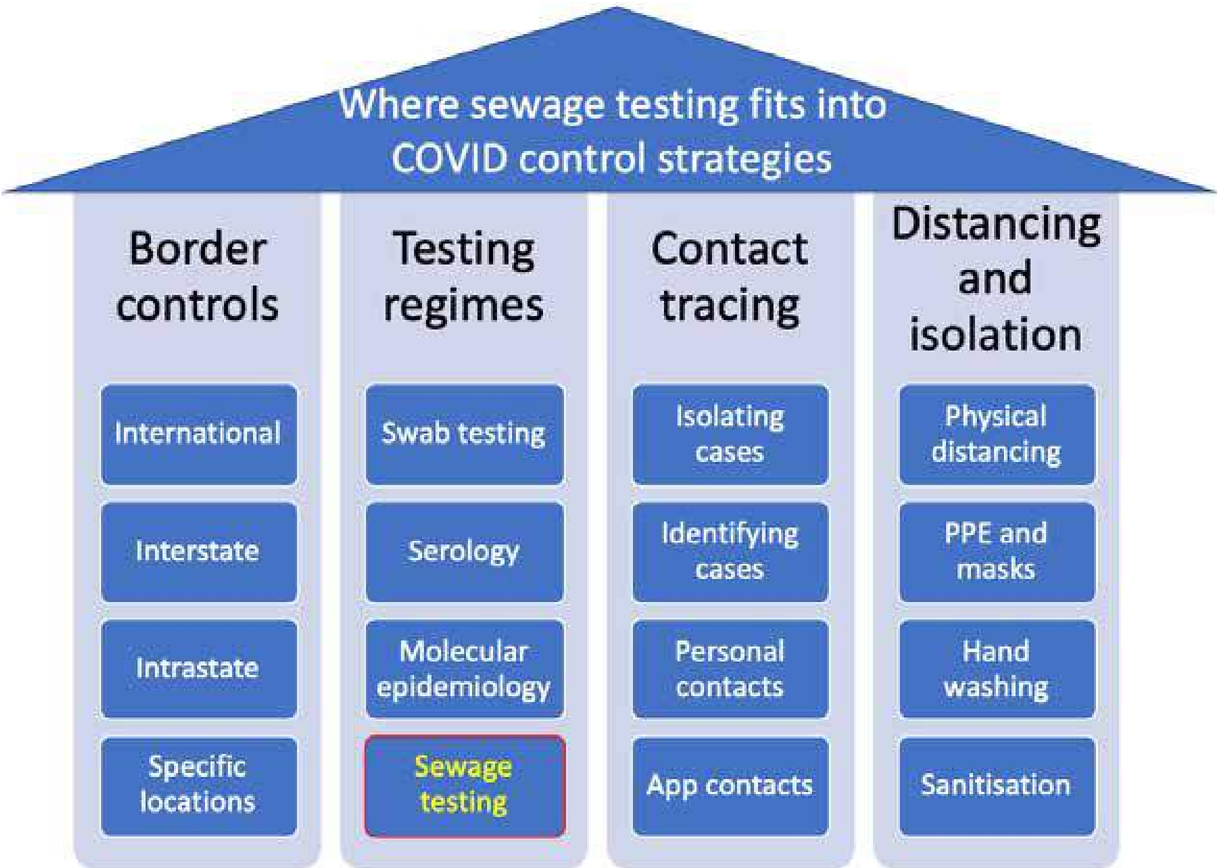

Figure 1. Illustration of where the testing of sewage for SARS-CoV-2 provides one extra tool to help inform the control of COVID.

Think of it like one more tool in the toolkit. Figure 1 illustrates where sewage testing fits in using a diagram that sets it in the context of the "four fundamental pillars" spoken of by the Federal Minister for Health in June 2020: one of the pillars being "testing". Sewage surveillance can be considered one component of testing.

What is a Virus?

Viruses aren't strictly "alive". They are simply packages that transport genetic information from one living cell to another. Once the virus manages to infect a cell, the genetic material from the virus instructs that cell to make many copies of the virus. Those copies of the virus are then shed where they can go on to infect other cells, and so the cycle continues. The multiplication process means that a single virus infecting one cell in a person's body can ultimately result in millions or billions of viruses being shed within just days to weeks. These viruses can then go on to infect other people.

Most viruses are so small that they can't be seen even with a light microscope. Other microorganisms, such as bacteria (e.g. *E. coli*) and protozoa (e.g. *Cryptosporidium*) can be seen using powerful lenses. But most viruses are smaller than the wavelength of light and so can only have images artificially created using electronic microscopes. An image created for coronavirus SARS-CoV-2 is given in Figure 2.

The image shows the "spikes" that allow the virus to attach to and enter cells to begin the infection process. There are many kinds of coronaviruses, including those that cause the common cold, and they have been studied for a long time. The spikes on coronaviruses were thought to look like the "corona" of rays seen around the sun, hence it got the name coronavirus ("corona" being Latin for "crown"). These spikes sit within a membrane envelope that surrounds the internal contents of the virus, which includes the RNA genes (Figure 3). Like many viruses, the coronaviruses have genes made up of ribonucleic acid (RNA) although many other viruses have the more familiar deoxyribonucleic acid (DNA) genes.

How Might the Virus Get into the Sewer?

People that are infected typically "shed" the virus from their mouth, nose and throat during the early stages of infection (first few days to weeks) and then gradually move to shed the virus via their faeces later on (sometimes for several months). Therefore, the virus gets into the sewer when infected people shed the virus into basins, showers, toilets, swimming pools and spas or when washing contaminated clothes or nappies in their laundry. Activities that can pass the virus into the sewerage system include things such as:

- Brushing teeth.
- Rinsing the mouth into the sink.
- Nasal cleansing.
- Sneezing, coughing or breathing whilst in the bath or shower or into the sink.
- Laundering clothes.
- Using tissues to capture coughs or blow noses and putting them into the toilet.
- Normal use of the toilet.

The Sewage Testing Process

The process of testing sewage for SARS-CoV-2 involves four steps:

1. Collecting raw sewage samples from the sewerage network, sewage treatment plant or other source of sewage, such as a sullage tank or septic tank. The virus very quickly becomes inactive, or non-infectious, in sewage. After that it quite quickly breaks down to the point where it is no longer detectable. In fact, the testing doesn't even try to detect the infectious virus as it loses its ability to infect so rapidly. Instead the test detects the genetic (RNA) remnants of the virus. But even those genetic remnants break down so fast in sewage that only raw sewage is worth testing. The samples need to be collected within a day or two of a person shedding viruses into the sewer otherwise the material is likely to be too degraded to be worth testing.
2. Extracting and concentrating the genetic information from the sewage and at the same time, setting it up for subsequent testing. This is where the skills of the environmental labs become so important. Routine clinical testing labs that test swabs for the virus aren't usually set up to handle sewage samples and won't be able to test for the virus in wastewater. The levels of substances that interfere with the test are too high; and at the same time the levels of virus present are just too low and degraded.
3. Testing for the presence and quantities of the target viral genetic information. If adequately concentrated and cleaned from sewage, the final part of the test is more or less identical to that used to test nasal, throat and anal swab samples.

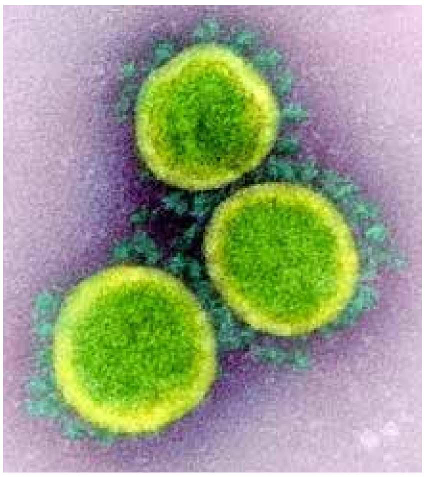

Figure 2. SARS-CoV-2 image from the National Institute of Allergy and Infectious Diseases (NIAID).

