WATER WORKS

OFFICIAL JOURNAL OF THE WATER INDUSTRY OPERATORS ASSOCIATION OF AUSTRALIA

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WaterWorks
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Editorial Committee
Peter Mosse, Editor
peter.mosse@gmail.com
George Wall
george@wioa.org.au

Direct mail to:
Peter Mosse
WaterWorks Editor
c/o WIOA, 24 New Dookie Road
Shepparton, VIC 3630

Advertising & Production
executive MEDIA
Executive Media Pty Ltd
Level 2, 38 Currie Street, Adelaide SA 5000
Tel: (08) 8231 4433 Fax: (08) 8231 3402
Email: adelaide@executivemedia.com.au
Web: www.executivemedia.com.au

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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

CONTENTS

NETWORK OPERATOR DEVELOPMENT PROGRAM

George Wall

A group of committed Victorian water industry network Operations and Maintenance (O&M) representatives, with the full support of the Water Industry Operators Association of Australia (WIOA), have come together to create the Networks Operator Development Program.

The field of network O&M is often viewed as the poor cousin to the water, wastewater and recycled water treatment functions. This notion possibly emerges as a result of less recent investment in network improvements; perceptions of lower complexity than operating treatment processes; and less direct interest from Regulators. As a result, there is often a lower emphasis placed on professional and skill development opportunities for network operators.

However, the overall value of the network assets is significantly larger than the treatment assets; opportunities for improved network operations are significant; and by the nature of the work undertaken, there is a there is a risk of an adverse health outcome for consumers living downstream of a water mains repair site plus a direct link to the experience and satisfaction of customers. The importance of network O&M through the efficient delivery of safe drinking water and the provision of sewerage services, are critical and fundamental aspects of the water industry.

The purpose of the Network Operator Development Program is to identify, mentor and develop future leaders in the Network Operations field across the Victorian Water industry.

The aim of the Program is to expand the knowledge, skill set, network of colleagues and practical experience of Network Operators by exposing them to strategic thinking and best practice initiatives in technology, business management and leadership.

Graduates will be guided on how to identify and implement best practice approaches, increase productivity and enhance a professional culture within their respective organisations, in order to deliver an improved customer focus in their O&M related activities.

The Program involves one day each month over an eight month period, with sessions held at venues across Victoria, depending on the content of the particular day. The sessions will incorporate a mixture of technical workshops, field days, comparative analysis of practices within the industry and projects.

Specific session topics will include:

- Leadership & Industry Focus
- Water Quality
- Water Distribution
- Wastewater Collection Systems
- Pumps and Pumping Systems
- Asset Management.

Each participant must undertake set tasks following each session and provide evidence that they are taking their knowledge back to their workplace, whether it is implemented or not. The organising Committee members will act as mentors for the group and individuals.

Given the amount of thinking and effort invested in developing the Program, WIOA believes that the Committee has developed a template which could be easily rolled out right around Australia. We will watch with great interest to see how the Program unfolds during 2017.

More information on the Network Operator Development Program is available from the WIOA website at www.wioa.org.au

OUR COVER

Our cover photograph shows Scott Rathjen, Eastern Treatment Team Leader, from South Gippsland Water, monitoring the quality of water at the Foster Reservoir, South Gippsland, Victoria.

DEVELOPING A SAFE WATER MAINS REPAIR PROCEDURE

Neville Whittaker and the GVW Central O&M Team

Goulburn Valley Water (GVW) owns and manages 1,800 km of water pipeline. The Operation and Maintenance (O&M) crews are often faced with the task of urgent mains repairs in response to a leakage or burst in the water distribution system. In addition to the risk of contamination typically associated with mains breaks and depressurisation, the O&M operators responsible for water mains repair also work in sewerage networks. As a result, without strict working procedures and care, there is a significant risk of cross contamination and therefore an increased risk to consumers of exposure to microbial pathogens.

In early 2016, Peter Mosse approached GVW to determine whether there might be interest in developing a practical and acceptable procedure for the repair of water mains. GVW decided the time was right to act and accepted the offer.

GVW covers a large geographic area in central Victoria with four districts. We identified the Central O&M crews as being the best place to start and try things out. Specific training was provided for the Central District O&M crews on distribution systems, their impact on public health and what was necessary to reduce the risk. The training also focused on the various main break types and appropriate responses, as well as hygienic work practices. The Central O&M crew quickly picked up on the challenge and started to develop a Safe Work Instruction (SWI) for Safe Water Mains Repairs in line with the WIOA *Practical Guide to the Operation and Optimisation of Distribution Systems,* the ADWG Framework for the Management of Drinking Water Quality and the November 2015 edition of *WaterWorks*, which featured articles from Unity Water in South East Queensland and Wingecarribee Shire Council in NSW.

Figure 1. Pipes are swabbed using an extendable pool rod and a swab soaked in 1% hypo.

Figure 2. Cleaned and disinfected small diameter pipes sealed with foam end caps.

Figure 3. Larger pipes are bagged after cleaning and disinfection.

The SWI focuses on the storage of pipes and fittings, the handling of tools and equipment, and control measures throughout the full cycle of the mains repair. It was identified that tools, equipment and PPE used during mains repair can be a source of contamination. The risk is significant at GVW as they are shared between water and sewerage network works. Hence, the following measures were implemented to minimise water quality risks to public health.

Cleaning and Storage of Pipes and Pipe Sections

- The pipes and pipe sections are pressure cleaned, sprayed and swabbed with disinfectant (hypo solution) and capped or otherwise sealed prior to storage (Figures 1, 2 and 3).
- Cleaning of pipes using hypo
  - » Hypo mix
    - › Decant from 20L drums using a hand pump
    - › Mix 100 ml (13% hypo) with 900 ml water for small spray packs for spraying pipes

Figure 4. Fittings in plastic bags in the store.

Figure 5. White gum boots in their lockers.

Figure 6. White gum boots being worn on-site.

› PPE for cleaning pipes – apron, gloves, eye protection are to be worn when cleaning pipes with disinfectant to protect personnel from chemical hazards (Figure 1).

Cleaning and Storage of Fittings

- Pipe fittings including gibaults and couplings are now stored in plastic bags (Figure 4). The fittings are not disinfected until on-site and prior to connection to the pipes.

PPE and Personal Hygiene

- The Central O&M operators have two sets of gum boots, black for working on sewer tasks and white for work on water mains (Figures 5 and 6). This avoids any cross contamination from boots. The boots are stored separately from each other with the white ones stored in separate lockers (Figure 5).
- White disposable overalls are always worn to keep operators clean, and reduce possible contamination from their clothing.
- Utes and burst trailers are installed with a hand wash facility including disinfection soap. Hypo spray bottles are carried in the burst trailers.

Tools and Equipment

- Tools and equipment are spray-disinfected with hypo prior to work commencement and washed after repair work.
- Tools and equipment are placed on plastic mats or a sheet of plastic to prevent contamination from the environment (Figure 7).

Pipes and Fittings at the Repair Site

- The fittings are placed on the mat and sprayed with hypo solution before installation (Figure 7). The pipes are delivered to site and placed on frames to prevent contact with the ground surface, still with end caps in place (Figures 8 and 9). The support frames are simply modified camp stools available cheaply from any store selling camping or leisure equipment.

Before and During Repair

A number of control measures have been introduced by the O&M crew to reduce the risk to water quality before and during repair works.

- **Maintain positive pressure:** When closing valves in preparation for mains repair, ensure the valves are not fully closed to maintain a positive pressure flow. This will significantly reduce the risk of contaminants entering the pipe.
- **Inspect, clean and disinfect fire plugs:** Fire plugs on the section to be shut down are checked and cleaned and sprayed with hypo to prevent fire plug balls dropping and becoming a source of contamination. They are covered with dust caps after this process.
- **Check chlorine residuals and turbidity in the area:** Prior to commencing excavation and a complete shutdown, a chlorine residual and turbidity test is completed upstream of the repair site. This is used as a verification of the flushing procedure when the main is repaired.

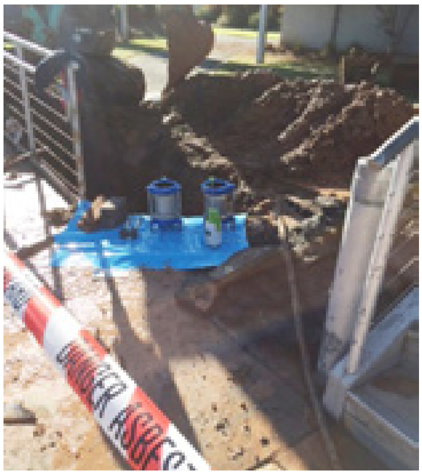

Figure 7. A sheet of plastic used as a mat for the fittings and tools.

Figure 8. A section of pipe placed on fold-up frames waiting to be laid.

Figure 9. Pipes are unloaded from the vehicle onto fold-up supports.

Figure 10. Fist size clearance under the pipe and spraying the end of the existing pipe with hypo.

Figure 11. Standpipe with digital flow meter for monitoring of flushing flow rates.

Figure 12. Shows instantaneous flow rate (L/s).

- **Expose, excavate and provide a sump:** A sump hole is excavated to ensure the pump keeps control of the water level during the repair. Attention is paid to ensure that the pump keeps operating, and that the hoses do not block with sand and or mud. This is important to maintain control of the site.
- **Establish pipe clearance:** When excavating to the pipe, ensure there is a minimum of a fist size (75 mm) gap under the pipe before cutting to prevent ingress of contamination into the open pipe end (Figure 10).
- **Spray pipes and fittings with hypo:** Ensure pipes and fittings are disinfected with fresh hypo solution prior to assembly, including the existing AC pipe (Figure 10).

After the Repair

Flushing

To achieve best practice for flushing after repairing a burst main, the hydrants must be operated to maintain an effective recommended flushing velocity (1 m/s). Flushing is carried out according to the flushing table available on the WIOA website (Table 1) at the rate of 1m/s, and long enough to renew the volume of the isolated section of pipe three times.

While there are ways to calculate the flow from the way the water flows out of the hydrant, the O&M crew elected to use a digital flow meter hydrant to monitor flushing flow rates. The Central O&M team has procured a standpipe fitted with digital flow meters (Figure 11, 12 and 13).

Figure 13. Shows totalised flow through hydrant (kL).

Checking Chlorine Residual and Turbidity

Prior to restoring the main to service, the chlorine residual and turbidity upstream and downstream of the main must be verified to meet internal operational targets. To assist this, the GVW Water

Table 1.

Recommended flushing velocity after a mains break is 3 ft/sec

3ft/sec approx = 1m/sec

Recommended flush 3 times pipe volume

Diameter	Radius (mm)	Radius (m)	Vol (m3) 1m	Vol (L) 1m	Rate (L/sec) for 1m/sec flush	3 x volume in 200m (L)	Flush time (mins)	3 x volume in 300m (L)	Flush time (mins)	3 x volume in 400m (L)	Flush time (mins)
50	25	0.025	0.001964	2.0	2.0	1178.1	10	1767.15	15	2356.2	20
100	50	0.05	0.007854	7.9	7.9	4712.4	10	7068.6	15	9424.8	20
300	150	0.15	0.070686	70.7	70.7	42411.6	10	63617.4	15	84823.2	20

Pipe Diameter (mm) - 100 Section Length (m) - 200 Required Flushing Rate (L/sec) - 7.9 Required Flushing Time (minutes) - 10

Figure 14. The town zone maps

Figure 15. Copies of case studies and discussion points from the internal workshops

Quality Team has produced zone maps for each GVW town (Figure 14) that show the chlorine residual and turbidity averages based on their sampling program over the past five years. The field results are compared to these zone map averages for verification and they are used as an alert measure for further conversation with the Water Quality Team if required.

