

Trunk Mains Cleaning Programme

AMP4 & AMP5 - summary and update

by Stuart Tilley & Richard Johnston

Over two AMP periods, collaboration, innovation and best practice has led a £66 million programme to clean and refurbish 375km of trunk mains in Gateshead, Newcastle, North Tyneside and Northumberland. Northumbrian Water's (NW) regulatory commitment to improve customers' water quality over a ten year period (AMP4 and AMP5) was labelled 'The Acceptability of Water to Customers (AoW) Programme'. This programme has demonstrated NW's commitment to ensuring the drinking water supplied to customers is of excellent quality. This paper is a summary of the Trunk Mains Cleaning programme and achievements which have been covered in previous UK Water Projects publications.



Hydrascan (Kilbride) pig about to be launched - Courtesy of Northumbrian Water

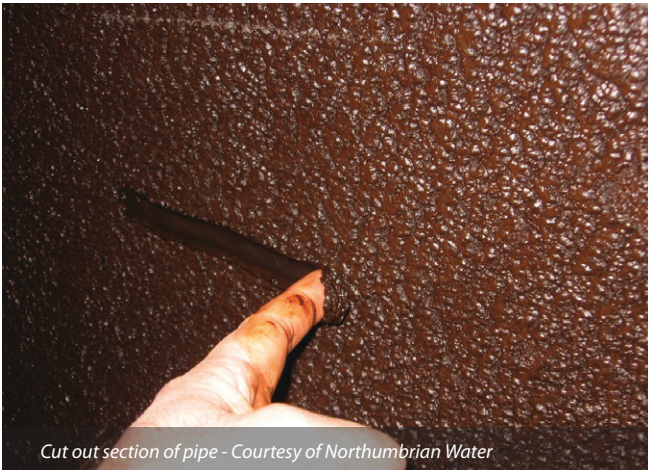
Programme background and feasibility

Since 2000 extensive water quality improvement schemes had been carried out at treatment works and within the distribution network. In 2006 NW launched a project to create a Trunk Mains Investigation Model to monitor customer contacts to assess, evaluate and prioritise improvement work in various drinking water distribution system zones, including discoloured water.

This exercise identified the two highest priority system zones which consisted of approximately 375km of trunk mains supplying approximately one million customers. The system zones are supplied from some of NW's largest treatment works, Whittle Dene WTW and Horsley WTW.

These trunk mains transfer in excess of 100ML/D into the Tyneside Low Service Network and 120ML/D into the High Service Network. Some of trunk mains that required work had been in use for over 100 years, had never been isolated and were of varied condition, material and size.

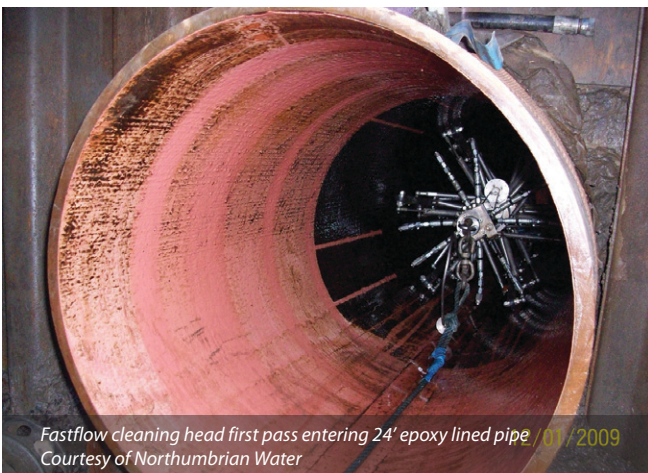
During the feasibility stage, NW carried out physical investigations of pipe lengths and more than 40 sediment analysis points were installed throughout the System Zone 06/07 networks. In addition water quality sampling and tests on cut out sections of pipe took place. Inspection data was gathered and analysed and it indicated that the sediment contained predominately Iron (Fe), Manganese (Mn) and Aluminium (Al).



Cut out section of pipe - Courtesy of Northumbrian Water



Pre-cleaning CCTV - Courtesy of Northumbrian Water



Fastflow cleaning head first pass entering 24' epoxy lined pipe, 03/2009
Courtesy of Northumbrian Water



Aqualogy carrying out ice pigging across Tyne Bridge
Courtesy of Paul Byrne

The results found that the residue was attracted to the pipe wall. This material was particularly susceptible to fluctuations in flow and velocity changes and under normal operating conditions the network was very difficult to manage in its current condition. Any changes to network in this area held a high risk of causing discoloured water.