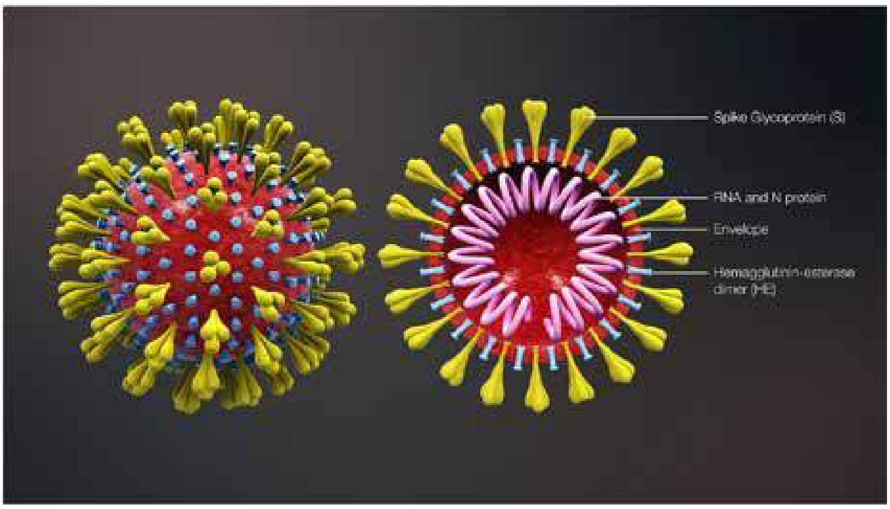

Figure 3. Coronavirus image and cross-sectional view showing the Spike S protein, viral envelope and RNA (Wikimedia Commons CC).

Figure 4. Sampling sewage to test for SARS-CoV-2 from a sewage treatment plant using a refrigerated autosampler (image courtesy Dan Deere from Unitywater's South Caboolture Sewage Treatment Plant).

Figure 5. Sampling sewage to test for SARS-CoV-2 from the sewer network using an autosampler (image courtesy Kaye Power at Sydney Water).

The test involves using a process called the "polymerase chain reaction", or PCR. The PCR process amplifies specific gene fragments from the SARS-CoV-2 virus through several dozen reaction cycles until it produces enough copies of the target RNA segments to enable the virus to be detected and quantified.

4. Communicating the results to the decision-makers involved in COVID control. The results are often hard to interpret and need careful review and analysis. Sometimes only low levels of the virus are found and often the results are just isolated detections making it hard to know if the result is just a person passing through the community or a person residing there.

The Critical Role of Operators

One thing that was learnt during the COVID pandemic was that water industry operators are among our most essential workers. In addition to their core role of providing safe water and sanitation, water utilities and water industry operators have played a vital role in the sewage testing program. Many of you reading this article will have already been involved.

There are a number of ways that you might have been involved, or might be in future:

- Operators are on the front line of sewage surveillance since they either collect the samples themselves, or guide and escort field samplers working for the laboratories who collect those samples. Accessing sewerage infrastructure safely is a specialist skill. Sewage surveillance can't be undertaken without that support. This often includes urgent sampling outside normal hours to follow up results of interest. Sampling may also involve finding innovative ways of collecting samples, particularly from within the network. Samples need to be kept cold, usually on ice or in a refrigerated autosampler, otherwise the genetic remnants of the virus break down and cannot be detected. The four most common sampling methods are: autosamplers at sewage treatment plants (Figure 4), autosamplers at sewer access points in the network (Figure 5), grab samples at various locations using conventional microbiology sample bottles (Figure 6), and passive samplers that are placed within the sewer network and capture viruses and their genetic material on some kind of capture medium such as a filter (Figure 7).

- To make sense of the results, the sewer network operators need to be able to communicate key features of the sewerage system to health agencies that interpret the results. Operator knowledge of sewer catchments, sewer flows, connectivity, when and where inflows occur, wet weather infiltration, and the potential for tankered or other wastewater inputs to be received, are all very important pieces of information, often requested at short notice.
- Similarly, operator knowledge of the sewage treatment plant is important to understand how, when and where to best collect samples, and how to interpret the results. Because SARS-CoV-2 is so fragile in wastewater, it is important that sampling takes place before any aeration or chemical treatments are applied.
- The environmental laboratories are very skilled at handling sewage samples but there are lots of challenges with wastewater. The molecular biological assays used to test for the virus are sophisticated (Figure 8) but can be subject to interference and inhibition by substances that are in the sewage.

Operator knowledge is very helpful to work out what sort of substances might be in the wastewater and when to best collect samples. This helps to avoid extremes of pH or detergents or other trade wastes that might degrade the virus or that might inhibit the testing process and stop it working.

Future Directions

The testing of sewage (which is variously termed “sewage surveillance”, “environmental surveillance”, “wastewater surveillance” and “wastewater-based epidemiology”) is growing in scope and is set to continue into the future, both for SARS-CoV-2 and for many other microorganisms and chemical substances.

Sewer operators will increasingly be spending time interacting with researchers, health agencies and criminal intelligence agencies to help mine information from the sewers that they operate. Operators will be asked to help collect samples as well as design and interpret sampling programs. This information will play an increasingly important role in the public health surveillance system to help ensure positive public health outcomes.

Safety Implications

WIOA maintains a webpage for members relating to working around wastewater and the implications of COVID. A key message is that SARS-CoV-2, the virus causing COVID, isn’t readily transmissible via sewage. The standard precautions taken by water industry workers and plumbers to protect from the many pathogenic microorganisms in sewage are perfectly adequate to protect from SARS-CoV-2 transmission.

The Authors

Dr Dan Deere (dan@waterfutures.net.au) is a Director at Water Futures Pty Ltd and **Dr Kelly Hill** (kelly.hill@waterra.com.au) is Research Manager at Water Research Australia.

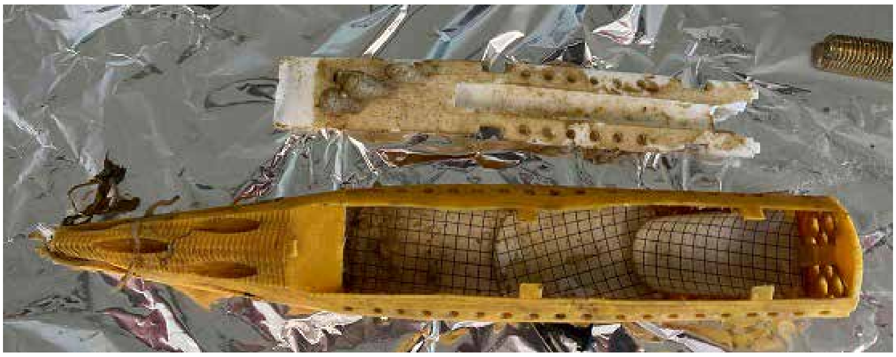

Figure 7. Sampling sewage to test for SARS-CoV-2 from the sewer network using a “torpedo” passive sampler (image courtesy Associate Professor David McCarthy, Monash University).

Figure 6. Standard microbiology sample bottle that can be used to collect sewage to test for SARS-CoV-2 (image courtesy Sydney Water Laboratories and ABC).

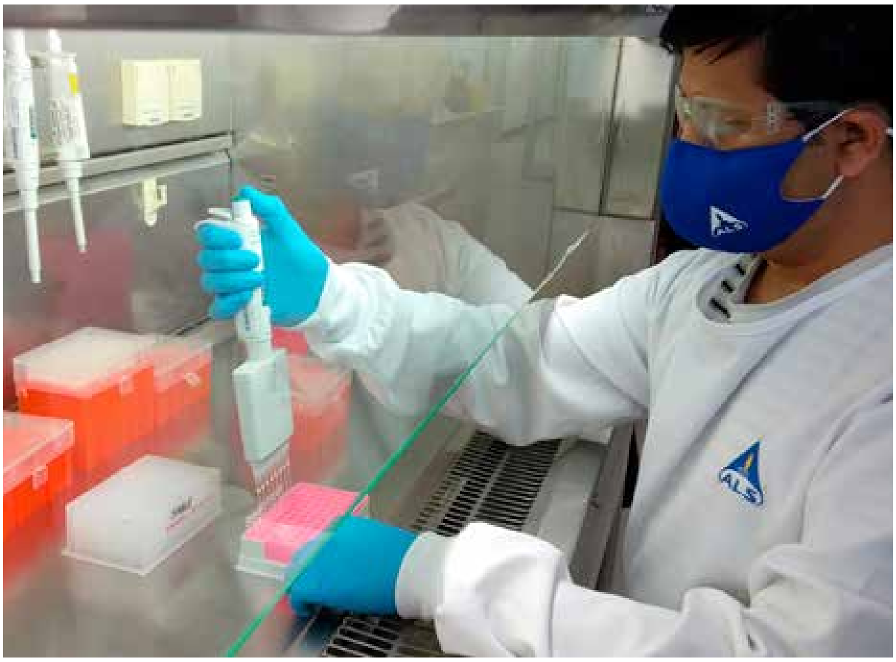

Figure 8. SARS-CoV-2 testing in a molecular biology laboratory (image courtesy Department of Health Victoria and ALS).