Case Studies

Once the basic Safe Work Instruction had been developed, the field crews undertook to trial it at all the next repair jobs. The crews kept notes and wrote up their accounts of the repairs. Two example case studies are provided on the next page.

These were then presented to the group (Figure 15) and discussed. Therefore, learnings from the case studies, namely "what's working" and "what's not working" were progressively incorporated into the SWI.

Summary of Workshops

The Central O&M team have proven that GVW has made a reduction of risks without significant impact to the business in relation to cost, KPIs and time on the job. These learnings are being passed on to the other three districts within GVW and they are at various stages of adopting the same process. The outcome will be a safe water mains repair process across all districts within GVW.

Training was provided for each of the districts as a common starting point and GVW is in the process of procuring several metered hydrants for the other GVW districts.

Conclusion

The Central O&M team has embraced the improvements in supplying safe water, and they have found that there has only been a very slight increase in the actions required onsite and there has been no impact on the additional workload and zero impact on the KPIs.

The main difference GVW has found in implementing this process is as follows.

- When the pipes are delivered to the depot they are cleaned, capped and stored ready for use. This means there is no impact on the KPIs when the pipes are required to be used on-site.
- On-site the operators take an upstream chlorine and turbidity reading which was not carried out previously. This takes approximately 10 minutes and is done by one person while the others on-site are setting up signs, excavating the trench etc. Therefore there is no impact on the overall repair times.
- The use of the mats and spraying of the fittings takes no extra time; in fact, keeping the fittings and tools clean and free of mud and dirty water makes the assembly quicker rather than slower.
- Flushing the mains repair from different directions may take approximately 10 to 15 minutes extra depending on the quality of the water. However, in the long run it has proven to be a positive as it has shown we have reduced any possible dirty water complaints after the repairs have been completed.
- As most of GVW bursts occur after hours, there is no evidence that overtime costs have increased, therefore the job is not taking any longer to complete.

The big positive for this improved process is the acceptance of the field operators to embrace these changes and how they have continuously stated "we are not doing much different to what we used to do". They have a direct ownership of this process as they have had such a great input into the improvements made.

By adopting the improved safe water mains repairs process, GVW is in a much better space to prove and confirm we are carrying out water mains repairs in accordance with the ADWG elements. We have preventive measures and process controls in place, we do carry out verification of water quality and we are training operators in water quality as well as carrying out reviews, and have a continuous improvement process in place.

In conclusion, Central O&M team has proven that GVW has made a reduction of risk without significant impact to the business in relation to cost, KPIs and time on the job, while still maintaining the support and input from the field operators.

CASE STUDY 1

TATURA BURST WATER MAIN

31 May 2016

- Arrived on-site, left one valve on until ready to start digging so customers still had water for as long as possible.
- Put signs and hats out.
- We turned last valve almost off as we left enough water going through by listening through the valve key.
- Confirmed with contractor where they had used their excavator last.
- Put white gum boots and white suits on.
- Dug up and exposed main, dug trench well below water main so water can slowly trickle out and so nothing can enter the main.
- Brought over one length of pipe that was cleaned with White King and ends bagged up. Also brought two gibaults and sand.
- Cut AC out and wrapped.
- Disinfected handsaw and cut length of pipe on pavement.
- Cut one metre of AC wrap and sliced it open and laid it down beside the hole.
- Disinfected mat with White King then placed gibaults and tools on mat and sprayed. Also sprayed the end of pipe.
- Repaired pipe.
- Backfilled with sand then we installed hydrant and slowly turned water main valves on to let dirty water and air out of the system.
- Flushed for more than 20 minutes then tested the water.
- Results: Chlorine = 5.2 Mg/L, Turbidity = 3.5 NTH.
- Shut hydrant off and tidy up the site. Then went back to depot and cleaned out ute and trailer and disposed of asbestos.

Works undertaken by Sam Sciuto, Neil Cooper, Jackson Wright and George Taylor

CASE STUDY 2

MOOROOPNA BURST WATER MAIN

31 May 2016

- Before leaving site, we cleaned pipes with hypo and bagged up pipes so they could stay clean. Used three short lengths of pipe so we could use them up and thought they would be easier to clean.
- Cleaned pipes, but realised we needed to chamfer the pipe to join them, so we chamfered and then cleaned again, also cleaned gibaults and bagged as well.
- Arrived on-site with the backhoe and truck full of sand and also a ute with the night trailer full of signs and equipment to do job.
- Got tools out on rubber mat as we dug out job and cut tree roots.
- Dug out sump and made sure the water was well below water main.
- Once accessible, cut pipe, removed from trench and then bagged up the asbestos to put in the bin at the depot
- Turned valves on slightly so water was coming through, so no foreign matter could get in and help tidy the AC pipe we were joining onto.
- Sprayed ends of AC pipe with hypo and also gave gibaults and pipe another spray to make sure it was done sufficiently.
- Backfilled trench with sand and slowly turned on the water main valves. Also had hydrant installed and turned on to let air and dirty water out of the pipe.
- Ran the hydrant at 8 L/s according to the graph and waited 10 minutes. Then took a chlorine test and the results were as follows
- Chlorine = 0.58 Mg/L.
- We didn't have a turbidity tester in the ute, we need every ute to be provided with a tester kit, both chlorine and turbidity.
- Shut off hydrant and cleaned up site. Went back to depot and disposed of asbestos and put back tools and trucks.

Works undertaken by Jackson Wright, Julian Clarke and Brad Clarke

The Author

Neville Whittaker (nevillew@gvwater.vic.gov.au) is District Manager Central O&M at Goulburn Valley Water in Victoria.

PROBLEM-SOLVING FOR THE BEST RESULT

Water utilities face problems daily. While most are easy to solve, others can impact safety and performance. Despite robust workplace health and safety procedures and site management practices, chemical delivery, water and odour monitoring or telemetry control systems can still go wrong. At times like this, utilities need help.

Solving problems quickly and effectively is crucial for ensuring a safe working environment and maintaining a quality water supply to customers. Having easy access to independent experts with specialised skill sets helps utilities to resolve problems and achieve the best results.

When a large utility wanted to gain a greater understanding of process safety across multiple treatment plants, it chose Advitech to help. Carl Fung, Lead Process Engineer for the safety audits, explained, 'Our field experts worked collaboratively with site personnel to identify root causes of process safety issues and regulatory non-compliance. The client was pleased our recommendations were easy to implement and improved safety and maintenance efficiencies'.

Advitech has provided engineering and environmental solutions for 30 years. Managing Director Steven Smith is proud of the company's reputation and track record. 'By choosing Advitech, customers can be confident they are tapping into a superior level of independence and credibility that is not accessible anywhere else in our field. We put the right minds on the job, so you can be assured your problem is in safe hands.'

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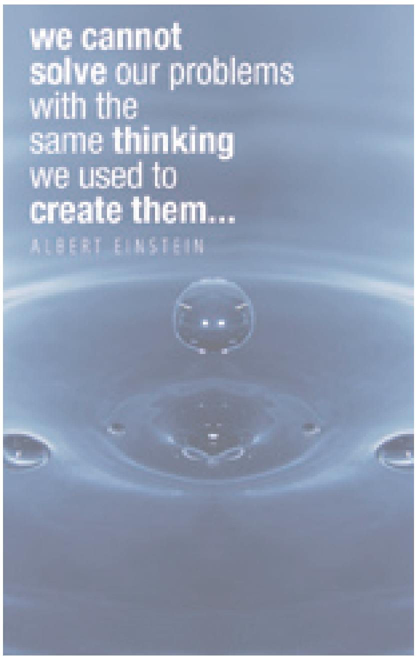

REDIRECTING WASTEWATER FLOWS

Trenchless construction was recently completed at the Eaton to Bunbury Wastewater Pressure Main Project, south of Perth. Water Corporation oversaw the pipe installation, which now redirects wastewater flow from the Eaton pumping station to the Bunbury Wastewater Treatment Plant in the Shire of Capel. The pipeline project spans 18 kilometres from the pumping station to the treatment plant, and will ensure that the long-term growth in the Shire of Dardanup is effectively serviced.

Project details

Prior to the new pipeline's construction, approximately 3.5 million litres of wastewater, from both Eaton and Australind, arrived daily at the Kemerton Wastewater Treatment Plant (KWWTP), located north of Bunbury. The new pipeline now relieves the Eaton load from the KWWTP, and allows for effective treatment of wastewater throughout the Shire.

Pipeline construction method

Open trench excavation, followed by backfill and restoration, was the approved construction method for most of the pipeline route; however, construction beneath all major roads and rail crossings, as well as the Preston River, was completed with trenchless techniques.

DM Civil was contracted to complete the trenchless construction at these sites, undertaking a total of 16 trenchless crossings of varying soil conditions.

Six of these crossings involved tunnelling beneath major roadways, such as the South Western Highway, Bunbury Bypass and Washington Avenue. The Preston River crossing involved a 310-metre drill shot, with the DN450 HDPE pipe being directionally drilled direct using a Vermeer D100x120 HDD machine, with ground conditions alternating between sand and clay layers. Two of the crossings took place beneath a major railway line.

DM Civil Manager Scott Feilding commented on the diversity of the project. 'This was a considerable trenchless contract given the number of crossings involved and different methodologies to be used. This included slurry microtunnelling, thrust boring, guided auger boring and horizontal directional drilling.'

Materials

During this project, DM Civil used Australian-owned kwik-ZIP spacer systems. Designed and developed by drilling professionals, the kwik-ZIP HDX range of spacers handles casing, bar and pipe diameters from 100 millimetres OD to greater than 1600 millimetres. Each spacer is manufactured from high-grade thermoplastic called ACETAL POM, which is characterised by its high flexural strength, high-temperature resistance, low coefficient of friction, and high resistance to organic chemicals, oils and synthetic detergents, even when immersed for long periods of time.

Using a unique load-sharing runner system, each HDX unit maximises its weight-bearing capacity by distributing the pipe load across multiple runners. This reduces point loading at any one location, boosting and optimising the overall support capacity of the spacer exponentially as pipe size increases.

The load sharing runner system also delivers a suspension and dampening effect, resulting in a reduction in the transfer of potentially damaging vibration and movement from the outer casing to the carrier pipe. This was particularly beneficial to the project's high-traffic crossings, where ongoing external vibration could affect the outer casing.

According to Feilding, kwik-ZIP spacers are cost effective, easy to use, resilient and flexible, and were effective throughout installation.

'Due to our trenchless installation capabilities ranging in diameters from DN150 to DN1600, we particularly like the kwik-ZIP spacers given their flexibility to adapt to these diameters by simply adding additional segments.'

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SANDGATE STP BIOSOLIDS STRATEGY

Winner of the Best Paper Overall and Best Operator Paper at the 2016 WIOA Queensland Operations Conference

Gary Fenwick

Background

Queensland Urban Utilities (QUU) operates 28 Sewage Treatment Plants (STP) which combine to produce approximately 150,000 wet tonnes of biosolids per year. By 2031, QUU has projected that biosolids disposal costs could double, or even triple, depending on population growth. A Biosolids Strategy was developed in 2012. One of the key goals of the strategy was to identify and implement operational cost savings.