The water industry had never undertaken trunk mains cleaning works of this type or scale before. Therefore, prior to embarking on the AMP4 Trunk Mains Cleaning Programme, NW worked with a number of contractors to carry out trials in order to:

- Assess the proposed techniques against NW aims and requirements.
- Gain an understanding of the cleaning process, techniques and timescales.
- Develop a cleaning specification and guidelines.
- Give Contractors and Developers the opportunity to gain experience in a live situation.
- Broaden the number of participants within the trunk mains cleaning field.
- Establish a specific NW water quality standard.

Two sites were identified to carry out the cleaning trial and it was envisaged to clean 4.6km of 36" steel bitumen lined pipe, 1.5 km of 15" cast iron cement mortar lined pipe. Three companies were invited to participate in the trials: Fastflow Pipeline Services, Durham Pipeline Technologies and Kilbride Industrial Cleaning Services.

The trials were carried out to a very high standard and a specific water quality standard was set by NW on a comparison with water quality of that leaving a water treatment works.

- Iron (Fe): <50 µg/l
- Manganese (Mn): <50 µg/l
- Aluminium (Al): <10 µg/l
- Turbidity: <1.0 NTU

The post cleaning sample results were within the specified targets and this, along with a combination of pre and post CCTV, became the benchmark standard for cleaning works going forward. As a result of the cleaning trials both Fastflow and Kilbride Industrial Cleaning Services were successful on a number innovation awards, UKSTT to name but one.

Prior to cleaning works starting, enabling works contracts were required. This work was necessary to either duplicate single feed pipes or install intermediate valves at strategic locations which would allow long sections of pipe to be removed from the trunk mains network for cleaning whilst at the same time secure the trunk mains network and water supplies to customers.

Programme targets

A number of external regulatory targets needed to be met with the Trunk Mains Cleaning programme:

- **DWI undertaking:** Reduce customer contacts for discoloured water from 14,000 per year in 2004 to 4,000 per year by the end of 2014.
- **Ofwat commitment:** Clean or refurbish a minimum of 328km of large diameter trunk mains in the Tyneside area by the end of March 2015.
- **Flush 222 District Meter Areas (DMAs):** Around 4,000km of distribution network that is downstream of the cleaned trunk mains.

AMP4 overview

In 2008, NW launched a £30m programme to clean 157km of trunk water mains in the north of Newcastle, North Tyneside and South

East Northumberland. The scheme comprised a £19.5m suite of contracts to clean or renew pipes and improve water quality to around 500,000 customers.

The project demonstrated NW's commitment to set water industry benchmark performance in new technology and innovation, and also reinforces the company's aspiration to be the national leader in drinking water quality and customer service.

AMP 5 overview

In 2012, NW launched a £36m programme to clean 218km of trunk water mains in Newcastle, Tyne Valley, Gateshead and areas of Northumberland. The scheme involved cleaning or renewing pipes to improve water quality to around 500,000 customers.

Five cleaning contracts were competitively tendered to clean a total of 218km of pipe.

Coordination planning

The trunk mains to be cleaned were broken down into individual sections and split into separate groupings. Each section presented the project team with challenges. They needed to ensure that high standards of customer service were maintained in line with the regulatory Service Incentive Mechanism (SIM) at the same time as achieving high standards of cleaning.

To enable each section of pipe to be de-commissioned and re-commissioned without impact or major disruption to the trunk mains distribution network, a dedicated NW coordination planning team was pulled together. The team, which worked closely with the contractors, consisted of colleagues from water quality, network analysis, distribution, operations, investment delivery, planning, communications and the customer team.

The planning team considered each of the sections on an individual basis, taking into account the sensitivity of the trunk mains system. Network modellers explored hydraulic performance, potential impact on customers and also built in the installation of local mitigation and enabling works where appropriate.

The distribution and operations teams compiled de-commissioning and re-commissioning valve schedules and network monitoring requirements for when sections of pipe were isolated. Joint contractor and NW contingency planning considered other on-going work within the trunk mains distribution network, and assisted with coordination.

Innovation in action

This programme of works has employed a number of cleaning and refurbishment techniques such as pressure jetting technology, lining rigs and swabbing.

After successfully trialling the ice pigging method in early 2013, which uses a semi-solid ice slurry to remove particulate deposits from the internal walls of water mains, NW adopted this as an approved cleaning method.

This technique has given NW's trunk mains cleaning numerous advantages including:

- Reduced enabling works.
- Reduced site footprint.
- A significantly reduced cleaning duration.
- Reduced customer, operations, stakeholder and environmental impact.