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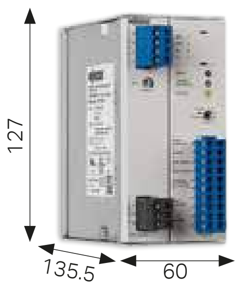

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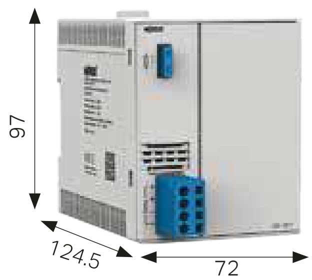

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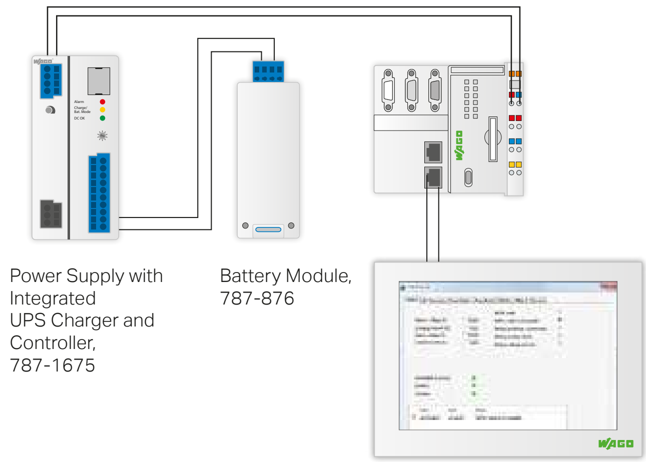

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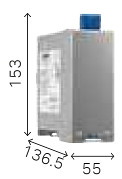

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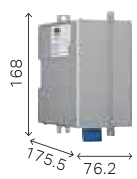

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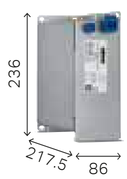

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MONITORING DISTRIBUTION NETWORKS

David Both, Elise O'Keeffe and David Reyne

The provision of safe drinking water to the customer tap requires optimised operation of the distribution network. The Aquadiag™ package was developed, originally in Paris, to improve the understanding of water quality within the network by providing up to date information on actual water quality throughout the network. This enables decisions on the scope, frequency and priorities for mains cleaning and flushing programs to be made based on actual water quality data.

Aquadiag™ can also be used to assess disinfection performance within the network, and address free chlorine decay and nitrification issues. A tailored investigation into customer complaints is also possible to provide water quality data for better management of the response and feedback to the customer.

Aquadiag™ is based on a mobile water quality diagnosis unit that can easily access any part of the water network using existing fireplugs (Figures 1 and 2). Water from the fireplug is fed through the unit for both on-line and grab sample water quality measurements.

Some of the equipment inside the mobile unit is shown in Figure 3.

Table 1. Standard Aquadiag™ analytical tests.

Sample Type	Parameters
On-line	Flow
	Turbidity
	Chlorine (free and total)
	pH
	O.R.P.
Grab	Turbidity
	Chlorine (free and total)
	pH
	Mono-chloramine
	Free ammonia
	Nitrite
	Nitrate

The water quality parameters that are typically measured by a combination of on-line analysers linked to a data logger, and grab samples analysed by the operator on-site are listed in Table 1. Additional testing can be carried out upon client request.

The Aquadiag™ operator connects the chosen hydrant to the mobile unit.

One of the special features of the system is that there is no disruption to the supply of water to the customers. Water is passed through the on-line analysers at a controlled flow and discharged to stormwater. Grab samples are taken at low flow and disinfection parameters are measured to assess nitrification or free chlorine residuals.

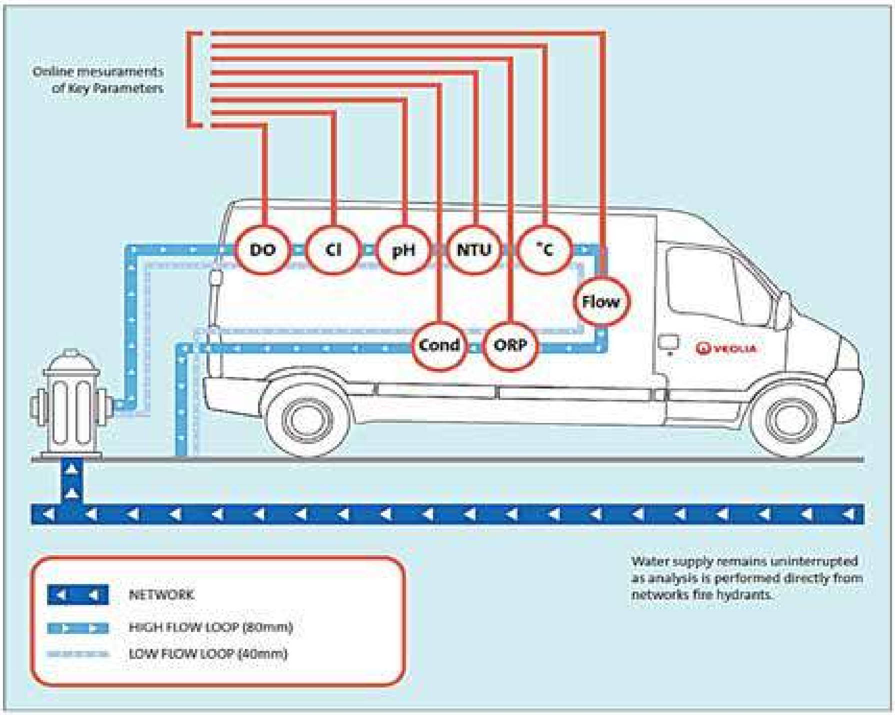

Figure 1. Schematic of the Aquadiag™ mobile testing unit.

Figure 2. The Aquadiag™ unit in operation in the field.

Figure 3. Some of the pipework and analysers in the mobile Aquadiag™ unit.

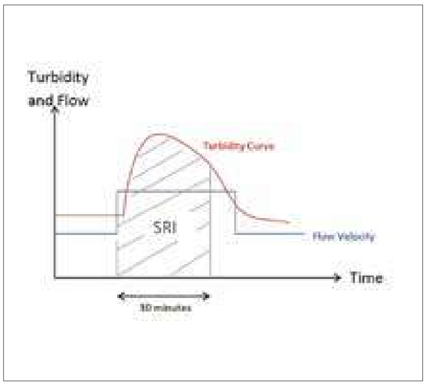

Figure 4. An example of the turbidity trend resulting from increasing the flow in a pipe to 0.35 m/s.

Disinfection Status

The disinfection status of the water in the mains at the sampling point can be assessed by measuring the free chlorine, total chlorine, ORP for chlorinated systems and total chlorine, mono-chloramine, nitrate, nitrite, free ammonia and pH for chloraminated systems. Importantly for chloraminated systems, some assessment of the extent of nitrification can be determined.

Sediment Resuspension Indicator (SRI) and Mains Cleaning

The system can also be used to assess the need for mains cleaning by determining the sediment resuspension indicator (SRI).

The flow in the high flow loop in the mobile unit (see Figure 1) is increased to achieve a flow rate of 0.35 m/s in the sampled main (e.g. 10 kL/hr for a 100 mm ID main and 22.25 kL/hr for a 150 mm ID main) thereby simulating a peak demand flow. Importantly this only occurs in the local main and does not disturb sediments throughout the supply system and cause widespread dirty water issues. The increased flow resuspends sediments and leads to changes in the turbidity of the water.

A sediment resuspension indicator (SRI) value is obtained by integrating the area under the on-line turbidity curve for the first 10 minutes at a flow velocity of 0.35 m/s as shown in Figure 4. The more sediment that is resuspended, the higher the turbidity, the higher the SRI.

The SRI provides some indication of the risk of dirty water complaints and the cleanliness of the network. Benchmarking of the SRI results between sites and between networks allows decisions to be made on the need for mains cleaning programs. The same testing can be done after mains cleaning to assess the effectiveness of the cleaning program and the various cleaning methods used e.g. flushing, air scouring, swabbing, or ice pigging.