To achieve the Biosolids Strategy, QUU developed the thermal hydrolysis Sludge Management Centre at the Oxley Creek STP. Oxley Creek STP is operated by QUU, and is one of the major treatment plants under its control.

Thermal hydrolysis is a two-step process of high-pressure treatment followed by rapid decompression. This treatment process tears apart organics, such as cellulose, and makes micronutrients readily available to microorganisms in the anaerobic digesters at the centre. Theoretically, this process can reduce biosolids tonnage by one third and increase methane gas production by three times.

Sandgate STP is another plant operated by QUU, and it produces approximately 8000 wet tonnes of biosolids per year. Historically, the plant produced a filter cake between 14% and 15% solids. This cake was transported to Cecil Plains for beneficial re-use on non-food crop agricultural land. When the Sludge Management Centre was developed, it was decided that Sandgate's cake would be used in the thermal hydrolysis process instead of for beneficial re-use. This decision was based on trucking costs to Cecil Plains and cake availability under the previous contractual agreements. To meet the requirements of the Sludge Management Centre, the dewatering system at Sandgate had to be adjusted to produce cake with solids lower than 14%. The changes resulted in operational difficulties and an increased tonnage of biosolids because of the extra water left in the solids (Table 1).

In March 2016, the haulage contract was renegotiated, allowing for more flexibility in the movement of biosolids to Cecil Plains and the Sludge Management Centre. QUU identified five treatment plants in the Ipswich region that were more suited to treatment by thermal hydrolysis due to their cake solids percentage and geographical location. So once again, Sandgate's biosolids were identified for beneficial re-use. This change in strategy required the cake produced at Sandgate to be as dry as possible. Haulage fees are charged per tonne, therefore reducing the total tonnage per day will save QUU a substantial amount of money each year.

Figure 1. The thermal hydrolysis Sludge Management Centre.

Sandgate Sewage Treatment Plant

Sandgate STP is located within the Boondall Wetlands just north of Brisbane. The facility receives domestic wastewater from Boondall, Sandgate and Brighton, totalling approximately 16 ML/d. Waste-activated sludge (WAS) is pumped onto an Andritz PowerDrain gravity drainage deck (GDD), which provides a large porous surface area for rapid dewatering and uniform sludge distribution. From the gravity drainage deck, the product passes to two Andritz PowerPress S models SAS 3000s belt filter presses (BFP) for dewatering. The sludge falls off the GDD and enters a long belt that is looped and doubles back over itself. The belt is tensioned along the 11 rollers using pneumatic rams and forms an "S" shape. As the sludge travels past the rollers, pressure increases as the roller's size decreases, resulting in a very high-compression force. The operator can adjust the GDD, BFP and WAS to optimise the quality of the cake being produced. Polymer is used to coagulate the WAS, which allows for better water separation. Polymer concentration and dosage can be selected on the control system. Dosage volume is determined by selecting a dry tonnes per kilo wasted ratio such as 6.0 kg/tonne. Increasing the ratio increases the volume of polymer dosed into the WAS.

Belt Filter Press Optimisation

The operational steps taken to increase the cake solids percentage and reduce the biosolids production per day are listed in Table 2. Using the Operational Manual as

Table 1. % Solids and production volume comparison.

% Solids of Cake	14	17
Daily Production (tonnes)	32.9	27.1

Table 2. Belt filter press trials to increase cake solids %.

Date	Operational Change	WAS Feed Rate (L/S)	GDD Speed %	BFP Speed %	Polymer Dosage (kg/tonne)	BFP 1 %	BFP 2 %
Initial Settings	None	40	60	60	4.0	13.3	13.0
4/04/2016	Reduced feed rate to increase dryness	35	60	60	4.0	13.0	13.3
5/04/2016	Reduced feed rate and GDD and BFP speeds to increase dryness	30	50	50	4.0	13.8	13.1
6/04/2016	Continuing to reduce the feed rate and further decreasing speeds of the BFP/GDD, increasing the time that the cake is being pressed	25	50	50	4.0	13.5	13.5
7/04/2016	Original settings before sludge was being taken to the SMC	40	100	50	6.0	13.3	13.8
12/04/2016	High-pressure water cleaning of BFP belts	40	100	50	6.0	14.2	14.3

a guide, the WAS feed rate was reduced, polymer dosage was increased and GDD/BFP running speeds were reduced. These changes did not make significant improvements to cake dryness.

After the operational changes failed to produce the desired results, the GDD/BFP equipment itself was considered as the limiting factor. Arrangements were made to have the belts on both BFPs high-pressure cleaned to increase their permeability. This was the only successful alteration made that increased dewatering capability and resulted in a higher cake solids (Table 2).

Further consideration has been given to the current operational state of the BFP, and recommendations have been made to the maintenance supervisor from QUU that the following mechanical improvements be made to the BFP.

Sandgate's Andritz PowerPress is supplied with an optional dewatering improvement kit called a "NIP". The NIP is composed of a pneumatic ram and roller attached to the bottom side of the BFP (Figures 2 and 3).

Just before the cake exits the BFP, the last roller receives extra compression from the NIP's roller, thereby increasing dewatering capabilities. The NIPs are not currently functioning as recommended in the Operational Manual. On BFP 1, the NIP is too low and is pressing on the outer belt after dewatering has been completed. On BFP 2, the NIP does not move or come into contact with the last roller. The NIPs need to be adjusted to function as designed.

Repeated tracking faults on BFP 1 and 2 have damaged their belts. Both belts have significant stretching, warping and tears resulting in poor dewatering. The belts need to be replaced to improve belt tensioning and increase permeability.

The BFPs have two wash boxes per press, which use high-pressure water sprayed through nozzles to clean the belts. The nozzles often become clogged with debris, reducing their ability to clean the belts. The wash boxes need to be dismantled and cleaned during the belt replacement.

Correct belt tension is critical in optimising dewatering because it ensures good belt alignment and maintains an even pressure throughout the rolling process. The current air regulators feeding the tension control panel are in disrepair. It has been recommended to the mechanical maintenance team that these regulators

Table 3. Historical dewatering capability.

	MLSS (mg/L)		BFP % Solids	
Date	Bioreactor 1	Bioreactor 2	BFP 1	BFP 2
10/02/2006	3010	2790	18.9	18.1
10/03/2008	2290	2230	15.2	15.3
1/03/2016	3150	3370	13.7	12.-9

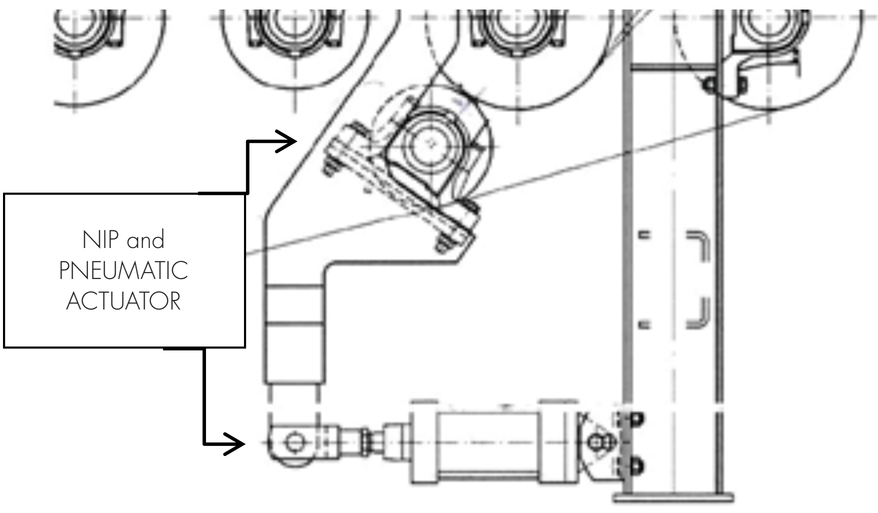

Figure 2. A schematic of the belt filter press and the NIP assembly.

Figure 3. The NIP components at the bottom of the belt filter press.

be replaced with new equipment to ensure that the correct air pressure is being received to the BFP's air control panel.

A high-pressure water blaster should be purchased for use by the operator to clean the BFP's belts daily. Keeping the belts clean will maintain good permeability and is proven to increase solids percentage levels in the cake.

Another Possibility

Historical information located within the QUU Scientific Analytical Services archives demonstrates that the BFPs have produced cake with a much higher solids content in the past (Table 3).

The BFPs were commissioned in 2006 and had initial cake dryness of about 18%. Production ability then dropped off dramatically, and has since wavered between 13% and 15%. Interestingly, the cake dryness seems to improve when the MLSS concentration is reduced from 3000 mg/L to 2200 mg/L. The plant is currently operated with a 20 day sludge, which typically results in an MLSS concentration of about 3000 mg/L. Further investigations and trials will need to be conducted to see whether a process change could be used to improve dewatering and therefore reduce costs.

The Author

Gary Fenwick (Gary.Fenwick@urbanutilities.com.au) is a Treatment Plant Operator with Queensland Urban Utilities.

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LAGOON MANAGEMENT AND DESLUDGING

Lagoon desludging is periodically required to remove accumulated sludge from settlement and treatment lagoons, as well as raw water storages. Sludge accumulation can affect lagoon efficiency and, in turn, may result in environmental damage.

Planning is an important tool for efficient and sustainable lagoon management. Having a desludging program in place is highly recommended – whether it be planned desludging on a yearly basis or once every five years.

Don't wait until issues arise before deciding to act. Dealing with very large quantities of sludge can limit options for desludging and re-use – in addition to being a huge financial burden for an organisation. As a rule of thumb, Epsom Environmental Services recommends desludging when lagoons become 30 per cent full.

Epsom Environmental Services can assist in all aspects of desludging and dewatering. As a company focused on quality, we aim to meet and exceed our customers' expectations. Here's what our customers had to say:

"Extremely happy with overall service and outcome of the project." – *Project Manager, Barandudа WWTP Desludging 2016, North East Water.*

"I've used them for a number of desludging jobs previously and have always been happy with the service provided." – *Project Manager, Drouin WWTP Lagoon No. 2 Desludging 2016, Gippsland Water.*

WHAT'S IN THE BOX?

Winner of the Best Paper Overall and Best Operator Paper at the 2016 WIOA NSW Operations Conference

Paul Gregg

A new activated sludge treatment plant was opened in Cowra in November 2011 to enable Cowra's wastewater treatment to comply with new legislative requirements, and to reduce expensive licensing fees.

In the original plans, the three proposed sludge lagoons were designed as a combined sludge lagoon and drying bed with a sand filter and underdrain system. Dried sludge was proposed to be removed by a long reach excavator. Unfortunately, the system did not work as planned because the sludge simply compacted on the surface of the sand and the supernatant couldn't drain through.

