

# Gravity II: McVeigh's Well to Old Park Service Reservoir

## £5m refurbishment project to an existing 33" precast concrete main in north Belfast, which was previously de-commissioned in the early 1980s

by Martin Gillen & Justin Keane

The majority of the 33" diameter precast concrete Gravity II main was originally laid between 1966 and 1967 from McVeigh's Well (the site of a break pressure tower) to Old Park Service Reservoir; a distance of 5km. Prior to this, a 250m section was constructed in 1963 from McVeigh's Well. This section pre-dated the remainder of the main to allow installation of pipes prior to the construction of junctions 2 to 4 on the newly proposed M2 motorway. Due to ongoing issues with bursts taking place on the Gravity II system, the decision to decommission the main was taken in the early 1980s. NI Water faces many challenges in ensuring it meets the needs of the population of north Belfast. High peak period demands from residents and businesses, potential bursts from an aging network plus the threat of a further freeze/thaw incident which put the water distribution network under extreme pressure in 2010. This case study details how these challenges are being addressed through the refurbishment and re-commissioning of the previously de-commissioned Gravity II main.



Pipe Installation with golf course in background - Courtesy of NI Water

### History

During the 1960s, at the time of installation, Belfast was a very different city from what it is now and much of the installation was through greenfield sites which had not been developed. Following commissioning of the new main in the late 1960s, problems soon started to develop. It appeared that the jointing system on the socket-spigot pipes had not been successful.

Bursts and leaks littered the early history of the main and many repairs had to be carried out. The repairs often consisted of cutting out the affected portion of main and replacing it with a steel split

collar which clamped onto the remaining sections of main. Due to these ongoing issues the decision to decommission the main was taken in the early 1980s.

### EU directives

With new EU directives on drinking water and increasing demand from new developments, it has been highlighted that security of supply to consumers had to be improved. With this undertaking, NI Water embarked on a programme of works to improve their network in the greater Belfast area; the Water Mains Rehabilitation Framework.



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Excavation in front garden and proximity to house - Courtesy of NI Water

As part of this framework, it was identified that by using the existing Gravity II main, NI Water could achieve their goal to safeguard water quality and supply to customers whilst also reducing the stress on the existing network and therefore reducing the number of bursts.

### Project design

Various methods were assessed to refurbish the existing main, including slip-lining and spray lining of the main. However, given the condition of the existing main slip-lining was considered to be the best fit as it allowed for what was essentially a new and robust pipeline.

Hydraulic modelling identified the pressures which the proposed refurbished main would be subjected to and allowed for the largest diameter of HPPE pipe to be selected which would fit into the existing main.

Following selection of the pipe material and refurbishment technique, liaison was able to commence with the various statutory bodies and affected landowners. Belfast has developed significantly since the installation of the main in the 1960s and large sections of the main were now located in gardens of residential properties and across golf courses. It was essential that early engagement took place with these parties due to the potential disruption they faced. A close working relationship was also established with the statutory bodies, especially Transport NI the local road authority.

The buy-in of Transport NI was considered to be essential to the success of the project during the construction phases. Furthermore, liaison with the Operations team at Northern Ireland Water was key to developing the design and locations of the proposed strategic connections to the existing distribution network.

The project scope included:

- CCTV survey of the existing main and remedial works where required.
- Slip-lining of the existing concrete main with a 710mm diameter HPPE main.
- Replacement of all line valves, air valves and washout scours.
- Connection to the existing distribution network at strategic points along the route of the main, including flow measuring and control devices.
- All MEICA work associated with the installation of flow measuring and control devices.
- The hydrostatic testing, chlorination and commissioning of the new system.

### Procurement

As Northern Ireland Water had already commenced the Water Mains Rehabilitation Framework programme to upgrade the network in Belfast and the Gravity II project was placed under the umbrella of this framework. A 'mini-competition' was run between the Contractors already employed on the framework. The project employed the NEC 3 Engineering and Construction Contract - Option A: Priced Contract with Activity Schedule. The project was awarded to Lagan Construction Limited, the successful tenderer of the mini-competition. The contract was awarded in December 2013 and construction commenced in February 2014.

### Construction

The programme for construction was ten months, with construction due to be completed in November 2014. While the original trunk main affected numerous city streets and two popular golf



HDD machine used to pull pipe through golf course - Courtesy of NI Water

courses, the challenge for Lagan's project team 50 years on, was to negotiate with the extensive additional residential properties, shopping complexes, car parks and associated services, including an electricity substation, which had been developed along the existing pipeline easement.

With the route impacting on many busy roads and densely populated residential areas, the non-intrusive slip-lining technique, combined with 'in-hole' PE butt welding, greatly minimised the impact upon home and land owners, road users and the general public at large.

Directional drill machines were employed to slip-line across the two golf courses via a long pull of 800m to minimise the amount of damage to the manicured playing surfaces and tee boxes. CCTV investigations determined that the host pipe had a number of engineering constraints which required innovative solutions to allow the new pipe to be put in.

Working collaboratively with the client, Lagan Construction along with the project manager and design team assessed the best options for each section to minimise public impact without affecting the integrity of the solution.

In one particular location the route was amended to avoid deep excavations, which would have been within 3m of private residential homes, utilising a route through a clearing in adjacent woodland instead. The contractor and project management team built up a very good relationship with affected homeowners, which allowed for the excavation of a deep 'launch' pit located within a private garden and therefore avoided the requirement to be located within the grounds of an adjacent primary school.

Excavations took place within roads, in car parks of private housing developments, shopping centre car parks, and council grounds

(including Belfast Castle) and on many occasions were in close proximity to residential properties. Where gardens had since been landscaped over the original pipeline bends, excavations up to 5m deep had to be carried out. Some of the deep excavations were less than 5m away from the owners' front doors within beautifully manicured, mature gardens.

A huge effort was concentrated on liaising with all stakeholders - particularly residents - before, during and after pipe laying and reinstatement works were completed promptly to keep them fully up to date and ensure all their expectations were met.

Up to 4 crews were employed over the 10 month programme, clocking up over 25,000 man hours in order to fulfil the contract. The works were completed within budget and on time.

#### Conclusion

The success of this project showcased the quality and capabilities of local companies to work together to overcome the challenges presented in delivering the Gravity II Project. The success of the project was reflected in the close collaborative working method employed by the project team which resulted in zero accidents on site during the project and no complaints to Northern Ireland Water's customer service team.

The new main will ensure future compliance with water quality regulations and increase security of supply and reliability for customers. The increased operational reliability and flexibility will enable Northern Ireland Water's operations team to deal with incidents on their network more effectively as a result.

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