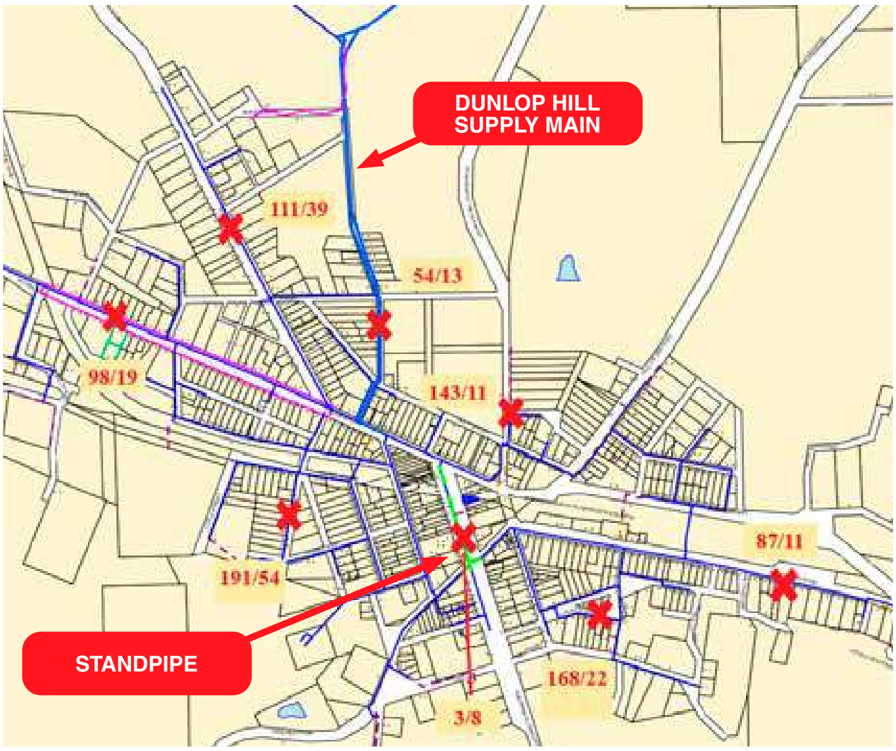

Figure 5. SRI data for Rushworth before and after cleaning. The first number in red is the SRI before cleaning and the second number in red is after mains cleaning.

CASE STUDY 1: RUSHWORTH

Historically, Goulburn Valley Water (GVW) has carried out mains cleaning based on operator availability, time, for example every 3 years, and reactively following dirty water complaints. In 2013, Aquadiag™ was used to better predict the need for cleaning water mains.

The town of Rushworth in central Victoria has been used as a case study by GVW, having had the Aquadiag™ study completed on it on an annual basis since 2013. GVW services 630 properties in Rushworth through 33 kms of water main. The town's water supply is fed from the Waranga Basin via a DAFF treatment process followed by pH correction and chlorine disinfection.

The Aquadiag™ study was used to determine the baseline turbidity for the town, following three years of no mains flushing or air scouring. After this was done, the entire town was air scoured with the exception of the supply main from the WTP, which was flushed only, and the Aquadiag™ study repeated to compare to the baseline.

The findings of the case study were as follows:

- Particle/turbidity build-up was different throughout the town, highlighting the areas of higher and lower risk for dirty water (Figure 5). It was also found that in an area of the town where the standpipe was located as indicated in Figure 5, particle/turbidity build-up was significantly lower, and it is thought that standpipe usage routinely flushes the main thereby keeping it fairly clean.
- Air scouring was an effective means of mains cleaning in the town. This can be seen in Figure 5 by the lower number of the red pairs of numbers.
- Flushing was effective at cleaning the supply main.
- Free chlorine residual was higher following mains cleaning.

Using Rushworth as a case study, cost savings are as follows:

- $440 per year in water losses from mains cleaning.
- $500 per year for labour and consumables to complete the mains cleaning.

Use of Aquadiag™ has allowed GVW to base mains cleaning programs on data, and also allow targeted cleaning of areas that have a high SRI reading, rather than taking a sweep all approach to flushing the entire town. This means less interruption to customers, and less wastage of water, which is particularly important in towns with water restrictions during drought. Other benefits include a shift from reactive mains cleaning to proactive cleaning, with customers given notice beforehand and less service interruption, and operational teams being able to allocate resources more efficiently.

CASE STUDY 2: CENTRAL HIGHLANDS WATER

Central Highlands Water's (CHW) first major use of Aquadiag™ came about due to a nitrification issue in a long distribution main supplying water to the south of Ballarat. Chloramine levels had been dropping along this 150 mm AC main for several weeks. An analyser at a large storage basin was indicating a low residual of 0.5 mg/L and the residual at the end of the system was dropping to nearly 0 mg/L.

Aquadiag™ was used to profile the main from Ballarat to the basin, a distance of some 30 km, to determine the extent of nitrification occurring before the basin.

The results showed that there was only a minor loss of chloramine prior to the basin which negated the need to dose free chlorine upstream of the basin. Dosing took place at the basin which was much easier than installing a dosing point along the main.

In the last 6 years, Aquadiag™ has been used to assist with the CHW mains cleaning program using ice pigging. Cleaning programs have been ramped up due to the end of drought conditions in the region and increased customer complaints.

CHW's methodology in determining where to focus its efforts in mains cleaning is based on customer complaints that occur in close proximity to each other, historical knowledge of system performance and routine water quality testing. This information is used to identify problem areas that likely need cleaning. Aquadiag™ is then used to further investigate those areas. Once the Aquadiag™ testing is complete, a report is generated indicating the level of sediment in the mains along with turbidity and chlorine residuals.

In some cases the data suggests that in fact cleaning is not required and plans for that area can be cancelled which gives CHW the ability to direct mains cleaning activities to areas that actually need cleaning, thereby preventing wasting valuable time and money in cleaning areas that don't require cleaning.

Aquadiag™ is also used after the mains cleaning has been completed at the same sites to give a detailed picture of the effectiveness of the cleaning (Figures 6 and 7). The dots in Figures 6 and 7 indicate the Aquadiag™ test sites before and after cleaning. More test sites were selected prior to cleaning to determine the extent of sediment in the network. Fewer sample sites were necessary after cleaning as it was proven to be effective.

The diagnosis and cleaning program have resulted in a more stable chloramine residual throughout the network, along with lower SRI values and lower turbidity. The pleasing results have clearly justified the mains cleaning program and have given CHW the confidence to continue with it.

Data of this type is invaluable when presenting to Management on the program and giving them peace of mind that the program has been effective.

The Authors

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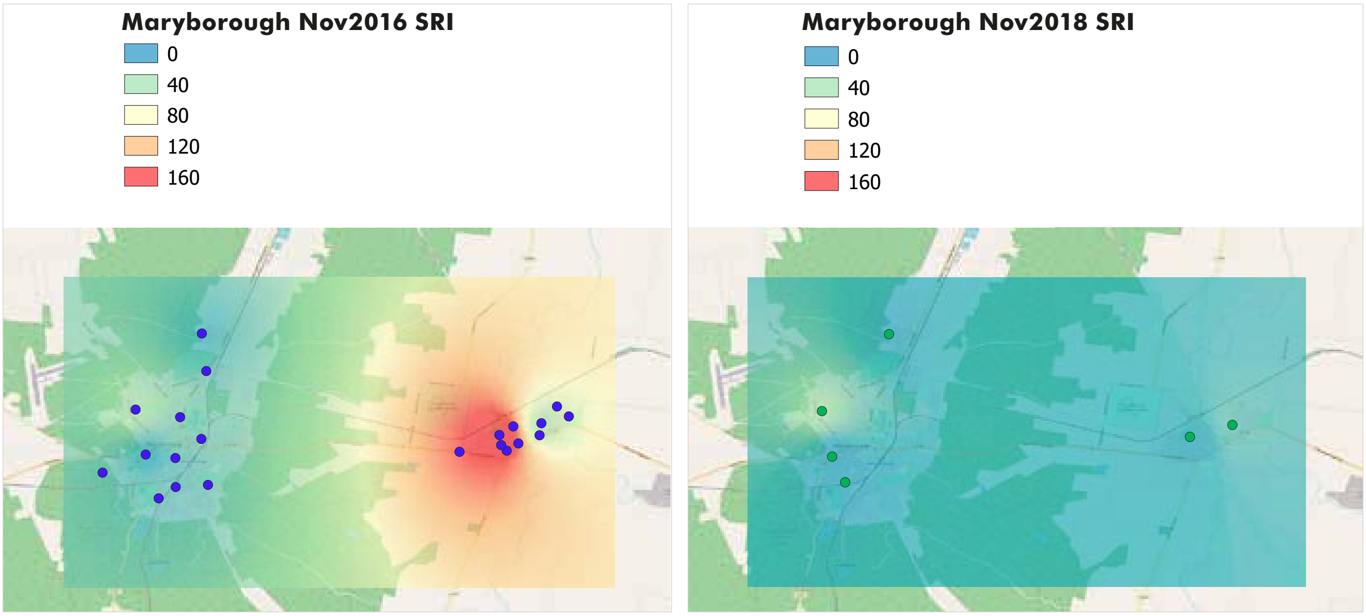

Figure 6. SRI "heat maps" for the town of Maryborough before and after cleaning.