As time progressed, all three sludge lagoons filled (Figure 1). A number of problems became apparent:

- The plant struggled to meet EPA licence requirements. As waste activated sludge builds up in sludge lagoons, the supernatant return increases in phosphates, nitrogen and ammonia, which creates a return that is outside the plant's design parameters. This effectively creates our own trade waste problems, placing excessive demands on the plant and risking a breach of EPA licence conditions.
- Two of the three lagoons were fitted with the original underdrainage system, and had to be manually emptied using excavators to remove the sludge and sand (Figure 2). This proved to be very expensive, time consuming and messy! Supernatant and sludge was pumped to old drying beds until the consistency was too thick to pump. Temporary clay ramps were built to allow access for a steel-tracked, 30 tonne excavator without damaging the concrete lagoons. A smaller 15 tonne rubber track excavator was used to deliver the sludge and sand to the larger excavator that had the reach to load trucks. The biosolids were stored on-site, allowing them to dry out before being taken to landfill.
- Short-circuiting in lagoon 3 reduced the retention time available.

Figure 1. Sludge lagoons full.

Figure 2. One of the lagoons with the sludge, sand filter and underdrains removed.

Figure 3. The box arrives.

Figure 4. Supernatant return and sludge samples.

Alternatives

Alternative dewatering solutions were investigated. Options considered were separate drying beds, geotubes, sludge-reducing bacteria and various mechanical devices.

The pros and cons of the various dewatering techniques were discussed with other NSW Regional Councils and during site visits. Some of the biggest issues were getting technicians for these devices to rural areas for support and servicing. When the machines worked they were great, but when they didn't, operators found themselves doing crash courses in fitting and mechanics, all while the sludge relentlessly built up.

A local waste treatment contractor was on-site doing some unrelated work. He had recently returned from America, where he was investigating solidification processes. He had seen a system used to dewater septic and grease trap waste. Information available on the internet was promising, but, due to patents on the system, it could not be replicated without risking legal action. The simplicity and efficiency of the system was the key: no high electricity costs, no belts, pulleys, bearings or bits, just a pontoon with a mixer and a delivery pump, a poly dosing unit, a box, and a truck.

An agreement was reached between the contractor and Council for the contractor to import the system under licence and for Council to trial the process.

The Box Trial

The plan was to desludge one lagoon over a 12 week period using a single dewatering box (Figure 3). The pontoon, mixer and pump were deployed in the lagoon and the sludge pumped to the box via the poly dosing unit. The pontoon was attached to winches secured at either end of the lagoon, and the pontoon simply winched up and down the lagoon. The pump offtake was about 1 m below the pontoon, and at the end of the desludging process about 300 mm of sludge was left in the lagoon.

The system started working immediately; the biosolids were shrinking whilst adjustments and optimisation continued (Figures 4 and 5). Variations in contact times and polymer dose rate were used to test the effectiveness of the box.

Figure 5. Poly dosing working well.

Figure 6 Sludge cake from the box.

Table 1. Some facts and figures from the first trial

Lagoon capacity	4.5 ML
Supernatant returned	3.5 ML (approx)
Box capacity	18 m^3
Pontoon mixer	1800 L/min delivery
Tonnes of solids	400 tonnes @ 10% solids (approx)
Dry solids	40 tonnes dry solids (approx)
Polymer used	500 litres @ 0.4% solution
Duration	Ten weeks using one dewatering box

Table 2. A comparison of the dewatering box supernatant and Cowra raw sewage

Compound	Box Supernatant	Cowra Raw Sewage
pH	7.7	7.7
Suspended Solids	12	329
Ammonia	184	72.8
Total Nitrogen	187	91.8
Total Phosphorus	10	11.8
Oil and Grease	<1	39
BOD	14	302
Coliforms	2	24000000

To avoid any adverse effect on the plant, the supernatant from the box was decanted and directed to an old tertiary lagoon on site. The supernatant was also used to thin down the sludge in the lagoon as the level in the lagoon got lower and the sludge got thicker. Once dewatered, the sludge was disposed of to landfill by simply tipping the trailer up and allowing the sludge to slide out (Figure 6).

The full dewatering and disposal cycle took about 3 hours: one hour to fill the box, one hour for dewatering and one hour for delivery of the product to the disposal site and wash down of the truck and box. Wet weather hindered progress simply because of problems with moving the truck from site to site.

It was found that the box handled whatever was thrown at it; if you could pump it, the box would dewater it!

Some facts and figures from the first trial using one box to desludge one lagoon are shown in Table 1.

Since the initial trial, another lagoon has been desludged using four dewatering boxes. The desludging time was reduced to about 4 weeks.

The supernatant still presents some problems. The quality is such that it cannot be returned to the head of the plant since it is high in nitrogen (N) and phosphorous (P) nutrients (Table 2). So, at present, the supernatant is directed to an old tertiary lagoon and allowed to evaporate.

The long-term plan is to convert the short circuiting sludge lagoon to a polishing lagoon with some nitrogen removal. The polished effluent could then be returned to the head of the plant.

We think we have found a long-term solution to our sludge managment issues that is versatile and cost-effective. Since Council only needs the boxes for about one month a year, it was felt better to lease the boxes from the contractor rather than purchase them, and this suited the local contractor as well, who uses the boxes for a wide range of dewatering jobs, including septic and grease trap waste, sale yards lagoons, industrial waste and water treatment sludge.

The Author

Paul Gregg (pgregg@cowra.nsw.gov.au) is a Senior Wastewater Plant Operator with Cowra Shire Council in New South Wales.

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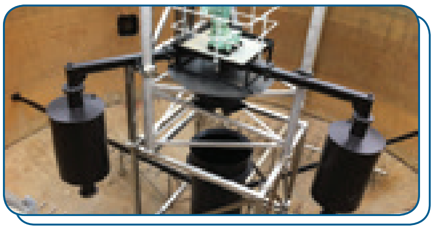

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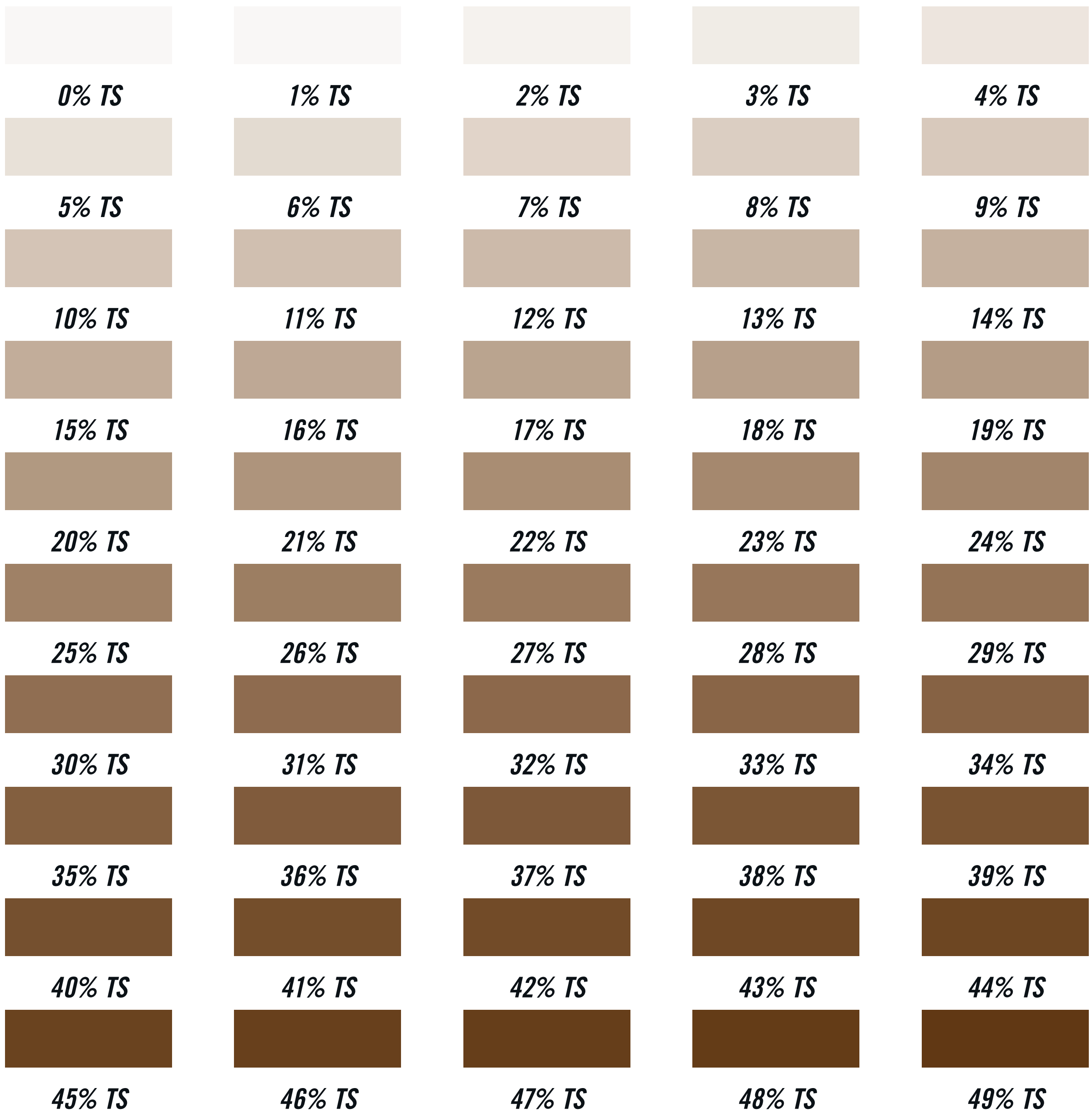

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SOLAR ENERGY AT SNOWY VALLEYS STPS

Vince Ridley

Figure 1. Adelong STP.

Modern Sewage Treatment Plants (STP) are highly mechanised, energy-hungry council assets. In the year ending 30th June 2013, the annual cost of electricity consumption at the five STPs operated by Snowy Valleys Council in NSW was $163,728.

During that period, the newly constructed Batlow STP was commissioned and the annual electricity cost of this plant was expected to be $22,000, bringing the annual cost to over $174,000 (based on 2013-14 tariffs). Electricity costs have risen significantly over the past few years and are expected to continue to rise, albeit hopefully at a slower pace.

Activated sludge STPs are typically designed to treat instantaneous sewage inflows, and these plant inflows have loading peaks early to mid-morning and late afternoon into the evening, with smaller peaks in the middle of the day. Night-time flows are usually minimal. This flow regime is inverse to that of lower cost, “off peak” electricity tariffs that apply between 10:00 pm to 7:00 am. It is not practical to divert and store incoming sewage to process it during the “off-peak”, low-tariff times. In sewage treatment, when the product arrives, you have to deal with it. However, given the demand for the majority of sewage treatment to occur during daylight hours, the provision of

Table 1. Aeration power requirements for the five Snowy Valleys Council STPs.

Plant	Process	EP	Aeration Power Requirement
Adelong	Pasveer Intermittent Decant Extended Aeration (IDEA)	1,300	22kW Brush Aeration
Batlow	Hybrid Biological Nutrient Removal (HBNR)	1,500	15 kW Diffused Aeration
Talbingo	Intermittent Decant Extended Aeration (IDEA)	500	6kW Jet Pump Aeration
Brungle	Intermittent Decant Extended Aeration (IDEA)	130	2kW Jet Pump Aeration
Tumut	Intermittent Decant Extended Aeration (IDEA)	12,000	176kW Surface Aeration

Table 2. The solar panel work schedule.