The trunk mains cleaning programme has not only further developed existing techniques but pushed the boundaries of an innovative technique into a world record breaking achievement. In March 2015, NW broke a world record for the largest diameter

AMP4

Implementation of cleaning work

Contract one

Awarded to: Balfour Beatty Utility Solutions Ltd
Cleaning method: Water jetting 7km of 49i steel bitumen lined pipe and link mains
 Commenced: July 2009
 Completed: January 2010

Contract two

Awarded to: Fastflow Pipeline Services
Cleaning method: Water jetting 84km of trunk mains, (ranging from 8" - 36") with existing linings and 9km of PU lining/pipe replacement
 Commenced: October 2008
 Completion due: June 2011

Contract three

Awarded to: Lumsden & Carroll Construction Ltd, cleaning works sub-contractor Kilbride/Hydrascan, PU lining works Needham Specialist Machines
Cleaning method: Water jetting 52km of trunk mains with existing linings (ranging from 12" - 36") and 5km of PU lining
 Commenced: April 2009
 Completion due: June 2011

AMP5

Implementation of cleaning work

Contract one

Awarded to: Seymour Civil Engineering
Cleaning method: Specialist cleaning contractor Kilbride/Hydrascan
Length: 69km trunk mains (ranging 8" - 42")
Network Improvements: Construction of 4 EOVs
Value: £5.2m
 Commenced: February 2012

Contract two

Awarded to: Seymour Civil Engineering
Cleaning method: Specialist cleaning contractor Kilbride/Hydrascan
Length: 22km of trunk mains (ranging from 8" - 30")
Value: £3.1m
 Commenced: February 2013

Contract three

Awarded to: Morrison Utility Services
Cleaning method: Specialist cleaning contractor Kilbride/Hydrascan and Aqualogy
Length: 44km trunk mains (ranging from 8" - 42")
Value: £4.1m
 Commenced: September 2013

Contract four

Awarded to: Seymour Civil Engineering
Cleaning method: Specialist cleaning contractor Kilbride/Hydrascan and Aqualogy
Length: 56km trunk mains (ranging from 8" - 42")
Value: £6.1m
 Commenced: September 2014

Contract five

Awarded to: Morrison Utility Services
Cleaning method: Specialist cleaning contractor Kilbride/Hydrascan and Aqualogy
Length: 20km trunk mains (ranging from 8" - 30")
Value: £1.9m
 Commenced: January 2014

and longest length of ice pigging in one operation on an iconic landmark, the Tyne Bridge. Ice pigging allowed the programme to clean a section of pipe across the bridge where a number of challenges presented themselves:

- Removal of pipe sections within the bridge would have structural integrity impacts.
- Work inside the galleries would provide access, confined space and safety implications.
- Any works on the Tyne Bridge, on the approach roads, would cause severe traffic disruption in a high profile location.

Customer, stakeholder and community engagement

Due to the high profile of this programme, it was vital to implement a communication strategy to engage with all customers, stakeholders and communities affected by the work. The urban environment and density of population in the AMP5 work specifically required a dedicated strategy which involved collaborating with contractors and key suppliers to deliver relevant, consistent and timely information to key stakeholders.

This innovative approach pushed NW's boundaries of customer communication where previously the majority of programme communication had been via post. The Main Event brand identity was created to aid in raising awareness of the programme. The strategy and plan used radio, outdoor, bus and taxi advertising as well as social media, personalised site signage information campaigns, community volunteering, a dedicated website and a customer liaison team to spread key programme messages and manage any queries about the programme.

Summary

Over the ten year period the programme encountered difficulties, such as severe weather affecting both plant and site equipment,

unforeseen operational issues on the network and a collapsed culvert affecting access to one of the key trunk mains supplying Newcastle city centre. These issues have led to an extension of the cleaning period end date but have also provided valuable lessons which will be carried through to other programmes.

Despite these challenges the project teams should also be congratulated in achieving all of the following targets:

- Reduction of 10,000 customer contacts in ten years, from 14,000 down to 4,000 per year.
- AMP 4 undertaking achieved.
- AMP 5 progress - At the time of writing (May 2015) 175km of trunk mains jetted, relined, replaced or ice pigged.
- Ofwat commitment achieved - to clean or refurbish a minimum of 328km of large diameter trunk mains in the Tyneside area by the end of March 2015.
- Additionally flush around 4,000km of distribution network downstream of the cleaned trunk mains - at the time of writing this is approximately 70% complete.
- Successfully trial and implement new technology to improve cleaning efficiency.
- During this period, the AoW works affected the water supply to over one million customers and only approximately 200 contacts have been received in relation to the programme - aiding in the reduction of NW's SIM score.

The editor and publishers would like to thank Stuart Tilley, NWL Trunk Mains Cleaning Programme Manager, and Richard Johnston, NWL Trunk Mains Cleaning Project Manager, for providing the above article for publication.

The authors thank Morrison Utility Services, Kilbride Industrial Solutions, Balfour Beatty, MWH, Aqualogy Environment Ltd, Seymour Civil Engineering and Fastflow for their assistance.



Morrison Utility Services preparing for ice pigging across Tyne Bridge - Courtesy of Paul Byrne