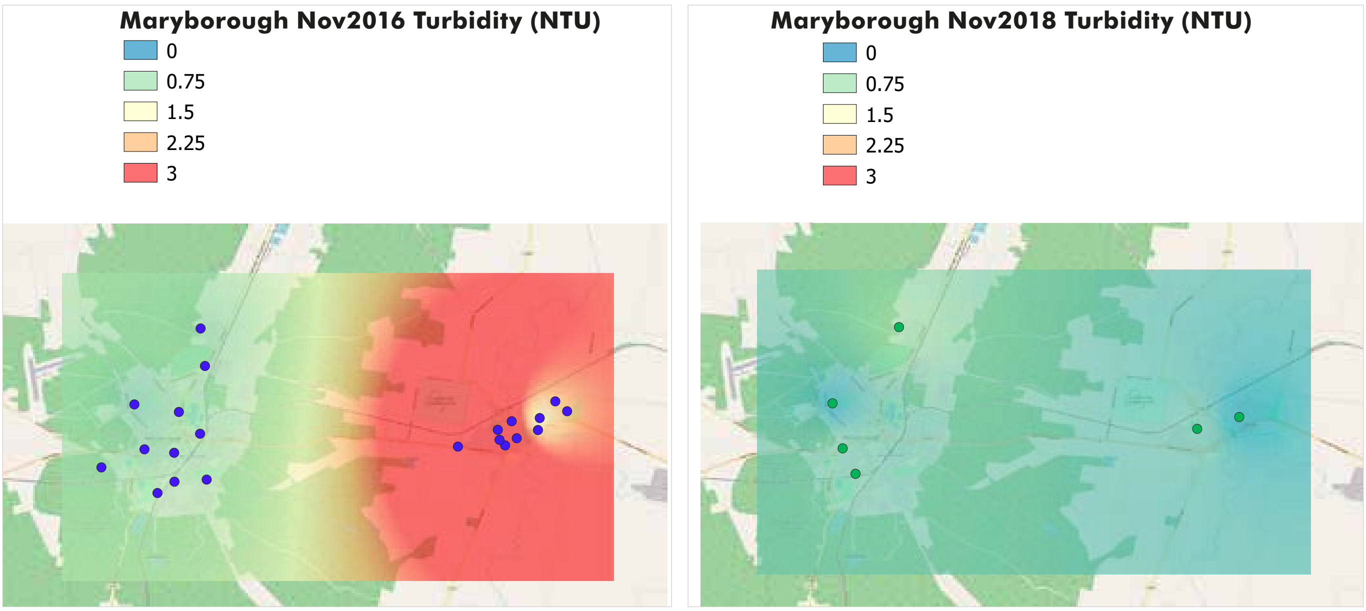

Figure 7. Turbidity "heat maps" for the town of Maryborough before and after cleaning.

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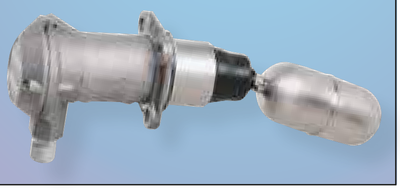

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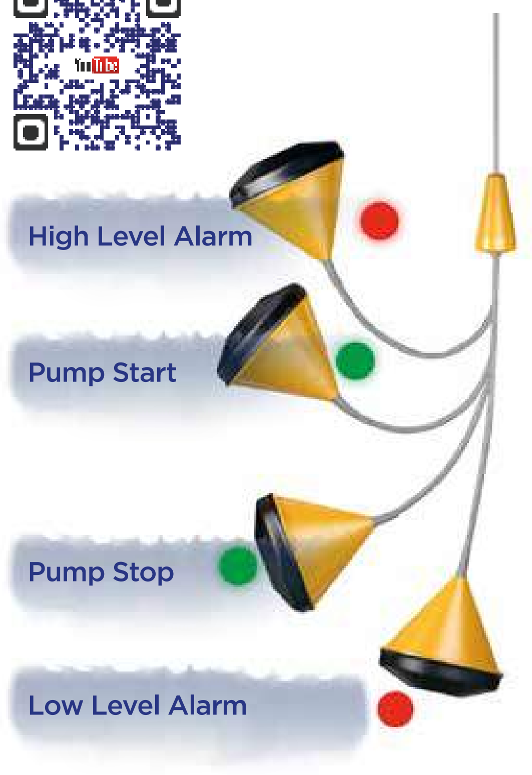

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TI TREE BEND BIOSOLIDS UPGRADE

Peter Sowter and Rennie Brown

The Ti Tree Bend STP is the largest in Tasmania, treating 15 ML per day of sewage from Launceston city. This includes significant trade waste loads in addition to stormwater and domestic sewage from the city's combined system. The plant is a conventional activated sludge process built in the 1970s with sludge handling consisting of anaerobic digestion and sludge drying lagoons.

In 2011, the plant received a non-compliance notice for odour. Causes identified included:

- The age of raw sewage entering the plant causing release of H_2S at the inlet works.
- The sludge quality (stabilisation) from the digesters.
- The large surface area of the sludge lagoons and drying beds.
- The raw sewage odours were largely controlled with chemical dosing installed in the sewerage network, but the other issues remained.

Two projects were initiated to address the remaining problems. The first project was to improve sludge quality by upgrading the digester systems by incorporating mixing, heating and thickening. The second project was to decommission the sludge lagoons and replace them with mechanical dewatering and solar drying. The projects combined cost was estimated to be about $12 million ($4 million for Project 1 and $8 million for Project 2), which were to be delivered separately with staggered schedules.

In addition to delivering on the project objectives, the upgrades had to be delivered while the plant continued to operate, as well as to cater for future growth, and meet the expectations of multiple stakeholders including the operators, the local community and the Environment Protection Agency (EPA).

When tenders were received for the digester upgrade (Project 1), the prices came in about $2 million over budget. This caused the project to be put on hold while we investigated the reasons for the higher than expected cost and the options for proceeding. Rather than seeking an increased budget to push on and deliver the two projects, the decision was made to rationalise the two projects into a single project. This delivery method reduced costs associated with separate projects such as project management and site establishment. It also avoided the risks of two interdependent projects being delivered at different times by different contractors.

The project objectives were also reviewed to minimise the cost of the project. Some scope items were removed that were not required to meet the project objectives. These included thickening and solar drying, which were replaced with onsite short-term storage.

Careful consideration was given to the allocation of scope items to minimise risk.

Figure 1. Lifting the floating roof off the digester.

For example, cleaning the digester was to be completed by TasWater as the level of risk to the contractor was perceived to be higher than compared to TasWater which benefited from the knowledge of operators and local contractors.

A project of this nature has multiple stakeholders, both internal (engineers, asset managers, operators and senior managers), and external (EPA, council and the local community). TasWater's community and stakeholder communications team kept the regulator and the local community fully informed and as a result there were no complaints received throughout the project.

Many of the Ti Tree Bend STP operators have been working at the plant for up to 30 years. Incorporating their experience and knowledge at concept and design stages of the project provided enormous benefits. For example, the method used to remove the digester floating lid for cleanout was based on previous operational experience. The 90-tonne digester lid was lifted by two cranes (Figure 1) and placed at ground level for safe, easy access for the purposes of renovation. The open top digester then allowed implementation of a quick and safe cleaning method using a crane and a large hydraulic clam shell grab to remove 25 years of accumulated solids that could not be pumped out. The digester was cleaned and ready for replacement of the floating roof within one week (Figure 2).

Ti Tree Bend utilises three rotary drum thickeners (two duty and one standby) for WAS thickening prior to anaerobic digestion.