Year	Location	Description	Estimated Cost	Actual Cost
2014-15	Adelong	10 kW solar PV array	$20,500	$13,080
2014-15	Batlow	20 kW solar PV array	$20,500	$30,700
2014-15	Talbingo	10 kW solar PV array	$40,000	$14,846
2014-15	Brungle	5 kW solar PV array	$12,000	$9,030
2015-16	Tumut 1	50 kW solar PV array	$100,000	$79,894
2015-16	Tumut 2	10 kW solar PV array	$20,500	Included in Tumut 1
		Total	**$213,500**	**$147,550**

solar panels to generate electricity on-site and reduce energy costs offers an attractive alternative to using more expensive peak tariff power.

In sewage treatment, the main demand on power is due to aeration. For each of the five plants operated by Snowy Valleys Council, the power required for aeration alone is summarised in Table 1.

Council engaged a specialist energy consultant to investigate the viability of installing solar panels at each of the STPs. The report recommended that the five STPs be fitted with solar panels over a two year period, as shown in Table 2, and that Council could expect an average payback period of 7.4 years.

Solar panels have now been successfully installed at all five STPs (Figures 1 to 5) at a cost of $147,550.

Apart from the warm fuzzy feeling that we are making a difference, the installation of the solar panels has delivered some real financial and environmental savings:

- Annual power usage at the plants prior to the project was 669,000 kWh of electricity, equivalent to 470 tonnes of carbon dioxide (CO_2) emissions.
- Total power usage for the year ending 30th June 2016 was 675,662 kWh.
- Total power produced was 213,308 kWh.
- Value at current peak tariff: $46,040.
- Total power exported: 58,815 kWh.
- Net solar power used in the plants was 154,500 kWh.
- Value at current peak tariff: $35,600.
- This represents a 150 tonne (30%) reduction in CO_2.
- Payback time of approximately 4 years.

In conclusion, the application of solar photovoltaic technology to reduce the dependence on imported power has proven to be successful with a very good payback period. Along with this, there is a real environmental benefit without impacting on the current operation of the plants.

The Author

Vince Ridley was formerly the Environment Water and Waste Water Officer with Snowy Valleys Council in New South Wales.

Figure 2. Batlow STP.

Figure 3. Talbingo STP.

Figure 4. Brungle.

Figure 5. Tumut.

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DARLINGTON TRUNK MAIN SHUTDOWN

Dan Ford

Works on large trunk mains, especially planned jobs for capital works, must be very well planned to prevent them going "pear-shaped" and potentially affecting thousands of customers. Burst mains often end up in the news, but rarely (none that I can remember in recent history) for literally running suburbs out of water. This is no doubt because all Utility Network Operators understand the absolute criticality of these large jobs on large mains.

Recently, a 1200 mm diameter trunk main in Darlington, in Adelaide, needed to be shut down for a T-section to be installed (Figure 1 & 2). The main feeds drinking water to water storage tanks and not customers directly. This means a shutdown of the main does not have immediate consequences to the customer. However, once the tanks fed by the trunk main empty, then there are widespread consequences for a large number of customers.

The work was part of the Darlington Expressway works. The 1200 mm main just happened to be one of the most critical trunk mains in Adelaide, and the shutdown was going to be extremely risky. Detailed below are the sequential steps taken to plan and undertake the shutdown, highlighting the risks and the actions undertaken to prevent any negative effects on the network.

Planning the Shutdown Period

Operational knowledge needs to be used to determine when the shutdown can occur. Often, operators will have a "feel", based on experience that the shutdown can occur in summer, or autumn/spring, or maybe only in winter due to demand. If this is not obvious, or if the operators are nervous even if the shutdown is doable in winter, then hydraulic modelling should be undertaken.

For the Darlington job, network operators identified that the job needed to be done in winter, but even then they did not know how long the network would last before running people out of water. The shutdown would mean that the Clapham EL103 tanks (Figure 3) would have no inflow and would start draining due to ongoing demand from consumers as soon as the isolation was started. These tanks are critical in Adelaide, and in the normal network setup, they feed the city. So, we had to rely on network changes to ensure that water remained in the tanks, and that customers in the EL103 zone noticed no change in their water supply.

Figure 1. The 1200 mm trunk main before the T-section is cut in.

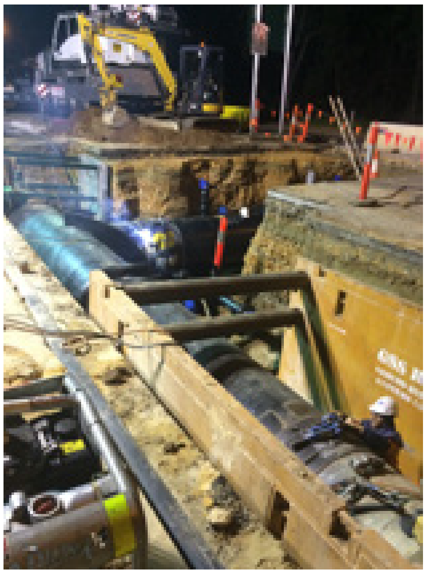


Figure 2. The 1200 mm T-section being welded in during the 31.5 hour job.

Modelling showed that with the "optimal network setup", the Clapham tanks would drain to 30% in 40 hours. Now we had the available time for the work to be completed.

Figure 3 shows the network setup identified by operations and then hydraulically modelled to get a theoretical time available for the job.

Construction Planning

Construction planning is the contractor's job, however, operations should closely review the plan in conjunction with the contractor. This provides an opportunity to cut down the construction time as much as possible. Are the contractors working rotating shifts if time is of the essence? Are they pre-digging everything first before we have even started isolating and draining the main? Are they focusing on the right aspects of the job in the right order?

For the Darlington job, we identified that the welding procedure was not focused on getting everything welded up in the right order, which if worst came to worst, would enable us to charge the main back up while they were still welding. Implementing this into the construction Work Method Statement (WMS) gave operations confidence that construction time was minimised.

Trial Isolation

Before the actual isolation for the works, a trial isolation should be conducted. This was done for Darlington to see how much water was passing the closed valves. This gives the contractor a good idea of how much water they would potentially have to tackle in order to get their welding done. For the 1200-mm Darlington main, a flow of approximately 10-15 L/s was identified. Hence, this enabled the contractor to incorporate cutting in some new scours to their design to keep water away from the tee point, and also to source adequate pumps.

In performing the trial isolation, operations also identified some network problems that needed fixing, especially a 2100 mm butterfly valve gearbox that was non-operational!

Environmental Considerations

A water discharge request must be submitted to the correct authorities. This must be done with enough time for the authorities to check out the scour locations in advance if they desire. They may also require some changes to the proposed dechlorination method, or ask for extra water quality sampling.

Work Method Statement

The WMS is often the "piece of paper" that can be neglected, forgotten, or not thought useful, especially if a job is not critical or high risk. For Darlington, operations wrote out a WMS that tied together all the before, during and after aspects of the job. The last thing you want to be doing for a 40 hour job is trying to remember things at the last minute, or worry about what's going on while you're asleep and other operators are looking after the works.

The WMS ties together modelling and operator knowledge for the required network setup. It includes the isolation plan, resourcing (including planning for breaks) and contingencies that can be enacted and when.

Undertaking the Shutdown

Crack the whip on the contractors. It is amazing how many times the contractors on-site didn't get the memo about the timeline they have from the engineers or supervisors that are involved with the planning. For the Darlington works this did not occur, and everyone had a controlled sense of urgency and energy about them.

It also pays for operations staff to hover around the worksite. Things to check include:

- Ensuring valves are installed in the correct position (open or closed) required for charge up.
- Ensuring the valve spindles will be accessible for charge up.
- Ensuring the new T-section was spray disinfected with a strong hypo solution.
- Checking communication is working well between operations and contractors.

Work on the Darlington main started on a Friday night. This was necessary because the worksite was on a major road, and the work had to occur across the weekend.

Recharge and Commissioning

Before recharging commences, it is really important that operations communicate with the right Site Supervisors and work through closing off "Permits to Work" and "Lock-out-tag-out" equipment. Once the main is back in operations control, it is time to get down to the business of recharging properly without causing dirty water (charging too fast) or milky water (air not getting expelled adequately).

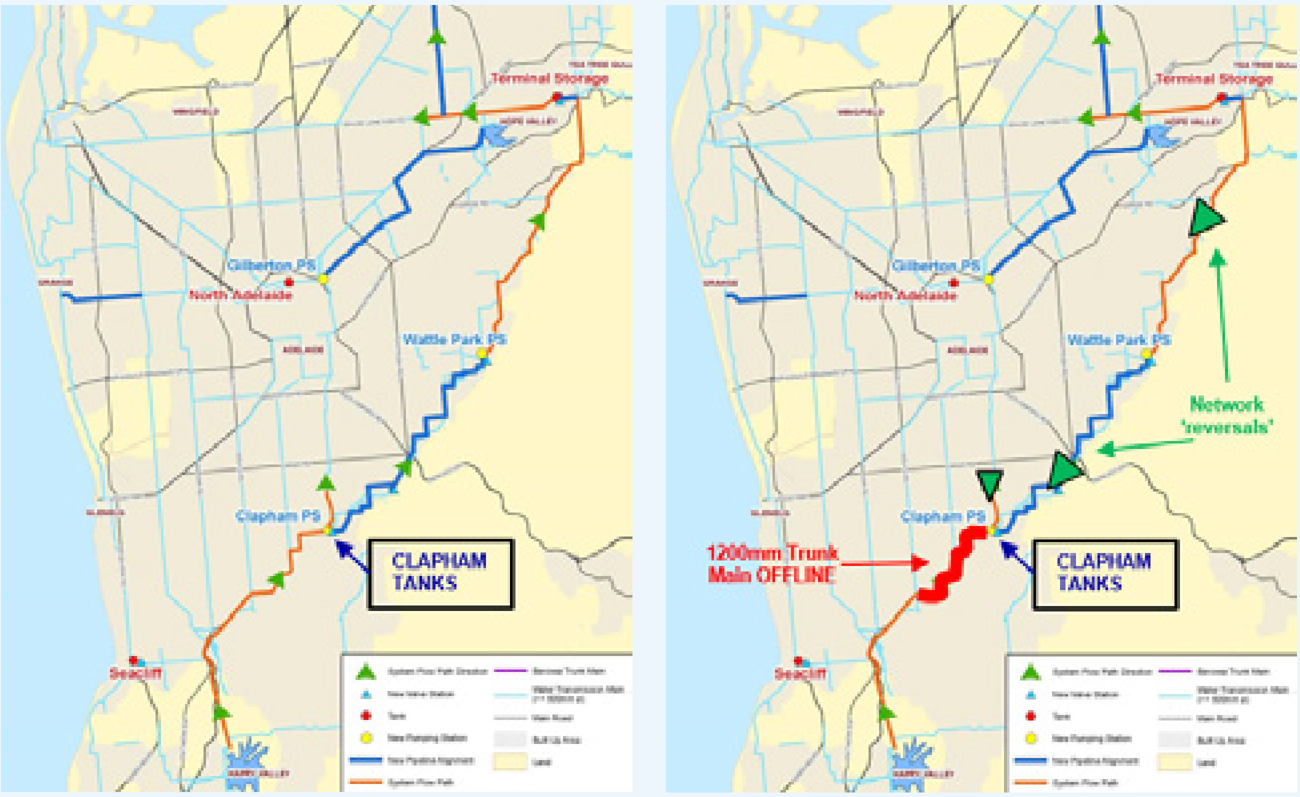
At this stage for the Darlington works, the Clapham tanks were closely following what the modelling had predicted, and the tanks had not dropped below 32%. It was Sunday morning when the main was fully recharged, and the job that was expected to take approximately 40 hours, including drain down and recharge, was completed in 31.5 hours.