The standby rotary drum thickener initially intended for pre-thickening was converted to provide for the recuperative thickening process stream (Figure 3). This created flexibility for it to be used either as a standby WAS pre-thickener or as a digester recuperative thickener, another operator driven idea. In recuperative thickening, the final digested solids stream is recycled to the digester inlet via a thickener. This allows the solids retention time (SRT) of the system to be decoupled from the hydraulic retention time (HRT) and the digesters to operate at higher solids concentrations. A higher solids concentration means higher SRT, resulting in an increased digester capacity and increased stabilisation for the same loads.

A new dewatering system consisting of two rotary screw presses and polymer dosing system was installed (Figure 4).

Figure 2. Aerial view of the cleaned digester.

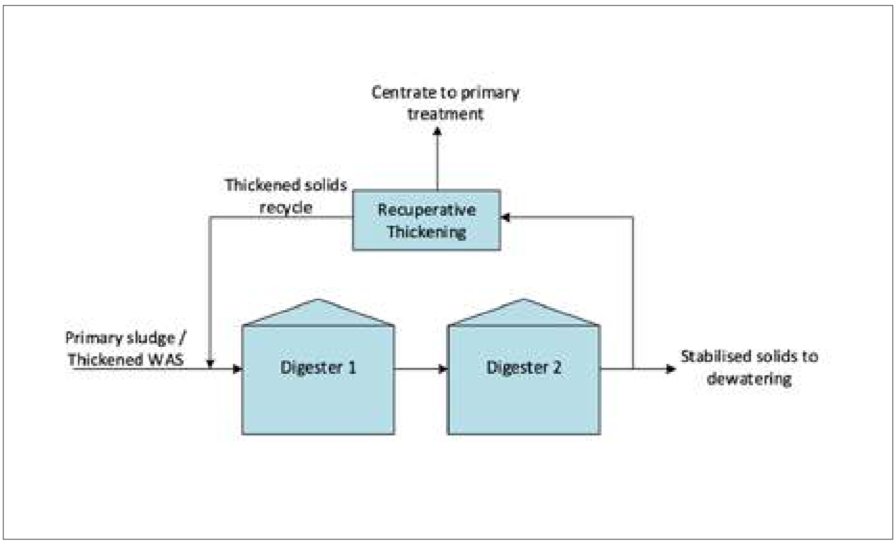

Figure 3. Schematic showing the recuperative thickening process.

Figure 4. The new dewatering system.

Figure 5. The new sludge heating system, including heat exchanger and furnace.

Figure 6. The new digester sludge feed and mixing pumps and associated piping.

In addition to the dewatering system, the project included upgrades of the digester heating and mixing systems (Figures 5 and 6), and a new treated effluent reticulation system (Figure 7). Two new sludge heaters were installed in the existing heater building with significantly constrained footprint. The old mixing pumps and pipework were replaced in the digester building.

The stabilised biosolids are now stored onsite in new storage containers (Figure 8). These containers are trucked to a landfill site for disposal of the biosolids which are unsuitable for beneficial reuse due to zinc contamination. The containers have an in-built conveyor to spread the solids evenly within the container, and a hatch opens at the back for emptying.

Implementation of the biosolids upgrade project at Ti Tree Bend has resulted in a significant reduction in odour at the plant. Digester performance and biosolids handling has been improved with a 25-year increase in asset life. The combined project was completed for approximately $9 million, well within the initial estimated $12 million, with the success of the project attributable to great teamwork.

The Authors

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Figure 7. The new treated effluent reticulation system, including pump-set and auto-backwashing filters.

Figure 8. The new onsite biosolids storage containers.

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ANAMMOX PLANT IN BRISBANE

Justin Todhunter

Urban Utilities operates 27 sewage treatment plants including the Luggage Point Resource Recovery Centre (RRC). The plant is Brisbane's largest municipal wastewater treatment facility and treats flows based on an equivalent population (EP) of 800,000. Approximately 67% of the flow is from domestic sources, while 33% is commercial and industrial.

Luggage Point is facing continued pressure on operational costs and plant capacity due to population growth and changes to the characteristics of the catchment.

The process of nitrification/denitrification has been the mainstay to the treatment of municipal and domestic wastewater in Australia since the establishment of the Australian National Water Quality Management Strategy guidelines. This biological process converts ammonium to nitrate through aerobic conversion, followed by the heterotrophic removal of nitrate through its reduction to nitrogen gas in the presence of organic carbon. Although effective for the removal of nitrogen, the process is energy intensive due to the aeration requirements and may require carbon supplementation depending on the wastewater composition and/or plant design.

In recent years, Anammox (Anaerobic Ammonium Oxidation) has developed as an alternative option to conventional biological nitrogen removal due to its efficient biological ability to short-cut the nitrogen cycle. It does this by oxidising ammonium directly to nitrogen using nitrite as the electron donor and without the need for an additional carbon source.

Since the discovery of Anammox in the mid 1990s and the commissioning of the first full-scale reactor in 2002, Anammox has been successfully applied and operated at plants across the globe to treat high strength ammonium wastewater, with more than 110 full-scale plants currently in operation.

The successful and timely implementation of these full-scale operations has been attributed to having sufficient biomass during start-up.

The Luggage Point RRC has six anaerobic digesters that provide methane for energy generation. While this strategy provides significant benefits in offsetting the plant's energy requirements, another issue that needs to be addressed is the return flows from the digesters. These flows account for approximately 12–15% of the Total Nitrogen load received by the plant (equivalent to approximately 70,000–80,000 people) and therefore contributes significantly to the plant's operating costs and emissions footprint.

As part of the plan to increase the capacity of Luggage Point, the use of Anammox was identified as a possible strategy to reduce Total Nitrogen load to the plant by treating the return flows from the digesters separately.

Unfortunately, due to Australia's strict quarantine regulations, the importation of Anammox bacterial sludge into the country is prohibited. Therefore, to enable the seeding of a full-scale installation at Luggage Point, several stages of Anammox enrichment and upscaling were required to develop sufficient Anammox biomass. The process commenced almost 10 years ago with a laboratory-grown Anammox inoculum, and then transferred to Urban Utilities's Innovation Centre at Luggage Point where the bacteria continued to grow and successfully progressed all the way to a 50 m^3 biofarm (Figure 1). The work was carried out with support from the University of Queensland and Veolia Water Technologies.

Figure 1. The 50 m^3 Biofarm tank at the Luggage Point Resource Recovery Centre where the Anammox bacteria were grown.

Figure 2. Justin Todhunter holding a jar containing Anammox bacteria growing on the special discs.

Figure 3. The Anammox reactor at Luggage Point Resource Recovery Centre retrofitted into existing pre-aeration tanks.

The resultant process called ANITA™ Mox - MBBR (Moving Bed Biofilm Reactor) successfully removes greater than 90% of ammonia and 75–85% of total nitrogen without the addition of an external carbon source and with considerably less energy in comparison to conventional nitrification-denitrification.

Anammox grows slowly with doubling times taking around 11 days at 32–33°C (Figure 2). Despite this, the implementation of Anammox at Luggage Point has moved from pilot-scale research to mainstream implementation.

Parallel to growing the seed biomass, four unused process tanks at Luggage Point were upgraded to accommodate the new full-scale side stream process (Figure 3).

The upgrade design needed to overcome the hydraulic limitation of the existing tanks, without the aid of mechanical mixing. This was achieved by altering the four tanks to operate in series, consisting of two hydraulically connected compartments. This configuration also had the added benefit of improving the seeding process which requires the seeded media to be added only to the front pairs of tanks.

As of March 2021, the new side stream tanks have been successfully retrofitted and commissioned with the seed media from the 50 m^3 biofarm, treating approximately 25% of the design flow.

As a result of implementing Anammox treatment at Luggage Point, Urban Utilities has or will realise several benefits:

- Once fully operational, the Anammox side stream process at Luggage Point will be treating up to 1 ML/day of high strength ammonium centrate with a design load of 975 kgN/day.
- It is expected Anammox will reduce Luggage Point treatment plant's operational costs by up to $500,000 every year, through reduced aeration and ethanol dosing.
- The Anammox biofarm will open opportunities to expand the use of Anammox technology by providing seed for use at other Urban Utility plants.

The biofarm means the Anammox technology can also be instantly accessible by utilities around the country to help them save on cost, energy and chemicals as part of their wastewater treatment upgrades.

The Author

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MANAGING WATER LEVELS USING EVAPORATION

Rod Curtis

Unprecedented growth in the Lancefield and Romsey communities has led to a substantial increase in recycled water levels at Western Water's Recycled Water Plant (RWP) in Romsey, north-west of Melbourne.

During winter and spring of 2020, the onsite volumes were at critical levels. To manage this, water was tankered to other plants with spare capacity for several months. Three trucks were operating for 16 hours per day, 6 days per week, moving about 6 ML per week.

This solution was not sustainable, either environmentally or economically. An alternative solution was needed.

An upgrade to the RWP to increase storage levels was not feasible in the short term.

The wet summer of 2020 meant using the excess for irrigation was not possible.

Some local residents were opposed to any discharge of excess into Deep Creek.

Other measures to manage the recycled water were putting a financial strain on the organisation and were not environmentally sustainable.

With longer-term upgrades at the plant continuing in the background, two new evaporators (Figures 1 and 2) were installed to help manage water levels in the interim. Two evaporators were considered to be optimal based on the manufacturer's data for theoretical water usage and the gap in the water balance to keep the storage below top water level (TWL).

The units were assembled onsite and lifted onto the water using a small crane truck. The evaporators are located in the winter storage where the water has received the highest level of treatment.

Operations staff from Western Water maintain the units by a weekly visual inspection and will conduct annual maintenance to descale the cooling fins. A higher frequency of maintenance will be required if the units need to operate on water with a higher total of dissolved solids content.

Initially, the units were powered using generators to ensure an immediate start. Underground power has now been installed as a longer-term solution. The units can potentially run-on solar power, since peak evaporation aligns with the typical bell-shaped curve output from a solar system; however, some batteries may be needed to provide the starting current.

The evaporators work by releasing the recycled water as a fine mist (Figure 1) with a large surface area thereby accelerating evaporation, and in turn, reducing storage levels at the plant.

Figure 1. The evaporator operating on the Romsey lagoon.

The units are linked to an onsite weather station to ensure they only operate in suitable climatic conditions. For example, they won't be used on high rainfall days when evaporation would be negligible, or on high wind days when spray drift might reach staff working on site or neighbouring properties. Currently, the units mainly run during the day, but Western Water is investigating the potential to operate them at night during heatwave conditions.

Transporting excess recycled water to alternative storages was a financial burden to the organisation, and unsustainable. By comparison, the evaporators offer an economic alternative. In perfect conditions, one unit could evaporate 75 kL per day with an operating cost of around $25 per day.

Installation and use of the evaporators has allowed Western Water to cease trucking the recycled water to other locations, thereby reducing exhaust emissions. It has also allowed ongoing operation of the Romsey Recycled Water Plant without the need to seek a discharge licence from the EPA.

Use of the evaporators with recycled water is an Australian first. Typical applications are normally landfill leachate ponds and mining tailing dams. Western Water is now working with the EPA on opportunities to expand to other sites and to promote evaporation processes to the wider industry.

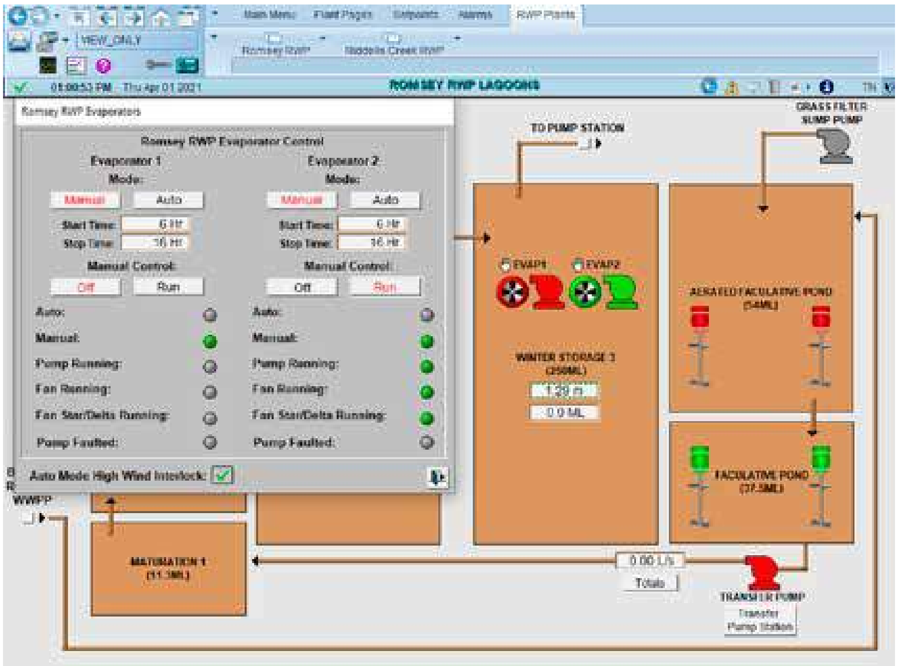
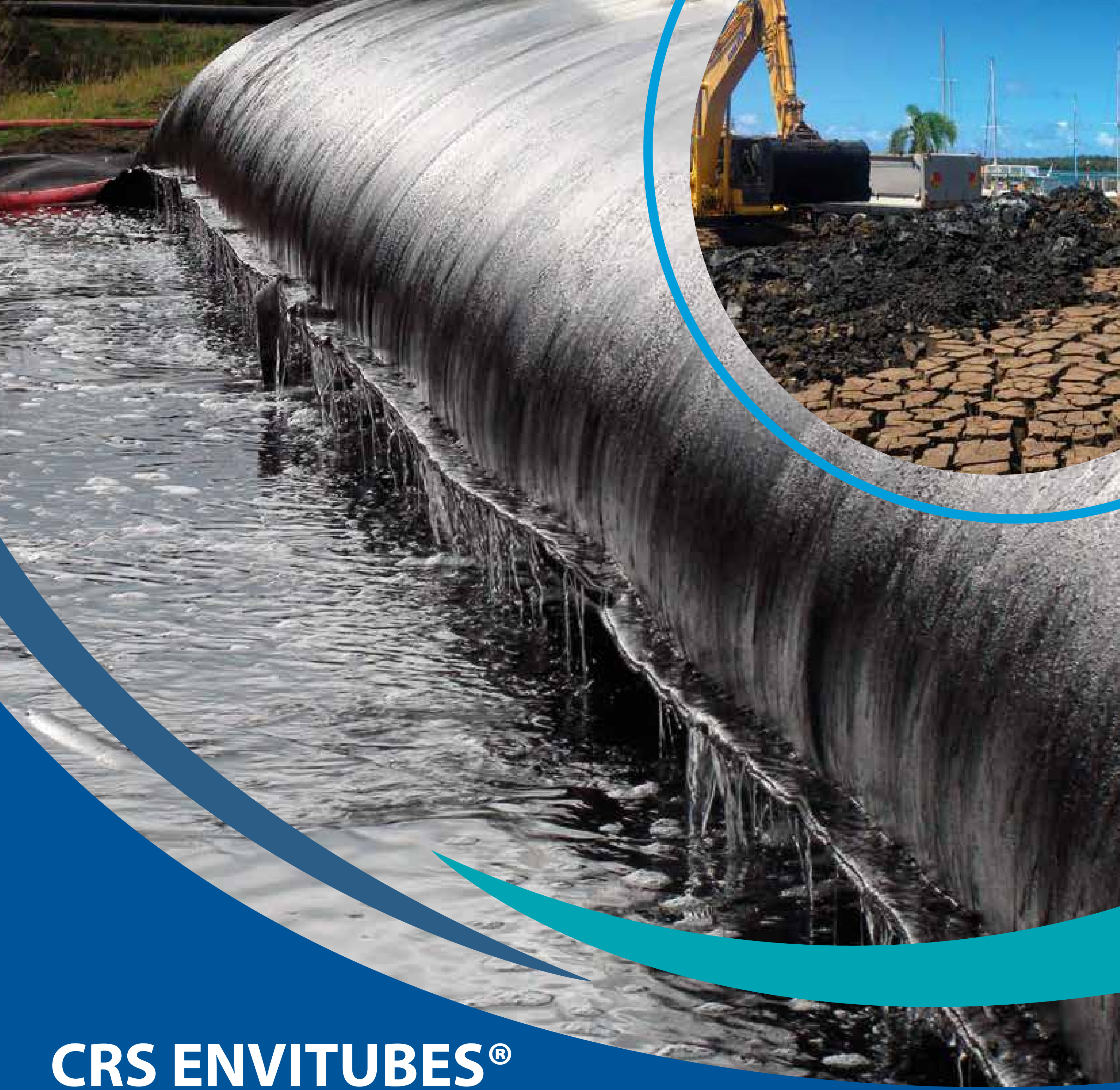


Figure 2. The SCADA screen for the evaporator.