Finish the Job

Thank the contractor and send them a job well done letter – if that hopefully was the case. Now that you've trained them up to do the job in a manner that operations need, hopefully you'll get this same contractor and work crew again!

The Author

Dan Ford (Daniel.ford@allwater.net.au) is Network Supply Manager with Allwater in Adelaide.



'Normal' Network setup.
Note the general south to north flow of water.

Network setup to facilitate the 1200 mm main offline.
Note the large-scale reversals of the network to feed backwards to Clapham from the north.

Figure 3. Hydraulic modelling of the outage.

NEW WASTEWATER PUMPS FROM GORMAN-RUPP

Gorman-Rupp, the world leader in solids handling self-priming centrifugal pumps, has released the most advanced pump for handling solids-laden liquids, according to Australian distributors Hydro Innovations. Called the Eradicator™ Solids Management System, the technology is ideal for the new challenges for sewage pumps, including the handling of stringy solids such as wet wipes and rags, which are increasingly present in sewage systems.

The new system comes as an option on the Gorman-Rupp range of Super T Series pumps, and is also available as an upgrade kit on the existing Super T Series pumps already in the field.

The Eradicator™ features an aggressive self-cleaning wear-plate incorporating a number of notches and grooves, as well as a patent-pending lacerating tooth that helps to break up stringy materials, scrape them off the impeller vanes and pass them through the pump – all without impacting performance or interrupting service.

System benefits include improved operational efficiency, increased uptime, reduced maintenance costs, lower life-cycle costs and easier access to the impeller.

Eradicator-equipped pumps do not require expensive chopper blades that need periodic replacement; rather, they rely on passing large solids and stringy materials straight through the pump. Pumps can handle flows from 5 litres per second through to 200 litres per second and heads to 45 metres.

More information on these pumps and the Eradicator™ system can be obtained from Hydro Innovations at info@hydroinnovations.com.au or by calling 02 9898 1800.

HIGH-QUALITY REPLACEMENT UV LAMPS AND UV SPARES

ADVANCE UV SYSTEMS Pty Ltd manufactures a broad range of WaterMark Level 1–certified ultra-violet water disinfection systems.
We are Australian distributors for DWGV/OVGW–certified UV units from Aquafides, Switzerland.

Through our sales and service partners, we also supply a wide range of high-quality spare parts for municipal UV disinfection plants. These include:

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- UV intensity sensors

We can provide technical support for our products and sizing information based on respected independent third-party software provided by Bolton Photosciences Inc.

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ADVANCE ADV-F™ series for medium to high flows

These low-pressure Amalgam UV Units are ideal for small to medium applications like disinfection of potable water, stormwater, rainwater, wastewater, swimming pools, chloramine reduction and more.

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Please contact us now so we can offer a solution for your UV disinfection requirements.
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GLOUCESTER OVER CHLORINATION EVENT

Runner up for Best Operator Paper at the 2016 WIOA NSW Operations Conference

Nathan Bakewell

Gloucester Water Treatment Plant (WTP) is situated approximately 2.5 hours north of Sydney and one hour west of Taree. The WTP services approximately 4000 people in 1900 homes with water extracted from the Barrington River. The current WTP, commissioned in 1979, is a conventional filtration plant comprising of coagulation, flocculation, clarification, media filtration, chlorine disinfection and fluoride dosing. The plant has a design capacity of 4.5 MLD with an average daily supply of 0.9 MLD. The water reticulation system comprises three service reservoirs, six booster pump stations, one transfer pump station and approximately 30 km of water mains.

The WTP had seen minimal improvements since commissioning. The plant remained a very manual process which lacked automation and monitoring. The plant utilised a radio telemetry system to initiate plant production based on reservoir and clear water tank levels, and recorded simple plant information such as raw water and clear water pump start and run times only.

In 2012, MidCoast Water (MCW) identified that the plant had significant operational and Workplace Health and Safety issues, and was internally reviewed for a significant upgrade in 2014. The four main areas where upgrades were required included:

- Sludge pond upgrade with associated backwash balance tank, supernatant pump station and pipework.
- Building upgrade, including amenities and switchroom.
- Roof over existing treatment tanks.
- Automation upgrade including switchboard, instrumentation, SCADA integration, functional specification and P&ID.

However, these upgrades were put on hold to enable an assessment of a longer term solution to be investigated. It was also determined that any significant augmentation was outside the capacity of the Long Term Financial Plan for the next 5-10 years.

In 2013, MCW aimed to improve the chemical storage areas by relocating the sodium hypochlorite and aluminium chlorohydrate (ACH) tanks into designated bunded areas (Figure 1), which were formerly non-existent. The sodium hypochlorite system also received an upgrade in the way of new dosing pumps, associated plumbing, and the dosing point was relocated from the rising main to the clear water chamber with the aim to improve contact time. The design and implementation was undertaken internally, replicating similar dosing systems at other MCW WTP's (Figure 2). It was assumed that the new system was fit for purpose and ideally suited to its new application.

Figure 1. The chemical storage tanks and bunding.

The Incident

On Tuesday the 24th of March 2015, the early signs of a chlorine incident were beginning to emerge. Upon arrival at the WTP at 6:00 am, the operator noted an unusual smell, however, proceeded with the daily routine. At approximately 7:30 am, the operator was notified by the routine reticulation sampler that chlorine levels were higher than normal in the rising main with a value of 3.7 mg/L. With this, the operator tested the clear water well and recorded a result of 3.8 mg/L. As a result, at 9:00 am, the operator reduced the dosage. At this point, the operator believed that the increase in chlorine residual was a result of increasing the dose rate on Saturday the 21st of March to accommodate the increased turbidity in the river, which at this point, was normal practice. The reticulation run continued throughout the morning, with results normal for the reservoirs and only a slight increase in the designated reticulation sample. Based on these results and the operator tests, along with the recent change in chlorine dosage, the high chlorine was seen as a minor incident. Since the chlorine levels were within the ADWG guidelines, the water was deemed fit for consumption.

Later in the day, at 12:04 pm, MCW Customer Service received the first complaint from a customer stating their water tasted like "sulphur and was bitter". In response, Customer Service raised a work order, and the reticulation crew undertook mains flushing in the area.

Between 2:00 pm and 3:00 pm, two more calls were received, one of those from the Gloucester Hospital. These were recorded and further work orders raised. At 3:00 pm, the high-chlorine issue was passed on to the Catchment and Treatment Manager and Area Coordinator for the first time. Since the initial testing had shown higher-than-normal chlorine residuals, which were, however, within the guidelines, it was decided to not utilise on-call staff and that further investigations would continue the following day. At the time of the incident, MCW was embarking on an exercise to reduce overtime, thus any after-hours work was scrutinised. Additional calls were received throughout the afternoon by Customer Service, who advised customers that the elevated chlorine levels were a result of the "fresh flow" in the river.

On Wednesday the 25th of March, MCW received a significant increase in customer calls and a media enquiry. After being delayed for various reasons, and oblivious to the significance of the crisis, chlorine sampling began at 10:30 am, starting with the two main reservoirs, Tyrell St and Ravenshaw St. Both reservoirs read over-range for the instrument, which is a figure of 8.8 mg/L and well above the ADWG limit for chlorine; at which point the drain valves were opened and discharged to parkland. At 11:20 pm, the incident was notified to the Executive and an incident management team was assembled, and by 12:00 pm, NSW Health and the EPA were notified. At 12:20 pm, Ravenshaw Reservoir flushing was reduced as water quality had improved and was back within the ADWG limits. Local staff then focused on responding to customer complaints by flushing affected areas. While the incident was developing, Telstra planned a shutdown of the mobile service between approximately 11:00 am and 3:00 pm, making communications difficult. Additional crews from Taree and Forster were called in to assist with reticulation flushing and water quality monitoring where water was being discharged to the environment. An emphasis was placed on flushing mains to areas that would have a minimal impact on the environment, such as open parklands, where chlorine would have an opportunity to dissipate. Areas adjacent to rivers, creeks and nearby catchments were avoided to protect aquatic life. Bottled water was purchased and delivered to the schools, hospital and to those customers who had requested water via Customer Service. Flushing and sampling continued to approximately 9:00 pm, at which point signs were emerging that the situation was improving.

However, tests early the following morning indicated that the chlorine residual was back to its previous high throughout the reticulation, and this trend continued for the following four days. On each of the days, there was an improvement in water quality; by end of the day, however, the chlorine level was back to its former state the following morning. It was becoming obvious that the reticulation system had received a large slug of sodium hypochlorite, and the flushing and normal household use were dragging this slug throughout different areas of the system. By Friday morning, approximately 1.5 ML of water had been used to flush the mains. While field staff prioritised removing non-compliant water from the system, the emergency response team engaged an independent engineering consultant to investigate the incident to find the root cause.

Friday the 27th of March saw an announcement of a $50 rebate to customers of the affected area and a visit to Gloucester by the MCW Executive to speak to the community. The community engagement occurred in the main street of Gloucester and was open to the public. The morning's forum allowed concerned rate payers to air their concerns and have their questions answered. Later feedback indicated that this was a positive exercise.

Flushing and sampling of the reticulation system continued until Monday 30th of March, at which point the chlorine residual had returned to normal.

The Investigation

An independent assessment of the event commenced at 1:00 pm on Friday the 27th of March. By the end of the initial site review, the consultants concluded that there were five likely causes for the high-chlorine incident.

- The chlorine dosing system could have continued to operate after the plant had shut down, due to a stuck or faulty inlet control float valve, which is the trigger for chemical dosing. However, this was deemed unlikely as the flocculator hour meters would have shown a longer run time, and the other chemical dosing systems would have affected pH and aluminium residual.

Figure 2. The sodium hypochlorite dosing system.

- The dosing pump could have been left in test/prime mode, which results in the operation of the pump at maximum dosage. However, this was also unlikely due to the requirement for an operator to manually and continuously hold this function locally.
- The speed of the pump may have been set to maximum, which would have resulted in a dose rate of between 21 and 25 mg/L of chlorine. Whilst this was a possibility, it was considered unlikely as both the operator and the reticulation sampler tested samples from the plant and rising main and found much lower results.
- Sabotage was also considered. The chlorine system is located outside the main plant and only protected by a chain wire fence. A person entering the plant could manually operate or adjust the pump, or physically dose chlorine into the clear water well via the external inspection hatch. The deliberate overdosing seemed unlikely since there is no drain valve on the sodium hypochlorite tank, which would have required the individuals to bring a bulk supply of chlorine with them. Additionally, viewing of the plant's CCTV system showed no signs of unauthorised entry.
- The chlorine system had continued to siphon either during normal pump operation and/or after the plant had shut down. Whilst efforts were made to replicate this cause during the visit, a siphon did not occur in any way.

At this point the consultants were confident that siphoning was the cause. They backed this theory with the following comments:

- The dosing pumps were rated to two bar maximum pressure only, minimising the ability to load the system to prevent a siphon.
- The loading valve showed signs of leaking backwards due to being incorrectly seated.
- The discharge point for the chlorine into the clear water well was below the base of the bulk storage tank, which would allow a siphon to occur.