The Author

Rod Curtis (rod.curtis@westernwater.com.au) is the Manager Water Systems and Solutions at Western Water.



INTELLIGENT WATER NETWORKS

Dean Barnett

The Intelligent Water Networks (IWN) program represents 16 Victorian water corporations testing and trialling new technology for our industry. The next step is the implementation of the identified successful technologies as business-as-usual tools for water corporations, driving business efficiencies and better customer outcomes.

IWN has been around for 10 years now and has evolved into the organisation it is today. We manage 9 programs:

1. *Knowledge Sharing and Collaboration*
   Manages our webinars, conference, and other initiatives to share information with our water industry members.
2. *Asset Management and Optimisation*
   Driving asset efficiencies.
3. *Biosolids and Resource Recovery*
   Turning biosolids from a waste product to a usable product.
4. *Digital Metering Solutions*
   Collaboration around digital metering, communication networks, back end data management systems, a business case and economic model.
5. *Pipeline Intelligence*
   Any information that can be gained from the water, sewer and recycled water networks for proactive management and better customer outcomes.
6. *Edge Technologies*
   Identification of latest technologies that can be applied to the water industry.
7. *Energy and Carbon*
   Aims to reduce our carbon footprint.
8. *Data and Analytics*
   Presenting and cleaning data so that it is manageable and can be used to make informed decisions.
9. *Leadership*
   Each member water corporation has a Champion that participates in our 2-year leadership and development program.

While the IWN is a membership-based organisation, it is also driven by the industry and the in-kind support provided by the member working groups, IWN Champions, Executive Group, Program and Deputy Program Managers who put in the hard work behind the scenes to deliver a step change within the Victorian water industry.

What Are We Working On?

IWN Biosolids and Resource Recovery Program is working on a pilot plant that will turn Biosolids into Biochar. This trial is in partnership with RMIT, Western Water and South East Water, with the trial site being at the Melton wastewater treatment plant. Results from this trial should be available around the middle of the year. If successful, this will be turning a generated waste product from our treatment plants into a usable product. Figure 1 shows the pilot plant under construction.

IWN Asset Management & Optimisation Program are working on using ultrasound to combat blue green algae blooms. In preparation for this trial, protocols and an evaluation process have been developed. The solar driven pontoon hosts the ultrasound device out in the reservoir (Figure 2) and was deployed at one of Central Highland Water's reservoirs in December, with the data being analysed in preparation for a draft report in the second half of the year.

Figure 1. The Biochar pilot plant.

Figure 2. The solar powered ultrasonic device being deployed at one of Central Highland Water's reservoirs.

IWN Data & Analytics Program is working closely with 11 member water corporations using visual recognition software to review sewer CCTV footage. This should reduce the manual review of sewer CCTV footage by around 85%. Next steps will be to use artificial intelligence around the operational and capital investment actions from these findings.

IWN Pipeline Intelligence Program is testing a modular sewer monitoring unit that can monitor level, flow and H_2S. This trial is designed to provide the water corporation with intelligence from the sewer network for early detection of issues so that they can be dealt with proactively.

IWN Edge Technologies Program has a timely trial underway for the remote field worker. This involves a headset that can link directly with Microsoft Teams (MST) and or Zoom, so that you can view what the field operator is looking at via MST. Data can also be sent to the field operator so they can visualise and record information while using the hands-free functionality. Case studies to date include the supervision of new employees and inductions to high-risk sites, project hand overs with one person on site and the hand over team on MST and supporting compliance with site COVID-safe plans.

IWN Digital Metering Systems Program are working on a 2021 Victorian water industry 'State of Play' document, that shows where each Victorian water corporation is situated along their digital metering journey. In addition to this, we are also developing a Victorian member water corporation, state-based business case template and economic model for all member water corporations to use and share learnings.

IWN Energy and Carbon Program is developing a wastewater fugitive emission report consisting of measurement and reporting methods, process innovations, performance, and optimisation. The report will be shared with member water corporations to help look for opportunities to reduce carbon emissions. Figure 3 summarises the broad range of IWN projects currently under way.

To get involved in the program, you can contact us at enquiries@iwn.org.au You do not have to be a subject matter expert, all we need is somebody that is keen to make a difference in our industry, we will show you the rest.

If you would like to receive monthly updates, sign up for the IWN newsletter to learn more about the trials and outcomes and what is happening with IWN. Just go to www.iwn.org.au and sign up for the newsletter.

The Author

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Figure 3. 2021 Projects.

RECYCLED WATER STANDPIPE IN EUROA

Ian Matheson and Steven Nash

In April 2019, Euroa and Violet Town in central Victoria, were placed on Stage 2 Water Restrictions due to declining availability of water from the Sevens Creek and Mt Hutt Creek systems.

While water use in the towns is predominantly residential, there are a number of businesses such as chicken farms, composting plants and concrete plants that used significant volumes of water. The local Council was also another large user with a number of recreation facilities in and around town, particularly in Euroa. Also during the restrictions, Council commenced a redevelopment project in Euroa, upgrading the oval grounds and including a new turf wicket area.

While the Council did have some access to bore water, those systems were also in decline necessitating restrictions on stock and domestic use in surrounding rural properties. Council in their desire to keep not only this new redevelopment viable, but to try to provide green areas around the town and also as part of maintaining their gravel road network, started to increase use of the town supplies.

An agreement was reached between Goulburn Valley Water (GVW) and Council to use Class C recycled water from the local Wastewater Management Facility (WMF). However, as there was no pipeline to do this, Council would have to rely on using water trucks to transfer the water to their sites. The trucks were given access to the final lagoon at the WMF through an unlocked gate. The arrangement was not ideal. A project was developed with the objectives to get the trucks out of the WMF, make it easier and safer to fill the trucks, improve accounting of the water taken and lastly, to provide access to any other contractors who were doing works for VicRoads, VicTrack and the local Council.

GVW already supplied Class C recycled water to the local Golf Club via a 1.2 km pipeline to a holding tank at the site. The Golf Club had for a number of years been requesting a review of the transfer process to improve the reliability of supply.

A site to fill trucks was identified just outside the Golf Club and discussions between the Council, Golf Club and GVW agreed that this was acceptable to all parties. So this meant there was already a way to get the recycled water from the WMF to a better location for filling trucks using the existing pipeline.

To support the proposed changes, some work was required at the WMF. These included improved reliability by installing a duty/standby pump arrangement, a new switchboard and replacing the old flow meter. These were all to be housed in a new transfer pump station (Figure 1).

GVW also decided that it was preferable to supply Class B recycled water rather than Class C recycled water. To do this a new hypo dosing unit was also installed. This included installing a Polymaster self-bunded chemical 7000 L storage tank, duty/standby dosing pumps, safety shower and dosing line to the existing pipeline (Figure 2).

At the truck fill area, a tee was installed in the existing pipeline with two new actuated valves, one on the continuing supply to the Golf Club and the other to fill a new storage tank at the tanker filling area.

Figure 1. The new transfer pump station and duty standby pumps.

A 55 kL tank, pumps and switchboard were installed at this site to allow controlled operation so that both supplies (Golf Club and filling station) could operate without affecting each other. Improved telemetry and PLC control were also included in the upgrade. Using the tank levels and actuated valves, the program directed water to fill these tanks based on demand.

GVW decided to use the same water dispensing units (Figure 3) that they had been using successfully at their drinking water standpipes. A couple of changes were necessary.

Programming had to include starting a pump as well as opening the internal control valve in the cabinet.

GVW Account Cards only were to be used, no PAYG function.

Normal drinking water GVW Account Cards were locked out of this unit as any approved User also has to enter into a Recycled Water Agreement with GVW.

The site was completed and commenced being used with the first load taken on 5 January 2021. Up until 21 February there had been 89 transactions with a total of just over 1820 kL of recycled water taken. On the busiest day so far, there were 12 transactions.

While this project was funded by GVW, it is considered to be Stage 1 of a joint project with a number of other parties under the Greening Euroa Banner, driven by a group from GVW, Strathbogie Shire Council, Goulburn Broken Catchment Management Authority and local schools. School students had originally petitioned Council to look at ways to keep Euroa green during drought conditions, and this project looks at ways to sustainably keep local parks, gardens and community spaces green to improve liveability.

The Authors

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Figure 2. The new chlorine dosing facility showing the hypo storage tank (left) and hypo dosing control cabinet (right).

Figure 3. A council tanker filling with recycled water (left) and a close up of the tanker user interface and recording system (right).

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