They further advised that the plant be manually operated until the cause was identified and corrected, and the valves of the chlorine system be manually closed when the system was not in operation.

A return visit was made by the consultants on the 31st of March to fully test the sodium hypochlorite system. The visit coincided with a delivery of chlorine that morning, resulting in a near full tank.

As the dosing system used carrier water, the initial tests focused on stopping and starting the carrier water whilst the pumps were running. It was observed that there was a sharp increase in the amount of chlorine dosed, though the continued operation of the dosing pump was enough to slow and break the siphon, thereby eliminating an intermittent supply of carrier water as the cause of the overdosing. However, when the carrier water and the dosing pump were turned off simultaneously, a siphon occurred instantly and continued on well after the dosing system had stopped. Further checking found that both the loading valves were only finger tight and therefore not performing as intended. The observations made with the full chlorine storage tank also explained why the problem had not been identified during the first visit when the chlorine storage tank was low.

Hindsight

Whilst the root cause had been identified, a number of other factors were identified that either contributed to the incident or should have triggered an investigation.

- Two weeks prior to the incident, chlorine dosing pump 1 had been put into service due to a leak on pump 2. This was the first time it had been used since its installation, two years prior, and there was no record of commissioning, no P&ID and no HAZOP undertaken.
- A review of the WTP chlorine monitoring data showed that the chlorination system, which was installed in November 2013, had a history of elevated chlorine levels. This should have indicated a system problem. It appeared that the siphoning had been occurring for quite some time though unacknowledged. Regular monitoring of the results and plotting trends would have highlighted the issue earlier.
- It took 20 hours from the first complaint before an incident was recognised, with one of those complaints from the hospital, a critical customer. It was stated by MCW that the increase in chlorine residual was a result of dealing with the fresh flow in the river, however, there had only been a total of five complaints regarding water quality in the past two years. The sheer volume of calls should have warranted a quicker response and alerted management to a potentially more significant issue.
- Sampling of the water quality was limited to a portable chlorine test kit, with a limit of 8.8 mg/L. Whilst this was an indicator of high chlorine and a further need to flush, no formal testing was done and analysed; thus the true levels in the reticulation were not actually known. It was not until a sample was provided by a customer taken on Tuesday night and submitted to the MCW laboratory several days later that an understanding of the quantity of chlorine dosed in the system could be established. Whilst the sample was not formal, it could not be ignored; the sample had a total and free chlorine reading of 140 mg/L. It must also be noted that a number of customers in Gloucester receive water directly off the rising main to the reservoirs, thus they would have received a highly concentrated slug of chlorine straight from the plant.

Post Incident

A post incident review identified a number of things that were well done.

- Once the incident was declared, management were quick to act, not only advising residents through the different forms of media but also contacting schools, the hospital and nursing home. Bottled water was also made available to those customers who were affected.
- The regulators were notified within 45 minutes of the declaration and given regular updates as they became available.
- Extra MCW staff were mobilised from nearby areas to assist with flushing and monitoring.
- MCW requested that the community assist by flushing household mains to remove the high-chlorine water from the system and to speed the recovery. This request came with a $50 dollar rebate.
- The community meeting in the main street of Gloucester.
- An apology letter to the community from MCW published in the *Gloucester Advocate*.
- Engagement of an Independent Consultant to review both the cause of the incident and how MCW responded, and to provide recommendations for any improvement.

However, from a business perspective, this incident also highlighted a number of weaknesses in MCW's systems, such as incomplete overarching business management frameworks and integrated management systems, lack of quality systems and internal control, a lack of system knowledge, inadequate training of staff, incomplete implementation of the Drinking Water Quality Management Plan, assets not up to current design standards and no overall disaster recovery plan. Due to budget restraints, MCW had also developed a reactive culture as opposed to proactive planning. This incident is an example of learning lessons and finding deficiencies the hard way!

As expected, the incident triggered an immediate response and concern for the entire plant. The review identified 60 actions to be addressed, with the most critical being the sodium hypochlorite system. Within a short period, the system was completely replaced, based on the external consultant's P&ID and risk assessment, including automation, online instruments and analysers. To date, the plant has received a considerable amount of required works, given the timeframe and resources available, in areas of both engineering and process. The programmed works are scheduled to be completed within the next 12 months, at a cost of approximately $1 million, and the plant's proficiency to be re-evaluated within 5-10 years.

The Author

Nathan Bakewell (nathan.bakewell@midcoastwater.com.au) is the Central Process Coordinator with MidCoast Water in New South Wales.

INNOVATIVE WATER TREATMENT SOLUTIONS

Lonza is a leading specialty chemical manufacturer and supplier to the global water treatment market. We take pride in making products that help make people's lives better, safer and healthier via sanitisation and the effective treatment of water.

Lonza does this with innovative water treatment solutions to selectively remove, destroy and control the growth of harmful microbes across a wide range of industries and water applications – from pools and spas to Constant Chlor® drinking water sanitising systems and even food hygiene and industrial cooling, papermaking, oil and gas, and related markets in aquatic plant management with our Applied Biochemist™ range to eliminate algae and other nuisance aquatic vegetation in drinking water reservoirs and other surface waters.

Lonza manufactures a range of oxidising and non-oxidising products, and our calcium hypochlorite–based products are all made to meet drinking water standards in ISO 9000-accredited facilities in the United States, Brazil and South Africa. Recognised brands HTH® cal-hypo and Constant Chlor® dosing systems are versatile and effective, our Constant Chlor® feeding systems provide control, consistency and effective sanitising and disinfecting in all industries.

HTH® and Constant Chlor® offer a viable, safe and simple alternative to chlorine gas and sodium hypochlorite for leading providers of drinking water, such as Sydney Water, in rechlorinating their drinking water.

Our brands HTH®, Pulsar® and FREXUS® are registered with the relevant Australian regulatory authorities for a wide range of applications from commercial pools, food contact and drinking water.

HTH® calcium hypochlorite is a concentrated source of chlorine – typically 65 to 70 per cent available chlorine (avCl) by weight, and, in Australia, has been approved for use in drinking water since 1983 (NHMRC).

Products

Lonza has a range of oxidizing and non-oxidising biocides and additives, with our HTH® and Constant Chlor® calcium hypochlorite range meeting drinking water standards across the globe. Constant Chlor® dosing systems create a constant strength chlorine solution on demand to provide safe, controlled and effective sanitising and disinfecting, and a strong alternative to other chlorination methods.

www.lonzawatertreatment.com.au

INFLUENT QUARANTINE AT EAST BURPENGARY STP

James Castle

The Event

Within one hour of foam being observed at the Burpengary East Sewage Treatment Plant (STP) inlet works in 2013 (Figure 1), a spike in bioreactor aeration demand resulted in all blowers being called to run at 100%. This lasted for several hours before the air demand began to trend down.

The treatment plant team saw this as a good indication that the process had been able to take the hit and cope with the shock. Thinking that the event had been successfully managed and the process would continue to return to normal operations, the site was left unattended at the close of business for the day, as per standard arrangements.

During peak flow the following morning, the operators became very concerned that there seemed to be an uncharacteristically low demand for air in the reactors and alerted the treatment plant's Management Team. Furthermore, the final effluent quality was beginning to deteriorate.

To our dismay, it became apparent that the spike in aeration demand that occurred on the previous day, followed by what appeared to be the process returning to normal operation, was in fact the first few hours of the process biomass being killed. We lost 25 tonnes of active living biomass across the plant's three parallel bioreactors and there was nowhere to run, nowhere to hide. The entire biomass of the activated sludge STP process was effectively dead.

The Plant

Unitywater's Burpengary East STP, with a process capacity of 50,000 EP, services a relatively notorious industrial estate which demands a high level of monitoring and regulation by our Trade Waste Team.

Unitywater undertook an upgrade of the Burpengary East STP to increase process capacity. During planning for the upgrade, operations staff were given the opportunity to have input into the process design. The operators lobbied the design team very hard to ensure that the design incorporated a Raw Sewage Balance Tank (RSBT), and that it was the largest capacity possible within budget constraints. After initial resistance, a 4 ML RSBT was approved (Figure 2). This tank turned out to be the saviour in dealing with our trade waste shock problem.

The treatment plant Operator in Charge (OIC) was also adamant that flow from the RSBT to the bioreactors should be pumped. Given that the process consisted of three parallel bioreactors, the OIC had little faith that the flow to each reactor could be controlled accurately using a conventional flow splitter. Previous experience (and untold levels of frustration by operators) supported this view. Pumped flow from the RSBT to the bioreactors would ensure that optimum flow control could be achieved to each of the three parallel reactors, ensuring that process performance could be tightly controlled.

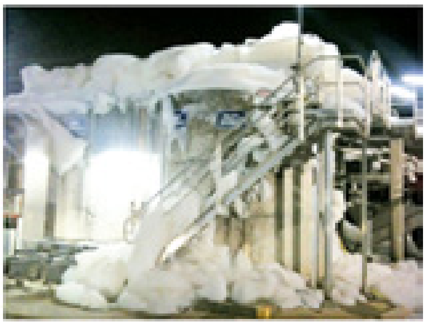


Figure 1. The "big foam" event at Burpengary East STP

Figure 2. The 4 ML Raw Sewage Balance Tank (RSBT)

In another win for operations, the request was approved (Figure 3).

As operators, we also wanted to ensure that maximum process flexibility was retained as part of the design. The thinking behind this was to ensure that process units could be easily bypassed and taken out of service for inspection, cleaning and maintenance.

Influent Quarantine

As a result of the above design concepts being accepted, the idea of being able to quarantine influent was developed. Necessity is the mother of invention!

The fact is that water Utilities cannot fully control the type of substances that are disposed of into the sewerage system 100% of the time. Unfortunately, a small percentage of the population either doesn't have any awareness of the potential environmental consequences that can occur as a result of an illegal discharge, or they don't care.

Taking this into consideration, we looked at options that might be available to us to deal with a trade waste shock under a worst-case scenario, that is, it's just arrived at the front door of the treatment plant process.

Figure 3. The RSBT pump station

Detection and Isolation

As soon as a distinct change in the quality of the influent is detected, for example foaming or odour or just the general appearance, the RSBT pumps are shut down. This means that any potentially toxic or inhibitory substance is captured in the RSBT.

We have also calculated the capacity of the trunk sewer between the industrial estate in the catchment and the inlet works of the STP, and use this information as part of the quarantine process. After operators become aware of a potential problem with influent quality, one detention time of this sewerage rising main is allowed to elapse, with the volume being stored in the RSBT. The bioreactors do not receive any flow for this period.

After this time has elapsed, the RSBT bypass valves are opened and flow is allowed back into the reactors with the RSBT offline. This effectively enables us to quarantine the suspect raw sewage.

Samples are then immediately taken from the RSBT and sent away for a full suite of analysis to determine if the raw sewage quality is satisfactory for processing through the bioreactors. In the interim, the process is fed raw sewage via the original flow split pathway without flow balancing. The plant has been operated this way on a number of occasions and process performance is satisfactory although not as well-controlled as when the RSBT is online.

After the results of the analysis of the quarantined sewage become available, Unitywater process engineers calculate a flow rate that the process is capable of treating, and the contents of the RSBT are bled back into the bioreactors at this rate. When the RSBT is emptied, the process flow is put back to its business-as-usual configuration, ready for us to be able to respond to the next influent quality concern.

Looking to the future, we hope to be able to use online sensors, automatically actuated valves and PLC control to manage any future events. Manually opening or closing 750 mm diameter valves pretty quickly knocks up the operators.

To date, there have been no repeat process knockdown events. However, it is comforting to know that a system is now in place to quickly confine the problem and save the biomass.

The Author

James Castle (James.Castle@unitywater.com) is the Treatment Plants Operations Manager with Unitywater in Queensland.

ON-THE-GROUND RAPID SUPPORT

A message from Hunter H2O's Paul Thompson, General Manager Process and Operations, and Lisa Procter, Operations Manager

We at Hunter H2O take pride in the knowledge that we were able to assist MidCoast Water in their time of need through our investigation into the chlorination incident at Gloucester Water Treatment Plant. Within 24 hours of being engaged, Hunter H2O was able to visit the site and commence an investigation to determine the root cause of the incident, constructively review MidCoast Water's incident response, and provide practical recommendations for future improvements.

As proven and reliable first responders, Hunter H2O is frequently seen as the water industry's go-to company for emergency response, with clients valuing our extensive operational background and technical knowledge. Thanks to this blend of operational and technical know-how, we are uniquely positioned to get to the crux of the issue and develop appropriate responses to swiftly mitigate incidents (like Gloucester) from worsening. Not only does this protect the community, it also saves time and money.

Being able to respond quickly is only half of the story. Like any operational team, we prefer to be on the front foot, partnering with our clients as early as possible to proactively identify and solve any issues before any unfortunate incidents can occur. This approach targets many operational fronts, including undertaking process audits; risk and mitigation assessments; operating systems development; plant optimisation; and operator training.

We have assisted many organisations develop state-of-the-art data spreadsheets and tracking tools that provide operators with prompt notification of water quality exceedances, and assist with regulatory reporting requirements such as load-tracking and annual returns.

Hunter H2O has also provided on-the-ground rapid support after floods to manage severe dirty water events, and assisted with re-establishing treatment plants impacted by lightning and electrical and fire damage.

Speak to us today for value-for-money operations support by practical experts who have designed and run some of Australia's most complex treatment plants.

INTEGRATED INTELLIGENCE – A WASTEWATER PUMP SYSTEM BREAKTHROUGH

Stefan M. Abelin – Director, Project Management, Xylem

Integrated intelligence

Tomorrow's wastewater pump station will require more functionality, higher reliability and advanced data communication. Owners and operators are already asking for this, plus flexibility, lower costs and better performance. To meet such demands, new thinking and new engineering must be used to create products and an offer that is higher on the value scale, yet one that will prove to be more economical over time.

In answer to these challenges, integrated intelligence has been created in wastewater pumping. This is made possible by the innovative adaptation of the components in a submersible wastewater pump. By integrating power electronics, a processor, software, sensors, a synchronous electric motor and a state-of-the-art, self-cleaning wastewater pump inside a submersible shell, intelligent wastewater pumping with integrated intelligence has been made possible.

The word "intelligent" in wastewater pumping is a result of factors that together contribute to a new level of operational autonomy and efficiency. This produces a pumping system designed to automatically deliver the desired performance at minimum energy consumption, while reducing the total cost of ownership. "Intelligence" refers to a pump system that can sense the environment in which it is working, as well as the load it is subjected to, and adjust its behaviour to meet the end-user optimisation targets. By collecting and analysing relevant data, the pump system can make smart decisions about how it operates and what feedback it will provide the user, resulting in precise process control, a reduced risk of clogging, clean and odour-free pump sumps, substantial reductions in energy consumption, comprehensive data reporting and lots more. In short, it delivers peace of mind for the end user.

The word "pumping" is used to show that the affected operational area has been expanded from the pump itself to include hardware, functionality and customer values that today reside in a wastewater pump, pump controls and external communication means.

Today's scenario

A typical submersible wastewater pump station consists of two pumps and a control panel that operates a sewage lift station based on varying liquid levels and an on/off controller. They are frequently found in duplex sewage lift stations serving municipal and private wastewater collection systems.

The pumps consist of a submersible enclosure containing an induction motor with a close-coupled hydraulic end and a seal unit. This pump type was originally developed in the 1950s, and now, 60 years later, it is considered a mature product that is globally available from many manufacturers. Some designs have been on the market for some 10 or 20 years, with little or no innovation added.

The pump station's control panel is often fitted with simple relay logic or basic "black-box" controllers that operate standard contactors in an on-off pumping mode. Pump station monitoring and protection is often limited to thermal overload and pump leakage. Universal pump station design codes lead to a significant pump oversizing, which in turn results in excessive energy usage and unnecessarily high equipment wear, and thus higher operational costs. On top of this, many pump designs suffer from frequent clogging, making the operation unreliable, unpredictable and overly energy intensive.

Recent attempts to improve pump efficiency, other than using self-cleaning hydraulics, have been realised by replacing standard induction motors with premium-efficiency motors – a very minor improvement that results in only a few percentage points' worth of better pump system efficiency.

Breakthrough intelligent wastewater pumping

An integrated, intelligent wastewater pump system consists of a submersible wastewater pump with integrated control and power electronics, and a pump station controller unit that operates the sewage pump station.

The in-pump processor controls the power electronics to achieve variable pump performance, always meeting the demand at hand. A single impeller size per volute size minimises the need for multiple spare impellers, and this also yields maximum hydraulic efficiency as the impeller is optimised for the volute. Instead of having to remove the pump to trim or change an impeller, a different duty point can simply be met by the touch of a button.

Instead of discrete pump performance curves, the new system offers an unlimited choice of performance curves within a large field. The specified duty point can always be met, yet can be easily changed to actual site conditions, if needed.

In total, the intelligent wastewater pump system uses very few unique parts, which drastically reduces the need to stock spare parts or spare pumps, whether at the end user level or at a supplier's warehouse.

A new, simpler and more compact high-performance synchronous motor further improves the pump system's efficiency, allowing operation at reduced pump capacity with maintained high-motor efficiency. The concentrated winding synchronous motor does this, and it meets the proposed super-premium motor efficiency standards (IE4).

The integrated, intelligent system offers functionality, such as soft-start, clog detection, pump cleaning, advanced motor protection and "always correct" impeller rotation. These are features that increase the life of the pump system, reducing downtime and giving users peace of mind. The pump station controller can handle up to four pumps and provides pump system management functions, such as pump energy minimiser, sump cleaning and pipe cleaning function, pump sequencing and alternation.

Integrated, intelligent pump station system

An integrated and intelligent pump station system can operate a sewage pump station with between one and four intelligent wastewater pumps. The powerful and patented energy-minimising software algorithm ensures that the lift station is always operating at the minimum specific energy level (in kilowatt hours per cubic metre), given the prevailing head and flow requirements. The pumps are soft started and soft stopped; the integrated clog detection function will protect the pumps from clogging by triggering a pump cleaning cycle, preventing unnecessary service calls. The sump and pipe cleaning functions will ensure that the pump sump is kept free of sediment, floatables and fat. Power and motor protection functions will protect the motor from supply grid issues and thermal overloads.

Additionally, the system will ensure that you have complete knowledge of what's going on with the pumps and the system. Local and remote operational data, such as pump and station status information, warnings and alarms, are readily available and are user configurable to suit different system requirements.

About the author

Stefan M. Abelin has more than 35 years of experience in the wastewater pump industry. He is the Director of the Marketing Project Office for wastewater pumping at Xylem.

Throughout his career, he has worked with pumps and their applications. Since 1995, he has actively participated in national and international pump industry committee work with the Hydraulic Institute, Europump and IPSC. Abelin has chaired and driven the development of new international pump standards, such as pump acceptance testing, pump intake design and submersible pump acceptance testing.

Abelin holds a Master of Science in Mechanical Engineering from Stockholm's KTH Royal Institute of Technology.

COST-EFFECTIVE, RELIABLE WET-WELL LEVEL MEASUREMENT FOR PUMP CONTROL

The FOGRod is a wastewater level sensor with a 10-year warranty.The FOGRod allows you to keep it simple, with its 10 high-grade stainless steel contacts, held in place by a tough PVC sleeve in equal segments along the sensor. There's no moving parts, no special sensors and no electronics.

How does it work?

The control panel unit (the LIT) puts a few volts onto each core of the 10-core cable and looks for current flow to ground. When a metal contact is under water, current flows through the water, through the concrete and steel of the wet well, back to control panel ground and back to the LIT. When a contact is in fresh air, no current flows.

That's how we measure level. It's like turning on a light bulb, but the water acts as the switch.

A real plus of this system is that once the liquid level is off the bottom of the rod, there's no way to get a false 'on' reading (because current can't flow through fresh air), so you always shut down your pumps. It's just the laws of physics.

What about grease and rag build-up affecting consistent measurement?

Up until now, the Achilles heel of conductivity rods has been grease and rag build-up. The FOGRod solves this problem – how?

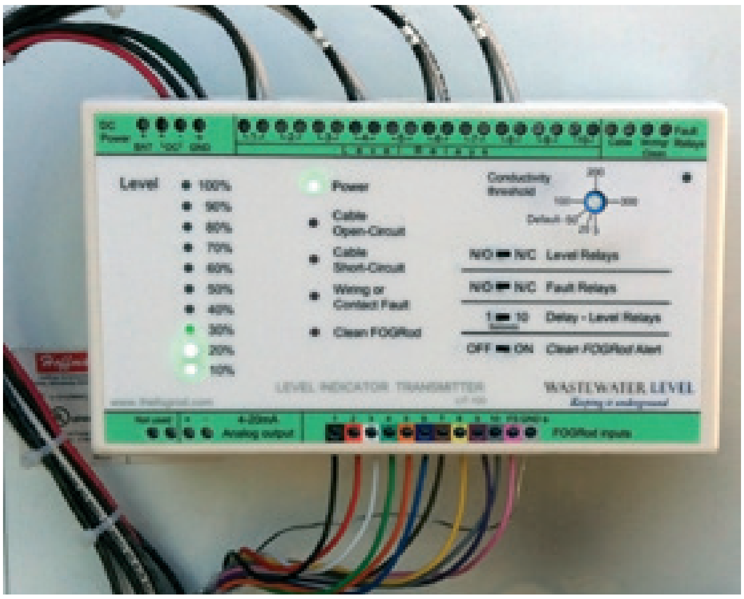
Grease is an insulator, and grease will build up on the FOGRod; however, if installed near the inflow, in the more turbulent flow, the grease is usually broken up. As a result, it is less likely to insulate a contact.

If it does insulate across a contact, when the liquid level rises up to the next contact, the LIT turns on all of the level relays up to the highest point detected (and sets the analog output to that value). You can therefore always start your pumps, because you have plenty of redundancy. Also, an alarm LED and fault relay will activate. The supplied cleaning tool allows the technician to clean the rod in seconds when this problem is encountered.

The more common problem of grease is similar to the ragging problem (and most people who have used conductivity rods in the past have experienced this): you short-cycle your pumps. Why? Wet rags will short out multiple contacts, and so the pumps turn on early. Big grease build-ups often act in a similar way – they hold water inside and act like a wet rag. The LIT detects this problem, and holds the pumps out for three minutes under this condition so that you can never short-cycle your pumps. It also shows a clean FOGRod alarm and activates a fault relay.

The FOGRod is available in varying lengths, from 1 metre to 2.3 metres.

Find out more at roycewater.com.au.



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